Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Recurring Decimal

A decimal with one or a group of digits that repeat itself indefinitely.

E.g. $0.\dot{2}\dot{3}$= 0.23232323…

Convert $0.\dot{8}\dot{4}$ to a fraction.

Multiply the decimal so that the repeated decimal digits are on the left side of the decimal point.

$$x = 0.84848484$$
$$100x = 84.848484$$

Subtract x from 100x.

$$99x = 84$$

Isolate x, then simplify:

$$x = \frac{84}{99} = \frac{28}{33}$$

Fractional Indices

The denominator of a fractional power acts as a 'root'. The numerator of a fractional power acts as a normal power.

$$a^{\frac{m}{n}} = (\sqrt[n]{a})^m$$

Example

$$27^{\frac{2}{3}} = \left(\sqrt[3]{27}\right)^2 = 3^2 = 9$$

$$\left(\frac{25}{16}\right)^{\frac{3}{2}} = \left(\frac{\sqrt{25}}{\sqrt{16}}\right)^3 = \left(\frac{5}{4}\right)^3 = \frac{125}{64}$$

Negative Indices

$$a^{-n} = \frac{1}{a^n}$$

Example $\quad 3^{-2} = \frac{1}{3^2}$

$$= \frac{1}{9}$$

Product Rule

To find the total number of outcomes for two or more events, multiply the number of outcomes for each event together. This is called the product rule because it involves multiplying to find a product.

Example:

A restaurant menu offers 4 starters, 7 main courses and 3 different desserts. How many different three-course meals can be selected from the menu?

Multiplying together the number of choices for each course gives 4 x 7 x 3 = 84 different three-course meals.

Upper and Lower Bounds

The upper and lower bound come from the largest and smallest values that would round to a particular number. Take 'half a unit above and half a unit below'. For example rounded to 1 d.p means nearest 0.1, so add 0.05 and subtract 0.05 to get the bounds.

All error intervals look the same like this - ≤ x <

Example - State the upper and lower bound of 360 when it has been rounded to 2 significant figures:

2 significant figures is the nearest 10, so 'half this' to get 5, and add on to 360 and take it off 360,

355 ≤ x < 365

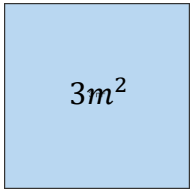
Surds

A surd is an expression with an irrational square root. An irrational number cannot be written as a fraction. We leave them in surd form as the decimal version is too long.

$\sqrt{2}$ and $\sqrt{3}$ are surds

$\sqrt{4} = 2$ *so* $\sqrt{4}$ is not a surd

If we were to write down the exact length of the square it would be $\sqrt{3}$.



Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Simplifying Surds

To simplify surds look for square number factors.

Rules:

$\sqrt{ab} = \sqrt{a} \times \sqrt{b}$

e.g. $\sqrt{75} = \sqrt{25} \times \sqrt{3} = 5\sqrt{3}$

e.g. $\sqrt{3} \times \sqrt{15} = \sqrt{45} = \sqrt{9}\sqrt{5} = 3\sqrt{5}$

$m\sqrt{a} + n\sqrt{a} = (m+n)\sqrt{a}$

e.g. $2\sqrt{5} + 7\sqrt{5} = (2+7)\sqrt{5} = 9\sqrt{5}$

$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

e.g. $\sqrt{\frac{72}{20}} = \frac{\sqrt{72}}{\sqrt{20}} = \frac{\sqrt{36}\times\sqrt{2}}{\sqrt{4}\times\sqrt{5}} = \frac{6\sqrt{2}}{2\sqrt{5}} = \frac{3\sqrt{2}}{\sqrt{5}}$

Expand (Quadratic)

Each term in one bracket needs to be multiplied by each term in the other bracket.

Example (grid method)

$(x+2)(x+5)$

	x	+5
x	x^2	$+5x$
+2	$+2x$	$+10$

Rationalising the denominator

This is the removing of a surd from the denominator of a fraction by multiplying both the numerator and the denominator by that surd.

$$\frac{a}{\sqrt{b}} = \frac{a}{\sqrt{b}} \times \frac{\sqrt{b}}{\sqrt{b}} = \frac{a\sqrt{b}}{b}$$

Example

e.g. $\frac{6}{\sqrt{12}} = \frac{6}{\sqrt{12}} \times \frac{\sqrt{12}}{\sqrt{12}}$ (multiply both top and bottom by $\sqrt{12}$)

$= \frac{6\sqrt{12}}{12} = \frac{\sqrt{12}}{2}$ (now simplify)

$= \frac{\sqrt{4}\times\sqrt{3}}{2} = \frac{2\sqrt{3}}{2} = \sqrt{3}$

Factorise (Quadratic)

Factorising is writing an expression as a product of terms by 'taking out' a common factor.

What numbers multiply to make the last number in the expression? Which of these factors add /subtract to make the number in the middle?

Example

$x^2 - 2x - 3$

$(x-3)(x+1)$

$x^2 - 6x + 5$

$(x-5)(x-1)$

Expand (Cubic)

Example - $(3x+2)(2x-4)(5x+7)$

First of all expand the first two brackets like normal (FOIL or Grid).

	$3x$	+2
$2x$	$6x^2$	$+4x$
-4	$-12x$	-8

$6x^2 + 8x - 8$

Now expand $(6x^2 + 8x - 8)(5x + 7)$:

	$6x^2$	+8x	-8
$5x$	$30x^3$	$+40x^2$	$-40x$
+7	$42x^2$	-56x	-56

$30x^3 + 2x^2 - 96x - 56$

Factorise (with coefficients)

.Factorise $6x^2 - 11x - 10$

This time we also need to find factors of the first term as well as the last term.

Factors of 10 – 1 and 10 OR 2 and 5
Factors of 6 – 1 and 6 OR 2 and 3.

Now I need to see which pairs of factors will multiply together so they will create 11x.

Answer: $(3x+2)(2x-5)$

Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Subject of a formula

More difficult questions – think about inverse operations to help you!

Examples

Make r the subject of $V = \frac{1}{3}\pi r^2 h$.

To start, isolate r^2 by multiplying by 3 and then dividing by πh.

$$3V = \pi r^2 h$$

$$\frac{3V}{\pi h} = r^2$$

Now we square root both sides.

$$\sqrt{\frac{3V}{\pi h}} = r$$

$$r = \sqrt{\frac{3V}{\pi h}}$$

Make x the subject of $3x + 5 = y - ax$.

When a formula contains the new subject more than once, start by isolating any terms including it on one side of the equals sign.

Here, add ax and subtract 5.

$$3x + ax = y - 5$$

Now we factorise the side with our new subject.

$$x(3 + a) = y - 5$$

Then divide by the bracket to leave x on its own.

$$x = \frac{y - 5}{3 + a}$$

Rearranging formulae (difficult)

More difficult questions may require you to factorise an expression to be able to make a certain variable the subject. This is usually when the variable appears twice in the formulae we need to rearrange.

Make x the subject of $3x + 5 = y - ax$.

When a formula contains the new subject more than once, start by isolating any terms including it on one side of the equals sign.

Here, add ax and subtract 5.

$$3x + ax = y - 5$$

Now we factorise the side with our new subject.

$$x(3 + a) = y - 5$$

Then divide by the bracket to leave x on its own.

$$x = \frac{y - 5}{3 + a}$$

Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Finding the nth term of a linear sequence

1. Find the **difference**.
2. **Multiply that by n.**
3. Substitute $n = 1$ to **find out what number you need to add or subtract to get the first number in the sequence**.

Example

Find the nth term of: 3, 7, 11, 15…

1. Difference is +4
2. Start with $4n$
3. $4 \times 1 = 4$, so we need to subtract 1 to get 3.

nth term = $4n - 1$

Geometric Sequence

A sequence of numbers where each term is found by **multiplying the previous one** by a number called the **common ratio, r**.

Example

An example of a geometric sequence is:

$$2, 10, 50, 250 \ldots$$

The common ratio is 5

Another example of a geometric sequence is:

$$81, -27, 9, -3, 1 \ldots$$

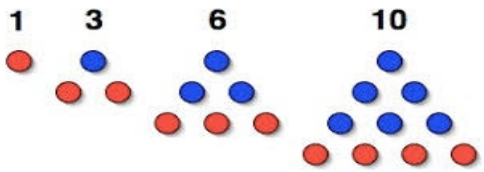
The common ratio is $-\frac{1}{3}$

Triangular numbers

The sequence which comes from a pattern of dots that form a triangle.

$$1, 3, 6, 10, 15, 21 \ldots$$

Example



nth term of a quadratic sequence

1. Find the first and second differences.
2. Halve the second difference and multiply this by n^2.
3. Substitute $n = 1,2,3,4 \ldots$ into your expression so far.
4. Subtract this set of numbers from the corresponding terms in the sequence from the question.
5. Find the nth term of this set of numbers.
6. Combine the nth terms to find the overall nth term of the quadratic sequence.

Substitute values in to check your nth term works for the sequence.

Example

Find the nth term of: 4, 7, 14, 25, 40..

Answer:

Second difference = +4 → nth term = $2n^2$

Sequence: 4, 7, 14, 25, 40

$2n^2$ 2, 8, 18, 32, 50

Difference: 2, -1, -4, -7, -10

Nth term of this set of numbers is $-3n + 5$

Overall nth term: $2n^2 - 3n + 5$

nth term of a geometric sequence

$$r^{n-1}$$

where a is the first term and r is the common ratio

Example

The nth term of $2, 10, 50, 250 \ldots$. Is

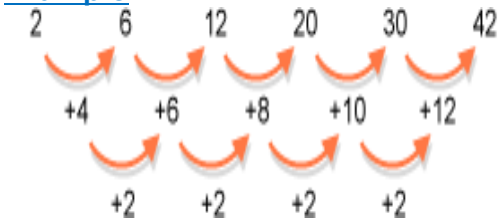
$$2 \times 5^{n-1}$$

Quadratic Sequence

A sequence of numbers where the **second difference is constant**.

A quadratic sequence will have a n^2 term.

Example



Fibonacci type sequences

A sequence where the next number is found by **adding up the previous two terms**

Example

The Fibonacci sequence is:

$$1,1,2,3,5,8,13,21,34 \ldots$$

An example of a Fibonacci-type sequence is:

$$4, 7, 11, 18, 29 \ldots$$

Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Parallel lines

If two lines are parallel, they will have the **same gradient**. The value of m will be the same for both lines.

Are the lines $y = 3x - 1$ and $2y - 6x + 10 = 0$ parallel?

Answer: Rearrange the second equation in to the form $y = mx + c$.

$2y - 6x + 10 = 0 \rightarrow y = 3x - 5$

Since the two gradients are equal (3), the lines are parallel.

Perpendicular lines

If two lines are perpendicular, the product (times together) of their gradients will always equal -1. The gradient of one line will be the **negative reciprocal** of the gradient of the other line.

Find the equation of the line perpendicular to $y = 3x + 2$ which passes through (6,5).

Answer: As they are perpendicular, the gradient of the new line will be −1/3 as this is the negative reciprocal of 3.

$$y = mx + c$$
$$5 = -\frac{1}{3} \times 6 + c$$
$$c = 7$$
$$y = -\frac{1}{3}x + 7$$

or

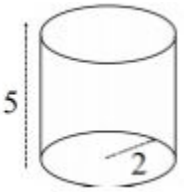
$$3x + x - 7 = 0$$

Surface Area of a cylinder

$$2\pi r^2 + 2\pi rh$$

Example:

$$2\pi(2)^2 + \pi(4)(5) = 28\pi$$

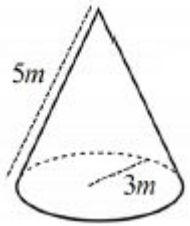


Surface Area of a cone

$$\pi rl + \pi r^2$$

Example:

$$\pi(3)(5) + \pi(3)^2 = 24\pi$$



Surface Area of a sphere

$$4\pi r^2$$

Example:

Find the surface area of a sphere with radius 3cm.

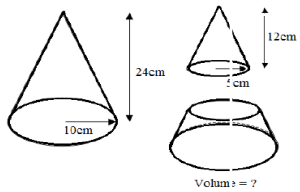
$$SA = 4\pi(3)^2 = 36\pi cm^2$$

Frustum

A frustum is a solid (usually a cone or pyramid) with the top removed.

Volume:

Find the volume of the whole shape, then take away the volume of the small cone/pyramid removed at the top.

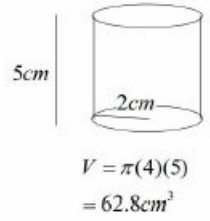


$$\frac{1}{3}\pi(10)^2(24) - \frac{1}{3}\pi(5)^2(12) = 700\pi cm^3$$

Volume of a cylinder

$$\pi r^2 \times height$$

Example:

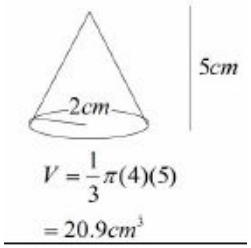


$V = \pi(4)(5) = 62.8cm^3$

Volume of a cone

$$\frac{1}{3} \times \pi r^2 \times height$$

Example:



$V = \frac{1}{3}\pi(4)(5) = 20.9cm^3$

Volume of a sphere

$$\frac{4}{3}\pi r^3$$

Example:

Find the volume of a sphere with diameter 10cm.

$$\frac{4}{3}\pi(5)^3 = \frac{500\pi}{3}cm^3$$

Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Transformations

The movement or manipulation of an object. The four transformations we use are rotation, reflection, translation and enlargement.

Reflection

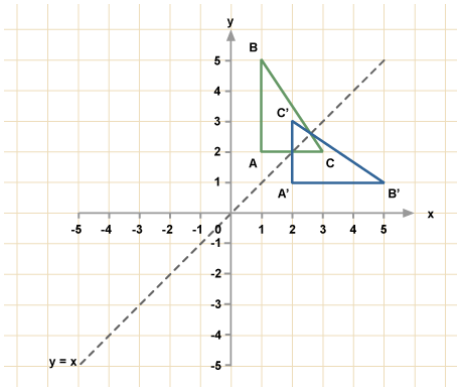
The size does not change, but the shape is 'flipped' like in a mirror.

To describe a reflection you need to give the equation of the mirror line

Line x=? is a vertical line.
Line y=? is a horizontal line.
Line y=x is a diagonal line.

Example:
Reflect shape C in the line y=x.

TIP: Reflect each point of the triangle separately then join them up.



Rotation

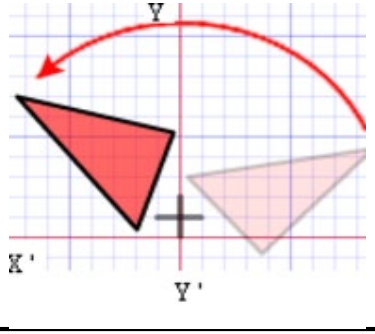
The size does not change, but the shape is turned around a point.

Use tracing paper.

To describe a rotation you need to give:
the direction (clockwise or anti-clockwise)
the angle
the centre of rotation (coordinate)

Example:

Rotate shape A 90° anti-clockwise about (0,1)



Translations

Translate means to move a shape.
The shape does **not** change size or orientation.

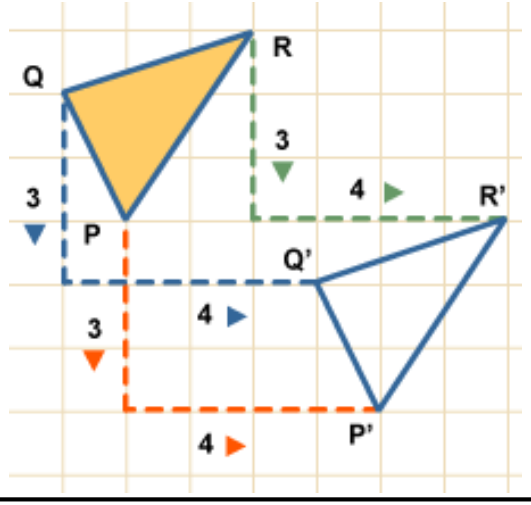
In a column vector, the top number moves left (-) or right (+) and the bottom number moves up (+) or down (-)

$\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ means '2 right, 3 up'

$\begin{pmatrix} -1 \\ -5 \end{pmatrix}$ means '1 left, 5 down'

Example:

In the example on the right, the shape has been translated by vector $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$



Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Enlargement

The shape will get bigger or smaller. Multiply each side by the scale factor.

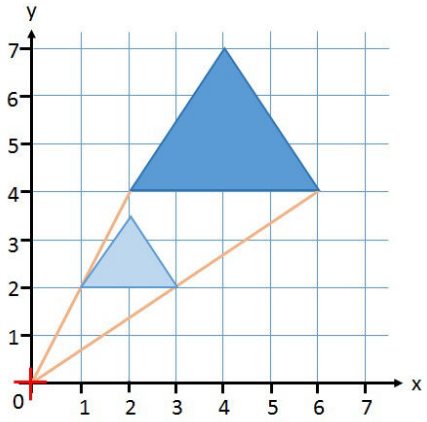
For example:

Scale factor 3 means '3 times larger = multiply all the lengths by 3'
Scale factor ½ means 'half the size = divide all lengths by 2'

Sometimes the shape may need to be enlarged from a specific point.

Example:

This shape has been enlarged by scale Factor 2 at the centre of enlargement (o, 0).

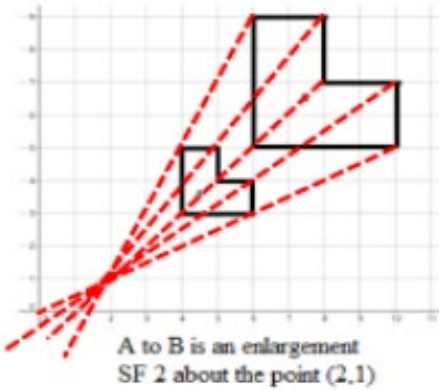


Finding the Centre of Enlargement

Draw straight lines through corresponding corners of the two shapes.
The centre of enlargement is the point where all the lines cross over.

Be careful with negative enlargements as the corresponding corners will be the other way around.

Example:

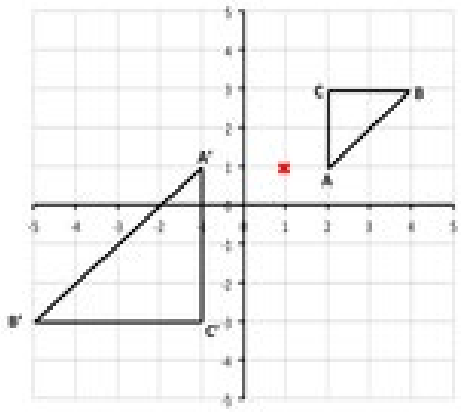


Negative Enlargement

Negative enlargements will look like they have been rotated. They are enlarged in the opposite direction to a positive enlargement.

Example

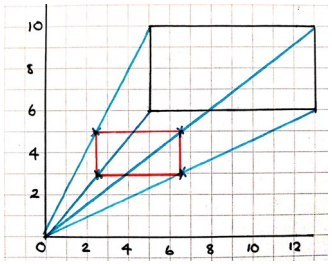
Enlarge ABC by scale factor -2, centre (1,1)



Fractional Enlargement

This is where the shape will get smaller. Such as scale factor 1/3 would make the shape 3 times smaller.

Example
This shape has been enlarged by scale factor ½



Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Iteration

Iteration is the repetition of a mathematical procedure applied to the result of a previous application, typically as a means of obtaining successively closer approximations to the solution of a problem.

Starting with $x_0 = 0$ use the iteration formula

$$x_{n+1} = \frac{2}{x_n^2 + 3}$$

3 times to find an estimate to the solution.

Calculate the values of x_1, x_2, x_3 to find an estimate for the solution to $x^3 + 3x = 2$

$x_{0+1} = \frac{2}{0^2+3} = 0.\dot{6}$ ← We substitute this value into the next step.

$x_{1+1} = \frac{2}{0.\dot{6}^2+3} = 0.5806451613$

$x_{2+1} = \frac{2}{(0.58\ldots)^2+3} = 0.5993140006$

An estimate of the solution is 0.6 because all of the solutions round to 1d.p.

Using the Quadratic Formula

The formula is:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Quadratics are usually in the form:

$$ax^2 + bx + c = 0$$

This is how we pick out the values that will be substituted into the formula:

$$x^2 + 4x + 2 = 0$$

$$a = 1 \quad b = 4 \quad c = 2$$

Now that you have the a. b and c values these can now be substituted into the formula – then gradually start to simplify the formula:

$$x = \frac{-4 \pm \sqrt{4^2 - 4 \times 1 \times 2}}{2 \times 1}$$

$$\Rightarrow x = \frac{-4 \pm \sqrt{8}}{2}$$

$$\Rightarrow x = -0.585\ldots$$

$$= -0.59\,(1\text{dp})$$

$$\text{or } x = -3.414\ldots$$

$$= -3.41\,(1\text{dp})$$

Completing the square

A quadratic in the form $x^2 + b + c$ can be written in the form $(x + p)^2 + q$.

1. Write a set of brackets with x in and half the value of b.
2. Square the bracket.
3. Subtract $\left(\frac{b}{2}\right)^2$ and add c.
4. Simplify the expression.

You can **use the completing the square form** to help **find the maximum or minimum** of quadratic graph.

Example:

Complete the square of

$$y = x^2 - 6x + 2$$

$$(x-3)^2 - 3^2 + 2$$

$$= (x-3)^2 - 7$$

The minimum value of this expression occurs when $(x-3)^2 = 0$, which occurs when x=3

When x = 3, y = 0 – 7 = -7

Minimum point = (3,-7)

If there is a coefficient in front of x^2 then use the same method as above, but factorise out a at the start.

Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Simultaneous Equations

This involves finding solutions that work in two (or more) equations at the same time – e.g.:

$$x + 2y = 8$$
$$2x + y = 7,$$

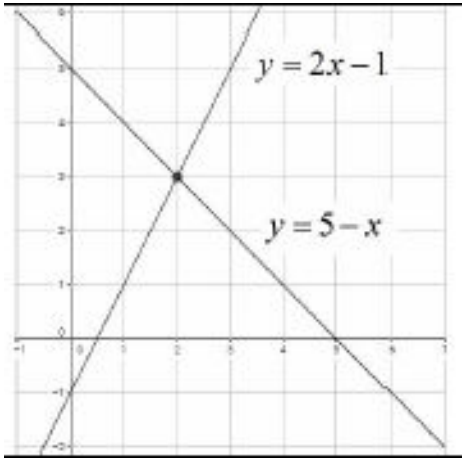
Solving Simultaneous Equations (Graphically)

Draw the graphs of the two equations. The **solutions** will be **where the lines meet**.

The solution can be written as a **coordinate**.

Example

$y = 5 - x$ and $y = 2x - 1$.



They meet at the point with coordinates (2,3) so the answer is $x = 2$ and $y = 3$

Simultaneous Equations

First label the equations

$$x + 2y = 8 \quad (1)$$
$$2x + y = 7 \quad (2)$$

Then multiply to match the coefficients (the number before the letter)

$$2x + 4y = 16 \quad (3) \quad [2 \times (1)]$$
$$2x + y = 7 \quad (2)$$

Next add (or subtract) to remove an unknown

$$2x + 4y = 16 \quad (3)$$
$$2x + y = 7 \quad (2)$$
$$3y = 9 \quad (3) - (2)$$

Here, we can see that y=3.

Finally, substitute into a previous equation to calculate the other unknown. Here we used equation:

$$x + 2 \times 3 = 8$$
$$x + 6 = 8$$

We can see here that x=2

So x = 2 and y = 3.

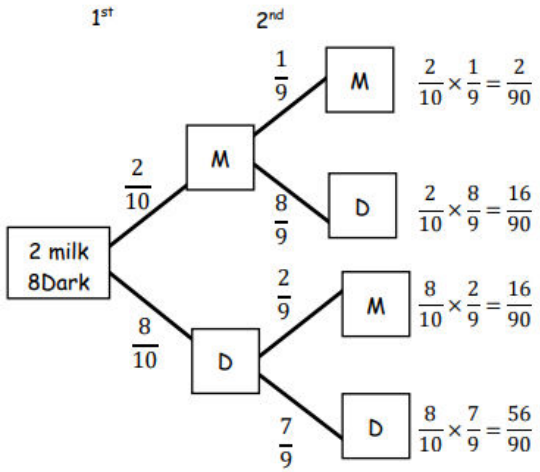
Conditional Probability

When events are dependent, the probability of the second event is called a conditional event because it is conditional on the outcome of the first event.

Example

2 milk and 8 dark chocolates in a box. Kate chooses one and eats it. She chooses a second one.

This can be shown on a tree diagram:



Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Direct Proportion (algebra)

Direct: $y = kx$ or $y \propto x$

1. Solve to find k using the pair of values in the question.
2. Rewrite the equation using the k you have just found.
3. Substitute the other given value from the question in to the equation to find the missing value.

Example:

p is directly proportional to q. When p = 12, q = 4.
Find p when q = 20.

1. p = kq
   12 = k x 4
   so k = 3

2. p = 3q

3. p = 3 x 20 = 60, so p = 60

ANSWER: **p = 60** and **q=120** (3 x 60)

Indirect Proportion (algebra)

Direct: $y = kx$ or $y \propto x$

1. Solve to find k using the pair of values in the question.
2. Rewrite the equation using the k you have just found.
3. Substitute the other given value from the question in to the equation to find the missing value.

Example:

p is directly proportional to q.
When p = 12, q = 4.
Find p when q = 20.

1. p = kq
   12 = k x 4
   so k = 3

2. p = 3q

3. p = 3 x 20 = 60, so p = 60

ANSWER: **p = 60** and **q=120** (3 x 60)

Congruence

Shapes are congruent if they are identical - same shape and same size.
Shapes can be rotated or reflected but still be congruent.

Similar

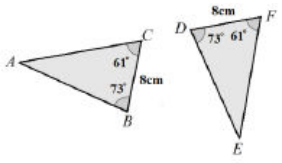
Shapes are similar if they are the same shape but different sizes.
The proportion of the matching sides must be the same, meaning the ratios of corresponding sides are all equal

Proving Congruence

4 ways of proving that two triangles are congruent:

1. SSS (Side, Side, Side)
2. RHS (Right angle, Hypotenuse, Side)
3. SAS (Side, Angle, Side)
4. ASA (Angle, Side, Angle) or AAS

Example:



$BC = DF$
$\angle ABC = \angle EDF$
$\angle ACB = \angle EFD$
$\therefore$ The two triangles are congruent by AAS.

Proving similarity

To show that two triangles are similar, show that:
1. The three sides are in the same proportion
2. Two sides are in the same proportion, and their included angle is the same
3. The three angles are equal

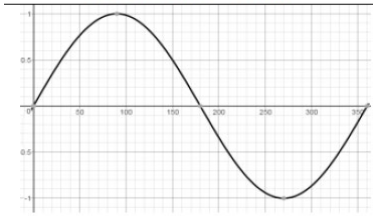
Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Trigonometry Exact Values

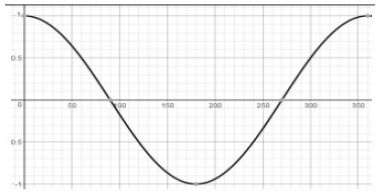
	0°	30°	45°	60°	90°
sin	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	----

Trigonometry Graphs

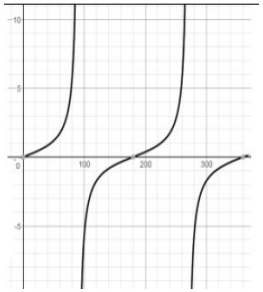
$y = \sin(x)$ for $0 \le x \le 360^o$



$y = \cos(x)$ for $0 \le x \le 360^o$



$y = \tan(x)$ for $0 \le x \le 360^o$

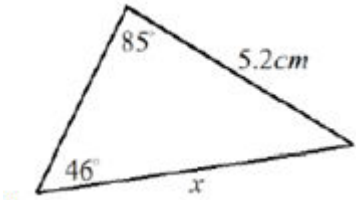


Sine Rule

Use with non right angle triangles.
Use when the question involves 2 sides and 2 angles.

For missing side:

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

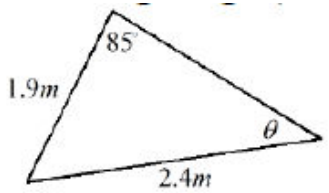


$$\frac{x}{\sin 85} = \frac{5.2}{\sin 46}$$

$$x = \frac{5.2 \times \sin 85}{\sin 46} = 3.75cm$$

For missing angle:

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$



$$\frac{\sin\theta}{1.9} = \frac{\sin 85}{2.4}$$

$$\sin\theta = \frac{1.9 \times \sin 85}{2.4} = 0.789$$

$$\theta = \sin^{-1}(0.789) = 52.1°$$

Cosine Rule

Use with non right angle triangles.
Use when the question involves 3 sides and 1 angle.

.

For missing side:

$$a^2 = b^2 + c^2 - 2bccosA$$

For missing angle:

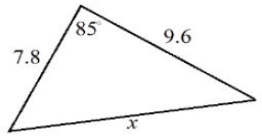
$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Cosine Rule (missing side)

For missing side:

$$a^2 = b^2 + c^2 - 2bc\cos A$$

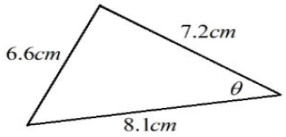


$$x^2 = 9.6^2 + 7.8^2 - (2 \times 9.6 \times 7.8 \times \cos 85)$$

$$x = 11.8$$

Cosine Rule (missing angle)

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

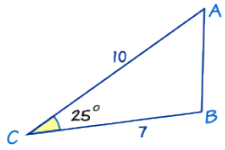


$$\cos\theta = \frac{7.2^2 + 8.1^2 - 6.6^2}{2 \times 7.2 \times 8.1}$$

$$\theta = 50.7°$$

Area of triangle

Area of a Triangle = $\frac{1}{2}\,ab\sin C$



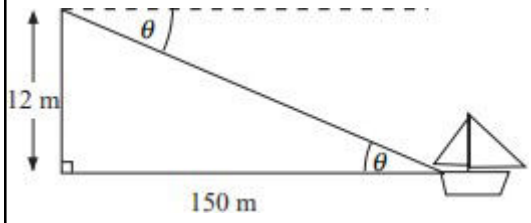
$$\frac{1}{2} \times 7 \times 10 \times \sin 25$$

$$A = 14.8$$

Trig Problem Solving

A man looks out to sea from a cliff top at a height of 12 metres. He sees a boat that is 150 metres from the cliff. What is the angle of depression?

The problem can be represented as this diagram…



We will use SOHCAHTOA as a right angled triangle is involved. Tan is the trig ratio that will apply (hypotenuse is not needed).

$$\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$$

$$\tan\theta = \frac{12}{150}$$

$$\tan^{-1}\left(\frac{12}{150}\right)$$

$$\theta = 4.6$$

Sampling

Population: the whole group that is being studied.

Sample: a selection taken from the population that will let you find out information about the larger group.

Representative: a sample group that accurately represents the population.

Random sample: a group completely chosen by change. No predictability to who it will include.

Bias: a built-in error that makes all values wrong by a certain amount.

Stratified Sampling

Stratified sampling is used to select a sample that is representative of different groups. The aim is to find a proportional sample based on the group size.

$$\frac{\text{number in category}}{\text{total}} \times \text{sample size}$$

Year 7	Year 8	Year 9
120	80	100

Miss Holland wants to take a stratified sample of 15 students. How many Year 7's should she survey?

$$\frac{120}{300} \times 15 = 6$$

Miss Holland should survey 6 students from year 7

Year 11 Higher (Set 1) Mathematics Knowledge Organiser

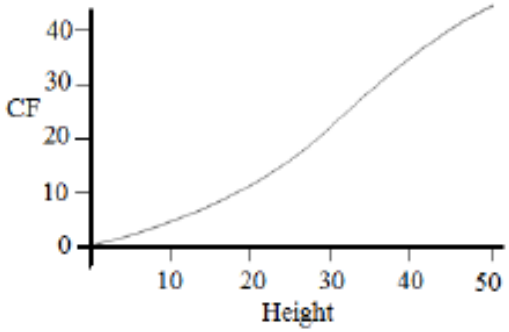
Cumulative frequency

Cumulative Frequency is a running total.

Age	Frequency	Cumulative Frequency
$0 < a \leq 10$	15	15
$10 < a \leq 40$	35	$15 + 35 = 50$
$40 < a \leq 50$	10	$50 + 10 = 60$

A cumulative frequency diagram is a curve that goes up. It looks a little like a stretched-out S shape.

Plot the cumulative frequencies at the <u>end-point of each interval.</u>



You can find the Lower Quartile, Median, and Upper quartile by drawing lines ¼ of the way, ½ of the way and ¾ of the way across the cumulative frequency axis. Then see where this line hits the curve and then read down onto the x axis.

Boxplot

The minimum, lower quartile, median, upper quartile and maximum are shown on a box plot.

Example

Students sit a maths test. The highest score is 19, the lowest score is 8, the median is 14, the lower quartile is 10 and the upper quartile is 17. Draw a box plot to represent this information.

Boxplot Keywords

Lower Quartile - represents the first ¼ of the data (halfway between minimum value and median).

Median – the middle value

Upper Quartile – represents ¾ of data (halfway between median and maximum value)

Interquartile Range (IQR) – Difference between upper quartile and lower quartile.

Comparing Boxplots

Write two sentences.

1. Compare the averages using the medians for two sets of data.

2. Compare the spread of the data using the range or IQR for two sets of data.

The smaller the range/IQR, the more consistent the data.

<u>You must compare box plots in the context of the problem.</u>

Example:

'On average, students in class A were more successful on the test than class B because their median score was higher.'

'Students in class B were more consistent than class A in their test scores as their IQR was smaller.'

Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Histograms

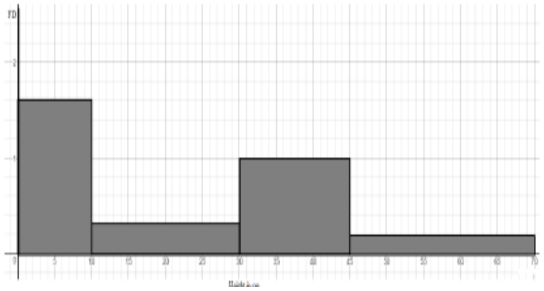
A visual way to display frequency data using bars. Bars can be unequal in width.

Histograms show *frequency density* on the y-axis, not frequency.

$$\textbf{Frequency Density} = \frac{\textbf{Frequency}}{\textbf{Class Width}}$$

Height(cm)	Frequency
$0 < h \leq 10$	8
$10 < h \leq 30$	6
$30 < h \leq 45$	15
$45 < h \leq 70$	5

Frequency Density (FD)
$8 \div 5 = 1.6$
$6 \div 20 = 0.3$
$15 \div 15 = 1$
$5 \div 25 = 0.2$

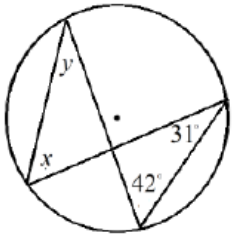


The area of the bar is proportional to the frequency of that class interval.

$$\textbf{Frequency} = \textbf{Freq Density} \times \textbf{Class Width}$$

Circle Theorem: Angles in the same segment are equal.

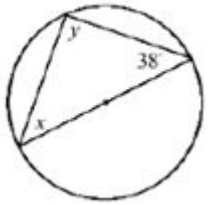
Example:



$x = 42°$
$y = 31°$

Circle Theorem: Angle in a semi-circle has a right angle at the circumference

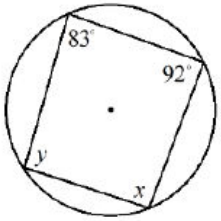
Example:



$y = 90°$
$x = 180 - 90 - 38$
$= 52°$

Circle Theorem: Opposite angles in a cyclic quadrilateral add up to 180°

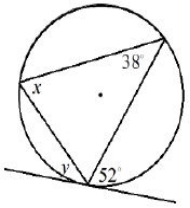
Example:



$x = 180 - 83 = 97°$
$y = 180 - 92 = 88$

Circle Theorem: Alternate segment theorem

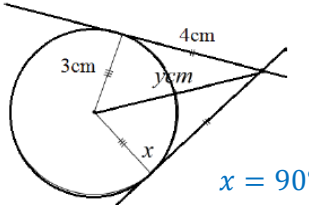
Example:



$x = 52°$
$y = 38°$

Circle Theorem: A tangent meets a radius at 90°

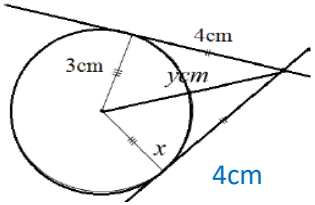
Example:



$x = 90°$

Circle Theorem: Tangents from an external point are equal in length.

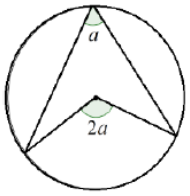
Example:



4cm

Circle Theorem: Angle at centre is twice the angle at circumference.

Example:



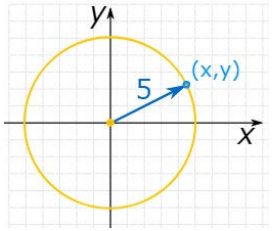
$x = 104 \div 2 = 52°$

Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Graphs of circles

The equation of a circle, centre (0,0), radius r, is:

$$x^2 + y^2 = r^2$$



$$x^2 + y^2 = 25$$

The equation of a circle is always in the form:

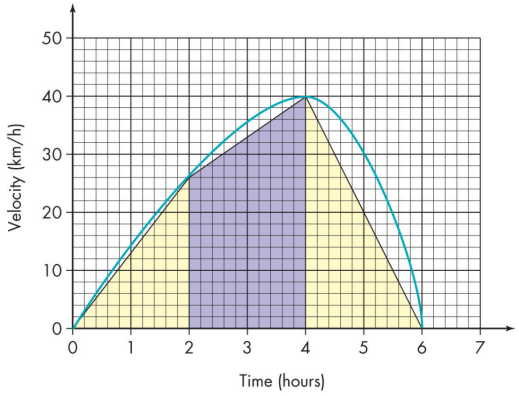
$$x^2 + y^2 = r^2$$

This is provided the centre of the circle is (0,0). This is because you can find the equation of a circle using Pythagoras theorem.

Area under a curve

You can only estimate the area under a curve.

This can be done by splitting the area up into similar shapes (such as rectangles, triangles and trapeziums). You can find the area of each of these shapes and then add them together.



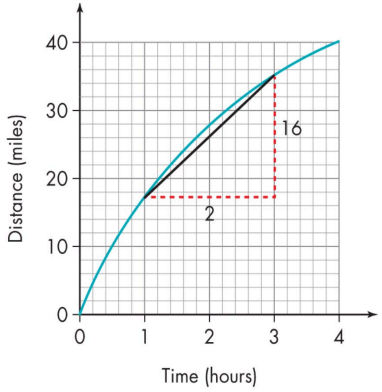
Gradient of a curve

Remember gradient is the change in y over the change in x!

The gradient of a curve at a point is the same as the gradient of the tangent at that point.

1. Draw a tangent carefully at the point.
2. Make a right-angled triangle.
3. Use the measurements on the axes to calculate the rise and run (change in y and change in x)
4. Calculate the gradient.

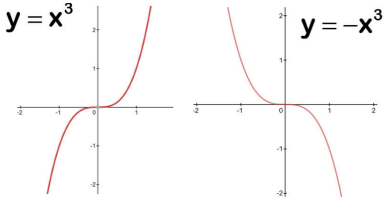
Example:



$$\text{Gradient} = \frac{16}{2} = 8$$

Cubic graph

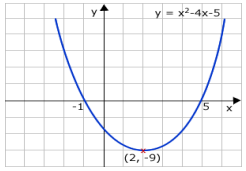
Cubic graphs are a curve shape – the diagram below shows the difference between a positive and negative cubic graph:



Cubic graphs are in the form $ax^3 + bx^2 + cx + d = 0$.

Quadratic graph

A 'U-shaped' curve called a parabola. The equation is of the form $y=ax^2 + bx + c$, where a, b and c are numbers, a≠0.



If a<0, the parabola is upside down.

A root is a solution. The roots of a quadratic are the x-intercepts of the quadratic graph

Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Adding and subtracting Algebraic Fractions

Use the same method for adding and subtracting fractions – find a common denominator!

Example:

$$\frac{1}{x}+\frac{x}{2y}$$
$$=\frac{1(2y)}{2xy}+\frac{x(x)}{2xy}$$
$$=\frac{\mathbf{2y+x^2}}{\mathbf{2xy}}$$

Multiplying Algebraic Fractions

Multiply numerators and multiply the denominators!

Example:

$$\frac{x}{3}\times\frac{x+2}{x-2}$$
$$=\frac{x(x+2)}{3(x-2)}$$
$$=\frac{\mathbf{x^2+2x}}{\mathbf{3x-6}}$$

Dividing Algebraic Fractions

Multiply the first fraction by the reciprocal of the second fraction.

Example:

$$\frac{x}{3}\div\frac{2x}{7}$$
$$=\frac{x}{3}\times\frac{7}{2x}$$
$$=\frac{\mathbf{7x}}{\mathbf{6x}}=\frac{\mathbf{7}}{\mathbf{6}}$$

Functions

A function is the relationship between two sets of values.

Notation:

f(x)

x is the input value

f(x) is the output value.

Composite Functions

A combination of two or more functions to create a new function. fg(x) is the composite function that substitutes the function g(x) into the function f(x).

fg(x) means 'do g first, then f'
gf(x) means 'do f first, then g'

Example:

$f(x)=5x-3,\ g(x)=\frac{1}{2}x+1$

What is $fg(4)$?

$$g(4)=\frac{1}{2}\times 4+1=3$$

$$f(3)=5\times 3-3=12=fg(4)$$

What is $fg(x)$?

$$fg(x)=5\left(\frac{1}{2}x+1\right)-3=\frac{5}{2}x+2$$

Inverse Functions

$f^{-1}(x)$

A function that performs the opposite process of the original function.

1. Write the function as y=f(x)
2. Rearrange to make x the subject.
3. Replace the y with x and the x with $f^{-1}(x)$

Example:

$f(x)=(1-2x)^5$. Find the inverse.

$$y=(1-2x)^5$$
$$\sqrt[5]{y}=1-2x$$
$$1-\sqrt[5]{y}=2x$$
$$\frac{1-\sqrt[5]{y}}{2}=x$$

$$f^{-1}(x)=\frac{1-\sqrt[5]{x}}{2}$$

Algebraic Proof

To demonstrate or show that a statement is true, we use examples. To prove that a statement is true you can use algebra.

Some useful generalisations

Consecutive Integers	n, n + 1, n + 2,...
Even Numbers	2n
Odd Numbers	2n + 1
Consecutive Evens	2n, 2n + 2, 2n + 4,...
Consecutive Odd	2n +1, 2n + 3,....

Year 11 Higher (Set 1) Mathematics Knowledge Organiser

Algebraic proof - Example:

Prove that the square of an odd number is always odd.

Let the odd number be $2n + 1$.

So $(2n + 1)^2 = (2n + 1)(2n + 1)$

$= 4n^2 + 4n + 1$

We can take out a factor of 2 (ignore the 1).

As $2(2n^2 + 2n)$ is even, then when we add 1, the number must be odd.

Prove for any 3 consecutive integers the difference between the product of the first 2 and the product of last two is always twice the middle number

Let the consecutive integers be $n, n + 1$ *and* $n + 2$.

The product of the first and second

$$n(n + 1) = n^2 + n$$

The product of the second and third

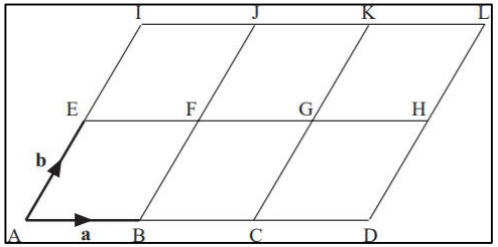
$$(n + 1)(n + 2) = n^2 + 3n + 2$$

So the difference between these products is

$$n^2 + 3n + 2 - n^2 + n = 2n + 2$$

This equals $2(n + 1)$ which is twice the middle number

Vectors can be used to describe movements in Geometry as seen below:



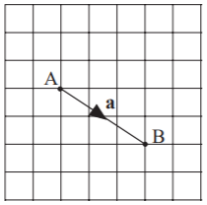
$\vec{AC} = 2\mathbf{a}$

$\vec{AF} = \mathbf{a} + \mathbf{b}$

$\vec{AL} = 3\mathbf{a} + 2\mathbf{b}$

$\vec{LE} = -3\mathbf{a} - \mathbf{b}$

Vectors describe a movement.
A vector has a direction and a distance.

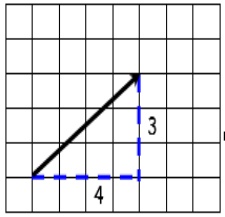


This diagram shows the vector: $\vec{AB} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$

Magnitude

Magnitude is defined as the **length** of a vector.

Example



Magnitude (length) can be calculated using Pythagoras Theorem:
$3^2 + 4^2 = 25$
$\sqrt{25} = 5$

Scalar of a Vector

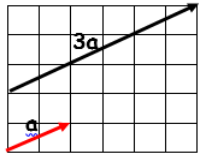
A **scalar** is the **number** we **multiply** a vector by.

Example

$3a + 2b = 3\begin{pmatrix} 2 \\ 1 \end{pmatrix} + 2\begin{pmatrix} 4 \\ -1 \end{pmatrix}$

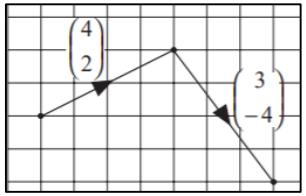
$= \begin{pmatrix} 6 \\ 3 \end{pmatrix} + \begin{pmatrix} 8 \\ -2 \end{pmatrix}$

$= \begin{pmatrix} 14 \\ 1 \end{pmatrix}$

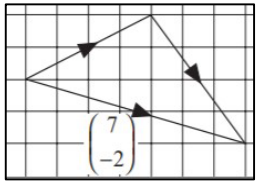


You can add vectors to get a resultant vector as seen below:

$$\begin{pmatrix} 4 \\ 2 \end{pmatrix} + \begin{pmatrix} 3 \\ -4 \end{pmatrix} = \begin{pmatrix} 7 \\ -2 \end{pmatrix}$$



=



Year 11 Higher (Set 2) Mathematics Knowledge Organiser

Depreciation

This is where the value of something devalues at the same percentage rate each year.

Example

John buys a car for £17000. It depreciates in value every year by 8%. What will it be worth after 5 years?

Cost - interest
100% - 8% = 92% = 0.92
$17000 \times 0.92^5 = 11204.39$

Answer £11204.39

Compound Interest

Amount of interest changes each year based on what is in the bank at the end of the year.

Example

John invests £3000 in a bank that pays 1.5% compound interest. How much will he have after 4 years?

Investment + interest
100% + 1.5% = 101.5% = 1.015
$3000 \times 1.015^4 = 3184.09$
Answer £3184.09

Simple Interest

Same amount of interest is added on each year.

Example

£200 is invested into a bank account with a rate of 3% simple interest for 2 years.

3% of 200 = £6

Year 1 = £200 + £6 = £206
Year 2 = £206 + £6 = £212

ANSWER: **£212 in bank account at end of the year.**

Reverse percentage

Example

Jane buys a pair of trousers in a sale for £68 after they were reduced by 15%. What was the original cost of the trousers?

Trousers now worth 85% of original price
85% = 68
1% = 68 ÷ 85 = 0.8
100% = 0.8 x 100 = 80
Original cost = £80

Subject of a formula

A formula usually has a single variable on one side of the equals sign. This is called the subject of the formula. Sometimes you will want to rearrange the formula so that one of the other variables becomes the subject. To do this you use inverse operations (in a similar way to solving equations) in order to isolate the new subject.

Examples

Make r the subject of $C = 2\pi r$.

To isolate r, divide by 2π.

$$\frac{C}{2\pi} = r$$

We often write formulae with the subject on the left-hand side, so this becomes

$$r = \frac{C}{2\pi}$$

Make x the subject of $y = \frac{x}{5} + 3$.

To isolate x, start by subtracting 3.

$$y - 3 = \frac{x}{5}$$

Next, multiply by 5 – remember to multiply each term of the left-hand side.

$$5(y - 3) = x$$

$$x = 5(y - 3)$$

Year 11 Higher (Set 2) Mathematics Knowledge Organiser

Subject of a formula

More difficult questions – think about inverse operations to help you!

Examples

Make r the subject of $V = \frac{1}{3}\pi r^2 h$.

To start, isolate r^2 by multiplying by 3 and then dividing by πh.

$$3V = \pi r^2 h$$

$$\frac{3V}{\pi h} = r^2$$

Now we square root both sides.

$$\sqrt{\frac{3V}{\pi h}} = r$$

$$r = \sqrt{\frac{3V}{\pi h}}$$

Make x the subject of $3x + 5 = y - ax$.

When a formula contains the new subject more than once, start by isolating any terms including it on one side of the equals sign.

Here, add ax and subtract 5.

$$3x + ax = y - 5$$

Now we factorise the side with our new subject.

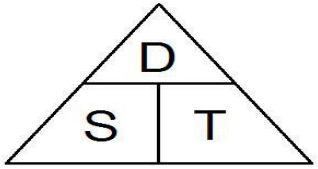
$$x(3 + a) = y - 5$$

Then divide by the bracket to leave x on its own.

$$x = \frac{y - 5}{3 + a}$$

Speed, Distance, Time

Speed = Distance ÷ Time
Distance = Speed x Time
Time = Distance ÷ Speed

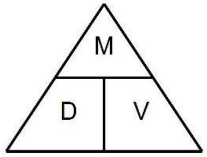


Example
Speed = 4mph
Time = 2 hours
Find the Distance.

$D = S \times T = 4 \times 2 = 8\ miles$

Density, Mass, Volume

Density = Mass ÷ Volume
Mass = Density x Volume
Volume = Mass ÷ Density



Example
Density = 8kg/m³
Mass = 2000g

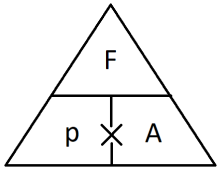
Find the Volume.

$V = M \div D = 2 \div 8$
$= 0.25m^3$

Year 11 Higher (Set 2) Mathematics Knowledge Organiser

Pressure, Force, Area

Pressure = Force ÷ Area
Force = Pressure x Area
Area = Force ÷ Pressure



Remember the correct units.

Example
Pressure = 10 Pascals
Area = 6cm²

Find the Force
$F = P \times A = 10 \times 6$
$= 60\ N$

Sampling

Population: the whole group that is being studied.

Sample: a selection taken from the population that will let you find out information about the larger group.

Representative: a sample group that accurately represents the population.

Random sample: a group completely chosen by change. No predictability to who it will include.

Bias: a built-in error that makes all values wrong by a certain amount.

Primary data: data collected from an original source for a purpose.

Secondary data: data taken from an external location. Not collected directly.

Outlier: a value that stands apart from the data set

Stratified Sampling

Stratified sampling is used to select a sample that is representative of different groups. The aim is to find a proportional sample based on the group size.

$$\frac{\text{number in category}}{\text{total}} \times \text{sample size}$$

Year 7	Year 8	Year 9
120	80	100

Miss Holland wants to take a stratified sample of 15 students.
How many Year 7's should she survey?

$\frac{120}{300} \times 15 = 6$

Miss Holland should survey 6 students from year 7

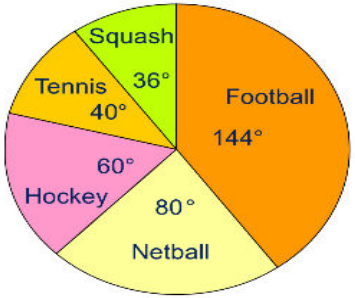
Pie Chart

Used for showing **how data breaks down into** its constituent **parts**.

Remember to **label** the category that each sector in the pie chart represents.

Example

If there are 40 people in a survey, then each person will be worth 360÷40=9° of the pie chart.



Year 11 Higher (Set 2) Mathematics Knowledge Organiser

Find the angle in a Pie Chart

When drawing a pie chart, **divide 360° by the total frequency**. This will tell you how many degrees to use for the frequency of each category.

$$\text{Angle} = \frac{Frequency}{Total\ Frequency} \times 360$$

Example

In a survey of 30 people, each person would be represented by $\frac{1}{30}$ of the full circle.

$$360 \div 30 = 12°$$

Each person would get 12°

In a survey of 30 people, 12 said their favourite colour is red.

$$\frac{12}{30} \times 360 = 144°$$

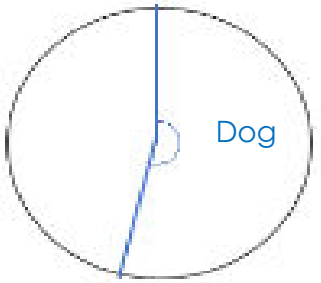
Draw and interpret Pie Charts

Example

Type of pet	Dog	Cat	Hamster
Frequency	32	25	3

There were 60 people asked in this survey (Total frequency)

"32 out of 60 people had a dog" (32/60)
This fraction of the 360 degrees represents dogs is
32/60 X 360 = 192°
Use a protractor to draw
This is 192°



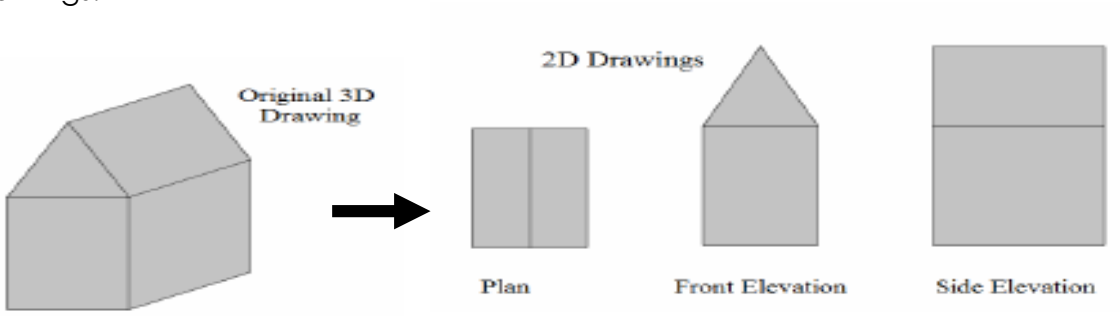
Multiple method
As 60 goes into 360 – 6 times.
Each frequency can be multiplied by 6 to find the degrees (proportion ot 360)

Comparing Pie Charts:
You NEED the overall frequency to make any comparisons

Plans and Elevations

This takes 3D drawings and produces 2D drawings.
Plan View: from **above**
Side Elevation: from the **side**
Front Elevation: from the **front**
Example

See to the right for the example.

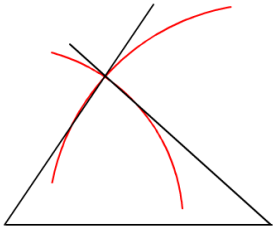


Year 11 Higher (Set 2) Mathematics Knowledge Organiser

Constructing Triangles (Side, Side, Side)

Angle Bisector: Cuts the angle in half.

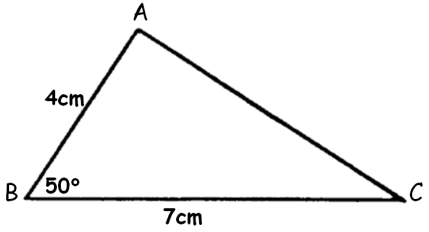
1. Draw the base of the triangle using a ruler.
2. Open a pair of compasses to the width of one side of the triangle.
3. Place the point on one end of the line and draw an arc.
4. Repeat for the other side of the triangle at the other end of the line.
5. Using a ruler, draw lines connecting the ends of the base of the triangle to the point where the arcs intersect.



Constructing Triangles (Side, Angle, Side)

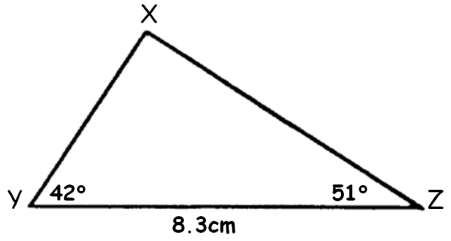
Perpendicular Bisector: Cuts a line in half and at right angles.

1. Draw the base of the triangle using a ruler.
2. Measure the angle required using a protractor and mark this angle.
3. Remove the protractor and draw a line of the exact length required in line with the angle mark drawn.
4. Connect the end of this line to the other end of the base of the triangle.



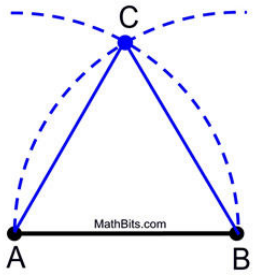
Constructing Triangles (Angle, Side, Angle)

1. Draw the base of the triangle using a ruler.
2. Measure one of the angles required using a protractor and mark this angle.
3. Draw a straight line through this point from the same point on the base of the triangle.
4. Repeat this for the other angle on the other end of the base of the triangle.



Constructing an Equilateral Triangle (also makes a 60° angle)

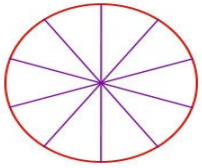
1. Draw the base of the triangle using a ruler.
2. Open the pair of compasses to the exact length of the side of the triangle.
3. Place the sharp point on one end of the line and draw an arc.
4. Repeat this from the other end of the line.
5. Using a ruler, draw lines connecting the ends of the base of the triangle to the point where the arcs intersect.



Equidistant

A point is equidistant from a set of objects if the **distances between that point and each of the objects is the same.**

Example

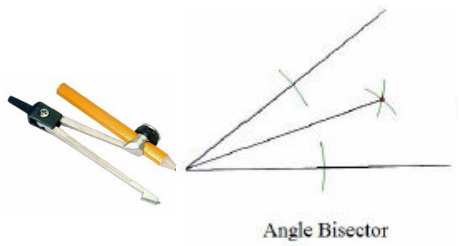


Year 11 Higher (Set 2) Mathematics Knowledge Organiser

Angle Bisector

Angle Bisector: Cuts the angle in half.

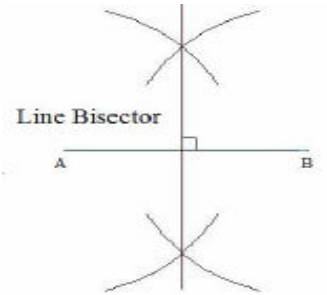
1. Place the sharp end of a pair of compasses on the vertex.
2. Draw an arc, marking a point on each line.
3. Without changing the compass put the compass on each point and mark a centre point where two arcs cross over.
4. Use a ruler to draw a line through the vertex and centre point.



Perpendicular Bisector

Perpendicular Bisector: Cuts a line in half and at right angles.

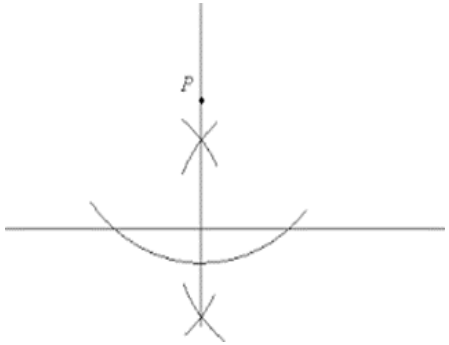
1. Put the sharp point of a pair of compasses on A.
2. Open the compass over half way on the line.
3. Draw an arc above and below the line.
4. Without changing the compass, repeat from point B.
5. Draw a straight line through the two intersecting arcs



Perpendicular from an External Point

The **perpendicular distance** from a point to a line is the **shortest distance** to that line.

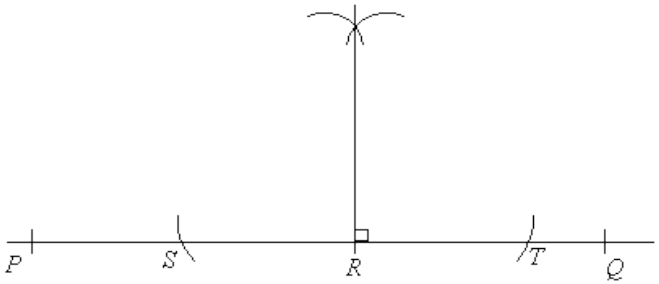
1. Put the sharp point of a pair of compasses on the point.
2. Draw an arc that crosses the line twice.
3. Place the sharp point of the compass on one of these points, open over half way and draw an arc above and below the line.
4. Repeat from the other point on the line.
5. Draw a straight line through the two intersecting arcs.



Perpendicular from a Point on a Line

Given line PQ and point R on the line:

1. Put the sharp point of a pair of compasses on point R.
2. Draw two arcs either side of the point of equal width (giving points S and T)
3. Place the compass on point S, open over halfway and draw an arc above the line.
4. Repeat from the other arc on the line (point T).
5. Draw a straight line from the intersecting arcs to the original point on the line.

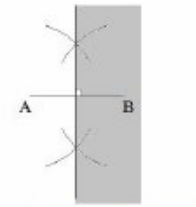


Year 11 Higher (Set 2) Mathematics Knowledge Organiser

Loci and Regions

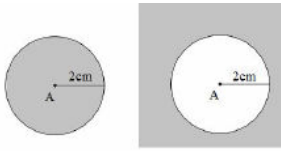
A **locus** is a **path of points that follow a rule**.

For the locus of points **closer to B than A**, create a **perpendicular bisector** between A and B and shade the side closer to B.



Points Closer to B than A

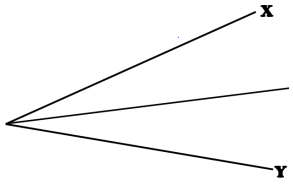
For the locus of points **equidistant from A**, use a compass to draw a **circle**, centre A.



Points less than 2cm from A

Points more than 2cm from A

For the locus of points **equidistant to line X and line Y**, create an **angle bisector**.



For the locus of points a set **distance from a line**, create **two semi-circles** at either end joined by **two parallel lines**.

Congruence

Shapes are congruent if they are identical - same shape and same size.
Shapes can be rotated or reflected but still be congruent.

Similar

Shapes are similar if they are the same shape but different sizes.
The proportion of the matching sides must be the same, meaning the ratios of corresponding sides are all equal

Proving similarity

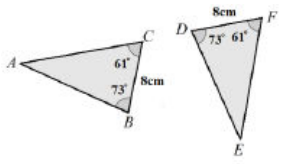
To show that two triangles are similar, show that:
1. The three sides are in the same proportion
2. Two sides are in the same proportion, and their included angle is the same
3. The three angles are equal

Proving Congruence

4 ways of proving that two triangles are congruent:

1. SSS (Side, Side, Side)
2. RHS (Right angle, Hypotenuse, Side)
3. SAS (Side, Angle, Side)
4. ASA (Angle, Side, Angle) or AAS

See the example on the right.



$BC = DF$

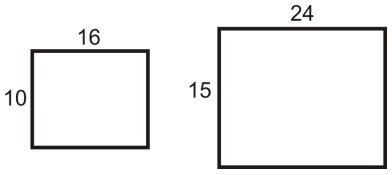
$\angle ABC = \angle EDF$

$\angle ACB = \angle EFD$

$\therefore$ The two triangles are congruent by AAS.

Finding a scale factor

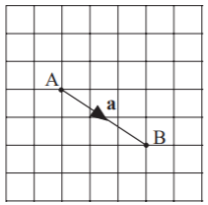
To find a scale factor, divide a length on one shape by the corresponding length on a similar shape.



Scale Factor = 15÷10=1.5

Year 11 Higher (Set 2) Mathematics Knowledge Organiser

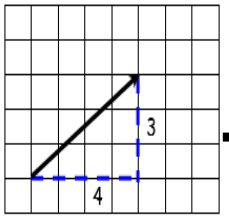
Vectors describe a movement.
A vector has a direction and a distance.



This diagram shows the vector:

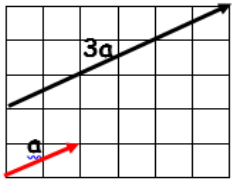
$$\vec{AB} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$$

Magnitude
Magnitude is defined as the **length** of a vector.
Example



Magnitude (length) can be calculated using Pythagoras Theorem:
$3^2 + 4^2 = 25$
$\sqrt{25} = 5$

Scalar of a Vector
A **scalar** is the **number** we **multiply** a vector by.

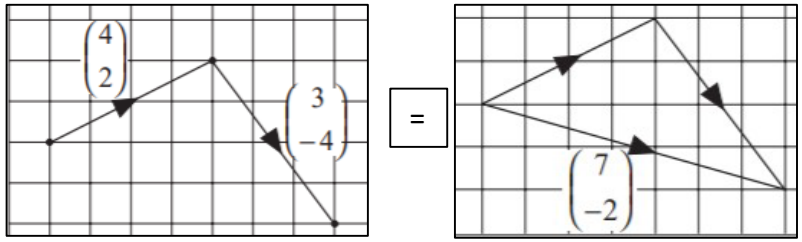


Example

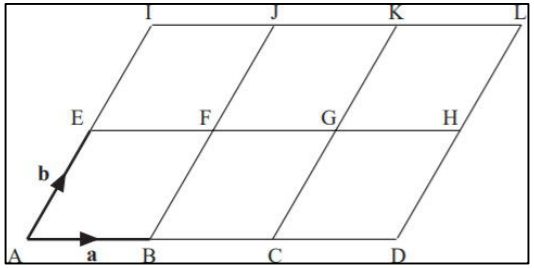
$3a + 2b =$
$= 3\begin{pmatrix} 2 \\ 1 \end{pmatrix} + 2\begin{pmatrix} 4 \\ -1 \end{pmatrix}$
$= \begin{pmatrix} 6 \\ 3 \end{pmatrix} + \begin{pmatrix} 8 \\ -2 \end{pmatrix}$
$= \begin{pmatrix} 14 \\ 1 \end{pmatrix}$

You can add vectors to get a resultant vector as seen below:

$$\begin{pmatrix} 4 \\ 2 \end{pmatrix} + \begin{pmatrix} 3 \\ -4 \end{pmatrix} = \begin{pmatrix} 7 \\ -2 \end{pmatrix}$$



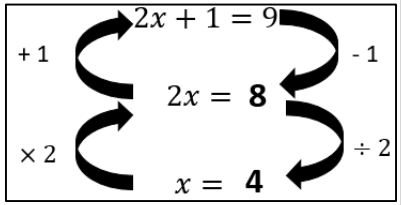
Vectors can be used to describe movements in Geometry as seen below:



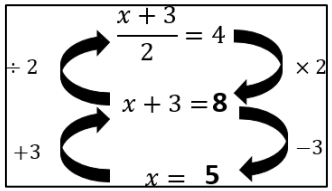
For the diagram on the left:

$\vec{AC} = 2\mathbf{a}$
$\vec{AF} = \mathbf{a} + \mathbf{b}$
$\vec{AL} = 3\mathbf{a} + 2\mathbf{b}$
$\vec{LE} = -3\mathbf{a} - \mathbf{b}$

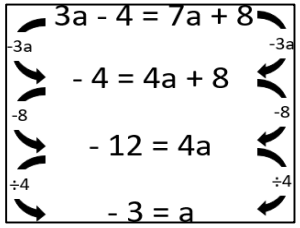
Solving Two Step Equations Finding the value of an unknown, by identifying operations performed and doing the inverse operation:



Solving Equations involving fractions
Finding the value of an unknown. To eliminate a denominator, multiply every term by the denominator:



Solving Equations with unknowns on both sides
Add/subtract the smallest algebraic term from both sides:



Year 11 Higher (Set 2) Mathematics Knowledge Organiser

Forming Equations / Formulae

Substitute letters for words in the question.

Example

Bob charges £3 per window and a £5 call out charge.

$$C = 3N + 5$$

N=number of windows and C=cost

Simultaneous Equations

Finding solutions that work in two (or more) equations at the same time, like the ones below…

$$x + 2y = 8$$
$$2x + y = 7,$$

is called solving simultaneous equations.

Simultaneous Equations (substitution)

The idea here is to rearrange one of the equations into the for y=. Then substitute this equation into the other equation.

$$y - 2x = 3$$
$$3x + 4y = 1$$

Rearrange: $y - 2x = 3 \rightarrow y = 2x + 3$

Substitute: $3x + 4(2x + 3) = 1$

Solve: $3x + 8x + 12 = 1$

$$11x = -11$$
$$x = -1$$

Substitute: $y = 2 \times -1 + 3$

$$y = 1$$

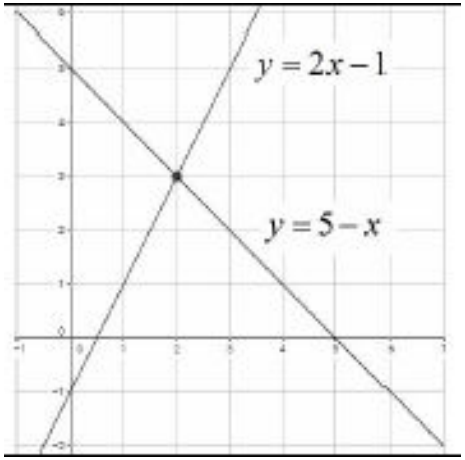
Solution: $x = -1, y = 1$

Solving Simultaneous Equations (Graphically)

Draw the graphs of the two equations.
The **solutions** will be **where the lines meet**.
The solution can be written as a **coordinate**.

Example

$y = 5 - x$ and $y = 2x - 1$.



They meet at the point with coordinates (2,3) so the answer is $x = 2$ and $y = 3$

Simultaneous Equations

First label the equations

$$x + 2y = 8 \quad (1)$$
$$2x + y = 7 \quad (2)$$

Then multiply to match the coefficients (the number before the letter)

$$2x + 4y = 16 \quad (3) \quad [2 \times (1)]$$
$$2x + y = 7 \quad (2)$$

Next add (or subtract) to remove an unknown

$$2x + 4y = 16 \quad (3)$$
$$2x + y = 7 \quad (2)$$
$$3y = 9 \quad (3) - (2)$$

Here, we can see that y=3.

Finally, substitute into a previous equation to calculate the other unknown. Here we used equation:

$$x + 2 \times 3 = 8$$
$$x + 6 = 8$$

We can see here that x=2

So x = 2 and y = 3.

Year 11 Higher (Set 2) Mathematics Knowledge Organiser

Proportion

Proportion compares the size of one part to the size of the whole.
Usually written as a fraction.

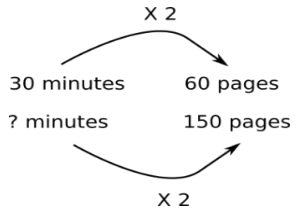
Example

In a class with 13 boys and 9 girls, the proportion of boys is $\frac{13}{22}$ and the proportion of girls is $\frac{9}{22}$

Proportional Reasoning

Comparing two things using multiplicative reasoning and applying this to a new situation.
Identify one multiplicative link and use this to find missing quantities.

Example



Best Buys

Find the unit cost by dividing the price by the quantity.
The lowest number is the best value.

Example

8 cakes for £1.28 → 16p each (÷by 8)
13 cakes for £2.05 → 15.8p each (÷by 13)
Pack of 13 cakes is best value.

Unitary Method

Finding the value of a single unit and then finding the necessary value by multiplying the single unit value.

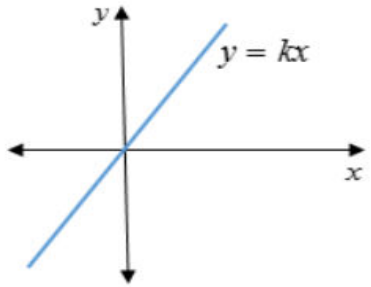
Example

3 cakes require 450g of sugar to make.
Find how much sugar is needed to make 5 cakes.
3 cakes = 450g
So 1 cake = 150g (÷ by 3)
So 5 cakes = 750 g (x by 5)

Direct Proportion

If two quantities are in direct proportion, as one increases, the other increases by the same percentage. k is the ratio between x and y

Example



Y is directly proportional to x
When x = 500 y = 10
Calculate the value of y when x = 150
Y = k x
10 = 500k therefore k = 1 / 5 0
Y= 1 / 5 0 x
y =1 / 5 0 x 150 y = 3

Indirect proportion

If two quantities are in indirect proportion, as one increases, the other decreases by the same percentage.
$1/k$ is the ratio between x and y

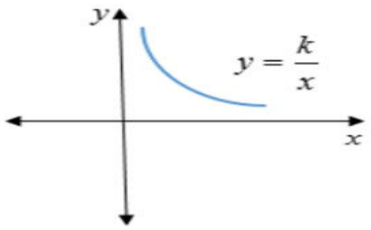
Example

P is inversely proportional to V
When P = 6 V = 8
Calculate the value of P when V = 2
P =k/v 6 = k/8
therefore k = 48
P = 48/2 P=24

Inverse proportion

If two quantities are inversely proportional, as one increases, the other decreases by the same percentage.
If y is inversely proportional to x, this can be written as $y \propto \frac{1}{x}$
An equation of the form $y = \frac{k}{x}$ represents inverse proportion.

Example



Year 11 Higher (Set 2) Mathematics Knowledge Organiser

Recurring Decimal

A decimal with one or a group of digits that repeat itself indefinitely.

E.g. $0.\dot{2}\dot{3}$= 0.23232323…

Convert $0.\dot{8}\dot{4}$ to a fraction.

Multiply the decimal so that the repeated decimal digits are on the left side of the decimal point.

$$x = 0.84848484$$
$$100x = 84.848484$$

Subtract x from 100x.

$$99x = 84$$

Isolate x, then simplify:

$$x = \frac{84}{99} = \frac{28}{33}$$

Fractional Indices

The denominator of a fractional power acts as a 'root'. The numerator of a fractional power acts as a normal power.

$$a^{\frac{m}{n}} = (\sqrt[n]{a})^m$$

Example

$$27^{\frac{2}{3}} = \left(\sqrt[3]{27}\right)^2 = 3^2 = 9$$

$$\left(\frac{25}{16}\right)^{\frac{3}{2}} = \left(\frac{\sqrt{25}}{\sqrt{16}}\right)^3 = \left(\frac{5}{4}\right)^3 = \frac{125}{64}$$

Negative Indices

$$a^{-n} = \frac{1}{a^n}$$

Example $3^{-2} = \frac{1}{3^2}$

$= \frac{1}{9}$

Expand (Linear)

To expand a bracket, **multiply** each term **in the bracket** by the expression **outside** the bracket.

Example

$$3(m + 7) = 3x + 21$$

Factorise (Linear)

The **reverse** of **expanding**.

Factorising is writing an expression as a product of terms by '**taking out' a common factor**.

Example

$$6x - 15 = 3(2x - 5),$$

where 3 is the common factor.

Expand (Quadratic)

Each term in one bracket needs to be multiplied by each term in the other bracket.

Example (grid method)

$(x + 2)(x + 5)$

	x	+5
x	x^2	$+5x$
+2	$+2x$	$+10$

Factorise (Quadratic)

What numbers multiply to make the last number in the expression? Which of these factors add /subtract to make the number in the middle?

Example

$$x^2 - 2x - 3$$
$$(x - 3)(x + 1)$$

Upper and Lower Bounds

The upper and lower bound come from the largest and smallest values that would round to a particular number. Take 'half a unit above and half a unit below'. For example rounded to 1 d.p means nearest 0.1, so add 0.05 and subtract 0.05 to get the bounds.

All error intervals look the same like this - ≤ x <

Example - State the upper and lower bound of 360 when it has been rounded to 2 significant figures:

2 significant figures is the nearest 10, so 'half this' to get 5, and add on to 360 and take it off 360,

355 ≤ x < 365

Year 11 Higher (Set 2) Mathematics Knowledge Organiser

Solving Quadratics By Factorising

Make the equation equal to 0 and factorise. The solutions of the unknowns is the value to make each bracket equal to 0:

$x^2 - 3x = 18$

+18 $\quad x^2 - 3x - 18 = 0$ $\quad$ +18

Factorise

$$(x+3)(x-6) = 0$$

$x + 3 = 0 \qquad x - 6 = 0$

$x = -3 \quad$ or $\quad x = 6$

The Quadratic Formula

This is a proven formula to solve quadratics. The $\pm$ part is how you get more than one solution.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

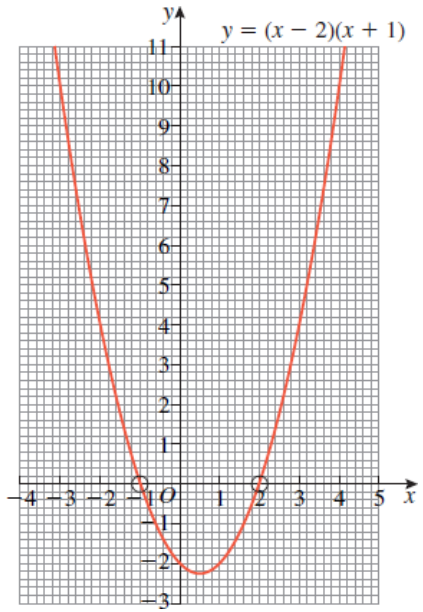
The quadratic expression must be equal to zero first. This formula needs to be memorised!

Solving Quadratics graphically

Quadratics can also be solved graphically.

Draw the graph of the quadratic – by substituting in values from the graph.

x	−3	−2	−1	0	1	2	3	4
y	10	4	0	−2	-2	0	4	10



The Solutions or Roots are where y=0, at the points (-1,0) and (2,0)

Using the Quadratic Formula

Quadratics are usually in the form:

$$ax^2 + bx + c = 0$$

This is how we pick out the values that will be substituted into the formula:

$$x^2 + 4x + 2 = 0$$

$$a = 1 \quad b = 4 \quad c = 2$$

Now that you have the a. b and c values these can now be substituted into the formula – then gradually start to simplify the formula:

$$x = \frac{-4 \pm \sqrt{4^2 - 4 \times 1 \times 2}}{2 \times 1}$$

$$\Rightarrow x = \frac{-4 \pm \sqrt{8}}{2}$$

$$\Rightarrow x = -0.585\ldots$$

$$= -0.59\,(1\text{dp})$$

$$\text{or } x = -3.414\ldots$$

$$= -3.41\,(1\text{dp})$$

NOTE:

Another way you can solve quadratics is to 'complete the square' and 'iteration'. You will come across these later in the year.

Year 11 Higher (Set 2) Mathematics Knowledge Organiser

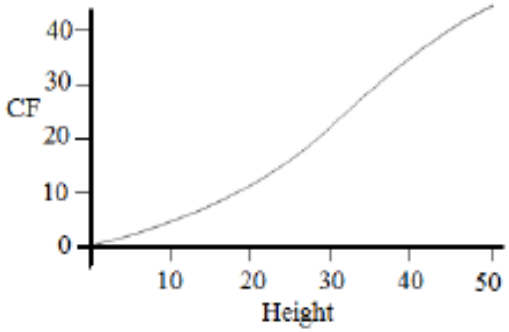
Cumulative frequency

Cumulative Frequency is a running total.

Age	Frequency	Cumulative Frequency
$0 < a \leq 10$	15	15
$10 < a \leq 40$	35	$15 + 35 = 50$
$40 < a \leq 50$	10	$50 + 10 = 60$

A cumulative frequency diagram is a curve that goes up. It looks a little like a stretched-out S shape.

Plot the cumulative frequencies at the <u>end-point of each interval.</u>



You can find the Lower Quartile, Median, and Upper quartile by drawing lines ¼ of the way, ½ of the way and ¾ of the way across the cumulative frequency axis. Then see where this line hits the curve and then read down onto the x axis.

Boxplot

The minimum, lower quartile, median, upper quartile and maximum are shown on a box plot.

Example

Students sit a maths test. The highest score is 19, the lowest score is 8, the median is 14, the lower quartile is 10 and the upper quartile is 17. Draw a box plot to represent this information.

Boxplot Keywords

Lower Quartile - represents the first ¼ of the data (halfway between minimum value and median).

Median – the middle value

Upper Quartile – represents ¾ of data (halfway between median and maximum value)

Interquartile Range (IQR) – Difference between upper quartile and lower quartile.

Comparing Boxplots

Write two sentences.

1. Compare the averages using the medians for two sets of data.

2. Compare the spread of the data using the range or IQR for two sets of data.

The smaller the range/IQR, the more consistent the data.

<u>You must compare box plots in the context of the problem.</u>

Example:

'On average, students in class A were more successful on the test than class B because their median score was higher.'

'Students in class B were more consistent than class A in their test scores as their IQR was smaller.'

Year 11 Higher (Set 2) Mathematics Knowledge Organiser

Histograms

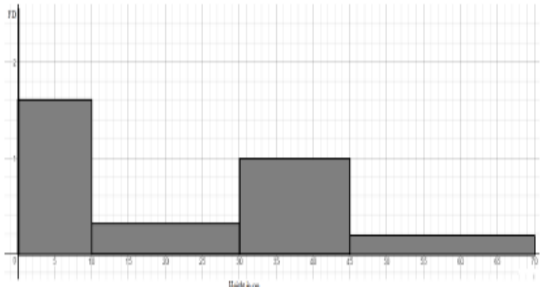
A visual way to display frequency data using bars. Bars can be unequal in width.

Histograms show *frequency density* on the y-axis, not frequency.

$$\textbf{Frequency Density} = \frac{\textbf{Frequency}}{\textbf{Class Width}}$$

Height(cm)	Frequency
$0 < h \leq 10$	8
$10 < h \leq 30$	6
$30 < h \leq 45$	15
$45 < h \leq 70$	5

Frequency Density (FD)
$8 \div 5 = 1.6$
$6 \div 20 = 0.3$
$15 \div 15 = 1$
$5 \div 25 = 0.2$

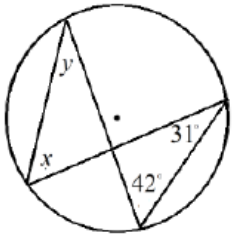


The area of the bar is proportional to the frequency of that class interval.

$$\textbf{Frequency} = \textbf{Freq Density} \times \textbf{Class Width}$$

Circle Theorem: Angles in the same segment are equal.

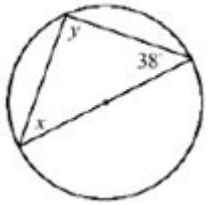
Example:



$x = 42°$
$y = 31°$

Circle Theorem: Angle in a semi-circle has a right angle at the circumference

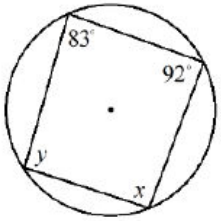
Example:



$y = 90°$
$x = 180 - 90 - 38$
$= 52°$

Circle Theorem: Opposite angles in a cyclic quadrilateral add up to 180°

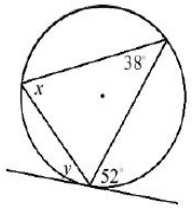
Example:



$x = 180 - 83 = 97°$
$y = 180 - 92 = 88$

Circle Theorem: Alternate segment theorem

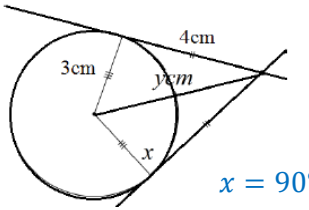
Example:



$x = 52°$
$y = 38°$

Circle Theorem: A tangent meets a radius at 90°

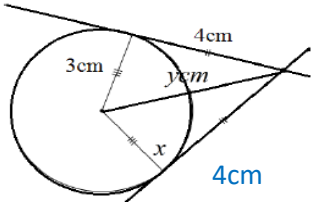
Example:



$x = 90°$

Circle Theorem: Tangents from an external point are equal in length.

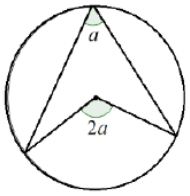
Example:



4cm

Circle Theorem: Angle at centre is twice the angle at circumference.

Example:



$x = 104 \div 2 = 52°$

Year 11 Foundation Mathematics Knowledge Organiser (Term 1 - Unit 1&2 Percentages)

Percentage (MW – 40)
Number of parts per 100.
Example
31% means $\frac{31}{100}$

Finding 10%
To find **10%**, **divide by 10**
Example
10% of £36 = 36÷10=£3.60

Finding 1%
To find **1%**, **divide by 100**
Example
1% of £8 = 8÷100 = £0.08

Percentage Change (MW – 109)
$$\frac{Difference}{Original} \times 100\%$$
Example
A games console is bought for £200 and sold for £250.

% change = $\frac{50}{200} \times 100 = 25\%$

Percentages to Fractions (MW – 85)
Percentage is just a fraction out of 100.
Write the percentage over 100 and simplify.
Example
$$14\% = \frac{14}{100} = \frac{7}{50}$$

Fractions to Percentages (MW – 85)
Percentage is just a fraction out of 100. **Make the denominator 100 using equivalent fractions.** When the denominator doesn't go in to 100, use a calculator and **multiply the fraction by 100.**
Example
$$\frac{9}{17} \times 100 = 52.9\%$$

Fractions to Decimals (MW – 85)
Divide the numerator by the denominator using the bus stop method.
Example
$$\frac{3}{8} = 3 \div 8 = 0.375$$

Decimals to Fractions (MW – 85)
Write as a fraction over 10, 100 or 1000 and simplify.
Example
$$0.36 = \frac{36}{100} = \frac{9}{25}$$

Percentages to Decimals
Divide by 100
Example
$$8\% = 8 \div 100 = 0.08$$

Decimals to Percentages
Multiply by 100
Example
$$0.4 = 0.4 \times 100\% = 40\%$$

Repeated percentage change/decrease (MW – 164)
Example
John buys a car for £17000. It depreciates in value every year by 8%. What will it be worth after 5 years?

Cost - interest
100% - 8% = 92% = 0.92
17000 x 0.92^5 = 11204.39 Answer £11204.39

Repeated percentage change/increase (MW – 164)
Example
John invests £3000 in a bank that pays 1.5% compound interest. How much will he have after 4 years?

Investment + interest
100% + 1.5% = 101.5% = 1.015
3000 x 1.015^4 = 3184.09
Answer £3184.09

Reverse percentage (MW – 110)
Example
Jane buys a pair of trousers in a sale for £68 after they were reduced by 15%. What was the original cost of the trousers?

Trousers now worth 85% of original price
85% = 68
1% = 68 ÷ 85 = 0.8
100% = 0.8 x 100 = 80
Original cost = £80

Percentage Increase/decrease _Non calculator method
Example
Increase/decrease £150 by 11%

10% of £150 = £15.00
1% of £150 = £ 1.50
11% of £150 = £16.50
Increase = £150 + £16.50 Decrease = £150 - £16.50

Year 11 Foundation Mathematics Knowledge Organiser (Term 1 - Unit 3 Subject of a formula)

Subject of a formula (MW – 136 / 190)

A formula usually has a single variable on one side of the equals sign. This is called the subject of the formula. Sometimes you will want to rearrange the formula so that one of the other variables becomes the subject. To do this you use inverse operations (in a similar way to solving equations) in order to isolate the new subject.

Examples

Make r the subject of $C = 2\pi r$.

To isolate r, divide by 2π.

$$\frac{C}{2\pi} = r$$

We often write formulae with the subject on the left-hand side, so this becomes

$$r = \frac{C}{2\pi}$$

Make x the subject of $y = \frac{x}{5} + 3$.

To isolate x, start by subtracting 3.

$$y - 3 = \frac{x}{5}$$

Next, multiply by 5 – remember to multiply each term of the left-hand side.

$$5(y - 3) = x$$

$$x = 5(y - 3)$$

Make r the subject of $V = \frac{1}{3}\pi r^2 h$.

To start, isolate r^2 by multiplying by 3 and then dividing by πh.

$$3V = \pi r^2 h$$

$$\frac{3V}{\pi h} = r^2$$

Now we square root both sides.

$$\sqrt{\frac{3V}{\pi h}} = r$$

$$r = \sqrt{\frac{3V}{\pi h}}$$

Make x the subject of $3x + 5 = y - ax$.

When a formula contains the new subject more than once, start by isolating any terms including it on one side of the equals sign.

Here, add ax and subtract 5.

$$3x + ax = y - 5$$

Now we factorise the side with our new subject.

$$x(3 + a) = y - 5$$

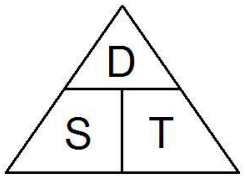
Then divide by the bracket to leave x on its own.

$$x = \frac{y - 5}{3 + a}$$

Year 11 Foundation Mathematics Knowledge Organiser
(Term 1 - Unit 4 Speed, Distance, time & Unit 5 Compound Measures & Unit 6 Sampling)

Speed, Distance, Time (MW – 142)

Speed = Distance ÷ Time
Distance = Speed x Time
Time = Distance ÷ Speed



Remember the correct units.

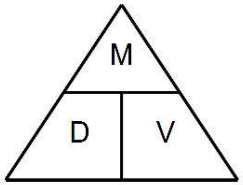
Example

Speed = 4mph
Time = 2 hours
Find the Distance.

$D = S \times T = 4 \times 2$
$= 8\ miles$

Density, Mass, Volume (MW – 142)

Density = Mass ÷ Volume
Mass = Density x Volume
Volume = Mass ÷ Density



Remember the correct units.

Example

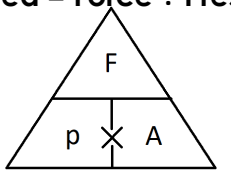
Density = 8kg/m³
Mass = 2000g

Find the Volume.

$V = M \div D = 2 \div 8$
$= 0.25m^3$

Pressure, Force, Area (MW – 142)

Pressure = Force ÷ Area
Force = Pressure x Area
Area = Force ÷ Pressure



Remember the correct units.

Example

Pressure = 10 Pascals
Area = 6cm²

Find the Force

$F = P \times A = 10 \times 6$
$= 60\ N$

Sampling (MW – 152 / 176)

Population: the whole group that is being studied.

Sample: a selection taken from the population that will let you find out information about the larger group.

Representative: a sample group that accurately represents the population.

Random sample: a group completely chosen by change. No predictability to who it will include.

Bias: a built-in error that makes all values wrong by a certain amount.

Primary data: data collected from an original source for a purpose.

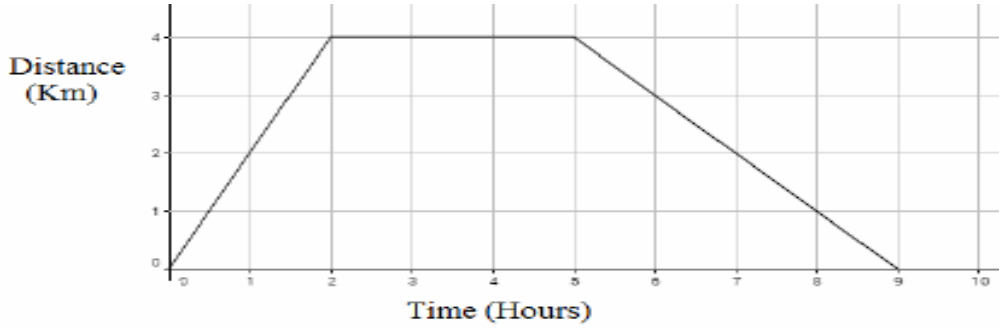
Secondary data: data taken from an external location. Not collected directly.

Outlier: a value that stands apart from the data set

Distance-Time Graphs (MW – 216a)

You can find the **speed** from the **gradient** of the line (Distance ÷ Time)
The steeper the line, the quicker the speed.
A **horizontal** line means the object is not moving (**stationary**).

Example



Year 11 Foundation Mathematics Knowledge Organiser (Term 1 - Unit 7 - Pie Charts)

Types of Data (MW – 63)

Qualitative Data – **non-numerical** data
Quantitative Data – **numerical** data
Continuous Data – data that can take **any numerical value** within a given range.
Discrete Data – data that can take **only specific values** within a given range.

Example

Qualitative Data – eye colour, gender etc.
Continuous Data – weight, voltage etc.
Discrete Data – number of children, shoe size etc.

Find the angle in a Pie Chart

When drawing a pie chart, **divide 360° by the total frequency**. This will tell you how many degrees to use for the frequency of each category.

$$\text{Angle} = \frac{Frequency}{Total\ Frequency} \times 360$$

Example

In a survey of 30 people, each person would be represented by $\frac{1}{30}$ of the full circle.

$$360 \div 30 = 12°$$

Each person would get 12°

In a survey of 30 people, 12 said their favourite colour is red.

$$\frac{12}{30} \times 360 = 144°$$

Grouped Data

Data that has been **bundled in to categories**.
Seen in grouped frequency tables, histograms, cumulative frequency etc
.

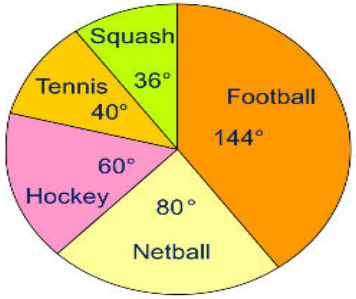
Example

Foot length, l, (cm)	Number of children
$10 \leqslant l < 12$	5
$12 \leqslant l < 17$	53

Pie Chart (MW -128a)

Used for showing **how data breaks down into** its constituent **parts**.
When drawing a pie chart, **divide 360° by the total frequency**. This will tell you how many degrees to use for the frequency of each category.
Remember to **label** the category that each sector in the pie chart represents.

Example



If there are 40 people in a survey, then each person will be worth 360÷40=9° of the pie chart.

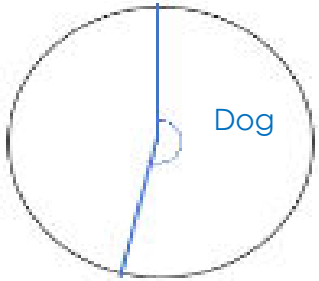
Draw and interpret Pie Charts

Example

Type of pet	Dog	Cat	Hamster
Frequency	32	25	3

There were 60 people asked in this survey (Total frequency)

"32 out of 60 people had a dog" (32/60)
This fraction of the 360 degrees represents dogs is
32/60 X 360 = 192°
Use a protractor to draw
This is 192°



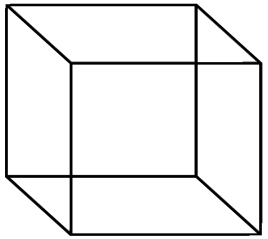
Multiple method
As 60 goes into 360 – 6 times.
Each frequency can be multiplied by 6 to find the degrees (proportion of 360)

Comparing Pie Charts:
You NEED the overall frequency to make any comparisons

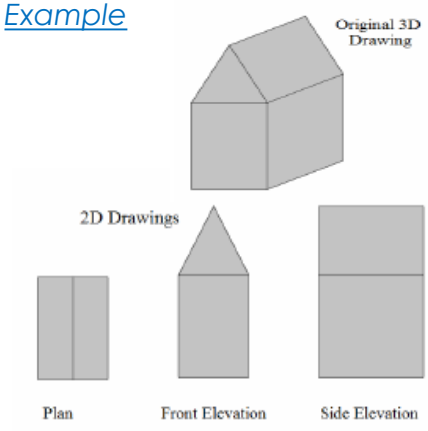
Year 11 Foundation Mathematics Knowledge Organiser
(Term 1 - Unit 9 – Plans & Elevations)

Properties of Solids (MW – 43)
Faces = flat surfaces
Edges = sides/lengths
Vertices = corners

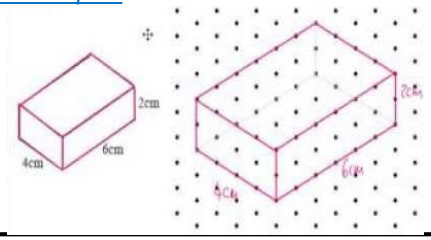
Example
A cube has 6 faces, 12 edges and 8 vertices.



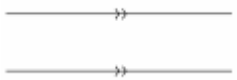
Plans and Elevations (MW – 51)
This takes 3D drawings and produces 2D drawings.
Plan View: from **above**
Side Elevation: from the **side**
Front Elevation: from the **front**
Example



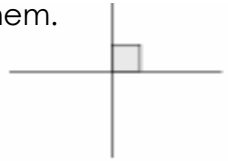
Isometric Drawing
A method for visually **representing 3D objects in 2D**.
Example



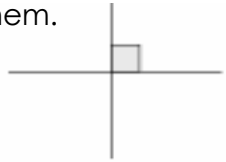
Parallel
Parallel lines never meet.
Example



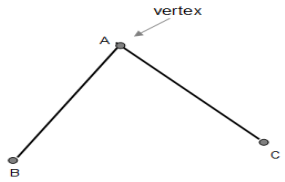
Perpendicular
Perpendicular lines are at right angles. There is a 90° angle between them.
Example



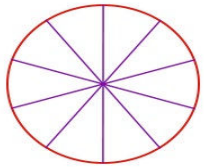
Perpendicular
Perpendicular lines are at right angles. There is a 90° angle between them.
Example



Vertex
A corner or a point where two lines meet.
Example

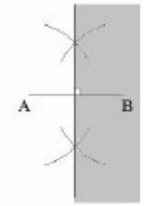


Equidistant
A point is equidistant from a set of objects if the **distances between that point and each of the objects is the same**.
Example

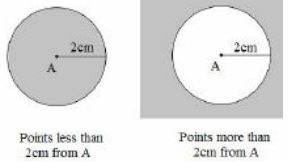


Loci and Regions (MW – 165)
A **locus** is a **path of points that follow a rule**.

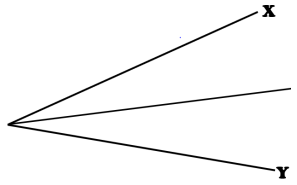
For the locus of points **closer to B than A**, create a **perpendicular bisector** between A and B and shade the side closer to B.



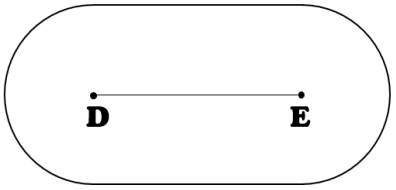
For the locus of points **equidistant from A**, use a compass to draw a **circle**, centre A.



For the locus of points **equidistant to line X and line Y**, create an **angle bisector**.



For the locus of points a set **distance from a line**, create **two semi-circles** at either end joined by **two parallel lines**.

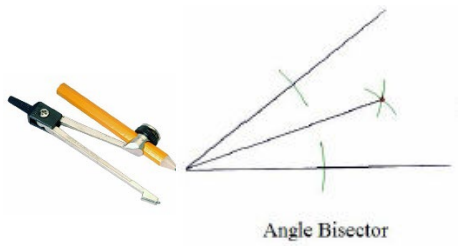


Year 11 Foundation Mathematics Knowledge Organiser (Term 1 - Unit 10 – Construction)

Angle Bisector (MW – 145)

Angle Bisector: Cuts the angle in half.

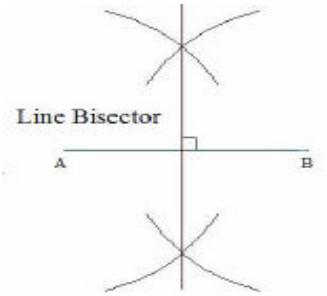
1. Place the sharp end of a pair of compasses on the vertex.
2. Draw an arc, marking a point on each line.
3. Without changing the compass put the compass on each point and mark a centre point where two arcs cross over.
4. Use a ruler to draw a line through the vertex and centre point.



Perpendicular Bisector (MW – 146a)

Perpendicular Bisector: Cuts a line in half and at right angles.

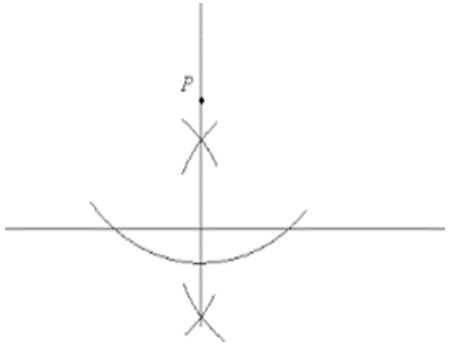
1. Put the sharp point of a pair of compasses on A.
2. Open the compass over half way on the line.
3. Draw an arc above and below the line.
4. Without changing the compass, repeat from point B.
5. Draw a straight line through the two intersecting arcs



Perpendicular from an External Point

The **perpendicular distance** from a point to a line is the **shortest distance** to that line.

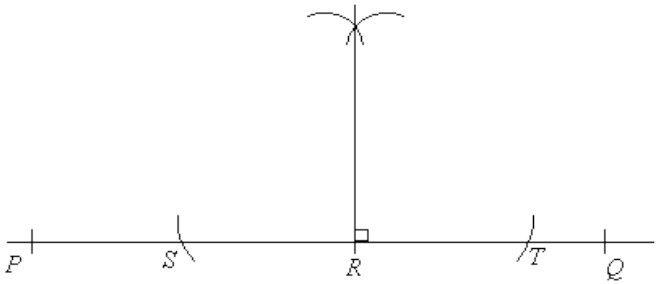
1. Put the sharp point of a pair of compasses on the point.
2. Draw an arc that crosses the line twice.
3. Place the sharp point of the compass on one of these points, open over half way and draw an arc above and below the line.
4. Repeat from the other point on the line.
5. Draw a straight line through the two intersecting arcs.



Perpendicular from a Point on a Line (MW – 146b)

Given line PQ and point R on the line:

1. Put the sharp point of a pair of compasses on point R.
2. Draw two arcs either side of the point of equal width (giving points S and T)
3. Place the compass on point S, open over halfway and draw an arc above the line.
4. Repeat from the other arc on the line (point T).
5. Draw a straight line from the intersecting arcs to the original point on the line.

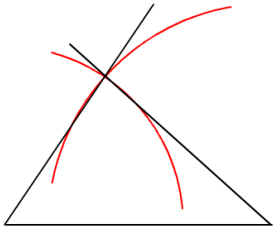


Year 11 Foundation Mathematics Knowledge Organiser (Term 1 - Unit 10 – Construction)

Constructing Triangles (MW – 147) (Side, Side, Side)

Angle Bisector: Cuts the angle in half.

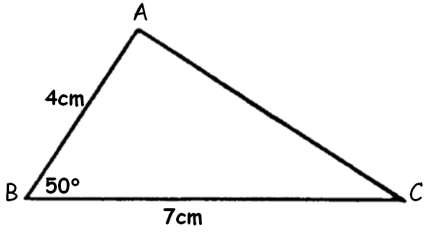
1. Draw the base of the triangle using a ruler.
2. Open a pair of compasses to the width of one side of the triangle.
3. Place the point on one end of the line and draw an arc.
4. Repeat for the other side of the triangle at the other end of the line.
5. Using a ruler, draw lines connecting the ends of the base of the triangle to the point where the arcs intersect.



Constructing Triangles (MW – 47) (Side, Angle, Side)

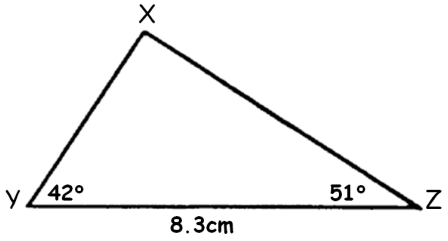
Perpendicular Bisector: Cuts a line in half and at right angles.

1. Draw the base of the triangle using a ruler.
2. Measure the angle required using a protractor and mark this angle.
3. Remove the protractor and draw a line of the exact length required in line with the angle mark drawn.
4. Connect the end of this line to the other end of the base of the triangle.



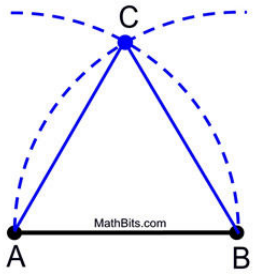
Constructing Triangles (Angle, Side, Angle) (MW – 47)

1. Draw the base of the triangle using a ruler.
2. Measure one of the angles required using a protractor and mark this angle.
3. Draw a straight line through this point from the same point on the base of the triangle.
4. Repeat this for the other angle on the other end of the base of the triangle.



Constructing an Equilateral Triangle (also makes a 60° angle)

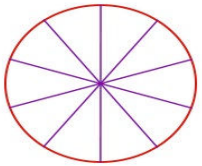
1. Draw the base of the triangle using a ruler.
2. Open the pair of compasses to the exact length of the side of the triangle.
3. Place the sharp point on one end of the line and draw an arc.
4. Repeat this from the other end of the line.
5. Using a ruler, draw lines connecting the ends of the base of the triangle to the point where the arcs intersect.



Equidistant

A point is equidistant from a set of objects if the **distances between that point and each of the objects is the same.**

Example



Year 11 Foundation Mathematics Knowledge Organiser
(Term 1 – Unit 11 – Congruence, Unit 12 – Similar Shapes)

Congruent Shapes (MW – 166)

Shapes are congruent if they are **identical** - **same shape** and **same size**.
Shapes can be rotated or reflected but still be congruent

Example

Similar Shapes

Shapes are similar if they are the **same shape but different sizes**.

The proportion of the matching sides must be the same, meaning the ratios of corresponding sides are all equal.

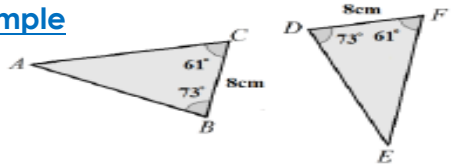
Example

Congruent Triangles (MW – 166)

4 ways of proving that two triangles are congruent:
1. **SSS** (Side, Side, Side)
2. **RHS** (Right angle, Hypotenuse, Side)
3. **SAS** (Side, Angle, Side)
4. **ASA** (Angle, Side, Angle) or **AAS**

ASS does not prove congruency.

Example

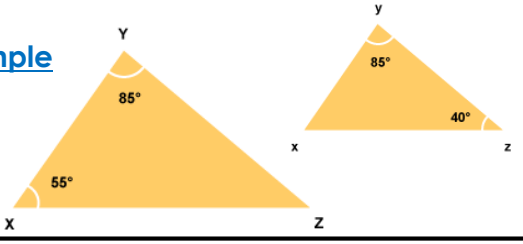


$BC = DF$
$\angle ABC = \angle EDF$
$\angle ACB = \angle EFD$
$\therefore$ The two triangles are congruent by AAS.

Similar Triangles

To show that two triangles are similar, show that:
1. The three sides are in the same proportion
2. Two sides are in the same proportion, and their included angle is the same
3. The three angles are equal

Example

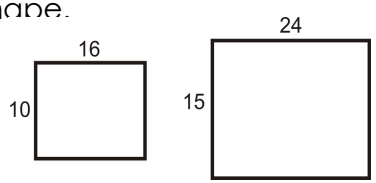


Scale Factor (MW – 148)

The **ratio of corresponding sides** of two similar shapes.

To find a scale factor, **divide a length** on one shape **by the corresponding length** on a similar shape.

Example



Scale Factor = $15 \div 10 = 1.5$

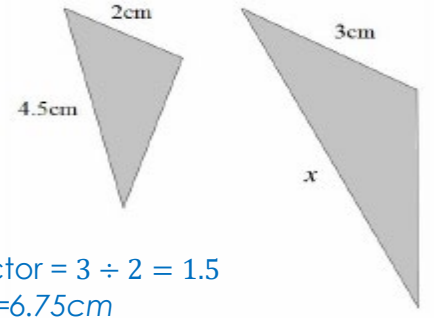
Finding missing lengths in similar shapes

1. Find the **scale factor**.
2. **Multiply or divide** the corresponding side to find a missing length.

If you are finding a missing length on the larger shape you will need to multiply by the scale factor.

If you are finding a missing length on the smaller shape you will need to divide by the scale factor.

Example



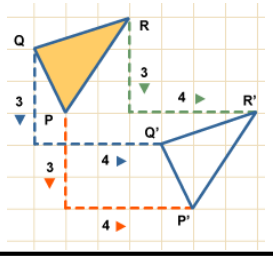
Scale Factor = $3 \div 2 = 1.5$
$x = 4.5 \times 1.5 = 6.75cm$

Year 11 Foundation Mathematics Knowledge Organiser
(Term 1 – Unit 13 – Vectors)

Translation (MW – 50)

Translate means to **move a shape**. The shape does not change **size** or **orientation**.

Example



Vector Notation

A vector can be written in 3 ways:

a or $\overrightarrow{AB}$ or $\begin{pmatrix}1\\3\end{pmatrix}$

Column Vector

In a column vector, the **top** number moves **left (-) or right (+)** and the **bottom** number moves **up (+) or down (-)**

Example

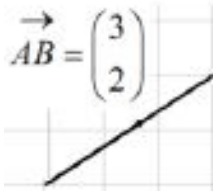
$\begin{pmatrix}2\\3\end{pmatrix}$ means
'2 right, 3 up'

$\begin{pmatrix}-1\\-5\end{pmatrix}$ means
'1 left, 5 down'

Vector (MW – 174 / 219)

A **vector** is a quantity represented by an arrow with both **direction** and **magnitude**. $\overrightarrow{AB} = -\overrightarrow{BA}$

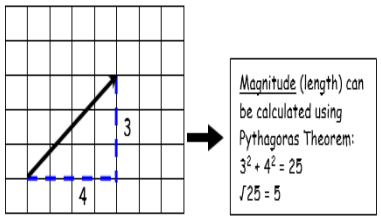
Example



Magnitude

Magnitude is defined as the **length** of a vector.

Example



Equal Vectors

Magnitude is defined as the **length** of a vector.

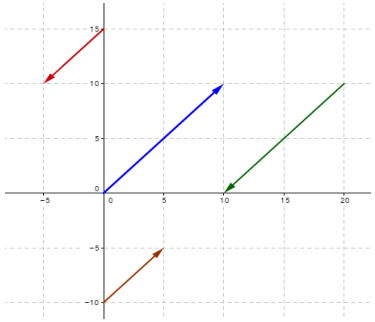
Example

Parallel Vectors

Parallel vectors are **multiples** of each other.

Example

2**a**+**b** and 4**a**+2**b** are parallel as they are multiple of each other.

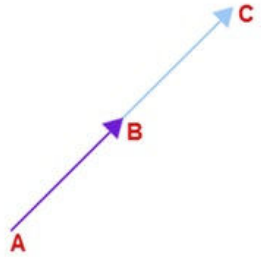


Collinear Vectors

Collinear vectors are vectors that are on the **same line**.

To show that two vectors are **collinear**, show that one vector is a **multiple** of the other (parallel) **AND** that both vectors **share a point**.

Example



Resultant Vector

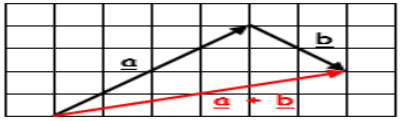
The **resultant** vector is the vector that results from **adding** two or more vectors together.

The resultant can also be shown by **lining up** the **head** of one vector with the **tail** of the other

Example

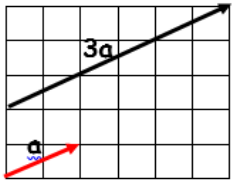
if **a** = $\begin{pmatrix}4\\4\end{pmatrix}$ and **b** = $\begin{pmatrix}2\\-2\end{pmatrix}$

then **a** + **b** = $\begin{pmatrix}4\\4\end{pmatrix} + \begin{pmatrix}2\\-2\end{pmatrix} = \begin{pmatrix}6\\2\end{pmatrix}$



Scalar of a Vector

A **scalar** is the **number** we **multiply** a vector by.



Example

3a + 2b =
$= 3\begin{pmatrix}2\\1\end{pmatrix} + 2\begin{pmatrix}4\\-1\end{pmatrix}$
$= \begin{pmatrix}6\\3\end{pmatrix} + \begin{pmatrix}8\\-2\end{pmatrix}$
$= \begin{pmatrix}14\\1\end{pmatrix}$

Year 11 Foundation Mathematics Knowledge Organiser
(Term 1 – Unit 14 – Forming and Solving Equations)

Solve (MW – 135a)

To find the **answer**/value of something

Use inverse operations on both sides of the equation (balancing method) until you find the value for the letter.

Example

To find the **answer**/value of something

Use inverse operations on both sides of the equation (balancing method) until you find the value for the letter.

Rearranging Formulae (MW – 136/190)

Use inverse operations on both sides of the formula (balancing method) until you find the expression for the letter.

Example

Make x the subject of $y = \frac{2x-1}{z}$

Multiply both sides by z

$$yz = 2x - 1$$

Add 1 to both sides

$$yz + 1 = 2x$$

Divide by 2 on both sides

$$\frac{yz+1}{2} = x$$

We now have x as the subject.

Inverse

Opposite

Example

The inverse of addition is subtraction.

The inverse of multiplication is division.

Forming Equations / Formulae (MW – 137)

Substitute letters for words in the question.

Example

Bob charges £3 per window and a £5 call out charge.

$$C = 3N + 5$$

Where N=number of windows and C=cost

Substitution (MW – 95)

Replace letters with numbers.

Be careful of $5x^2$. You need to square first, then multiply by 5.

Example

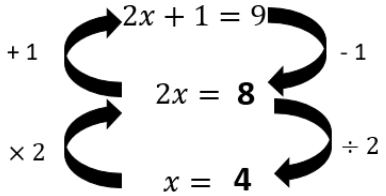
$a = 3, b = 2$ *and* $c = 5$. Find:

1. $2a = 2 \times 3 = 6$
2. $3a - 2b = 3 \times 3 - 2 \times 2 = 5$
3. $7b^2 - 5 = 7 \times 2^2 - 5 = 23$

Solving Two Step Equations (MW – 135a)

Finding the value of an unknown, by identifying operations performed and doing the inverse operation:

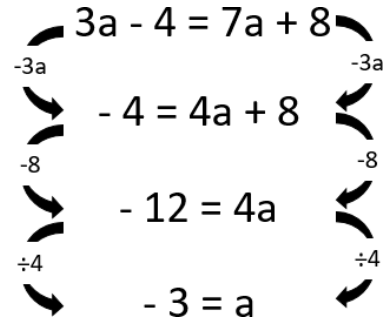
Example



Solving Equations with unknowns on both sides

Add/subtract the smallest algebraic term from both sides:

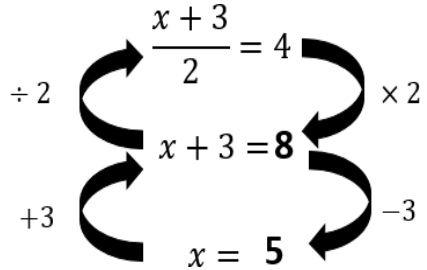
Example



Solving Equations involving fractions

Finding the value of an unknown. To eliminate a denominator, multiply every term by the denominator:

Example



Year 11 Foundation Mathematics Knowledge Organiser
(Term 1 – Unit 15 – Simultaneous Equations)

Simultaneous Equations

A set of **two or more equations**, each involving **two or more variables** (letters).

The **solutions** to simultaneous equations **satisfy both**/all of the **equations**.

Example

$$2x + y = 7$$
$$3x - y = 8$$

$$x = 3$$
$$y = 1$$

Variable

A **symbol**, usually a **letter**, which **represents a number** which is usually unknown.

Example

In the equation $x + 2 = 5$, x is the variable.

Coefficient

A **number** used to **multiply** a **variable**.

It is the number that comes before/in front of a letter.

Example

6z

6 is the coefficient

z is the variable

Solving Simultaneous Equations (by Elimination) (MW – 162)

1. **Balance** the **coefficients** of one of the variables.
2. **Eliminate** this variable by adding or subtracting the equations (**Same Sign Subtract, Different Sign Add**)
3. **Solve** the linear equation you get using the other variable.
4. **Substitute** the value you found back into one of the previous equations.
5. **Solve** the equation you get.
6. **Check** that the two values you get satisfy both of the original equations.

Example

$$5x + 2y = 9$$
$$10x + 3y = 16$$

Multiply the first equation by 2.

$$10x + 4y = 18$$
$$10x + 3y = 16$$

Same Sign Subtract (+10x on both)

$$y = 2$$

Substitute $y = 2$ in to equation.

$$5x + 2 \times 2 = 9$$
$$5x + 4 = 9$$
$$5x = 5$$
$$x = 1$$

Solution: $x = 1, y = 2$

Solving Simultaneous Equations (Graphically) (MW – 140)

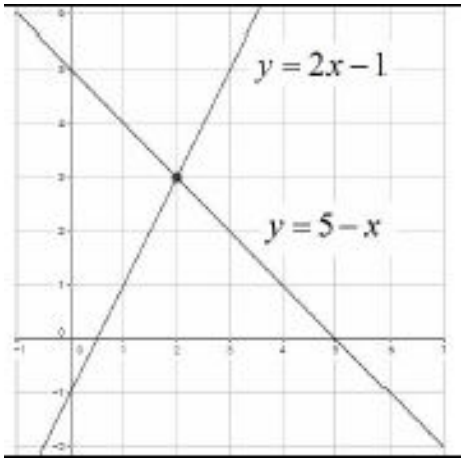
Draw the graphs of the two equations.

The **solutions** will be **where the lines meet**.

The solution can be written as a **coordinate**.

Example

$y = 5 - x$ and $y = 2x - 1$.



They meet at the point with coordinates (2,3) so the answer is $x = 2$ and $y = 3$

Year 11 Foundation Mathematics Knowledge Organiser
(Term 1 - Unit 16 - Direct Proportion & Unit 17 - Inverse Proportion)

Proportion (MW – 42)

Proportion compares the size of one part to the size of the whole.
Usually written as a fraction.

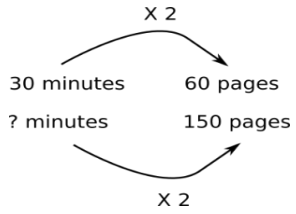
Example

In a class with 13 boys and 9 girls, the proportion of boys is $\frac{13}{22}$ and the proportion of girls is $\frac{9}{22}$

Proportional Reasoning (MW – 39)

Comparing two things using multiplicative reasoning and applying this to a new situation.
Identify one multiplicative link and use this to find missing quantities.

Example



Best Buys

Find the unit cost by dividing the price by the quantity.
The lowest number is the best value.

Example

8 cakes for £1.28 → 16p each (÷by 8)
13 cakes for £2.05 → 15.8p each (÷by 13)
Pack of 13 cakes is best value.

Unitary Method

Finding the value of a single unit and then finding the necessary value by multiplying the single unit value.

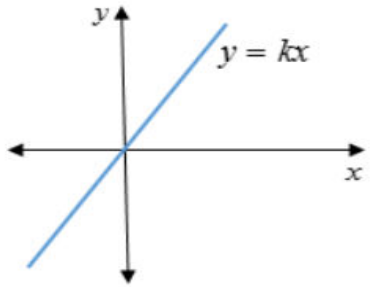
Example

3 cakes require 450g of sugar to make.
Find how much sugar is needed to make 5 cakes.
3 cakes = 450g
So 1 cake = 150g (÷ by 3)
So 5 cakes = 750 g (x by 5)

Direct Proportion (MW – 199)

If two quantities are in direct proportion, as one increases, the other increases by the same percentage. k is the ratio between x and y

Example



Y is directly proportional to x
When x = 500 y = 10
Calculate the value of y when x = 150
Y = k x
10 = 500k therefore k = 1 / 5 0
Y= 1 / 5 0 x
y =1 / 5 0 x 150 y = 3

Indirect proportion

If two quantities are in indirect proportion, as one increases, the other decreases by the same percentage.
$1/k$ is the ratio between x and y

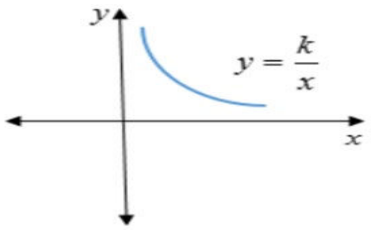
Example

P is inversely proportional to V
When P = 6 V = 8
Calculate the value of P when V = 2
P =k/v 6 = k/8
therefore k = 48
P = 48/2 P=24

Inverse proportion (MW – 199)

If two quantities are inversely proportional, as one increases, the other decreases by the same percentage.
If y is inversely proportional to x, this can be written as $y \propto \frac{1}{x}$
An equation of the form $y = \frac{k}{x}$ represents inverse proportion.

Example



AQA Biology (Combined Science) Unit 7: Ecology Knowledge Organiser

Keywords

Biodiversity - the variety of living organisms.

Carrion - decaying flesh and tissue of dead animals.

Community - made up of the populations of different species living in a habitat.

Competition - the negative interaction between two or more organisms which require the same limited resource.

Consumers - feed on other organisms for their energy. Can be primary, secondary or tertiary.

Decomposers - organisms which feed on dead and decaying organisms. They break down the biomass and release nutrients into the soil.

Deforestation - the removal and destruction of trees in forest and woodland.

Ecosystem - the interaction between the living organisms and the different factors of the environment.

Global warming - the increase of the average global temperature.

Habitat - where a living organism lives.

Interdependence - the interaction between two or more organisms, where it is mutually beneficial.

Population - the number of individual organisms of a single species living in a habitat.

Predators - organisms which kill for food.

Prey - the animals which are eaten by the predators.

Producers - convert the sun's energy into useful compounds through photosynthesis. They are green plants or algae.

Scavengers - organisms which feed on dead animals (carrion).

Species - organisms of similar morphology which can interbreed to produce fertile offspring.

Abiotic and Biotic Factors

Abiotic factors are the non-living factors of an environment. E.g. moisture, light, temperature, CO_2, wind, O_2 or pH.

Biotic factors are the living factors of an environment. E.g. predators, competition, pathogens, availability of food.

Adaptations

Adaptations are specific features of an organism which enable them to survive in the conditions of their habitat.

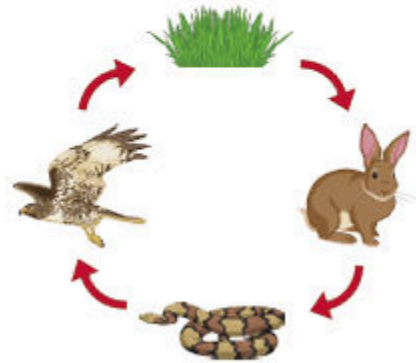
Adaptations can be structural, behavioural or functional:

- **Structural adaptations** are features of the organism's body e.g. colour for camouflage.
- **Behavioural adaptations** are how the organism behaves e.g. migration to a warmer climate during colder seasons.
- **Functional adaptations** are the ways the physiological processes work in the organism e.g. lower metabolism during hibernation to preserve energy.

A plant or animal will not physically change to adapt to its environment in its lifetime. Instead, there is natural variation within the species and only organisms whose features are more advantageous in the environment survive. The survivors then go on to reproduce and pass on their features to some of their offspring. The offspring who inherit these advantageous features are better equipped to survive. Charles Darwin described this process as 'survival of the fittest'.

Food Chains

The source of all energy in a food chain is the sun's radiation. It is made useful by plants and algae which produce organic compounds through photosynthesis.

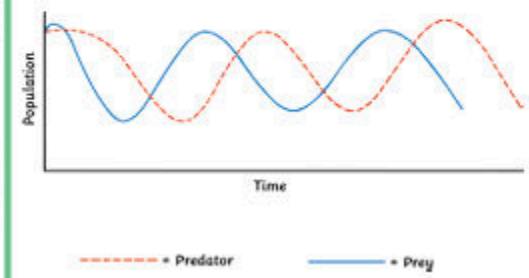


The living organisms use the energy to produce biomass and grow.

When a living organism is consumed, some of the biomass and energy is transferred. Some of the energy is lost.

Remember: the arrow in a food chain indicates the direction of the flow of energy.

Populations of predators and prey increase and decrease in cycles. The size of the predator population depends on the size of the prey population and vice versa. Overall, there is a stable community.



Competition

Species will compete with one another and also within their own species to survive and to reproduce.

Mutualism occurs when both species benefit from a relationship.

Parasitism occurs when a parasite only benefits from living on the host.

Animals compete for resources such as food, water and space/shelter. They may also compete within their own species for mates.

Plants compete for resources including light, water, space and minerals. All these resources are needed for photosynthesis so the plant can make its own food. Plants do not need to compete for food.

Deforestation and Land Use

Humans use land for buildings, quarrying, mining, agriculture and landfill. As the human population increases and we take more land, there is less space for other organisms to live.

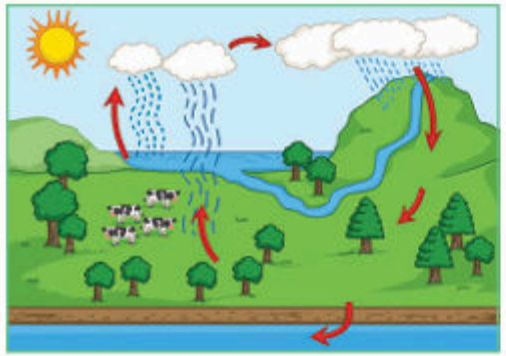
Deforestation (to use wood as a fuel/material or to clear space for other uses) destroys habitats where other organisms live.

Peat bogs are produced when decomposition occurs over a very long time. Peat stores a lot of carbon and can be extracted for use by gardeners or as an energy source. Burning peat releases a lot of carbon dioxide into the atmosphere which contributes to the greenhouse effect.

Trees absorb carbon dioxide for photosynthesis, so as they are cut down and removed, less carbon dioxide is taken from the atmosphere. Furthermore, when the trees are burned, they release carbon dioxide back into the atmosphere. The excess carbon dioxide can lead to global warming and the changes to the ecosystem cause reduced biodiversity.

AQA Biology (Combined Science) Unit 7: Ecology Knowledge Organiser

Water Cycle



Convection is the movement caused within a fluid as the hotter, less dense material rises and colder, denser material sinks under the influence of gravity. This results in the transfer of heat.

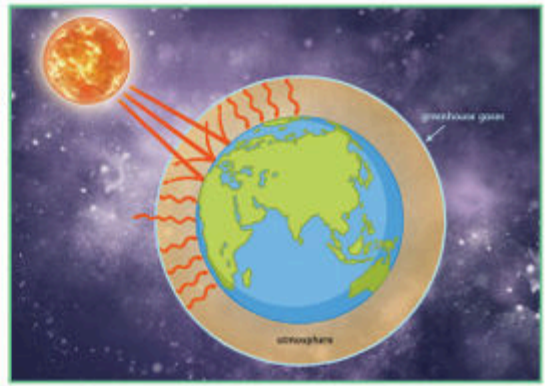
Evaporation occurs when heat energy from the surroundings (or a heat source) is transferred to water particles as kinetic energy. The particles begin to move more rapidly and can turn from a liquid into a gas.

Condensation occurs when moving particles transfer kinetic energy to the surroundings. The particles begin to move even more slowly and can turn from a gas into a liquid.

Precipitation occurs when rain, snow, sleet, or hail falls to (or **condenses** on) the ground.

Transpiration is the process by which water is carried through plants from roots to the stomata on the underside of leaves and it evaporates into the surroundings.

Global Warming



The **greenhouse effect** is the natural process where some of the Sun's radiation is trapped within the insulating layer of the atmosphere. This maintains a temperature suitable to support life on Earth.

Most of the radiation from the Sun is absorbed by the Earth when it reaches the surface. The rest of the infrared radiation is reflected from the surface and absorbed by the greenhouse gases and clouds in the atmosphere. This is then re-emitted in all directions.

However, due to many contributing factors, the global temperature is gradually increasing. Several gases, called greenhouse gases, trap the heat around the Earth; the most concerning is carbon dioxide. Human activities contribute to the excess amount of carbon dioxide in the atmosphere and so are a cause of global warming.

Global warming leads to the melting of ice caps, rising sea levels, flooding, changes to climate, changes in migration patterns, changes in species distribution and reduction in biodiversity.

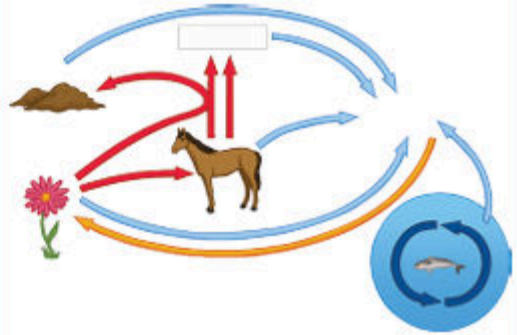
RPI: Field Techniques Quadrats and Transects

The distribution of an organism is affected by the environment and abiotic factors.
Quadrats can be used to measure the frequency of an organism in a given area e.g. the school field. You could count the individual organisms or estimate the percentage cover. You must collect data from at least two areas to make a comparison. Quadrats should always be placed randomly.

Transects are used to measure the change of distribution across an area e.g. from the edge of a river and moving further from the water's edge. You could either count the number of organisms touching the transect at regular intervals or use a quadrat placed at regular intervals along the transect.

$$\text{mean} = \frac{\text{total number of organisms}}{\text{number of quadrats}}$$

Carbon Cycle

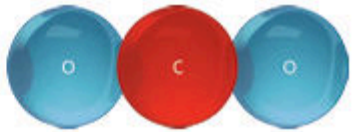


The main focus on the carbon cycle is its transfer to and from the atmosphere. When carbon is in the atmosphere, it combines with oxygen to form carbon dioxide, a greenhouse gas.

Carbon is transferred from the atmosphere when plants absorb carbon dioxide for photosynthesis and when the gas is dissolved into oceans.

Carbon is transferred to the atmosphere through respiration by animals, plants and bacteria and by combustion of fossil fuels (coal, oil and natural gas).

Dead animals and plants are decomposed and their matter is broken down by microbes and fungi. These organisms are collectively called decomposers. When the organisms are broken down, the microbes and fungi release carbon dioxide into the atmosphere through respiration.



AQA Biology (Combined Science) Unit 7: Ecology Knowledge Organiser

Biodiversity and Waste Management

Biodiversity is the variety of living organisms on the earth or in an ecosystem. It is important in helping to maintain stable ecosystems. Organisms are often interdependent, relying on others as food sources, or to create suitable environmental conditions to survive. Human survival is also dependent on this biodiversity.

The global human population has exceeded 7 billion.
Human population has increased due to modern medicine and farming methods, reducing famine and death from disease.
This means a greater demand for food, resources and water.
It also means more waste and emissions are created.

Sewage, toxic chemicals, household waste and gas emissions pollute the water, land and air, killing plants and animals and reducing biodiversity.

Maintaining Ecosystems and Biodiversity

There are many ways that biodiversity and ecosystems are maintained:

- Breeding programmes can help to protect endangered species from extinction.
- Conservation programmes can help to protect and preserve specialised ecosystems and habitats such as peat bogs and coral reefs.
- Reintroduction of hedgerows and field margins on agricultural land can help improve biodiversity by breaking up the monoculture crops.
- Sustainable forestry programmes help to manage the woodlands and reduce the deforestation to a sustainable rate.
- Societies actively encourage recycling and reusing of products and packaging to reduce the household waste going to landfill sites.

Unfortunately these programmes can be difficult to manage. They are often expensive and are difficult to regulate. People who are employed in certain areas, e.g. tree felling, cannot always transfer their skills to an environmentally friendly role and so become unemployed. It is difficult to maintain biodiversity whilst preventing crops being overrun with pests and weeds, which would affect food security for the human population.

AQA GCSE Chemistry (Combined Science) Unit 10: Using Resources

Sustaining Human Life on Earth

The human **population** is **increasing** rapidly and our use of earth's finite resources has increased. If humans continue to use these resources at the rate at which we are, then we will reach a point where the human population cannot be sustained on earth.

Humans use the **earth's natural resources** for warmth, shelter, food, clothing and transport. Scientists are making **technological advances** in **agricultural** and **industrial processes** to provide food and other products that meet the growing needs of the human population but it is of major importance that this is done in a sustainable way so that our finite resources are not used up.

Earth's Resources

Finite resources are those of which there is a **limited supply**, for example coal, oil and gas. These resources can be used to provide energy but, one day, their supply will run out.

Crude oil is processed through **fractional distillation** and **cracking** to produce many useful materials such as petrol, diesel and kerosene.

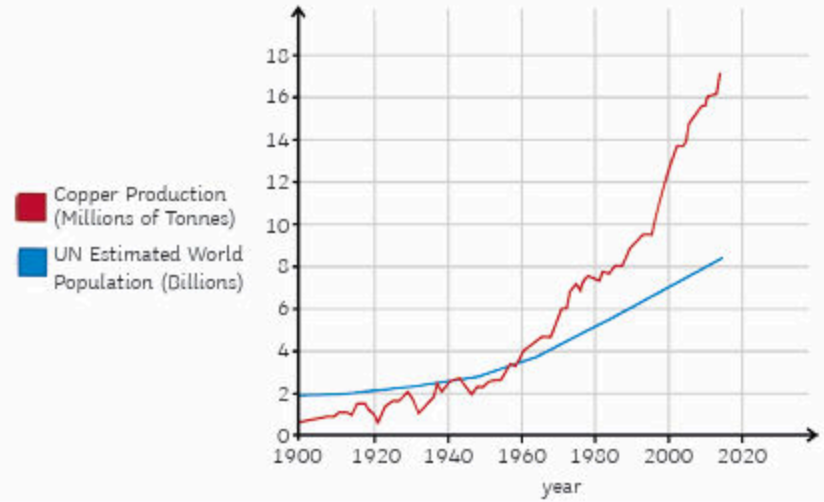
Renewable resources will not run out in the near future because the reserves of these resources are high. Examples of renewable resources include solar energy, wind power, hydropower and geothermal energy.

Haber Process and Copper

Scientists often discover new ways to produce a product; **synthetic methods** of production replace **natural methods**. For example, fertilisers were obtained from manure (a natural resource).

The **Haber process** allowed the synthetic production of **fertilisers** and this enabled **intensive farming** methods to spread across the globe. In turn, this supported the growing human population.

Copper is another resource that has been exploited over time. As the human population has increased since 1900, the demand for copper has also increased. Copper is a finite resource which means that there is a limited supply.



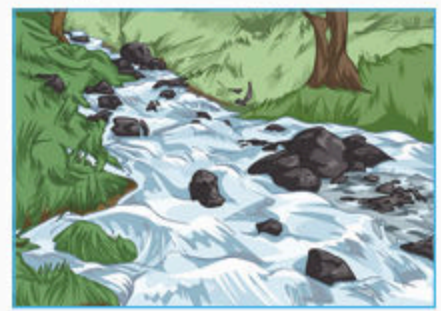
Water

Potable water is water that is **safe to drink**. Potable water is **not pure; dissolved impurities** still **remain** in the water. Pure water is odourless, tasteless and colourless compared to rainfall or water from streams and wells as these **harbour chemicals** such as acid.

Pure – the **definition** of a pure substance is one that contains only a single type of material that has not been contaminated by another substance.

Potable water must contain **low levels** of microbes and salts for it to be deemed safe to consume. This is because **high levels** of microbes and salts can be harmful to human health.

The methods of making water safe vary depending on where you live. Starting with sea water is harder than starting with fresh water. This is because the **energy cost** of removing large amounts of sodium chloride from seawater is greater.



In the UK, our populations' water needs are met through **rainfall**. During the **summer, water levels** in reservoirs **decrease** and local areas are encouraged to reduce their water usage by swapping baths for showers and they are asked to avoid using hosepipes.

In the UK, **insoluble particles** are **removed** from naturally occurring fresh water by passing it through **filter beds**. **Microbes** are **killed** by **sterilising the water**. Several different sterilising agents are used for potable water. These are chlorine, ozone or ultraviolet light. The right amount of chlorine and ozone gas (O_3) must be used as both are harmful to human health.

AQA GCSE Chemistry (Combined Science) Unit 10: Using Resources

Desalination of Sea Water

If fresh water supplies are limited, sea water can undergo a process called **desalination**. This process requires **large amounts of energy**, but can be done by distillation or the use of membranes such as **reverse osmosis**.

Distillation involves **heating** the sea water until it reaches **boiling point**. Once the water is boiling, it will begin to **evaporate**. The steam then rises up where it cools and condenses in a condensing tube. The salt is left behind. The **downside** to this process is the **energy cost** of boiling the water and cooling down the steam sufficiently in the condensing tube. Not all of the water evaporates which leaves behind a **salty wastewater** that can be **difficult to sustainably dispose of** without harming aquatic organisms.

Reverse Osmosis of Salt Water

Osmosis, as you will have learnt in biology, is the **movement of particles** from an area of **high** concentration **to** an area of **low** concentration through a **semi-permeable membrane**.

Reverse osmosis involves **forcing water** through a **membrane** at **high pressure**. Each membrane has tiny holes within it that only allow water molecules to pass through. Ions and other molecules are prevented from passing through the membrane as they are too large to fit through the holes.

The **disadvantage** of this method is that it produces **large amounts of wastewater** and requires the use of **expensive membranes**. Due to a large amount of wastewater produced, the efficiency of this method is very small.

Water Treatment

Before the **wastewater** from industry, agriculture and peoples' homes can be released back into the environment, it must be **treated**.

Pollutants such as human waste contain **high levels of harmful bacteria** and **nitrogen compounds** which can be a **danger to aquatic organisms**.

Industrial and agricultural waste may contain **high levels** of **toxic metal compounds** and **fertilisers and pesticides** which may also damage the ecosystem.

Cleaning sewage requires several steps:

Step 1 – The water must be **screened**. This is where material such as branches, twigs and grit is removed.

Step 2 – The water undergoes **sedimentation**; wastewater is placed in a settlement tank. The heavier solids sink to the bottom and form a sludge whilst the lighter effluent floats on the surface above the sludge.

Step 3 - The effluent is then transferred to another tank where the organic matter undergoes **aerobic digestion**. Although not pure, this water can be safely released back into the environment. The sludge is placed in another tank where the organic matter undergoes **anaerobic digestion**. It is broken down to produce fertiliser and methane gas which can be used as an energy resource (fuel).

Required Practical 8 – Analysis and Purification of Water Samples from Different Sources

Analysing the pH of Water Samples

Test the pH of each water sample using a pH meter or universal indicator. If using universal indicator, use a pH colour chart so that you are able to identify the pH of the sample against the colour produced by the indicator.

Analysing the Mass of Dissolved Solids

To measure the mass of dissolved solids in a water sample, measure out 50cm^3 of the sample using a measuring cylinder. Take the mass of an evaporating basin before heating and record the mass in a table. Place the measured amount of water into an evaporating basin and gently heat over a Bunsen burner until all the liquid has evaporated. Once the evaporating basin has cooled, place it on a top pan balance and record its mass. Calculate the mass of the solid left behind.

Distillation of the Water Sample

To distil a water sample, set up your equipment as per the diagram.

Heat the water sample gently using a Bunsen burner. After a short period of time, distilled water should be produced.

Life-Cycle Assessment (LCA)

Life-Cycle Assessments follow the four main stages of the life cycle of a product.

Stage 1 – Extracting the raw materials needed to make the products and then processing them.

At this stage, the energy and environmental costs need to be considered. For example, if the raw material being used is a finite or renewable resource, the energy to extract and transport the raw material should be considered. Environmental factors also play a large part in stage 1 as the extraction of the raw material can leave scars on the landscape and waste products may be produced that could damage local ecosystems.

AQA GCSE Chemistry (Combined Science) Unit 10: Using Resources

Life-Cycle Assessment (LCA) (continued)

Stage 2 – Manufacturing and packaging of the product.

The main consideration is how much energy and resources are needed to manufacture the product. Energy may be used in the form of fuel, electricity or chemicals used in the production of the product. In the manufacturing process, there may be pollution and waste products that need to be considered. Transportation of the goods from the factory to the user will have an environmental impact.

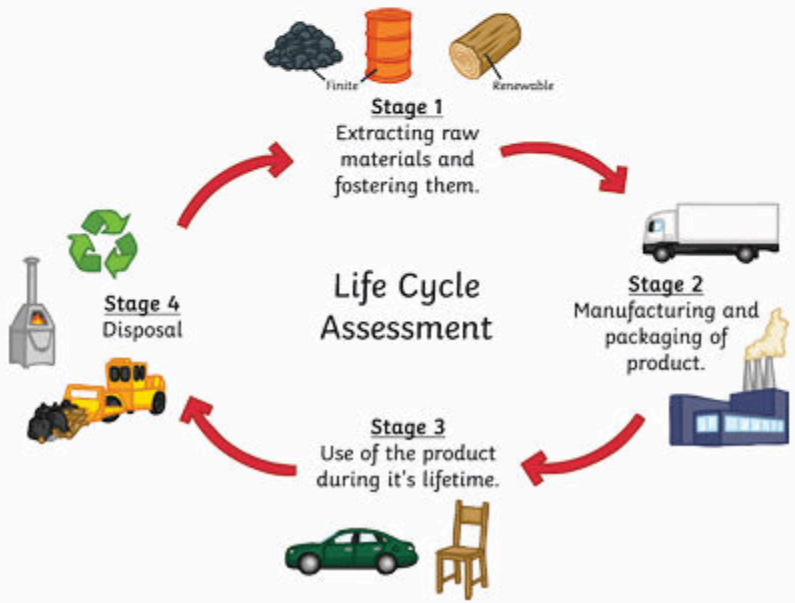
Stage 3 – Use of the product during its lifetime.

The environmental impact of a product during its life depends on the type of product. For example, a car will have a significant impact i.e. it needs to be filled with petrol or diesel, a finite resource, to get to where you are going. A car's engine releases harmful emissions into the atmosphere. On the other hand, a wooden chair may only need minor repairs and is made from a renewable resource.

Stage 4 – Disposal at the end of a product's life.

There are different methods of disposal:

1. Landfill – the product is put in a hole in the ground – high environmental impact.
2. Incineration (organic matter) – burning of the product – low environmental impact.
3. Recycling – for example, batteries contain metal compounds that are not good for the environment. By recycling, it means that no new compounds have to be taken out of the ground.



Comparative LCAs

Comparative LCAs are used to evaluate products and to find which one will have a lower environmental impact.

Stage of Life Cycle	Plastic Bag	Paper Bag
Stage 1 – raw material	Uses a finite resource (crude oil). The processes of fractional distillation, cracking and polymerisation all require energy to make crude oil useful.	Made from trees/recycled paper. Making paper from trees requires more energy than recycled paper because trees have to be chopped down. Still uses less energy than making plastics from crude oil.
Stage 2 – manufacture	Cheap to make.	More expensive to make.
Stage 3 – use	Plastic bags have a low environmental impact as they can be used a number of times. In comparison to paper bags, they are much stronger.	Paper bags can only be reused a limited number of times and so have a short lifetime.
Stage 4 – disposal	The downside to plastic bags is that they do not biodegrade easily in landfill. Recycling options are available. If they are not disposed of correctly, plastic bags can have a detrimental impact on the environment and animal habitats.	Paper bags biodegrade easily in landfill sites.

AQA GCSE Chemistry (Combined Science) Unit 10: Using Resources

Disadvantages of Comparative LCAs

The disadvantage of **comparative LCAs** is that some parts of it require certain judgements to be made.

Different people have different opinions and this is dependent on who completes the LCA and whether a certain level of bias is added. For example, if the LCA is completed by a company that is manufacturing a specific product, they may only discuss **some** of the environmental impact of their product in the LCA. Accurate numerical values, for example, show a company how much energy has been used in the **manufacturing process** or how much **carbon dioxide** was produced when the goods were transported.

Recycling

Many materials are made from **natural resources** that have **limited supplies**. Reusing items such as glass bottles that only need washing and sterilising saves energy and reduces the environmental impact. Not all products can be reused, some need to be recycled before reuse.

There are both advantages and disadvantages to recycling materials.

Advantages

- Fewer resources such as **mines** and **quarries** are needed to remove raw, finite materials from the ground. For example, copper.
- Crude oil, the raw material used in the production of plastics, does not need to be extracted. This, in turn, **avoids** high energy cost processes such as fractional distillation and cracking. If more items are recycled, less would end up in landfill sites.
- The amount of greenhouse gases would reduce as the energy cost of recycling is a lot **less** than making a new product.

Disadvantages

- Recycling items require collection and transport of the goods to the organisation. This involves using staff, vehicles and the use of fuel.
- Some materials, such as **metals**, can be **difficult to sort**; the amount of sorting is dependent on the purity of the materials or metals and the level of purity required for the final product. For example, copper used in electrical appliances must have a high purity. To achieve this, the copper needs to be processed and then melted down again to make copper wiring.
- Steel that is used in the construction industry does not require such high purity. Often scrap iron is added to the furnace when steel is made. This reduces the need for as much iron ore and reduces the cost of making steel.

Biological Extraction Methods (Higher Tier Only)

Biological methods of extraction are needed as the resources of **metal ores** on earth are in **short supply**. Large scale **copper mining** leaves **scars on the landscape** and produces significant amounts of waste rock that must be disposed of. Biological methods have a lower impact on the environment and make use of waste containing small amounts of copper. The disadvantages of **biological extraction methods** are that they are **slow**, but they do reduce the need to obtain new ore through mining and conserve limited supplies of high-grade ore.

Phytomining

Phytomining involves the use of **plants**. Plants absorb the metal compounds found in the soil. The plants cannot get rid of the copper ions and it builds up in the leaves. The plants are then **harvested, dried** and then placed in a furnace. The ash that is produced from the burning process contains soluble metal compounds that can be extracted. The ash is dissolved in an acid such as hydrochloric or sulfuric and the copper is then extracted by electrolysis or through a **displacement reaction** with iron.

Bioleaching

Bioleaching uses **bacteria** to produce an acidic solution called **leachate** which contains **copper ions**. The disadvantage of bioleaching is that it produces **toxic substances** that are **harmful to the environment**. To process the copper, the copper undergoes a displacement reaction with iron. Iron is cheaper and a **more cost-effective** way of producing copper from the leachate.

AQA Combined Science: **Physics Topic 7 Magnetism and Electromagnetism**

Poles of a Magnet

A magnet has two ends called **poles**: the **north pole** and the **south pole**. The magnetic forces of the magnet are strongest at the poles.

When two magnets are brought close together, they will **attract** or **repel**, depending on which poles are brought together:

- **Like poles** will **repel** one another e.g. N-N or S-S.
- **Opposite poles** will **attract** e.g. N-S.

The forces exerted between the poles of two magnets are a type of **non-contact force**: the magnets do not have to be touching for the effect to be observed.

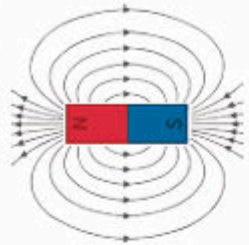
Remember that only **iron**, **cobalt** and **nickel** (or alloys containing these metals) are magnetic.

A **permanent magnet** is one with its own magnetic field. The magnetism cannot be turned on or off e.g. a bar magnet or a horseshoe magnet.

An **induced magnet** is a material which becomes magnetic only when placed within a magnetic field. Induced magnets only attract other materials and lose most (if not all) of their magnetism when removed from the magnetic field e.g. iron filings.

Magnetic Fields

The **magnetic field** is the area surrounding a magnet where the force is acting on another magnet or magnetic material. It can be observed using a compass placed at different points around a bar magnet. The field lines can be drawn by using the compass to mark the direction at a range of points.



A magnet always causes a magnetic material to be **attracted**. The strength of the magnetic field is determined by the proximity to the magnet.

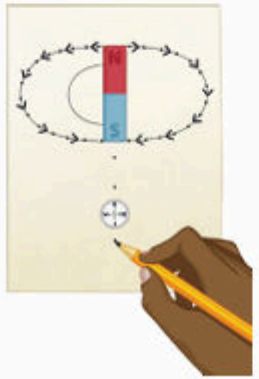
When looking at a diagram of magnetic field lines, the force is strongest where the lines are closest together. The magnetic field of the magnet is strongest at the poles. The direction of the magnetic field shows the direction the force would act on another north pole. As a result, magnetic field lines always come away from the north pole (like poles repel) and towards the south pole (unlike poles attract).

The earth produces a magnetic field and a magnetic compass uses this to help aid navigation. The core of the earth is made of iron (a magnetic material). A compass contains a small bar magnet shaped as a needle, which points in the direction of the earth's magnetic field.

Plotting Magnetic Field Lines

A magnetic compass can be used to plot and draw the magnetic field lines around a magnet.

You should be able to describe this method for a bar magnet.



1. Place the bar magnet in the centre of a sheet of plain paper.
2. Using a magnetic compass, position it on the paper somewhere around the magnet.
3. Observe the direction of the needle and carefully draw a dot at the circumference of the magnet, in line with each end of the needle. Make sure you include an arrow to indicate the direction of north.
4. Repeat steps 2 and 3 for several positions around the magnet.
5. Join the arrows to complete the magnetic field lines and whole pattern.

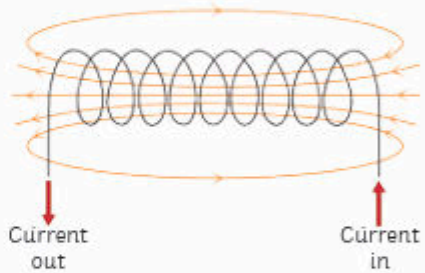
Electromagnetism

A circular **magnetic field** is produced when a current is passed through a conducting wire. This produces an **induced magnet**.

Switching off the current causes the magnetism to be lost.

The strength of the magnetic field can be increased by increasing the current flowing through the wire. The strength of the magnetic field is stronger closer to the wire.

Coiling the wire to form a **solenoid** will also increase the strength of the magnetic field. The strength of the magnetic field created by a solenoid is strong and uniform throughout.



To increase the strength of the magnetic field around a solenoid you can...

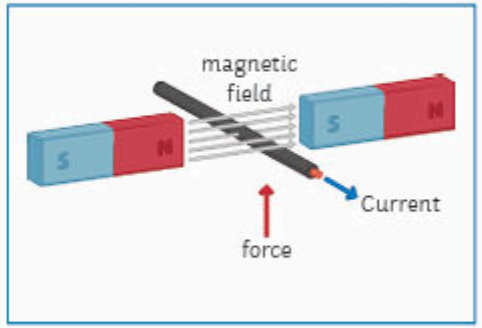
- add an iron core;
- increase the number of turns in the coil;
- increase the current passing through the wire.

An **electromagnet** is a solenoid with an iron core. Electromagnets are **induced magnets** and can be turned on and off.

Electric motors, loudspeakers, electric bells and remotely controlled door locks all use **electromagnets**.

The Motor Effect and Flemings Left-Hand Rule

When a wire carrying a current is exposed to the magnetic field of another magnet, then a **force** is produced on the wire at a **right angle** to the direction of the magnetic field produced.



This is called the **motor effect**.

The force produced by the motor effect can be calculated using this equation:

force (N) = magnetic flux density (T) × current (A) × length (m)

For example:
A current of 8A is flowing through a wire that is 75cm long. The magnetic field acting at a right angle on the wire is 0.5T. Calculate the force.

$F = B \times I \times l$

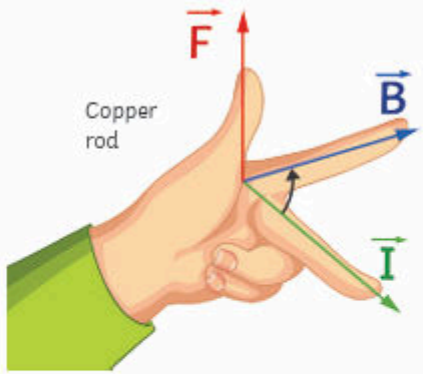
Remember: the equation uses length measured in m. The question gives you the length in cm so you need to convert it before you calculate your answer.

$F = 0.5 \times 8 \times 0.75$

$F = 3N$

From the equation we can see that the force acting on a given length of wire (e.g. 1m) will be increased if the current increases or the magnetic flux density increases. If the current flowing through a wire is **parallel** to the magnetic field, then **no force** is produced – there is no motor effect.

You might be shown a diagram and asked to indicate the direction of the force produced. **Fleming's left-hand rule** can help you do this because it represents the **relative orientation** of the force produced by the motor effect.

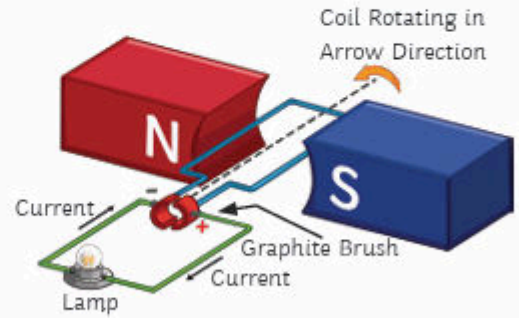


Remember:

- Use your **left hand**!
- The angle between your index finger and middle finger should be a **right angle** on the horizontal plane.
- The angle between your index finger and thumb should be a **right angle** on the vertical plane.
- Your **thumb** represents the direction of the **force**.
- Your **index finger** represents the direction of the **magnetic field**.
- Your **middle finger** represents the direction of the **current** flowing through the wire.

Electric Motors

When the wire carrying the current is **coiled**, the motor effect acting on it causes the wire to **rotate**. This is how an **electric motor** works.



As the **current** flows (from negative to positive), the force produced in each side of the coil acts in **opposite directions**, causing the coil to **rotate** overall.

When the coil reaches a **vertical position**, the force produced is now **parallel** to the magnetic field line and so would be **zero**. This would cause the motor to stop rotating.

To maintain the rotation of the coiled wire, a **split ring commutator** is used to supply the current to the wire. The DC supply reaches the split ring via graphite or metal **brushes** which maintain the connection while allowing it to rotate freely on the **axle**.

The two halves of the split ring commutator ensure that the **current supplied** to the wire **changes direction** each half-turn (or that the current supplied is the same direction on each side of the motor) and as a result, the force produced maintains a **constant rotation** in one direction overall.

AQA Ecology Knowledge Organiser

Keywords

Biodiversity - the variety of living organisms.

Carrion - decaying flesh and tissue of dead animals.

Community - made up of the populations of different species living in a habitat.

Competition - the negative interaction between two or more organisms which require the same limited resource.

Consumers - feed on other organisms for their energy. Can be primary, secondary or tertiary.

Decomposers - organisms which feed on dead and decaying organisms. They break down the biomass and release nutrients into the soil.

Deforestation - the removal and destruction of trees in forest and woodland.

Ecosystem - the interaction between the living organisms and the different factors of the environment.

Global warming - the increase of the average global temperature.

Habitat - where a living organism lives.

Interdependence - the interaction between two or more organisms, where it is mutually beneficial.

Population - the number of individual organisms of a single species living in a habitat.

Predators - organisms which kill for food.

Prey - the animals which are eaten by the predators.

Producers - convert the sun's energy into useful compounds through photosynthesis. They are green plants or algae.

Scavengers - organisms which feed on dead animals (carrion).

Species - organisms of similar morphology which can interbreed to produce fertile offspring.

Abiotic and Biotic Factors

Abiotic factors are the non-living factors of an environment. E.g. moisture, light, temperature, CO_2, wind, O_2 or pH.

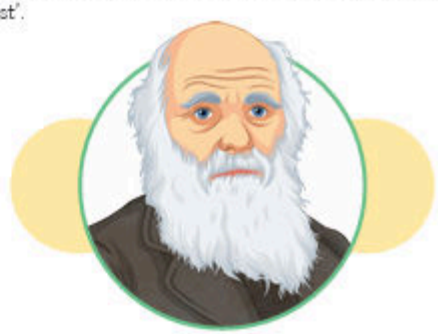
Biotic factors are the living factors of an environment. E.g. predators, competition, pathogens, availability of food.

Adaptations

Adaptations are specific features of an organism which enable them to survive in the conditions of their habitat.
Adaptations can be structural, behavioural or functional:

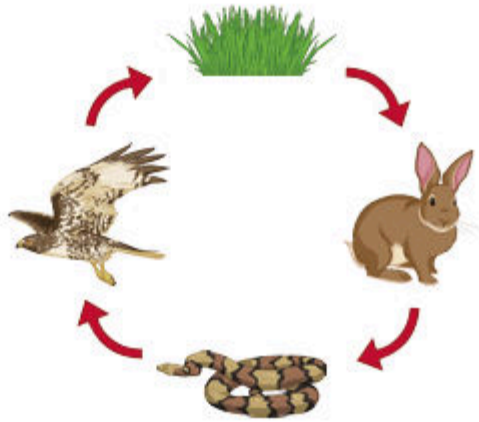
- **Structural adaptations** are features of the organism's body e.g. colour for camouflage.
- **Behavioural adaptations** are how the organism behaves e.g. migration to a warmer climate during colder seasons.
- **Functional adaptations** are the ways the physiological processes work in the organism e.g. lower metabolism during hibernation to preserve energy.

A plant or animal will not physically change to adapt to its environment in its lifetime. Instead, there is natural variation within the species and only organisms whose features are more advantageous in the environment survive. The survivors then go on to reproduce and pass on their features to some of their offspring. The offspring who inherit these advantageous features are better equipped to survive.
Charles Darwin described this process as 'survival of the fittest'.



Food Chains

The source of all energy in a food chain is the sun's radiation. It is made useful by plants and algae which produce organic compounds through photosynthesis.

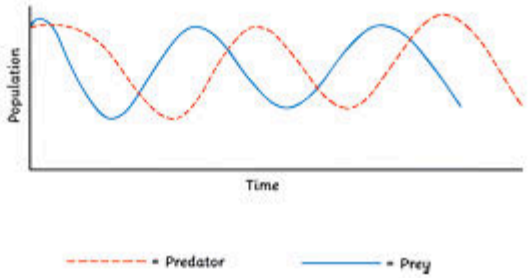


The living organisms use the energy to produce biomass and grow.

When a living organism is consumed, some of the biomass and energy is transferred. Some of the energy is lost.

Remember: the arrow in a food chain indicates the direction of the flow of energy.

Populations of predators and prey increase and decrease in cycles. The size of the predator population depends on the size of the prey population and vice versa. Overall, there is a stable community.



AQA Ecology Knowledge Organiser

Competition

Species will compete with one another and also within their own species to survive and to reproduce.

Mutualism occurs when both species benefit from a relationship.
Parasitism occurs when a parasite only benefits from living on the host.

Animals compete for resources such as food, water and space/ shelter. They may also compete within their own species for mates.
Plants compete for resources including light, water, space and minerals. All these resources are needed for photosynthesis so the plant can make its own food. Plants do not need to compete for food.

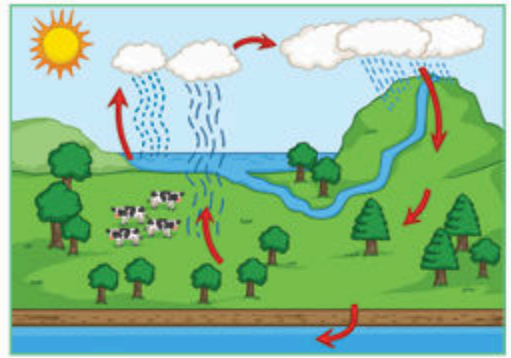
Deforestation and Land Use

Humans use land for buildings, quarrying, mining, agriculture and landfill. As the human population increases and we take more land, there is less space for other organisms to live.
Deforestation (to use wood as a fuel/material or to clear space for other uses) destroys habitats where other organisms live.

Peat bogs are produced when decomposition occurs over a very long time. Peat stores a lot of carbon and can be extracted for use by gardeners or as an energy source. Burning peat releases a lot of carbon dioxide into the atmosphere which contributes to the greenhouse effect.

Trees absorb carbon dioxide for photosynthesis, so as they are cut down and removed, less carbon dioxide is taken from the atmosphere. Furthermore, when the trees are burned, they release carbon dioxide back into the atmosphere. The excess carbon dioxide can lead to global warming and the changes to the ecosystem cause reduced biodiversity.

Water Cycle



Convection is the movement caused within a fluid as the hotter, less dense material rises and colder, denser material sinks under the influence of gravity. This results in the transfer of heat.

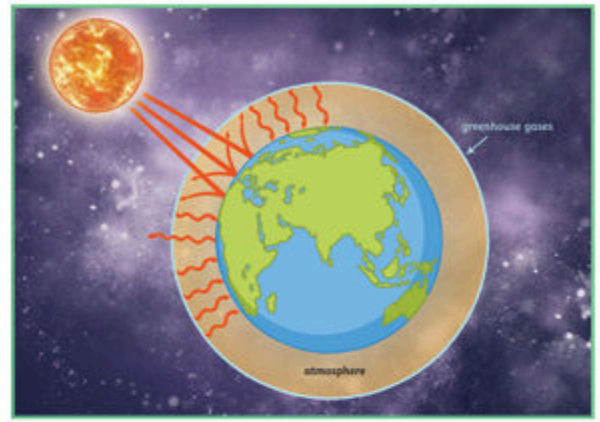
Evaporation occurs when heat energy from the surroundings (or a heat source) is transferred to water particles as kinetic energy. The particles begin to move more rapidly and can turn from a liquid into a gas.

When moving particles transfer kinetic energy to the surroundings, the particles begin to move more slowly and can turn from a gas into a liquid. This is **condensation**.

Precipitation occurs when rain, snow, sleet, or hail falls to (or **condenses** on) the ground.

Transpiration is the process by which water is carried through plants from roots to the stomata on the underside of leaves and it evaporates into the surroundings.

Global Warming



The greenhouse effect is the natural process where some of the Sun's radiation is trapped within the insulating layer of the atmosphere. This maintains a temperature suitable to support life on Earth.

Most of the radiation from the Sun is absorbed by the Earth when it reaches the surface. The rest of the infrared radiation is reflected from the surface and absorbed by the greenhouse gases and clouds in the atmosphere. This is then re-emitted in all directions.

However, due to many contributing factors, the global temperature is gradually increasing. Several gases, called greenhouse gases, trap the heat around the Earth; the most concerning is carbon dioxide. Human activities contribute to the excess amount of carbon dioxide in the atmosphere and so are a cause of global warming.

Global warming leads to the melting of ice caps, rising sea levels, flooding, changes to climate, changes in migration patterns, changes in species distribution and reduction in biodiversity.

AQA Ecology Knowledge Organiser

RP1: Field Techniques Quadrats and Transects

The distribution of an organism is affected by the environment and abiotic factors.
Quadrats can be used to measure the frequency of an organism in a given area e.g. the school field. You could count the individual organism or estimate the percentage cover. You must collect data from at least two areas to make a comparison. Quadrats should always be placed randomly.

Transects are used to measure the change of distribution across an area e.g. from the edge of a river and moving further from the water's edge. You could either count the number of organisms touching the transect at regular intervals or use a quadrat placed at regular intervals along the transect.

$$\text{mean} = \frac{\text{total number of organisms}}{\text{number of quadrats}}$$

Carbon Cycle

The main focus on the carbon cycle is its transfer to and from the atmosphere. When carbon is in the atmosphere, it combines with oxygen to form carbon dioxide, a greenhouse gas.

Carbon is transferred from the atmosphere when plants absorb carbon dioxide for photosynthesis and when the gas is dissolved into oceans.

Carbon is transferred to the atmosphere through respiration by animals, plants and bacteria and by combustion of fossil fuels (coal, oil and natural gas).

Dead animals and plants are decomposed and their matter is broken down by microbes and fungi. These organisms are collectively called decomposers. When the organisms are broken down, the microbes and fungi release carbon dioxide into the atmosphere through respiration.

Biodiversity and Waste Management

Biodiversity is the variety of living organisms on the earth or in an ecosystem. It is important in helping to maintain stable ecosystems. Organisms are often interdependent, relying on others as food sources, or to create suitable environmental conditions to survive. Human survival is also dependent on this biodiversity.

The global human population has exceeded 7 billion.
Human population has increased due to modern medicine and farming methods, reducing famine and death from disease.
This means a greater demand for food, resources and water.
It also means more waste and emissions are created.

Sewage, toxic chemicals, household waste and gas emissions pollute the water, land and air, killing plants and animals and reducing biodiversity.

Maintaining Ecosystems and Biodiversity

There are many ways that biodiversity and ecosystems are maintained:

- Breeding programmes can help to protect endangered species from extinction.
- Conservation programmes can help to protect and preserve specialised ecosystems and habitats such as peat bogs and coral reefs.
- Reintroduction of hedgerows and field margins on agricultural land can help improve biodiversity by breaking up the monoculture crops.
- Sustainable forestry programmes help to manage the woodlands and reduce the deforestation to a sustainable rate.
- Societies actively encourage recycling and reusing of products and packaging to reduce the household waste going to landfill sites.

Unfortunately these programmes can be difficult to manage. They are often expensive and are difficult to regulate. People who are employed in certain areas, e.g. tree felling, cannot always transfer their skills to an environmentally friendly role and so become unemployed. It is difficult to maintain biodiversity whilst preventing crops being overrun with pests and weeds, which would affect food security for the human population.

Decomposition and Decay

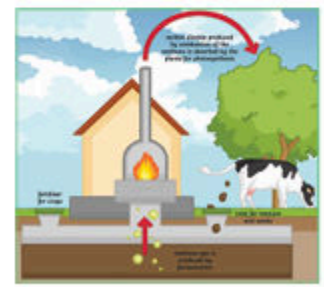
Decomposition is the process of rotting (decay) of a material. The optimum conditions for decay to occur are warm, moist conditions with a plentiful supply of oxygen available. This is because it is microorganisms which are breaking down the larger material into smaller pieces. The microorganisms can digest the material more efficiently and quickly when the conditions are warm, moist and there is a high level of oxygen.

Food can be preserved by many methods to prevent or reduce the rate of decay. These include cooling, canning, freezing, drying, pickling (adding vinegar) or adding salt or sugar.

Some microorganisms ferment waste materials, producing biogas, which can be used as a fuel source. Biogas is produced in a generator (or a digester) using many different microorganisms to ferment the carbohydrates in plant and animal waste. Waste from factories or sewage treatment plants can also be used in a biogas generator. By-products of the fermentation process can be used to fertilise crops and gardens.

There are two main types of generators: batch and continuous.

- A batch generator is manually loaded with the waste and emptied by hand afterwards. It only runs for a short while each time.
- A continuous generator is more automated and the waste is continually fed in. The products made are removed at a steady, continuous rate. It is used for more large-scale projects.

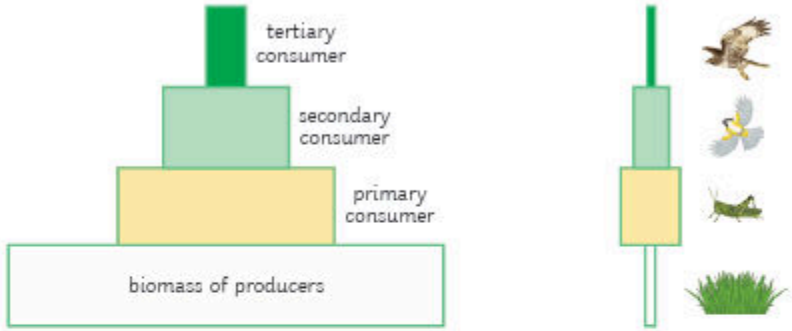


AQA Ecology Knowledge Organiser

Pyramids of Biomass and Biomass Transfer

Biomass is the amount of living matter in a given area.

To find the biomass, we simply multiply the mass of an individual organism by the number of organisms.



A **pyramid of biomass** shows you how much biomass there is in each trophic level. They should be drawn to scale so each bar accurately represents the amount of biomass in that trophic level.

A **pyramid of number** shows you how many of each organism there is in each trophic level.

On average, only 10% of the biomass is transferred to the next trophic level each time.

Energy is lost from trophic levels as heat energy when the organism respires or moves.

Energy is used by the organism for life processes such as homeostasis and growth.

Some of the biomass cannot be eaten e.g. snail shell.

Not all of the organism is eaten by a consumer e.g. stalks and roots.

Biomass and energy are lost in excretions (like poo).

$$\text{Efficiency} = \frac{\text{energy available to the next trophic level}}{\text{energy that was available to the previous trophic level}} \times 100$$

Impact of Environmental Change (HT only)

Changes in the environment can affect the abundance and distribution of the organisms living there.

Abundance means a very large number of organisms.

Distribution means the way in which the organisms are spread over an area.

The changes can be **seasonal**, **geographical** or caused by **human interaction** with the environment. The changing seasons mean that factors including temperature and availability of water can change. These factors impact the organisms living in the ecosystem.

- Birds such as geese migrate south from Europe during the winter months when the temperatures are colder.
- Whales migrate south through the oceans to breed in warmer waters near the equator.
- Worms bury themselves deeper into the earth during the winter to avoid the effects of frost and cold temperatures.
- Land animals such as caribou migrate to find warmer temperatures and food during the colder months.

Some species depend on certain conditions to thrive and give us an indication of factors, such as oxygen availability or pollution. For example, lichens: there are three types of lichens. A lichen is a plant species which grows in exposed areas such as rock surfaces or tree bark. They are adapted to absorbed nutrients from sparse sources, such as rain water. Depending on the level of pollution, different types of lichen are more abundant. We call these types of organisms **bioindicators** and they can help us to monitor the level of pollution or the different factors affecting an ecosystem.

Intensive Farming and Sustainable Fishing

To increase the efficiency of the energy transfer, farmers employ techniques to reduce the amount of energy lost between the trophic levels. These techniques are collectively known as **intensive farming**.

- Animal enclosures are covered and heated to regulate the temperature of the surroundings. This reduces heat loss and energy use for homeostasis and growth.
- Plant growing spaces are covered and heated to regulate the temperature. This improves the growth and enables the environmental conditions to be controlled more closely.
- Some animals are fed high-protein foods and supplements to their usual diet to increase their growth and produce higher yields of meat, milk or eggs.

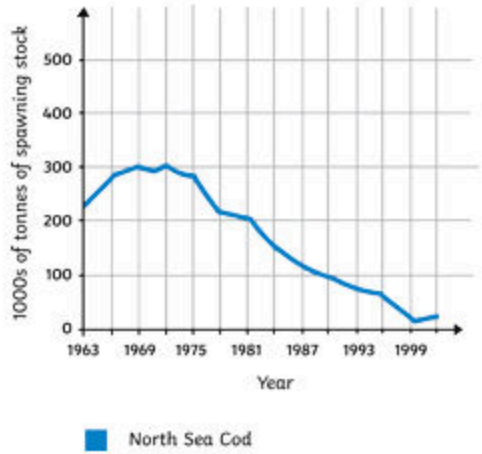
Although these methods increase the output, many people believe it is unnecessarily cruel to the animals. Due to the crowded nature of the enclosures, animals are given antibiotics to prevent disease. These antibiotics can be transferred to humans through our food, and scientists claim this is a possible cause of increasing bacterial resistance to antibiotics.

AQA Ecology Knowledge Organiser

Ocean fish stocks are declining across the world. If the population size is depleted too much, then the breeding rate will no longer sustain a stable population and the species may become extinct.

Fishing regulations are enforced by many countries to help promote the recovery of natural fish stocks in the oceans and to help maintain populations at sustainable levels.

Regulations control the size of the nets allowed to be used and the introduction of fishing quotas helps to limit overfishing in some areas.



RP1: Decay - Investigating the Effect of Temperature on the Rate of Decay of Milk by Measuring pH Change

Milk is an alkaline solution.

- Phenolphthalein (an indicator) is pink in solutions with a pH of 10 or above.
- If the pH drops to about 8, the solution will become colourless.
- Lipase is an enzyme that will break down the fat in milk.
- As lipase breaks down fat to fatty acids, the pH of the solution lowers.

Independent variable – temperature (controlled by water baths and measured using a thermometer).
Dependent variable – time taken for indicator to change colour (measured using a timer).

To calculate the mean:

$$\frac{\text{total time taken for pink colour to disappear (s)}}{\text{number of trials}}$$

Remember to check for any anomalies. If there is an anomaly, discard it and do not add it to your total. Collecting repeated results and calculating an average allows you to identify any anomalous results and improves the reliability of your data.

1. The investigation is carried out at five different temperatures: 0, 20, 40, 60 and 80°C.
2. Label five test tubes as 'lipase' and add 1cm^3 of lipase to each one.
3. Take another five test tubes and add five drops of phenolphthalein to each one.
4. Add 5cm^3 of full fat milk to the test tubes containing phenolphthalein solution and label them 'milk'.
5. Using a clean pipette, add 7cm^3 of sodium carbonate solution to the milk (the solution should turn pink).
6. Place a test tube of lipase and a milk test tube into the water baths until they are both of the desired temperature.
7. To achieve 0°C, place the test tubes in a beaker of ice.

Biotechnology

Biotechnology and agriculture can be combined to provide some possible solutions. These include the following:

- Mass production of mycoprotein which is a protein-rich food suitable for vegetarians.
- Genetically modified bacterium which produce human insulin which is a chemical used in the treatment of diabetes.
- Genetically modified crops, such as golden rice, which provide higher yields or greater nutritional values per unit.

Mycoprotein Fermenters

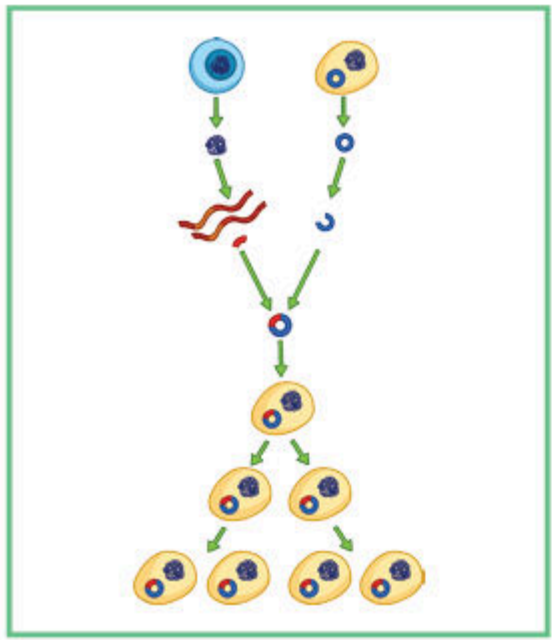
- Mycoprotein is a protein product.
- It is made by the fungus *Fusarium*.
- The fungus is grown in 40m-high fermenters which run continuously in 5-week cycles.
- After the growth cycle, the fungus is harvested, purified, dried and prepared for food products.
- The fermenter is sterilised and ready to repeat the process with a new batch of fungi.

- Genetic modification uses technology to transfer genes from one species to another.
- It can be used to improve food production.
- Genes can be transferred to give plants increased resistance to herbicides, for example.

Genetically modified organisms may present a hazard to human health. They could lead to allergic reactions or have higher than natural levels of toxins.

AQA Ecology Knowledge Organiser

Recombinant DNA technology involves the transfer of genes from one species to another. It can be used to make another organism, usually bacteria, produce a protein. The bacteria are grown in fermenters and can produce huge amounts of the protein. Human insulin is now produced using recombinant DNA technology, as described below.



Food Security

Food security means a whole population have access to enough nutritious food to sustain a healthy lifestyle. This is achieved using methods which the planet can continue to sustain for further generations of the population.
However, there are several biological factors which can threaten food security.

These factors include:

- increasing birth rate
- changing diets
- new pests and pathogens
- widespread famine
- drought
- increasing costs
- war and conflicts

Trophic Levels

Trophic levels describe the position of an organism within the food chain.

They can be represented by numbers.

The higher the number, the further along the food chain.

Trophic levels only represent the living organisms (so the sun isn't included).

Scavengers and decomposers are not represented in the trophic levels either.

Level 1: Producers

Level 2: Primary Consumers

Level 3: Secondary Consumers

Level 4: Tertiary Consumers

AQA GCSE Chemistry (Separate Science) Unit 10: Using Resources

Sustaining Human Life on Earth

The human **population** is **increasing** rapidly and our use of earth's finite resources has increased. If humans continue to use these resources at the rate at which we are, then we will reach a point where the human population cannot be sustained on earth.

Humans use the **earth's natural resources** for warmth, shelter, food, clothing and transport. Scientists are making **technological advances** in **agricultural** and **industrial processes** to provide food and other products that meet the growing needs of the human population but it is of major importance that this is done in a sustainable way so that our finite resources are not used up.

Earth's Resources

Finite resources are those of which there is a **limited supply**, for example coal, oil and gas. These resources can be used to provide energy but, one day, their supply will run out.

Crude oil is processed through **fractional distillation** and **cracking** to produce many useful materials such as petrol, diesel and kerosene.

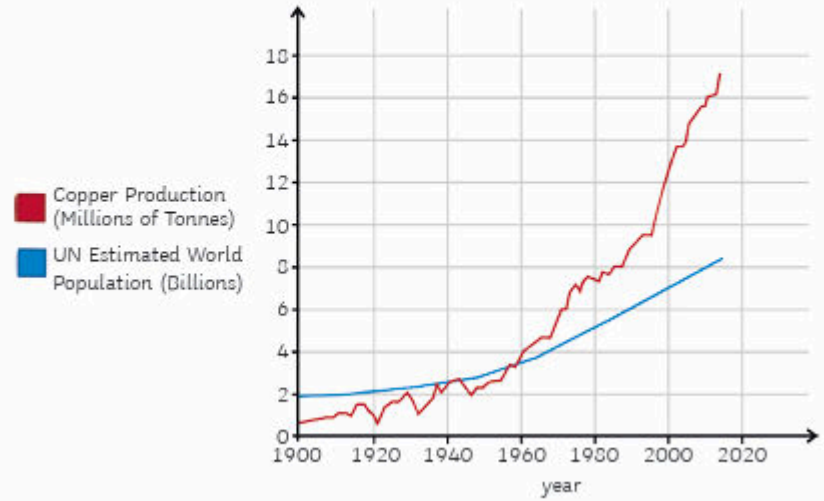
Renewable resources will not run out in the near future because the reserves of these resources are high. Examples of renewable resources include solar energy, wind power, hydropower and geothermal energy.

Haber Process and Copper

Scientists often discover new ways to produce a product; **synthetic methods** of production replace **natural methods**. For example, fertilisers were obtained from manure (a natural resource).

The **Haber process** allowed the synthetic production of **fertilisers** and this enabled **intensive farming** methods to spread across the globe. In turn, this supported the growing human population.

Copper is another resource that has been exploited over time. As the human population has increased since 1900, the demand for copper has also increased. Copper is a finite resource which means that there is a limited supply.



Water

Potable water is water that is **safe to drink**. Potable water is **not pure; dissolved impurities** still **remain** in the water. Pure water is odourless, tasteless and colourless compared to rainfall or water from streams and wells as these **harbour chemicals** such as acid.

Pure – the **definition** of a pure substance is one that contains only a single type of material that has not been contaminated by another substance.

Potable water must contain **low levels** of microbes and salts for it to be deemed safe to consume. This is because **high levels** of microbes and salts can be harmful to human health.

The methods of making water safe vary depending on where you live. Starting with sea water is harder than starting with fresh water. This is because the **energy cost** of removing large amounts of sodium chloride from seawater is greater.

In the UK, our populations' water needs are met through **rainfall**. During the **summer, water levels** in reservoirs **decrease** and local areas are encouraged to reduce their water usage by swapping baths for showers and they are asked to avoid using hosepipes.

In the UK, **insoluble particles** are **removed** from naturally occurring fresh water by passing it through **filter beds**. **Microbes** are **killed** by **sterilising the water**. Several different sterilising agents are used for potable water. These are chlorine, ozone or ultraviolet light. The right amount of chlorine and ozone gas (O_3) must be used as both are harmful to human health.

AQA GCSE Chemistry (Separate Science) Unit 10: Using Resources

Desalination of Sea Water

If fresh water supplies are limited, sea water can undergo a process called **desalination**. This process requires **large amounts of energy**, but can be done by distillation or the use of membranes such as **reverse osmosis**.

Distillation involves **heating** the sea water until it reaches **boiling point**. Once the water is boiling, it will begin to **evaporate**. The steam then rises up where it cools and condenses in a condensing tube. The salt is left behind. The **downside** to this process is the **energy cost** of boiling the water and cooling down the steam sufficiently in the condensing tube. Not all of the water evaporates which leaves behind a **salty wastewater** that can be **difficult to sustainably dispose of** without harming aquatic organisms.

Reverse Osmosis of Salt Water

Osmosis, as you will have learnt in biology, is the **movement of particles** from an area of **high** concentration **to** an area of **low** concentration through a **semi-permeable membrane**.

Reverse osmosis involves **forcing water** through a **membrane** at **high pressure**. Each membrane has tiny holes within it that only allow water molecules to pass through. Ions and other molecules are prevented from passing through the membrane as they are too large to fit through the holes.

The **disadvantage** of this method is that it produces **large amounts of wastewater** and requires the use of **expensive membranes**. Due to a large amount of wastewater produced, the efficiency of this method is very small.

Water Treatment

Before the **wastewater** from industry, agriculture and peoples' homes can be released back into the environment, it must be **treated**.

Pollutants such as human waste contain **high levels of harmful bacteria** and **nitrogen compounds** which can be a **danger to aquatic organisms**.

Industrial and agricultural waste may contain **high levels** of **toxic metal compounds** and **fertilisers and pesticides** which may also damage the ecosystem.

Cleaning sewage requires several steps:

Step 1 – The water must be **screened**. This is where material such as branches, twigs and grit is removed.

Step 2 – The water undergoes **sedimentation**; wastewater is placed in a settlement tank. The heavier solids sink to the bottom and form a sludge whilst the lighter effluent floats on the surface above the sludge.

Step 3 - The effluent is then transferred to another tank where the organic matter undergoes **aerobic digestion**. Although not pure, this water can be safely released back into the environment. The sludge is placed in another tank where the organic matter undergoes **anaerobic digestion**. It is broken down to produce fertiliser and methane gas which can be used as an energy resource (fuel).

Required Practical 8 – Analysis and Purification of Water Samples from Different Sources

Analysing the pH of Water Samples

Test the pH of each water sample using a pH meter or universal indicator. If using universal indicator, use a pH colour chart so that you are able to identify the pH of the sample against the colour produced by the indicator.

Analysing the Mass of Dissolved Solids

To measure the mass of dissolved solids in a water sample, measure out $50cm^3$ of the sample using a measuring cylinder. Take the mass of an evaporating basin before heating and record the mass in a table. Place the measured amount of water into an evaporating basin and gently heat over a Bunsen burner until all the liquid has evaporated. Once the evaporating basin has cooled, place it on a top pan balance and record its mass. Calculate the mass of the solid left behind.

Distillation of the Water Sample

To distil a water sample, set up your equipment as per the diagram.

Heat the water sample gently using a Bunsen burner. After a short period of time, distilled water should be produced.

Life-Cycle Assessment (LCA)

Life-Cycle Assessments follow the four main stages of the life cycle of a product.

Stage 1 – Extracting the raw materials needed to make the products and then processing them.

At this stage, the energy and environmental costs need to be considered. For example, if the raw material being used is a finite or renewable resource, the energy to extract and transport the raw material should be considered. Environmental factors also play a large part in stage 1 as the extraction of the raw material can leave scars on the landscape and waste products may be produced that could damage local ecosystems.

AQA GCSE Chemistry (Separate Science) Unit 10: Using Resources

Life-Cycle Assessment (LCA) (continued)

Stage 2 – Manufacturing and packaging of the product.

The main consideration is how much energy and resources are needed to manufacture the product. Energy may be used in the form of fuel, electricity or chemicals used in the production of the product. In the manufacturing process, there may be pollution and waste products that need to be considered. Transportation of the goods from the factory to the user will have an environmental impact.

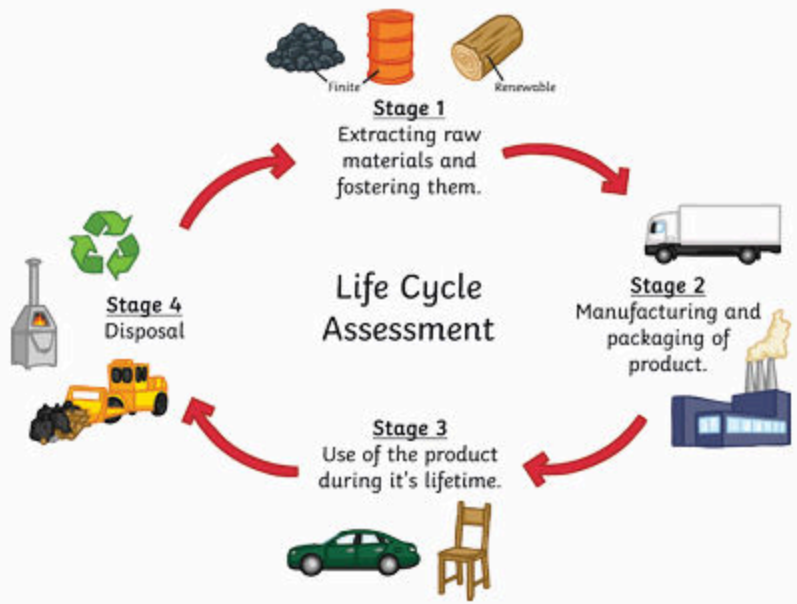
Stage 3 – Use of the product during its lifetime.

The environmental impact of a product during its life depends on the type of product. For example, a car will have a significant impact i.e. it needs to be filled with petrol or diesel, a finite resource, to get to where you are going. A car's engine releases harmful emissions into the atmosphere. On the other hand, a wooden chair may only need minor repairs and is made from a renewable resource.

Stage 4 – Disposal at the end of a product's life.

There are different methods of disposal:

1. Landfill – the product is put in a hole in the ground – high environmental impact.
2. Incineration (organic matter) – burning of the product – low environmental impact.
3. Recycling – for example, batteries contain metal compounds that are not good for the environment. By recycling, it means that no new compounds have to be taken out of the ground.



Comparative LCAs

Comparative LCAs are used to evaluate products and to find which one will have a lower environmental impact.

Stage of Life Cycle	Plastic Bag	Paper Bag
Stage 1 – raw material	Uses a finite resource (crude oil). The processes of fractional distillation, cracking and polymerisation all require energy to make crude oil useful.	Made from trees/recycled paper. Making paper from trees requires more energy than recycled paper because trees have to be chopped down. Still uses less energy than making plastics from crude oil.
Stage 2 – manufacture	Cheap to make.	More expensive to make.
Stage 3 – use	Plastic bags have a low environmental impact as they can be used a number of times. In comparison to paper bags, they are much stronger.	Paper bags can only be reused a limited number of times and so have a short lifetime.
Stage 4 – disposal	The downside to plastic bags is that they do not biodegrade easily in landfill. Recycling options are available. If they are not disposed of correctly, plastic bags can have a detrimental impact on the environment and animal habitats.	Paper bags biodegrade easily in landfill sites.

AQA GCSE Chemistry (Separate Science) Unit 10: Using Resources

Disadvantages of Comparative LCAs

The disadvantage of **comparative LCAs** is that some parts of it require certain judgements to be made.

Different people have different opinions and this is dependent on who completes the LCA and whether a certain level of bias is added. For example, if the LCA is completed by a company that is manufacturing a specific product, they may only discuss **some** of the environmental impact of their product in the LCA. Accurate numerical values, for example, show a company how much energy has been used in the **manufacturing process** or how much **carbon dioxide** was produced when the goods were transported.

Recycling

Many materials are made from **natural resources** that have **limited supplies**. Reusing items such as glass bottles that only need washing and sterilising saves energy and reduces the environmental impact. Not all products can be reused, some need to be recycled before reuse.

There are both advantages and disadvantages to recycling materials.

Advantages

- Fewer resources such as **mines** and **quarries** are needed to remove raw, finite materials from the ground. For example, copper.
- Crude oil, the raw material used in the production of plastics, does not need to be extracted. This, in turn, **avoids** high energy cost processes such as fractional distillation and cracking. If more items are recycled, less would end up in landfill sites.
- The amount of greenhouse gases would reduce as the energy cost of recycling is a lot **less** than making a new product.

Disadvantages

- Recycling items require collection and transport of the goods to the organisation. This involves using staff, vehicles and the use of fuel.
- Some materials, such as **metals**, can be **difficult to sort**; the amount of sorting is dependent on the purity of the materials or metals and the level of purity required for the final product. For example, copper used in electrical appliances must have a high purity. To achieve this, the copper needs to be processed and then melted down again to make copper wiring.
- Steel that is used in the construction industry does not require such high purity. Often scrap iron is added to the furnace when steel is made. This reduces the need for as much iron ore and reduces the cost of making steel.

Biological Extraction Methods (Higher Tier Only)

Biological methods of extraction are needed as the resources of **metal ores** on earth are in **short supply**. Large scale **copper mining** leaves **scars on the landscape** and produces significant amounts of waste rock that must be disposed of. Biological methods have a lower impact on the environment and make use of waste containing small amounts of copper. The disadvantages of **biological extraction methods** are that they are **slow**, but they do reduce the need to obtain new ore through mining and conserve limited supplies of high-grade ore.

Phytomining

Phytomining involves the use of **plants**. Plants absorb the metal compounds found in the soil. The plants cannot get rid of the copper ions and it builds up in the leaves. The plants are then **harvested, dried** and then placed in a furnace. The ash that is produced from the burning process contains soluble metal compounds that can be extracted. The ash is dissolved in an acid such as hydrochloric or sulfuric and the copper is then extracted by electrolysis or through a **displacement reaction** with iron.

Bioleaching

Bioleaching uses **bacteria** to produce an acidic solution called **leachate** which contains **copper ions**. The disadvantage of bioleaching is that it produces **toxic substances** that are **harmful to the environment**. To process the copper, the copper undergoes a displacement reaction with iron. Iron is cheaper and a **more cost-effective** way of producing copper from the leachate.

Corrosion

Metals can corrode when **exposed** to **oxygen**; they oxidise and can form metal oxides. Some metals oxidise more quickly than others, like sodium, and some such as gold are very unreactive and do not oxidise at all.

Corrosion occurs when a metal continues to oxidise and the metal becomes weaker over time until it eventually becomes a metal oxide.

Rusting occurs when **iron or steel** reacts with **oxygen** in the **air or water**. Rusting is an example of corrosion.

iron + oxygen + water $\longrightarrow$ hydrated iron(III) oxide

$4Fe + 3O_2 + 6H_2O \longrightarrow 4Fe(OH)_3$

How Can Rusting Be Prevented?

To prevent rusting, oxygen and water must be kept away from the iron or steel.

Storing the metal in an atmosphere containing unreactive argon prevents it from reacting with oxygen.

A substance such as calcium chloride can be used to absorb water vapour and keep the metal dry.

AQA GCSE Chemistry (Separate Science) Unit 10: Using Resources

Barriers to Prevent Rusting

There are several different methods that are used to prevent rusting.

1. painting
2. coating with plastic
3. oiling and greasing

Electroplating

To improve the appearance of metal or to prevent corrosion, a thin layer of a metal can be applied to an object using electrolysis. This process is called **electroplating**.

In electrolysis, there are two electrodes – the **positive anode** (plating metal) and the **negative cathode** (the iron or steel object). The **electrolyte** is the solution that contains the metal ions needed to plate the metal. For example, cutlery made of steel can be electroplated with silver.

Sacrificial Protection

Metals such as iron can be **prevented** from rusting if they are put into contact with **more reactive metals** such as zinc. The reactive metals will react more readily with oxygen whilst iron does not corrode.

We say that the more reactive metal has **'sacrificed'** itself. Once the more reactive metal has corroded away, it can simply be replaced.

Galvanising

Galvanisation is the process of coating iron with zinc. The purpose is to **prevent** oxygen and water reacting with iron and so prevents **rusting**. Zinc acts as a **sacrificial** metal.

Alloys

Name of Alloy	Component Metals	Uses
bronze	copper and tin	bells coins statues
brass	copper and zinc	locks taps instruments door hinges door knobs
gold	Alloyed with other metals such as silver, zinc and copper.	jewellery

Steel Alloys

Steel is an **alloy** made up of **iron** mixed with certain amounts of **carbon**. Different steels have different properties and this determines their use.

- **High-carbon steel** contains a **high proportion of carbon**. This type of steel is **strong and brittle** and is used in the construction industry.
- **Low-carbon steel** contains a **low proportion of carbon** and is softer and more **easily shaped**. This makes it useful for making car body panels.
- **Stainless steel** is made up of **iron** but also the elements **chromium** and **nickel**. It is used for making **cutlery** as it does not rust.

Glass

Glass is made by **melting** a mixture of **sand** (silicon dioxide), **limestone** and **sodium carbonate**. Once it has melted, the molten liquid then cools and solidifies. Glass made with this mixture of ingredients is called soda-lime glass. **Soda-lime glass** is used for window panes, glass jars and bottles.

Glassware that is used in **baking** and in the **laboratory** contains boron trioxide. **Borosilicate glass** has a **higher melting point** than soda-lime glass which makes it better suited to its function where high temperatures are often used.

Ceramics

Ceramics made from **clay** include china, porcelain and brick. Wet clay is shaped and then placed into a furnace where it is heated to a **high temperature**. Crystals form in the clay and join it together.

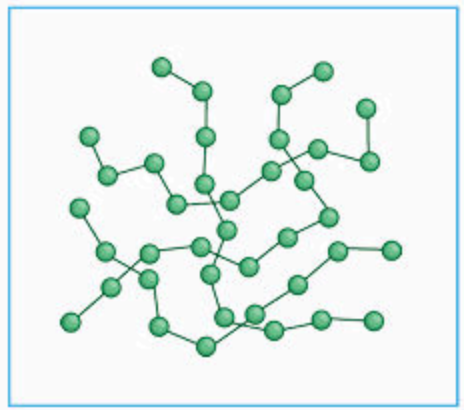
Dinner plates and bowls are made from clay ceramics. Once taken out of the furnace, the ceramics are allowed to cool and are coated with a glaze. This glaze hardens over time and forms a waterproof layer.

Polymers

Polymer properties are dependent upon the **monomer** that it is made from and the conditions in which it was made. For this reason, different polymers have different jobs. For example, **low-density** (LD) and **high-density** (HD) poly(ethene) are made from the monomer ethene using different catalysts and reaction conditions. Low-density poly(ethene) LDPE is flexible and is commonly used in carrier bags and bubble wrap. High-density poly(ethene) HDPE is much stronger, flexible, resists shattering and chemical attack. It is commonly used in plastic bottles, pipes and buckets.

Thermosetting and Thermosoftening Plastics

The polymer chains in **thermosetting plastics** are held together by strong **covalent bonds**. This means that plastics in this group can withstand **higher temperatures** and do not melt when heated – they have **high melting points**. Thermosetting plastics are used to make electrical plugs. Even if there is a fault and the wiring becomes hot, the plastic casing will not melt.



AQA GCSE Chemistry (Separate Science) Unit 10: Using Resources

Composite Materials

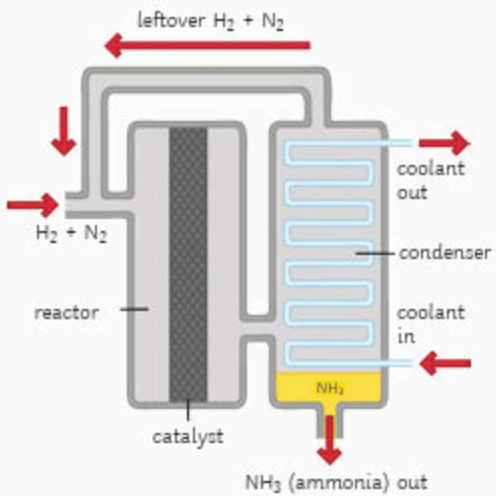
Composites are made up of two materials: a **reinforcement** and a **matrix** which binds the reinforcement together.

Wood is a natural composite. The matrix is **lignin** which is a material that can be found lining the xylem vessels of plants. Wood is reinforced with **cellulose**; in wood, the cellulose fibres are lined up next to each other and this makes the wood stronger in one direction than another. **Chipboard** is a material that can be used for kitchen worktops and doors. Chipboard is made up of **wood chips** (reinforcement) that is randomly arranged and held together by **resin glue** (matrix). This makes it **strong in all directions**.

Fibreglass and carbon fibre reinforced polymer (CFRP) contain fibres that are strong under tension. Fibreglass contains glass fibres and CRFP contains **carbon fibres**, both of the fibre types are used as **reinforcement**. The fibres themselves are flexible but do not easily stretch. The fibres in each of these composite materials are held together by **polymer resin** (matrix) which helps to bind the fibres together making them stiff.

Concrete is such a versatile material and is often used in the construction industry. The strength of concrete can be increased by **reinforcing** it with other materials such as **wire mesh or steel rods**. The compressive strength of **concrete** (matrix) is greater than its tensile strength. This means that it can withstand more force from crushing than it can force under tension. **Steel** (reinforcement), on the other hand, has greater tensile strength. This means that by combining the two materials, one is created that is both strong under tension and strong under compression. This makes reinforced concrete an important material in the construction of large buildings.

Haber Process



The Haber process is used by the chemical industry to synthesise **ammonia**. Ammonia is used in the production of fertilisers, dyes and explosives.

The reaction is a **reversible** one and involves nitrogen reacting with hydrogen to produce ammonia. As the reaction is reversible, some of the ammonia will decompose back into nitrogen and hydrogen.

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$$

The reaction mixture is cooled, the ammonia liquifies and is then removed. The hydrogen and nitrogen that has not reacted is recycled to increase the efficiency of the process. The reaction reaches **dynamic equilibrium** and this is where the rate of the forward reaction occurs at the same rate as the backward reaction.

In the Haber process, nitrogen and hydrogen are pumped through pipes at a pressure of **200 atmospheres**.

Nitrogen is obtained by extraction from the air and hydrogen is obtained from natural gas. The gases are passed through a tank containing a **catalyst** (iron); catalysts speed up the rate of a chemical reaction without getting used up themselves. The gases are heated to **450°C** as they pass through the tank.

The reaction mixture is allowed to cool and this allows the ammonia to turn from a gas to a liquid. Once this has happened, the ammonia is removed. Any unreacted nitrogen and hydrogen is then recycled.

Fertilisers

Fertilisers contain lots of **mineral ions** that are key to the growth of healthy crops. Plants absorb these minerals through their root hair cells; these mineral ions need to be replaced and so farmers need to add fertiliser to the soil in order to replace the lost mineral ions.

Farmers often use **NPK fertilisers**. These are fertilisers that contain the elements **nitrogen, phosphorus and potassium**.

- Ammonium nitrate - NH_4NO_3 - and ammonium sulfate - $(NH_4)_2SO_4$ - are examples of fertilisers that contain the essential element nitrogen.
- Ammonium phosphate - $(NH_4)_3PO_4$ - contains the elements nitrogen and phosphorus.
- Potassium nitrate - KNO_3 - contains the elements potassium and nitrogen.

AQA GCSE Chemistry (Separate Science) Unit 10: Using Resources

Ammonia

Ammonia has the chemical formula NH_3.

Ammonia produces the ammonium ion NH^{4+} when it is involved in neutralisation reactions. Ammonia is an alkali. Oxidation of ammonia produces nitric acid HNO_3; nitric acid is the source of the nitrate ion NO^{3-}.

alkali + acid ⟶ salt

ammonia + nitric acid ⟶ ammonium nitrate

$NH_3 + HNO_3 \longrightarrow NH_4NO_3$

In aqueous solutions:

ammonium hydroxide + nitric acid ⟶ ammonium nitrate + water

$NH_4OH + HNO_3 \longrightarrow NH_4NO_3 + H_2O$

Mining

The raw materials for fertilisers need to be mined. The minerals needed to make fertilisers are extracted from the **earth's crust**.

Potassium chloride and **potassium sulfate** are a source of potassium ions and are used as fertilisers. **Phosphate rock** is **insoluble** and so cannot be used in fertilisers, but it does contain **phosphorus** which when reacted with acid, will produce **soluble compounds**.

Phosphate rock when reacted with **nitric acid** produces calcium nitrate and phosphoric acid.

Phosphate rock when reacted with **sulfuric acid** produces a mixture of calcium sulfate and calcium phosphate which is called single superphosphate.

Phosphate rock when reacted with **phosphoric acid** produces calcium dihydrogen phosphate also called triple superphosphate.

Ammonium Sulfate

The salt ammonium sulfate ($(NH_4)_2SO_4$) is used as a fertiliser and is made when ammonia and sulfuric acid react.

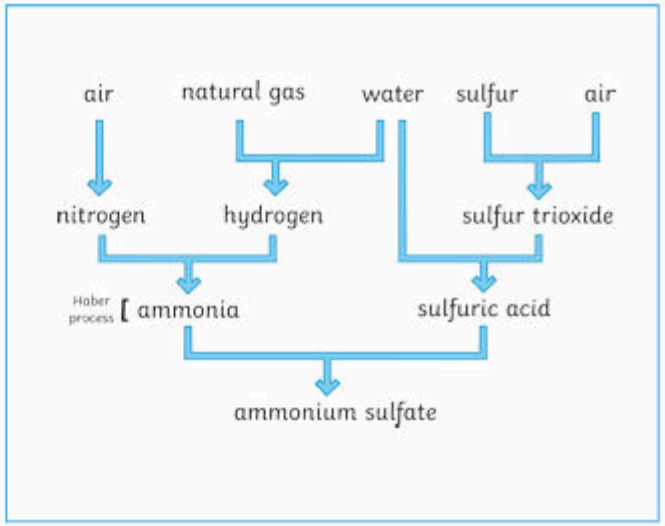
ammonia + sulfuric acid ⟶ ammonium sulfate

$2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$

Chemical Industry

To make sulfuric acid, sulfur, air and water are needed.

Sulfur first reacts with oxygen to produce sulfur dioxide. The sulfur dioxide further reacts with oxygen at a temperature of 450°C to produce sulfur trioxide. This in turn reacts with water to produce sulfuric acid.



In the Laboratory

Ammonium sulfate is produced by reacting ammonia solution with sulfuric acid.

Stage 1 – A measured amount of ammonium sulfate solution is poured into a conical flask.

Stage 2 – Two to three drops of the indicator methyl orange is added. The ammonia solution will turn yellow as it is an alkaline.

Stage 3 – The conical flask is placed under a burette containing sulfuric acid. Slowly the sulfuric acid is added to the flask until the indicator turns orange. If the indicator turns red, this means that too much acid has been added.

Stage 4 – Once the solution turns orange, the volume of acid that was added is recorded and the neutral ammonium sulfate solution containing the indicator is discarded.

Stage 5 – The experiment is then repeated with the same volumes of sulfuric acid and ammonia solution, but this time the indicator is not added. The solution is then heated and the water evaporates leaving behind crystals. The crystals left in the evaporating basin are then placed in an oven.

AQA GCSE Physics (Separate Science) Unit 7: Magnetism and Electromagnetism

Poles of a Magnet

A magnet has two ends called **poles**: the **north pole** and the **south pole**. The magnetic forces of the magnet are strongest at the poles.

When two magnets are brought close together, they will **attract** or **repel**, depending on which poles are brought together:

- **Like poles** will **repel** one another e.g. N-N or S-S.
- **Opposite poles** will **attract** e.g. N-S.

The forces exerted between the poles of two magnets are a type of **non-contact force**: the magnets do not have to be touching for the effect to be observed.

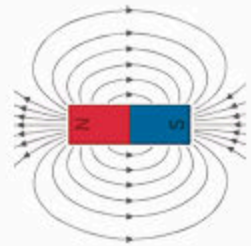
Remember that only **iron**, **cobalt** and **nickel** (or alloys containing these metals) are magnetic.

A **permanent magnet** is one with its own magnetic field. The magnetism cannot be turned on or off e.g. a bar magnet or a horseshoe magnet.

An **induced magnet** is a material which becomes magnetic only when placed within a magnetic field. Induced magnets only attract other materials and lose most (if not all) of their magnetism when removed from the magnetic field e.g. iron filings.

Magnetic Fields

The **magnetic field** is the area surrounding a magnet where the force is acting on another magnet or magnetic material. It can be observed using a compass placed at different points around a bar magnet. The field lines can be drawn by using the compass to mark the direction at a range of points.



A magnet always causes a magnetic material to be **attracted**. The strength of the magnetic field is determined by the proximity to the magnet.

When looking at a diagram of magnetic field lines, the force is strongest where the lines are closest together. The magnetic field of the magnet is strongest at the poles. The direction of the magnetic field shows the direction the force would act on another north pole.
As a result, magnetic field lines always come away from the north pole (like poles repel) and towards the south pole (unlike poles attract).

The earth produces a magnetic field and a magnetic compass uses this to help aid navigation. The core of the earth is made of iron (a magnetic material). A compass contains a small bar magnet shaped as a needle, which points in the direction of the earth's magnetic field.

Plotting Magnetic Field Lines

A magnetic compass can be used to plot and draw the magnetic field lines around a magnet.

You should be able to describe this method for a bar magnet.

1. Place the bar magnet in the centre of a sheet of plain paper.
2. Using a magnetic compass, position it on the paper somewhere around the magnet.
3. Observe the direction of the needle and carefully draw a dot at the circumference of the magnet, in line with each end of the needle. Make sure you include an arrow to indicate the direction of north.
4. Repeat steps 2 and 3 for several positions around the magnet.
5. Join the arrows to complete the magnetic field lines and whole pattern.

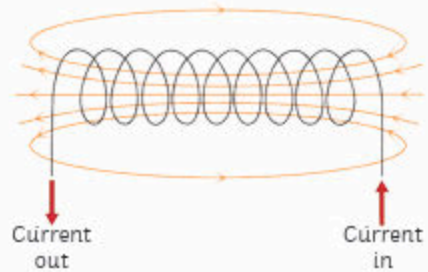
Electromagnetism

A circular **magnetic field** is produced when a current is passed through a conducting wire. This produces an **induced magnet**.

Switching off the current causes the magnetism to be lost.

The strength of the magnetic field can be increased by increasing the current flowing through the wire. The strength of the magnetic field is stronger closer to the wire.

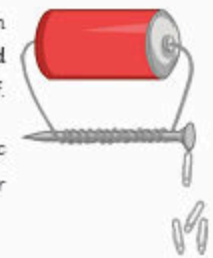
Coiling the wire to form a **solenoid** will also increase the strength of the magnetic field. The strength of the magnetic field created by a solenoid is strong and uniform throughout.



To increase the strength of the magnetic field around a solenoid you can...

- add an iron core;
- increase the number of coils in the wire;
- increase the current passing through the wire.

An **electromagnet** is a solenoid with an iron core. Electromagnets are **induced magnets** and can be turned on and off.

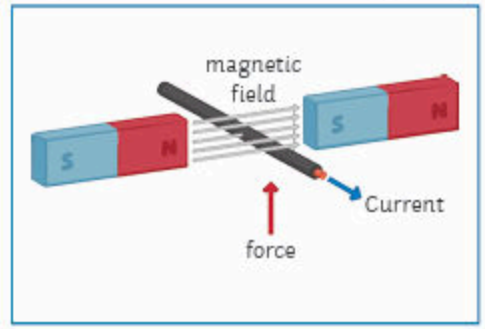


Electric motors, loudspeakers, electric bells and remotely controlled door locks all use **electromagnets**.

AQA GCSE Physics (Separate Science) Unit 7: Magnetism and Electromagnetism

The Motor Effect and Flemings Left-Hand Rule

When a wire carrying a current is exposed to the magnetic field of another magnet, then a **force** is produced on the wire at a **right angle** to the direction of the magnetic field produced.



This is called the **motor effect**.

The force produced by the motor effect can be calculated using this equation:

force (N) = magnetic flux density (T) × current (A) × length (m)

For example:
A current of 8A is flowing through a wire that is 75cm long. The magnetic field acting at a right angle on the wire is 0.5T. Calculate the force.

F = B × I × l

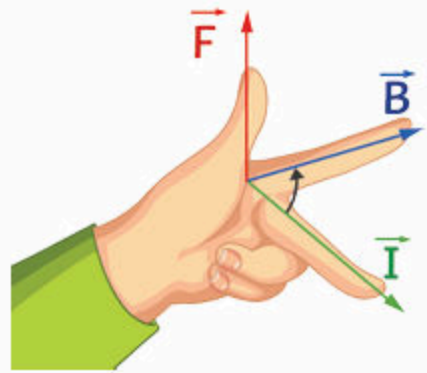
Remember: the equation uses length measured in m. The question gives you the length in cm so you need to convert it before you calculate your answer.

F = 0.5 × 8 × 0.75

F = 3N

From the equation we can see that the force acting on a given length of wire (e.g. 1m) will be increased if the current increases or the magnetic flux density increases. If the current flowing through a wire is **parallel** to the magnetic field, then **no force** is produced – there is no motor effect.

You might be shown a diagram and asked to indicate the direction of the force produced. **Fleming's left-hand rule** can help you do this because it represents the **relative orientation** of the force produced by the motor effect.

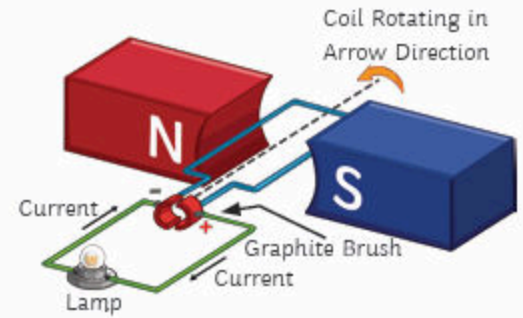


Remember:

- Use your **left hand**!
- The angle between your index finger and middle finger should be a **right angle** on the horizontal plane.
- The angle between your index finger and thumb should be a **right angle** on the vertical plane.
- Your **thumb** represents the direction of the **force**.
- Your **index finger** represents the direction of the **magnetic field**.
- Your **middle finger** represents the direction of the **current** flowing through the wire.

Electric Motors

When the wire carrying the current is **coiled**, the motor effect acting on it causes the wire to **rotate**. This is how an **electric motor** works.



As the **current** flows (from negative to positive), the force produced in each side of the coil acts in **opposite directions**, causing the coil to **rotate** overall.

When the coil reaches a **vertical position**, the force produced is now **parallel** to the magnetic field line and so would be **zero**. This would cause the motor to stop rotating.

To maintain the rotation of the coiled wire, a **split ring commutator** is used to supply the current to the wire. The DC supply reaches the split ring via graphite or metal **brushes** which maintain the connection while allowing it to rotate freely on the **axle**.

The two halves of the split ring commutator ensure that the **current supplied** to the wire **changes direction** each half-turn (or that the current supplied is the same direction on each side of the motor) and as a result, the force produced maintains a **constant rotation** in one direction overall.

AQA GCSE Physics (Separate Science) Unit 7: Magnetism and Electromagnetism

Headphones and Loudspeakers

Headphones work because they contain small loudspeakers inside them. A loudspeaker makes use of the motor effect to produce sound. Variations in the AC electric current supplied to the device causes variations in the magnetic field produced. These variations cause the cone in the loudspeaker to move and the vibrations are transferred to the air particles and generate a sound wave.

- An alternating current is supplied through a coil of wire in the loudspeaker.
- This produces an electromagnetic field around the wire.
- The electromagnetic field interacts with the magnetic field of the surrounding permanent magnetic and a force is produced (the motor effect).
- The force produced pushes the cone in the loudspeakers outwards.
- The current is reversed and the force changes direction, pulling the cone back inwards.
- The vibrations of the cone moving in and out creates vibrations in the air particles, which are transferred as sound waves.
- The sound waves produced match the electrical signals supplied.

Induced Potential and the Generator Effect

Induced potential or **electromagnetic induction** is when a **potential difference** (voltage) is created across a **conductor** (e.g. a wire) due to a change in the **magnetic field**.

If the conductor is connected in a **closed circuit**, then it will cause a **current** to flow.

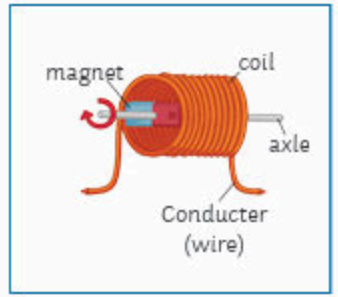
Induced potential can be produced by either...

- moving a **magnet** in a **coil** of wire;
- moving an **electrical conductor** (wire) through **magnetic field lines**;
- moving a **coil** of wire in and out of a **magnetic field**.

Moving the conductor in the **opposite direction** or reversing the **polarity** of the magnet will cause the potential difference to reverse and the current will flow in the opposite direction.

Continuously moving the magnet or conductor to repeatedly change the direction of the potential difference is how an **alternating current** is produced.

A **generator** uses an induced potential to produce an alternating current.



A magnet on an axle is positioned in a coil of wire. The poles of the magnet are on the outer edges as the magnet is spun on the axle. Every half-turn on the axle rotation, the poles are reversed (swap sides in the coil) and this causes the induced potential to change direction. This produces an alternating current in the conducting wire.

To increase the voltage of a induced potential you can...

1. increase the **strength of the magnet** used;
2. increase the **number of turns** in the conducting coil of wire;
3. increase the **area** of the coil;
4. increase the **speed of the movement** (of the magnet or conductor).

Turning the magnet more quickly will not only increase the **voltage**, but also increase the **frequency**.

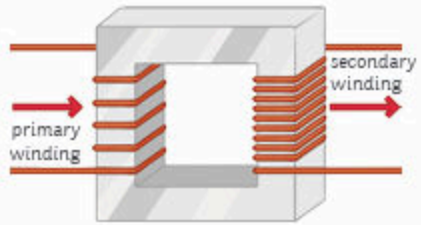
Transformers

A **transformer** changes the **voltage** using an **induced potential** (electromagnetic induction).

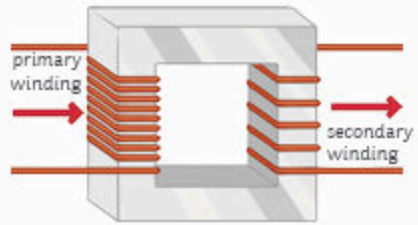
Transformers only work for an **alternating current potential difference**. A transformer is simply **two coils of wire** (primary coil and secondary coil) connected by an **iron core**.

There are two main types:

Step-up transformers: **increase** (step-up) the **voltage**. There are fewer primary coils than there are secondary coils.



Step-down transformers: **decrease** (step-down) the **voltage**. There are more primary coils than there are secondary coils.



AQA GCSE Physics (Separate Science) Unit 7: Magnetism and Electromagnetism

Transformers (continued)

A current doesn't flow through the **iron core**. The role of the iron core is to **transfer the changing magnetic field** between the two coils only.

When an **alternating current** is supplied to the primary coil, it produces a magnetic field with the iron core. The magnetic field in the iron core constantly changes direction due to the alternating current.

The voltage of the induced potential in the secondary coil depends on the ratio of turns between the primary and secondary coils:

- If there are **more turns** in the **secondary coil**, the **potential difference** will be **greater** (a step-up transformer).
- If there are **fewer turns** in the **secondary coil**, the **potential difference** will be **less** (a step-down transformer).

Remember: an **induced potential** can only be produced by a **changing magnetic field** so it only works with an **alternating current (AC)** and **not a direct current (DC)**.

The power supplied by a transformer can be calculated using the equations:

power (W) = potential difference (V) × current (A)

Transformers are almost 100% efficient:

electrical power in = electrical power out

So...

potential difference across primary coil × current in the primary coil = potential difference across secondary coil × current in the secondary coil

This can also be written simply as:

$V_p I_p = V_s I_s$

Worked example:

Shannon is using her hair straighteners on holiday in Europe. A travel adaptor transforms the 110V AC mains supply to 230V. The current in the hair straighteners is 6A. Assuming the transformer is 100% effiecient, calculate the current draw by the adaptor from the mains supply (in the primary coil). Give your answer to two decimal places.

$V_p I_p = V_s I_s$

$110 \times I_p = 230 \times 6$

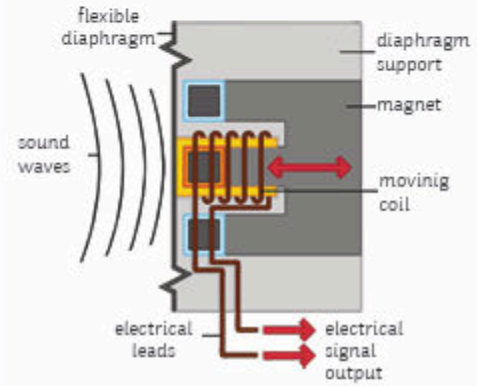
$110 \times I_p = 1380$

$I_p = \frac{1380}{110}$

$I_p = 12.55A$

Microphones

Essentially, a **microphone** works like a loudspeaker but uses the generator effect in reverse. Instead of using the alternating current to produce a changing magnetic field and cause movement in the cone, a microphone uses movement in a diaphragm to produce a changing magnetic field and create an alternating current.

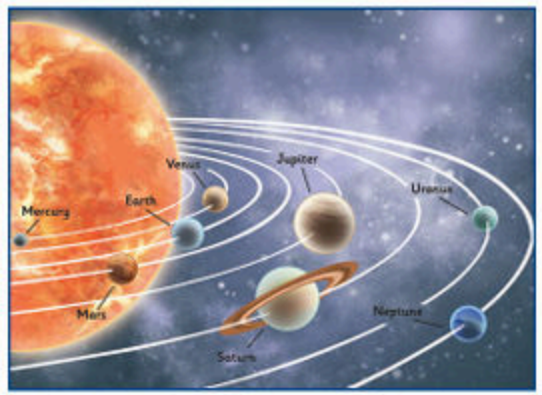


- The **sound wave** vibrations in the air particles are transferred to the **flexible diaphragm**.
- This causes the diaphragm to move, **vibrating the coil**.
- The coil moves through the **magnetic field** of the **permanent magnet** and an **induced potential** is created.
- The induced potential causes a **current** to flow in the **closed circuit** which the coil is attached to.
- The induced potential changes to match the vibrations of the sound waves, which results in the current changing to match the induced potential, transferring the sound wave.

AQA Physics Unit 8: Space Physics

Formation of a Star

The Solar System



The solar system is part of the Milky Way galaxy and is made up of the Sun and anything that goes round it (orbit). There are 8 planets and some dwarf planets, including Pluto.

Planets are objects that orbit a star (the Sun). A dwarf planet will orbit a star but will be too small to be a planet, or not quite fit the pattern of a normal planet. Pluto is an example of a dwarf planet. Moons orbit planets and are also known as natural satellites. Planets are natural satellites of the Sun. Artificial satellites are satellites that humans have built and they mostly orbit the Earth.

Formation of a Star

1. Stars are made from a cloud of dust and gas – a **nebula**. Gravity pulls the dust and gas together, forming a **protostar**.
2. The more dense the star, the hotter it becomes. Fusion of the hydrogen nuclei starts, emitting a lot of energy.
3. The next stage is the **main sequence star**. This stage will last for a few billion years. This is a stable phase as the force of gravity and fusion of hydrogen are balanced. Hydrogen is fused and forms helium; as this happens, energy is released.
4. Hydrogen begins to run out, turning the star into **a red giant (like the Sun)** or a **red super giant**, depending on the size of the star.
5. A red giant will become a **white dwarf** by getting rid of the outer layers of dust and gas. It will then cool down and become a **black dwarf**.
6. Red super giants will initially glow brightly. Then, they will explode into a **supernova**. The supernova will get rid of its outer layer of dust and gas and will form a black hole.

Orbits

Gravity is a force that causes planets and satellites to circle an object. It acts towards the centre of the orbit. This occurs in both natural and artificial satellites.

Higher Tier Only

When an object is in orbit around something, it is constantly changing velocity as the direction constantly changes.
The speed, however, will stay the same.

Examples of satellites include the planets orbiting the Sun and the Moon orbiting Earth.

Remaining in Orbit

For an orbit to remain stable, the radius must change if the speed changes.

The closer something is to an object, the quicker it has to travel in order to keep in orbit.

If the force is stronger, then the object will have to travel quicker to remain in orbit.

The Expanding Universe

Evidence suggests that the universe is expanding (getting bigger). Galaxies are moving further away from each other. The redshift provides us with some evidence for the expanding universe and the big bang theory.

When we see light coming from galaxies that are far away from us, the wavelength has increased. The light has shifted towards the red end of the spectrum (**redshift**) and is moving away from us. Galaxies that are more distant have a greater redshift which means they are moving away more quickly.

If you imagine dots on a balloon moving away from each other as the balloon is being blown up, this helps to visualise the expanding universe.

Dark Mass and Energy

There is so much about the universe that scientists do not fully understand.

Scientists have discovered dark mass and dark energy but they do not know much about it.

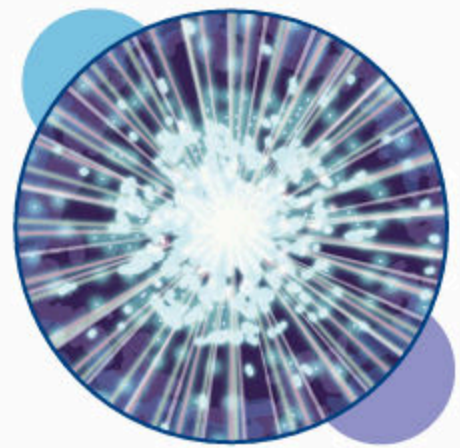
The Big Bang

The big bang is a theory about how the universe began.

In the beginning, matter in the universe took up a very small amount of space. This space was very dense and so became hot. This caused an explosion 13.7 billion years ago – the big bang. After **the big bang**, space then continued to expand as it is now.

Observations of supernovae since 1998 suggest that distant galaxies are moving away faster.

The big bang is a theory and is the best theory that we have at the moment.



Knowledge Organiser: Language Paper 1: 19th Century Fiction Reading and Imaginative Writing

Module Overview: You will read a variety of unseen 19th Century fiction texts and will practise comprehension, analysis, evaluation and comparison.

AO1: Identification	**AO2: Analysis**	**AO4: Evaluation**	**AO5/6: Writing and SPaG**
Identify and select key information	Explaining how language / structural devices are used.	Exploring how and why a text is effective.	Use of ideas, language and structure. Accurate and effective SPaG.

Assessment Overview: 45 minutes – Writing – You will consolidate the reading skills, but the assessment will focus on the imaginative writing skills

Revising Questions 1-4: Unseen 19th century text			**Q5/Q6: Imaginative Writing: Choice of two questions, you will answer one**	
Q1/2: (3) AO1	**Q3: (6 marks)** AO2	**Q4: (15 marks)** AO4	A05 **(24 marks)**	AO6 **(16 marks)**
Find and copy key quotes from the text. 5 minutes	Identify key quotes Analyse language devices Analyse structural choice Analyse word choices 20 minutes	Embed short, concise quotes Link back to key word in question Explain what writer was trying to do and how they've done it Refer to writers' choices 30 minutes	Communicate clearly, effectively and imaginatively, selecting and adapting tone, style and register for different forms, purposes and audiences. Organise information and ideas, using structural and grammatical features to support coherence and cohesion of texts.	Candidates must use a range of vocabulary and sentence structures for clarity, purpose and effect, with accurate spelling and punctuation.

Key Terms:	**Key Vocabulary**	**Story Structure**
Perspective: How the characters view and process what's happening within the story. **Semantic Field:** a group of words that belong together through a similar theme/topic. **Mood:** atmosphere or emotions **Motif:** unifying element can be a repeated image, theme, symbol, character, subject, or detail. **Voice:** Expresses the narrator or author's emotions, attitude, tone and point of view through artful **Tone:** how a piece of writing makes a reader feel towards a subject **Atmosphere:** the mood of a story.	**Plot:** the series of events that make up a story **Setting:** where a story or event takes place. Authors can describe a setting to include geographic location, time, weather, and environment. **Persona**: the person who is understood to be speaking **Genre**: share a certain style, form or content. Protagonist: the main character of a story. **Character**: Are the people, animals, or creatures in a story. Characters can think, feel, or act. **Isolated:** the act of keeping apart from others. **Gothic:** Writing designed to incite fear or to explore the supernatural. **Realism:** Writing to explore the realities of everyday life.	**Exposition:** Sets up the story providing any contextual background the reader needs, but most importantly it contains the inciting moment. This incident sets the story in motion. An incident forces the protagonist to react. It requires resolution, producing narrative tension. **Rising Action:** this is the challenges that the protagonist faces as they attempt to resolve the inciting incident **Climax:** This is the turning point of the story. It is the point of the highest tension. **Falling Actions**: The falling action is that part of the story in which you're moving away from the climax and heading to the conclusion. **Denouement:** This is the resolution of the story where conflicts are resolved and loose ends tied up.

<table>
<tr><th colspan="2">Structure Devices</th><th>Word Classes</th></tr>
<tr>
<td>Order of ideas: Thinking about what the writer started/finished with; why they saved something until last or shared it early on.
Paragraph length: Is it particularly long/short?
Sentence length: As above.
Simple sentence: A sentence with only one subject and one verb: The cat sat on the chair.
Compound sentence: Two main clauses joined with a connective that both make sense independently: The cat sat on the chair and the man sat on the floor.
Complex sentence: A sentence with a main clause and a subordinate clause: The cat, who was spoilt, sat on the chair whilst the man sat on the floor.</td>
<td>Imperative sentence: A command or instruction
Interrogative sentence: A legitimate question
Declarative sentence: A simple statement
Exclamatory sentence: An exclamation to show anger/shock/excitement
Punctuation: Consider how these devices have been used
Juxtaposition: Two opposite ideas used close by one another
Repetition: Using the same words, phrase or ideas more than once
Main Clause: The main part of a sentence; makes sense on its own.
Subordinate Clause: A clause which does not make sense on its own.</td>
<td>Noun: Name of person, place, thing
Adjective: Describes noun
Determiner: Gives information about the noun: the/a/every/some
Abstract Noun: An idea/concept love/anger
Concrete Noun: Something you can touch/hold
Verb: Doing word
Adverb: Describes verb
Modal Verb: Gives information about the verb: should/could/might
Imperative Verb: A command
Pronoun: In place of noun I/he/it/they
Preposition: Tells you where something is on/over/under
Conjunction: A connective and/or/but/although
Superlative: The most extreme version tallest/smallest</td>
</tr>
<tr><th colspan="3">Figurative Language Devices</th></tr>
<tr><td colspan="3">Alliteration: Repeated letter/sound
Triple emphasis: List of three words / sentence structures to create imagery
Imagery: Description which creates a clear picture
Hyperbole: Exaggeration of an image
Oxymoron: Two opposite words used side-by-side to describe one thing
Metaphor: A comparison without ‘like’ or ‘as’ – saying something is something else
Simile: A comparison with ‘like’ or ‘as’
Semantic Field: A range of vocabulary which all shares a similar theme.
Personification: Giving something inanimate human qualities
Onomatopoeia: A word to reflect a sound pop/bang/crash
Idiom: Non-literal phrase we recognise: raining cats and dogs
Euphemism: Polite way of saying something: the man had passed away
Litotes: Play down something negative: My dog is not the friendliest</td></tr>
</table>

Animal Farm KNOWLEDGE ORGANISER

Context – *Animal Farm* was written by George Orwell in 1945.

George Orwell – George Orwell was the writing name of Eric Blair (1903-1950). He was outspoken in his support of democratic socialism, and spoke out frequently against totalitarianism and social injustice. He wrote a wide range of fiction, poetry, literary criticism and polemical journalism, although without doubt his two most famous works are *Animal Farm* (1945) and *Nineteen Eighty-Four* (1949).

The Russian Revolution – The revolution was the movement that removed the reigning Tsarist autocracy from power and led to the rise of the Soviet Union. The Bolsheviks, led by Vladimir Lenin, were able to overthrow the provisional government and establish their own federal government, creating the world's first socialist republic. Eventually they became reconstituted as the Communist Party.

Nicholas II– Tsar Nicholas II was the last emperor of Russia. Tsar Nicholas was deemed to be a poor ruler – the country lost key battles against Japan and Germany during his reign, costing large military casualties and financial losses. There were also gross inequalities: Nicholas lived in luxury while thousands of unemployed peasants struggled to survive. Tsar Nicholas was eventually overthrown by the Bolsheviks and was executed in July 1917.

Jospeh Stalin –Following the death of Lenin in 1924, Stalin rose to power through discreetly canvassing, manipulating and intimidating others, sidelining other potential leaders such as Victor Trotsky. Under Stalin, the Soviet Union became more autocratic and totalitarian: he oversaw mass repressions, hundreds of thousands of executions and millions of non-combatant deaths. He has hence become known as one of the most significant and vilified figures of the 20th Century.

Karl Marx and Communism– Karl Marx was a German philosopher from the 19th Century, who rejected capitalism. He instead believed in the introduction of a system in which wealth was communal and labour was shared. He believed this would produce a fairer, more stable way of life. Whilst he lived a long time before the Russian Revolution (and in a different country) his theories formed the foundations for what became Communism.

Life in the Communist Soviet Union – The working class in the Soviet Union were supposed to be the country's ruling class under the doctrines from which their socialism was derived, and yet they grew increasingly repressed throughout the progression of the USSR's existence. It is generally accepted that the standard of living decreased, working conditions deteriorated, and personal freedoms were significantly violated.

Main Characters – Consider what Orwell intended through his characterisation of each of the below…

Napoleon – Napoleon is the pig who emerges as the leader of Animal Farm after the rebellion. Napoleon's character is based on Joseph Stalin – the leader of the communist Soviet Union. Napoleon is cunning, treacherous, lazy and selfish. He uses Squealer (propaganda) and the dogs (military force) to exert power over others. He has no real talents, rather he is a corrupt opportunist.	**Snowball** – Snowball is one of the other leading pigs, who challenges Napoleon for leadership of the farm after the rebellion. He represents Leon Trotsky. He is intelligent and passionate, yet he does not resort to the same levels of cunning and manipulation as Napoleon. Despite largely winning the support of the animals on the farm, Snowball is driven from the farm by Napoleon's forces.
Napoleon Quote: "To the prosperity of The Manor Farm!" (10.32)	**Snowball Quote:** "liberty is worth more than ribbons" (2.7)
Boxer– Boxer is a cart-horse, who demonstrates incredible strength, work ethic, and loyalty. He represents those in the working classes who were hugely overworked. Boxer completes the most work on the farm, and is admired by others for his physical accomplishments and mental grit. His downfall is his slow wit, which ensures that he is unable to think for himself and is easily manipulated.	**Squealer –** Squealer represents the Soviet propaganda machine. He is a pig who is an exceptionally gifted and persuasive speaker, and is utilised to spread positivity about Napoleon, and negativity about Napoleon's competition. He uses false statistics to suggest that the farm thrives under Napoleon, and twists the truth to ensure that the pigs retain political and social control.
Boxer Quote: "Napoleon is always right" (5.22)	**Squealer Quote:** "It is for YOUR sake that we … eat those apples." (3.14)
Old Major – Old Major is a prize-winning boar whose vision of a place in which the animals work for themselves serves as the inspiration for the rebellion. He is based on both Karl Marx and Vladimir Lenin, who inspired communism. Old Major is well-respected, articulate, and persuasive. He is a clear leader who the other animals listen to. When he dies, Napoleon and Snowball are left to struggle for control over the animals.	**Benjamin** – Benjamin is a long-lived donkey who refuses to feel enthused by the rebellion. Some say he represents the aged people of Russia, who remained cynical of the revolution. Benjamin is seen by the other animals as a pessimist, however his prediction that life will remain unpleasant regardless of who is in charge proves correct. He is the only animal who appears able to understand the atrocities that are taking place, yet he refuses to openly oppose the pigs.
Old Major Quote: "my message to you, comrades: Rebellion!" (1.11)	**Old Major Quote:** "None of you has ever seen a dead donkey"(5.22)

Themes – A theme is an idea or message that runs throughout a text.

The Corruption of Socialist Ideals – *Animal Farm* is famous for being a stinging critique of the development of Soviet communism. Although Orwell strongly believed in the socialist ideals upon which the revolution was built, he abhorred the ways in which these values had been repeatedly manipulated by those who rose to power. The gradual disintegration of the seven commandments visually depicts this.

Class – *Animal Farm* demonstrates through its allegory the means by which human beings seek to maintain and reestablish class structures. The novella shows how the oppressed who are able to stand united in the face of adversity often generate their own class divisions over time after the enemy is eliminated. This is evident in the slow rise of the pigs to fill the void left by Mr Jones.

Naivety – *Animal Farm* is not only told from the viewpoint of those in power, but also from the viewpoint of those who are oppressed. Orwell makes clear that these types of situations are formed not only because of the strategies of the oppressors, but also the naiveté of the people who do not have the education or the position to know better. For example, Boxer believes everything that he is told.

Religion – An idea of heaven (Sugarcandy Mountain) is promised to the animals by Moses (the raven) at some points throughout *Animal Farm*. Moses is derived from the name of the bible character who brought the word of God to the people. The thought of an evergreen, beautiful afterlife awaiting them drives the animals on to work harder, and so the pigs use Moses to their benefit.

Scene-by-Scene Summary – Alongside key quotations from each scene.

Chapter I	A drunk Mr Jones stumbles to bed, forgetting to lock up his farm buildings. The animals thus convene in the big barn to hear Old Major's speech. He blames their short and miserable lives on man, and incites rebellion. He teaches them a song: Beasts of England.	*Weak or strong, clever or simple, we are all brothers. No animal must ever kill any other animal. All animals are equal.* 
Chapter II	Old Major dies in his sleep, and the other animals prepare for rebellion. The pigs (the cleverest animals) prepare the others, teaching them animalism, which they don't all fully understand. The Rebellion occurs, and Jones is driven from the farm. The farm is renamed 'Animal Farm' and seven commandments are made.	*"Never mind the milk, comrades!" cried Napoleon, placing himself in front of the buckets. "That will be attended to. The harvest is more important.* 
Chapter III	The animals labour in the fields throughout the summer. Boxer works hardest. There is a flag-raising ceremony each Sunday – Snowball and Napoleon often clash. Snowball spends time trying to educate the animals. Napoleon takes a group of puppies to 'educate' in a loft. When it is noted the pigs have been eating the apples and milk, Squealer persuades the animals that it is best.	*Milk and apples (and this has been proved by Science, comrades) contain substances absolutely necessary to the well-being of a pig. We pigs are brain-workers.* 
Chapter IV	The news of Animal Farm has spread to neighbouring farms (through the birds), where animals have begun singing Beasts of England. Jones and other farmers thus launch an attack, however they are easily beaten by the animals. Boxer and Snowball fight heroically and are awarded medals as a result. Only a single sheep is lost, who is given a hero's burial. Snowball tells Boxer not to feel guilt for a human's death.	*"Who will believe that I did not do this on purpose?" "No sentimentality, comrade!" "War is war. The only good human being is a dead one."* 
Chapter V	Mollie is tempted away from the farm by a red-faced man who feeds her. Snowball and Napoleon grow increasingly hostile towards one another. As Snowball announces plans for a new windmill, Napoleon unleashes his dogs, which attack Snowball and chase him off the farm. The animals are anxious about this, but Squealer's passionate defence and the growl of the dogs is enough to assure them that 'Napoleon is always right.'	*"One of them all but closed his jaws on Snowball's tail, but Snowball whisked it free just in time. Then he put on an extra spurt and, with a few inches to spare, slipped through a hole in the hedge and was seen no more."* 
Chapter VI	The animals work at a rapid pace to build the windmill, and their rations are cut. It is announced that the farm is now trading with humans, to the shock of the animals. It begins that the pigs have begun amending the commandments to suit their own interests. A storm destroys the windmill, yet Napoleon blames the destruction on the 'traitor Snowball.'	*"Comrades," he said quietly, "do you know who is responsible for this? Do you know the enemy who has come in the night and overthrown our windmill? SNOWBALL!"* 
Chapter VII	Snowball is blamed for more and more failures, which the humans attribute to planning errors. Hens eggs are now sold, which makes the hens rebel. Napoleon holds a meeting in which several animals are murdered by the dogs for their apparent treasons against the farm. It is revealed 'Beasts of England' may no longer be sung.	*One Sunday morning Squealer announced that the hens, who had just come in to lay again, must surrender their eggs. Napoleon had accepted… a contract for four hundred eggs a week."* 
Chapter VIII	More of the commandments appear to change, but the animals are persuaded that this is not the case. Napoleon has now taken the title of 'Leader' and has multiple other honours. Trading with humans intensifies. A further battle with humans takes place, with the windmill destroyed, several animals killed, and Boxer injured. The pigs begin drinking alcohol.	*"He called the animals together and told them that he had a terrible piece of news to impart. Comrade Napoleon was dying!"* 
Chapter IX	Animal Farm is named a republic and Napoleon unanimously named the president. Moses the raven returns and speaks of Sugarcandy Mountain. Boxer grows frailer and one day collapses. The pigs announce that he will be taken to hospital, but Benjamin reads on the van that he is in fact being taken to a slaughterhouse. Squealer announces that he died at the hospital, and that the van had only just been bought by the hospital.	*"Boxer!" cried Clover in a terrible voice. "Boxer! Get out! Get out quickly! They're taking you to your death!"* 
Chapter X	Years pass by. Many animals die and few can remember the rebellion. Only the pigs seem richer, yet all animals remain proud of being on Animal Farm. The pigs begin walking on two legs. Humans come over for a meeting and commend how hard the pigs make the animals work, for so little rations. The name Animal Farm is returned to 'Manor Farm.' The animals can no longer differentiate between people and pigs.	*"Somehow it seemed as though the farm had grown richer without making the animals themselves any richer…" "All animals are equal, but some animals are more equal than others."* 

The Power of Persuasion		Features of Allegory
Rhetorical Questions	Old Major uses this type of question to make the animals think deeply: *"Now, comrades, what is the nature of this life of ours?"*	**Writer's Values** – The writer normally holds strong political or moral views about a topic, e.g. Orwell didn't like how the Soviet Union had realised communism. 
List of Three	Old Major does this to build an argument: *our lives are miserable, laborious, and short.*	**Surface Level Story** – There must be a literal story that works on a surface level, e.g. The story of the animals taking over a farm and then some of the animals disputing power.
Dishonesty	Squealer uses lies and deception to convince the animals: *Many of us actually dislike milk and apples. I dislike them myself!*	**Symbolic Level Story** – There must also be a deeper, more symbolic meaning to the story, e.g. The Russian Revolution and subsequent duel for authority. 
Repetition	Squealer uses repetition to emphasise points: *Jones would come back! Yes, Jones would come back!*	**Polarising Relationships** – There needs to be oppositional views in the story in order for the reader to reflect on morals e.g. the views of Benjamin vs. the other animals during the revolution.

PERFORMING THEATRE – COMPONENT 2 – eduqas GCSE DRAMA

Remember:

The Component is externally assessed by an Examiner. It counts for 20% (60 marks in total).

Important Things!

Remember: Read your text, decide on your interpretation of the character and artistic intention. Be confident – full marks can be achieved in the Component.

YOUR DRAMA:

After deciding on the play you want to perform:

Remember: Read the whole play in order to understand the style, the playwright's intention, the period involved before analysing and interpreting your role.

Style: The style of the play - Naturalistic, Realistic, Absurd, Symbolic, Brechtian, Physical Theatre.

The Playwright's Intention: Discuss contemporary themes, e.g. mental health, family problem, anorexia, drugs. Discuss a historical theme, e.g. War and its impact on society?

Period: Historical, Political, Cultural

Research: Go online, look at Youtube clips and write rough notes.

ACTING ELEMENT:

Remember: Groups of 2 to 4

Time:

- groups of 2 actors – 5 to 10 minutes
- groups of 3 actors – 7 to 12 minutes
- groups of 4 actors – 9 to 14 minutes

You must: Perform two sections 10 minutes long that are key parts of the text.

You must: Perform a text that contrasts with the play you're studying for Component 3.

The play must: Be written by a different playwright, in different historical period and with different themes to the text in Component 3.

Why? To give you new experiences, and to be able to enjoy and challenge yourselves to learn and interpret different texts.

CHARACTERISATION:

Remember the criteria:

You will be marked on your physical skills, vocal skills, interaction, interpretation, communication with the audience and individual contribution.

Also remember:

Your artistic intention must be written and submitted to the examiner before or on the day of the examination.

Once you know your text, you will need to focus on your character. Remember to use a range of practice techniques that will help you develop your role and create the rounded character: The Red Chair, Role on the Wall, Improvisation, Mime Work, The Missing Scene, Emotional Memory, The Magic If.

During the rehearsal periods, develop your vocal and physical skills:

VOICE: pronunciation, emphasis, pauses, tone and tempo, accent, pitch, constructiveness, highlights.

MOVEMENT: gesture, body posture, walk, position on the stage, characters' territories.

INTERACTION: distance, proximity, back turned, eye-rolling, facial response, moving away, approaching, physical gestures.

Discuss with your group what your stage shape will be, what type of set will be needed, stage equipment and props. It is also a good idea to use sound to create a mood and atmosphere either at the beginning, between scenes or at the end. You will need to carefully consider the costume, hair and make-up suitable for your role. Remember that you need consistent rehearsals and a full dress rehearsal before your final performance.

Describing music using MAD T-SHIRT

MELODY

ASCENDING OR DESCENDING?
HIGH OR LOW PITCHED?
WIDE OR NARROW RANGE?
MOVING IN LEAPS/STEPS/SKIPS?
SCALES:
MAJOR/MINOR/BLUES/CHROMATIC/MODAL/ATONAL?
DEVICES:
REPETITION/MOTIFS/SEQUENCE/OSTINATO?
ORNAMENTS?

ARTICULATION

HOW ARE THE NOTES BEING PLAYED?
STACCATO – SHORT AND DETACHED?
LEGATO – SMOOTHLY AND CONNECTED?
ACCENTED NOTES?
PIZZICATO – PLUCKED WITH FINGERS?
ARCO – PLAYED WITH THE BOW?
SLURRED?

DYNAMICS

HOW LOUD OR SOFT IS THE MUSIC?
WHAT HAPPENS TO THE VOLUME?
pp – PIANISSIMO
p – PIANO
mp – MEZZO PIANO
mf – MEZZO FORTE
f – FORTE
ff – FORTISSIMO
CRESCENDO/DIMINUENDO?
SFORZANDO?

TEXTURE

HOW ARE THE INDIVIDUAL PARTS OF A PIECE WORKING TOGETHER?
THICK OR THIN? COMPLEX OR SIMPLE?
MONOPHONIC/POLYPHONIC/HOMOPHONIC/HETEROPHONIC?
MELODY & ACCOMPANIMENT?
COUNTERMELODY?
PARALLELL/CONTRARY MOTION?
UNISON? DRONE/PEDAL NOTE?
CONTINUO? CALL & RESPONSE?

STRUCTURE

HOW MANY SECTIONS IN THE PIECE AND IN WHAT ORDER?
WHAT IS THE FORM OF THE PIECE? BINARY – AB? TERNARY – ABA? RONDO – ABACADA?
SONATA? CONCERTO? THEME AND VARIATION? RITORNELLO?
POP MUSIC – VERSE? CHORUS? MIDDLE 8? BRIDGE? PRE-CHORUS? INTRO/OUTRO? SOLO?
12 BAR BLUES?

HARMONY

MAJOR OR MINOR KEY?
DIATONIC OR CHROMATIC?
CONSONANT/DISSONANT?
KEY CHANGES/MODULATION
CADENCES: PERFECT; PLAGAL; IMPERFECT; INTERRUPTED?
HARMONIC RHYTHM – DO CHORDS CHANGE SLOWLY OR QUICKLY?
IS THERE A PARTICULAR SEQUENCE E.G. I – IV – V

INSTRUMENTS

BRASS – TRUMPET/HORN/TROMBONE/TUBA. STRINGS – VIOLIN/VIOLA/CELLO/DOUBLE BASS. WOODWIND – PICCOLO/FLUTE/CLARINET/OBOE/BASSOON. PERCUSSION – TIMPANI/CHIMES/CYMBALS. PIANO/HARPSICHORD/ORGAN. GUITAR/ELECTRIC BASS/DRUMS/VOCALS/SYNTHS/LOOPS.
SITAR/TAMBURA/TABLA/BOUZOUKI/O'UD/DOUMBEK/DJEMBE/DUNDUN/SURDO/TAMBOURIN/DHOL/RIQ/STEEL DRUMS.

RHYTHM

DURATION – LONG OR SHORT NOTES? PULSE/BEAT.
SEMIQUVERS/QUAVERS/CROTCHETS/MINIMS/SEMIBREVES?
SYNCOPATION? DOTTED RHYTHMS? TRIPLETS?
CROSSRHTYHM/POLYRHTYHM?
CHAAL/TALA/WAZN.
UPBEAT/ANACRUSIS? RESTS?
PAUSES?
TIED NOTES?

TIME/TEMPO

REGULAR OR IRREGULAR METRE? SIMPLE OR COMPOUND METRE? SIGNATURE – 3/4, 4/4. 6/8, 12/8, 5/4. 7/8 ETC?

TEMPO – FAST OR SLOW?
LARGO, MODERATO, ANDANTE, ALLEGRO, PRESTO, ACCELLARANDO, RALLENTANDO, RUBATO? SPEEDING UP/SLOWING DOWN?

GCSE ART & DESIGN HT1-6 KNOWLEDGE ORGANISER

ASSESSMENT OBJECTIVE 4

PERSONAL PRESENTATION: PRESENT A PERSONAL AND MEANINGFUL RESPONSE THAT REALISES INTENTIONS AND DEMONSTRATES UNDERSTANDING OF VISUAL LANGUAGE

FORMAL ELEMENTS

COLOUR

Red, yellow and blue are **primary colours**, which means they can't be mixed using any other colours. In theory, all other colours can be mixed from these three colours.
Two primary colours mixed together make a **secondary colour**.
Tertiary colours are created by mixing a primary colour and the secondary colour next to it on the colour wheel.

TONE

This refers to the lightness or darkness of something. This could be a shade or how dark or light a colour appears.
Tones are created by the way light falls on a 3D object. The parts of the object on which the light is strongest are called **highlights** and the darker areas are called **shadows**. There is a range of tones in between the highlights and shadows.

PATTERN

A design that is created by repeating lines, shapes, tones or colours. The design used to create a pattern is often referred to as a **motif**. Motifs can be simple shapes or complex arrangements.
Patterns can be man-made, like a design on fabric, or natural, such as the markings on animal fur.

SHAPE

A shape is an area enclosed by a line. It could be just an outline or it could be shaded in.
Shapes can be either **geometric**, like a circle, square or triangle, or **irregular**.
When drawing shapes, you must consider the size and position as well as the shape of the area around it. The shapes created in the spaces between shapes are referred to as **negative space**.

FORM

Form is a **three dimensional shape**, such as a cube, sphere or cone.
Sculpture and 3D design are about creating forms.
In 2D artworks, tone and perspective can be used to create an illusion or form.

LINE

Line can be used to show many different qualities, such as:

- Contours – showing the shape and form of something
- Feelings or expressions – a short, hard line gives a different feeling to a more flowing one
- Movements

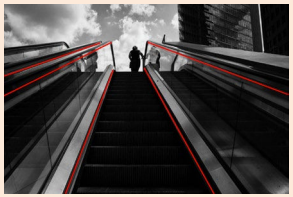
TEXTURE

This is to do with the **surface quality** of something, the way something feels or looks like it feels. There are two types of texture: actual texture and visual texture.
Actual texture really exists, so you can feel it or touch it.
Visual texture is created using marks to represent actual texture.

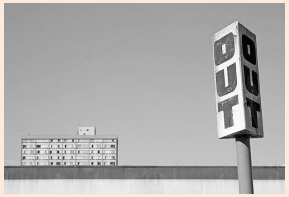
A ROUGH	VISUAL OR MODEL	FINAL PIECE
A BASIC SKETCH OF A FINAL IDEA	A SMALL IMAGE OR MODEL CREATED IN SELECTED MATERIALS (USUALLY SMALLER IN SCALE THAN INTENDED)	AN IMAGE OR SCULPTURE THAT IS THE END PRODUCT OF YOUR PROJECT/JOURNEY, PULLING ALL PREP WORK TOGETHER

COMPOSITIONAL LAYOUTS:

RULE OF THIRDS



LEADING LINES



BALANCED ELEMENTS

CROP

Level 1/2 Hospitality and Catering: Unit 1: Contributing factors to the success of hospitality and catering provision (AC1.4)

Contributing factors
The hospitality and catering sector is very competitive, and many businesses fail in the first year of operation. There are many factors that must be managed carefully for hospitality and catering businesses to make a profit and continue to operate in the long term.

Basic costs

Labour: These costs include employee wages, National Insurance contributions and pension contributions.

Material: These costs include decoration, furnishings, kitchen and dining equipment, ingredients, printing and health and safety equipment.

Overheads: These costs include rent, rates, gas and electricity, insurance, licensing, training and maintenance.

Economy

The value of the pound (**£**) can affect the hospitality and catering sector. If the economy is good, people will be willing to spend more. If the economy is weak (recession), people may decide that eating out or going on holiday is a luxury and will spend less.

VAT (Value Added Tax) is added to the final cost of goods and services offered in the hospitality and catering sector. The money from VAT goes to the government to pay for services everyone uses for example the NHS.

Environmental impact

Running a hospitality or catering provision uses a lot of resources. Businesses are encouraged to **reduce, reuse**, and **recycle**. Energy efficient equipment such as low energy light bulbs can save a business money. Using local and seasonal ingredients reduces the amount of CO_2 released into the atmosphere during transport. All waste should be separated and recycled or composted when possible.

Profit

Gross Profit: The difference between how much a menu item costs to make and how much it sells for. Ingredient costs should not be more than 30% of the gross profit. If the ingredient cost for a chocolate brownie dessert is £1.50 and the menu price is £4.50, the gross profit is £3.00.

Gross Profit % = (3.00 ÷ 4.50) x 100 = 66.6%

Net Profit = What is left from the gross profit once all costs (as listed above) are covered.

New technology

New technologies have benefitted the sector in positive ways. These include:

- **cashless systems** such as contactless cards and mobile payment apps
- **digital systems** such as online booking/ordering and key cards
- **office software** such as stock ordering systems.

Media

The hospitality and catering sector is very competitive, so most businesses try to make good use of the media to advertise. Most businesses will have their own **website**, which customers can use to view menus and make bookings.

- **Print Media:** Ads in magazines and newspapers, flyers and money-off vouchers.
- **Broadcast media:** Television, radio and online ads.
- **Social media:** Customer feedback and reviews.

Consumers are increasingly using smartphones to book, order, pay and review.

Level 1/2 Hospitality and Catering: Unit 1-1.1.1 - Standards and ratings

Standards and ratings: You will need to be able to know the importance of standards and ratings within the hospitality and catering industry, they are hotel and guest house standards, and restaurant standards.

Hotel and guest house standards

Hotels and guest houses standards are awarded and given star ratings. You should know what criteria is needed to be met for an establishment to receive each star rating.

Star rating 1 = Basic and acceptable accommodation and facilities. Simple rooms with no room service offered.

Star rating 2 = Average accommodation and facilities, a small establishment, and would not offer room service or have a restaurant.

Star rating 3 = Good accommodation and facilities. One restaurant in the establishment, room service available between certain hours, and Wi-Fi in selected areas are provided. The establishment could have a pool and gym.

Star rating 4 = Very good accommodation and facilities. Large hotel & reception area of a very good standard. Certain hours of room service, with a swimming pool and valet parking offered.

Star rating 5 = Excellent standard of accommodation, facilities, and cuisine. Offer valet parking, 24 hr room service, spa, swimming pool, gym, and concierge service.

Restaurant standards

Restaurant standards have three main possible awards or ratings that you should know. They are listed below:

AA Rosette award

Ratings between one and five rosettes could be awarded based on the following:

- different types and variety of foods offered
- quality of the ingredients used
- where the ingredients are sourced
- how the food is cooked, presented and tastes
- skill level and techniques used as well as the creativity of the chef.

https://www.stirkhouse.co.uk/about-us/awards/attachment/award-rosette

Michelin star

A rating between one and three Michelin stars could be awarded based on the following:

- quality of ingredients used
- cooking and presentation techniques
- taste of the dishes
- standard of the cuisine
- value for money.

https://guide.michelin.com/us/en/california/to-the-stars-and-beyond

Good food guide

A rating between one and 10 could be awarded based on the following:

- cooking skills
- quality of ingredients
- techninques and cooking skills shown.

Level 1/2 Hospitality and Catering Knowledge Organiser: Unit 1: 1.1.1 -
Types of Hospitality and catering provisions

Hospitality and catering providers
You must understand, be able to name, and explain the two different provisions in hospitality and catering.
Commercial: the business aims to **make profit** from the hospitality and catering provision that they provide.
Non-commercial: the service provider **doesn't aim** to make a profit from the service they provide.

Commercial (residential)

Commercial (residential): meaning the hospitality and catering provision aims to create a profit from the service they provide, but also offers accommodation.

For example:
- hotels, motels & hostels
- B&B, guest houses and Airbnb
- holiday parks, lodges, pods, and cabins
- campsites and caravan parks.

Non-commercial (residential)

Non-commercial (residential): the hospitality and catering provision offers accommodation but does not aim to make a profit from the service they provide.

For example:
- hospitals, hospices, and care homes
- armed forces
- prisons
- boarding schools, colleges, and university residences.

Commercial (non-residential)

Commercial (non-residential): catering establishments that aim to make a profit from their service, but no accommodation is provided.

For example:
- restaurants and bistros
- cafes, tea rooms and coffee shops
- takeaways
- fast food outlets
- public houses and bars
- airlines, cruise ships, long distance trains
- pop up restaurants
- food and drink provided by stadiums, concert halls and tourist attractions
- mobile food vans and street food trucks
- vending machines.

Non-commercial (non-residential)

Non-commercial (non-residential): catering establishments with no accommodation provided and don't aim to make a profit from their service.

For example:
- schools, colleges, and universities
- meals on wheels
- canteen in working establishments (subsidised)
- charity run food providers.

Level 1/2 Hospitality and Catering: Unit 1-1.1.1 -
Types of service in commercial and non-commercial provisions

Types of service in commercial and non-commercial provision
You need to be able to understand and know the different types of service within commercial and non-commercial provision. They are split into two main categories of food service and residential service.

Food service

The different types of food services in the catering sector are listed below. You should know the meaning of each one and be able to provide examples. For instance;

Table service
- Plate: the food is put on plates in the kitchen and served by waiting staff. Good portion control and food presentation consistent.
- Silver: a waiter will transfer food from a serving dish to the customer's plate using a silver spoon and fork at their table.
- Banquet: a range of foods suitable for large catered events such as weddings, parties, or award ceremonies.
- Family style: the food is placed on serving bowls on the customer's table for customers to share between them.
- Gueridon: is served from a trolley to the customer's table, the food is then cooked and/or finished and presented in front of the customer. Creates an atmosphere of sophistication and entertainment.

Counter service
- Cafeteria: all types of food and drink are shown on a long counter for customers to move along with a tray for them to choose what they want to eat.
- Fast food: the food and drink is displayed on a menu behind the counter, often with pictures. Quick, simple, and usually served with disposable packaging.
- Buffet: a range of foods served on a big serving table where customers walk up to collect their plate and help themselves to food and drink. The food can be hot or cold, and some items could be served by waiting staff.

Personal service
- Tray or trolley: the meals are served on trays from a trolley and customers sometimes order items in advance.
- Home delivery: the customer's order is made over the phone or online, and is then delivered by the business to their address.
- Takeaway: food that's cooked by the business onsite and then eaten elsewhere.

Residential service

Listed below are the different types of residential types of service in the hospitality and catering sector. You should know the different types of service offered in various hospitality provisions.

Rooms:
- single/ double/ king/ family
- suite (en-suite bath/ shower room, shared facilities).

Refreshments:
- breakfast/ lunch/ evening meal
- 24-hour room service/ restaurant available.

Leisure facilities:
- spa
- gym
- swimming pool.

Conference and function facilities:
- large rooms
- overhead projector and computer
- pens and paper provided
- refreshments available.

Level 1/2 Hospitality and Catering – Unit 1-1.1.2:
Personal attributes, qualifications and experience

You need to be able to know and understand the different personal attributes, qualifications and experience that an employer would look for to fulfil different job roles in the hospitality and catering industry.

Personal attributes

The list below names the different personal attributes that employees could need to fulfil different jobs in the industry:

- Team player
- Organised
- Flexible
- Good communicator
- Friendly
- Calm under pressure
- Willingness to learn and develop
- Pleasant
- Hygienic
- Punctual
- Hardworking
- Reliable
- Approachable
- Good listener
- Leadership qualities
- Sense of humour
- Ability to be proactive
- Good attention to detail
- High standard of personal appearance.

Qualifications

Apprenticeships and experience in the role or sector are two ways to fulfil certain job roles. Named below are some of the qualifications that could be required to fulfil certain jobs within the hospitality and catering sector.

Hospitality sector

- Level 1 Certificate in Business and Administration (office administration).
- Level 2 Certificate in Front of House Reception (hospitality and catering).
- Level 2 Diploma in Reception Operation and Services (hospitality and catering).
- GCSE English / Maths / Hospitality and Catering / Business / IT.

Catering sector

- Diploma in Catering.
- NVQ Food preparation and cooking.
- Bachelor's degree/catering management.
- City & Guilds diplomas in professional cookery.
- BTEC HND in professional cookery.
- A foundation degree in culinary arts.
- Health and safety and food hygiene certificates/food hygiene.
- Level 1/2 hospitality and catering.
- GCSE Food and Nutrition.
- Level 3 Food Science and Nutrition.
- First aid.

Level 1/2 Hospitality and Catering: Unit 1-1.1.2 -
Types of employment roles and responsibilities within the industry

Types of employment roles and responsibilities within the industry
There are four main areas within the industry that you should know the roles and responsibilities within. They are listed below:

Front of house

- Front of house manager: oversees all staff at the restaurant, provides training, hiring of staff, and ensures good customer service.
- Head waiter: oversees the waiting staff of the restaurant in high-end eating establishments.
- Waiting staff: greets customers, shows them their table, takes food and drink orders from customers, and serves them their order. Makes sure customers' needs are met, and that the food order is made correctly.
- Concierge: advises and helps customers with trips and tourist attractions. Books taxis for customers and parks customer cars.
- Receptionist: takes bookings, deals with questions and complaints from customers, checks-in customers, takes payment, and provides room keys.
- Maître d'hôte: oversees the service of food and drinks to customers. They greet customers, check bookings, reservations, and supervise waiting staff.

Kitchen brigade

- Executive chef: in charge or the whole kitchen, developing menus and overlooking the rest of the staff.
- Sous-Chef: the deputy in the kitchen and is in charge when the executive chef isn't available.
- Chef de partie: in charge of a specific area in the kitchen.
- Commis chef: learning different skills in all areas of the kitchen. Helps every chef in the kitchen.
- Pastry chef: prepares all desserts, pastry dishes and bakes.
- Kitchen assistant: helps with the peeling, chopping, washing, cutting of ingredients, and helps washing dishes and stored correctly.
- Apprentice: an individual in training in the kitchen and helps a chef prepare and cook dishes.
- Kitchen porter/ plongeur: washes the dishes and other cleaning duties.

Housekeeping

- Chambermaid: cleans guests' rooms when they leave, and restocks products that have been used, they also provide new bedding and towels.
- Cleaner: cleans hallways and the public areas of the establishment.
- Maintenance: repairs and maintains the establishment's machines and equipment, such as heating and air conditioning. These responsibilities could also include painting, flooring repair or electrical repair.
- Caretaker: carries out the day to day maintenance of the establishment.

Management

- Food and beverage: responsible for the provision of food and drink in the establishment which will include breakfast, lunch, dinner, and conferences.
- Housekeeping: ensuring laundering of bed linen & towels, ordering of cleaning products and overseeing housekeeping staff duties.
- Marketing: promotes events and offers to increase custom at the establishment, and is responsible for the revenue of the business.

Level 1/2 Hospitality and Catering: Unit 1-1.1.3 -
Working conditions in the hospitality and catering industry

Types of employment contracts and working hours

You need to know the following types of employment contacts and working hours.

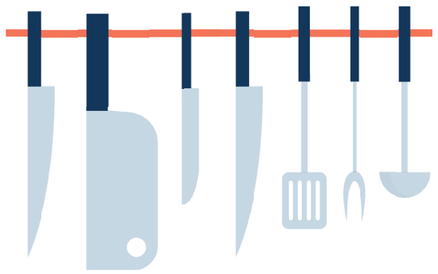
- **Casual:** this type of contact could be provided through an agency and used to cover employees that are absent from work due to illness. There is no sick pay or holiday entitlement with this type of employment.

- **Full time (permanent):** working hours including start and finishing times are fixed and stated in this type of contract. A contact of this nature allows the employee to have sick pay and holiday entitlement.

- **Part-time (permanent):** working hours mean that the employee works on certain days of the week. Work times are stated in the contract, including the starting and finishing times that are fixed in this type of contract. The employee has sick pay and holiday entitlement in this type of contact.

- **Seasonal:** this type of contract is used when a business needs more staff due to busy times throughout the year, such as the Christmas period. The contract will state for the employee to work for a specific time frame only. Also, the contract would not expect further or regular work after the contact is complete.

- **Zero hours contract:** this type of contact is chosen between the employer and the employee. This means that the employee can sign an agreement to be available for work when the employer needs staff. No number of days or hours is stated in the contract and the employer doesn't require to ask the employee to work, and neither does the employee have to accept the work offered. No sick pay or holiday entitlement is offered for this type of contract.



Pay and benefits in the industry

The following pay and benefits are what you should be aware of in the industry.

- **A salary:** this type of pay is a fixed amount of money paid by the employer monthly, but is often shown as an annual sum on the contract.
- **Holiday entitlement:** employees are entitled to 28 days paid a year. Part-time contracts are entitled less depending to their contract hours.
- **Pension:** on retirement age, an employee qualifies for a pension contribution by the employer and the government.
- **Sickness pay:** money paid to the employee with certain contracts when they are unable to go to work due to illness.
- **Rates of pay:** national minimum wage should lawfully be offered to all employees over 18 years of age. This rate is per hour and is reviewed each year by the government.
- **Tips:** money given to an employee as a 'thank you' reward for good service from the customer.
- **Bonus and rewards:** given from an employer to the employee as a way of rewarding all the hard work shown from the employee throughout the year, and helping make the business a success. Also known as remuneration.

Working hours

The working hours directive in the UK states that employees on average cannot work more than 48 hours which is worked out over a period of 17 weeks. Employees can choose not to follow this and work more hours if they want to.

People under the age of 18 cannot work more than eight hours a day and 40 hours a week.

Employees that work six hours or more a day must have a break of 20 minutes, and have the right to have at least one day off every week.

Level 1/2 Hospitality and Catering – Unit 1-1.1.4:
Positive and negative uses of media

You need to be able to know and understand the different types of media, as well as the positive and negative impacts they can have on the hospitality and catering industry.

Different types of media

The list below names the different types of media that can be used to promote the hospitality and catering industry.

- **Printed media:** Different types of printed media can include:
  - ◊ magazines
  - ◊ newspapers
  - ◊ billboards
  - ◊ business cards
  - ◊ posters.

- **Broadcast:** Different types of broadcasting media include:
  - ◊ television
  - ◊ radio.

- **Internet:** Ways of promoting through the internet include:
  - ◊ social media, e.g. Facebook, Instagram, Twitter, etc.
  - ◊ Websites, e.g. TripAdvisor
  - ◊ ads on podcasts
  - ◊ blogs
  - ◊ email.

- **Competitive:** This could include being competitive with other establishments to attract and retain customers through competitions, deals, special offers and themed events.

Positive and negative uses of media

Named below are some of the positives and negative impacts the media can have on the hospitality and catering sector.

Positive impacts:

- Social media is free and isn't an extra cost for the business.
- Able to contact a larger and wider audience quickly.
- Attracts new customers.
- Builds business awareness.
- Customers can feel more of a personal connection with the business.
- Creates and builds customer loyalty.
- Media can target specific groups easily.

Negative impacts:

- Advertising in media is expensive, e.g. printed media and broadcasting.
- Having a bad or negative review/comment on social media can rapidly decrease the reputation of a business, e.g. through a comment retweet or share.
- Rapid spread of negative reviews, comments and/or feedback can be detrimental to the success of a business, leading the business potentially having to close.
- Having a bad reputation would decrease customer loyalty and less likely to attract new customers.

Level 1/2 Hospitality and Catering: Unit 1: 1.2.2 Customer requirements in hospitality and catering

Customer needs

Customers can be divided into three groups:

- Business customers
- Leisure customers
- Local residents

Customer needs may include catering, equipment and/or accommodation.

Customer needs: Local residents

Local residents may use the facilities hospitality and catering provisions offer without using overnight accommodation. Examples include restaurants, bars, spas, and golf courses.

Hospitality and catering businesses will want to ensure that noise and parking issues are addressed if the provision is in a residential area.

Customer needs: Customer rights and inclusion

By law, hospitality and catering provision must provide for customer rights, inclusion and disabilities. No business can discriminate against a person because of:

- Age
- Disability
- Sexual orientation
- Ethnicity
- Gender
- Race and culture
- Pregnancy and maternity

Customer needs: Business customers

These customers use hospitality and catering provisions for work purposes. Examples include conferences, meetings, and training.

Catering:

- tea, coffee and food facilities for meetings
- early breakfast
- 24-hour room service.

Conference facilities:

- whiteboards, projectors, screens, flip charts, pens and notepaper, free Wi-Fi
- parking.

Accommodation:

- a quiet floor to work
- express check-in and check-out
- iron and ironing board or trouser press
- access to leisure facilities
- discount/loyalty points.

Customer needs: Leisure customers

These customers use hospitality and catering provisions for holidays, sight-seeing, travelling or when attending sporting and theatrical events.

The needs of leisure customers vary depending on their reason for travel. Some customers will want basic accommodation with value for money and some customers will look for a luxury experience.

Catering:

- drinks facilities in room
- snack/mini bar
- breakfast: included or at extra cost
- room service
- restaurant
- bar
- special dietary needs and children's menu options.

Accommodation:

- different room sizes
- disability access
- en-suite facilities
- free Wi-Fi
- concierge service
- cots
- extra pillows and bedding
- toiletries.

Level 1/2 Hospitality and Catering: Unit 1: 1.2.3 Hospitality and catering provision to meet specific requirements

Successful hospitality and catering provisions change to meet their customers' needs and expectations. Customer needs can change depending on their lifestyle, dietary requirements and income. Customers have an expectation that a hospitality and catering provision will keep up with current trends. An example is mobile apps which can be used for everything from booking a room to ordering and paying for food.

Customer requirements/needs

Understanding customer needs and requirements helps hospitality and catering provisions to attract more customers and make more profit.

Lifestyle: Successful hospitality and catering provisions analyse the needs of their customers based on their lifestyles, budgets, eating patterns, and interests such as sports and hobbies.

Nutritional needs: Successful hospitality and catering provisions will offer a range of dishes to suit the nutritional needs of their customers. Many menus will include nutritional information available to help their customers make informed choices.

Dietary needs: Most menus will offer a range of dishes to suit special dietary needs such as coeliac disease. Most menus will include vegetarian and vegan options as well as children's menus.

Time available: Some customers will want fast food, and some will prefer a leisurely meal.

Customer expectations

Customers will visit a range of hospitality and catering provisions, from fast food to fine dining, with expectations of an enjoyable experience.

Service: Customers will expect polite efficient service regardless of the type of provision they are visiting.

Value for money: Customers will expect meals that are nutritious, filling and sold at the right price for the type of provision they are visiting.

Trends: Customers will expect hospitality and catering provisions to keep up with trends such as mobile ordering apps.

Awareness of competition from other providers: Customers will expect hospitality and catering provisions to adapt their menus to attract new customers.

Media influence/interest: Customers will expect hospitality and catering provisions to match reviews.

Environmental concerns: Customers will expect eco-friendly hospitality and catering provisions.

Seasonality: Customers will expect dishes made with seasonal, local ingredients.

Customer demographics

Successful hospitality and catering provisions conduct marketing research by asking questions to find out the requirements, needs and expectations of potential customers. The information is used by the provision to create a USP (unique selling point).

Age: Do potential customers want fast food or a luxury experience? Do they need child-friendly facilities?

Location: Is your provision located in a residential area? On a high street? In a business area?

Accessibility: Is there parking? Is it accessible to people with mobility issues?

Money available: Do potential customers have a large amount of disposable income? Are they on a tight budget?

Access to establishments/provisions: Are they competing with similar provisions? Is there limited competition in the area?

Level 1/2 Hospitality and Catering – Unit 1-1.3.1:
Safety documents in hospitality and catering

Different documentation is required to be completed for potential health and safety risks and hazards to be avoided within the hospitality and catering industry. Accident forms and risk assessments are explained below, stating their importance and how to complete each document.

Accident forms

If an accident happens, it is vital that an accident form is completed correctly to develop control measures for potential risks and to avoid them from happening again. It should be reviewed and used to manage any health and safety risk. It is law to complete an accident form for accidents in the workplace. Below is an example of an accident form and how it should be completed.

Accident form	
Name of person in accident:	Date:
Description of accident & injury:	Description should include as many details as possible about what happened and how, e.g. slipped/fallen on oil spillage and broken arm as a result.
What was the hazard?	Named hazards could be spillage/liquid on floor or broken handrail, etc.
How could this accident have been prevented?	Suggested prevention could include: • correct storage • ensuring all staff had health and safety training • relevant health and safety posters visible in the workplace • correct usage of wet floor signs and clear spillages immediately.
Further action:	Points could include: • investigating the accident further • completing/updating risk assessment • reviewing storage of products • first aid that has been given to be logged • correct PPE to be worn, e.g. anti-slip footwear.
Signed:	

Risk assessment

A risk assessment should be completed and reviewed frequently for the document to be kept up to date. New risks should have control measures to reduce the risk of happening or not happen at all. Within the document hazards need to be identified, likelihood of the risk happening is stated and the control measure of how to avoid or reduce the risk is noted. Below are definitions of the main key words and an example of a risk assessment document.

Hazard: An object or something that can physically harm someone or cause harm to someone's health.
Level of risk: The likelihood of the hazard happening and being harmed or causing injury. Level of risks named could be low, medium or high.
Control measure: Steps or action taken to avoid or reduce the hazard from happening and causing injury.

Risk assessment			
Assessment carried out by:		Date of assessment:	Date of next review:
What are the hazards?	Level of risk	Control measure	Who needs to carry out action?
Examples could include, slips, trips, falls, burns from oven, electric shocks, etc.	**Low / medium / high** If it is a low risk, then the hazard is less likely to cause injury or harm compared to a high risk.	Examples could include providing training and PPE for employees, having appropriate safety posters and signs, e.g. wet floor signs.	Named employer and/or employees to reduce the hazard from happening.

Remember: Employers are responsible for the health and safety training needs of all staff.

Level 1/2 Hospitality and Catering: Unit 1-1.3.1 -
Health and safety in hospitality and catering provisions

Control of Substances Hazardous to Health Regulations (COSHH) 2022

What employers need to do by law	What paid employees need to do
Control substances that are dangerous to health.	Attend all training sessions regarding COSHH.
Provide correct storage for those substances and appropriate training for staff.	Follow instructions carefully when using the substances.
Some examples of substances that are dangerous to health include cleaning products, gases, powders & dust, fumes, vapours of cleaning products and biological agents.	Know the different types of symbols used to know different types of substances and how they can harm users and others when used incorrectly.

Health and Satefy at Work Act 1974 (HASAWA)

What employers need to do by law	What paid employees need to do
Protect the health, wellbeing and safety of employees, customers and others.	Take reasonable care of their own health and safety and the health and safety of others.
Review and assess the risks that could cause injuries.	Follow instructions from the employer and inform them of any faulty equipment.
Provide training for workers to deal with the risks.	Attend health and safety training sessions.
Inform staff of the risks in the workplace.	Not to misuse equipment.

Personal Protective Equipment at Work Regulations (PPER) 1992

What employers need to do by law	What paid employees need to do
Provide PPE e.g. masks, hats, glasses and protective clothes.	Attend training and wear PPE such as chef's jacket, protective footwear and gloves when using cleaning chemicals.
Provide signs to remind employees to wear PPE.	
Provide quality PPE and ensure that it is stored correctly.	

Report of Injuries, Diseases and Dangerous Occurences Regulations (RIDDOR) 2013

What employers need to do by law	What paid employees need to do
Inform the Health and Safety Executive (HSE) of any accidents, dangerous events, injuries or diseases that happen in the workplace.	Report any concerns of health and safety matters to the employer immediately. If nothing is resolved, then inform the HSE.
Keep a record of any injuries, dangerous events or diseases that happen in the workplace.	Record any injury in the accident report book.

Manual Handling Operations Regulations 1992

What employers need to do by law	What paid employees need to do
Provide training for staff.	Ask for help if needed.
Assess and review any lifting and carrying activities that cannot be avoided.	Squat with feet either side of the item. Keep back straight as you start to lift. Keep the item close to your body whilst walking. Make sure you can see where you're going.
Store heavy equipment on the floor or on low shelves.	
Provide lifting and carrying equipment where possible.	

Risks to health and security including the level of risk (low, medium, high) in relation to employers, employees, suppliers and customers

Review and assess level of risks in the workplace e.g. slips, trips, falls, burns etc by completing a risk assessment to avoid from happening.

Level 1/2 Hospitality and Catering: Unit 1-1.3.2 -
Food safety

Hazard Analysis and Critical Control Points (HACCP)

Every food business lawfully needs to ensure the health and safety of customers whilst visiting their establishment. To ensure this, they need to take reasonable measures to avoid risks to health. HACCP is a food safety management system which is used in businesses to ensure dangers and risks are noted and how to avoid them.

All food businesses are required to:

- assess and review food safety risks
- identify critical control points to reduce or remove the risk from happening
- ensure that procedures are followed by all members of staff
- keep records as evidence to show that the procedures in place are working.

Food Hazards

A food hazard is something that makes food unfit or unsafe to eat that could cause harm or illness to the consumer. There are three main types of food safety hazards:

- **Chemical** – from substances or chemical contamination e.g. cleaning products.
- **Physical** – objects in food e.g. metal or plastic.
- **Microbiological** – harmful bacteria e.g. bacterial food poisoning such as Salmonella.

HACCP table

Here is an example of a HACCP table – it states some risks to food safety and some control points.

Hazard	Analysis	Critical Control Point
Receipt of food	Food items damaged when delivered / perishable food items are at room temperature / frozen food that is thawed on delivery.	Check that the temperature of high-risk foods are between 0°C and 5°C and frozen are between -18°C and -22°C. Refuse any items that are not up to standard.
Food storage (dried/chilled/frozen)	Food poisoning / cross contamination / named food hazards / stored incorrectly or incorrect temperature / out of date foods.	Keep high-risk foods on correct shelf in fridge. Stock rotation – FIFO. Log temperatures regularly.
Food preparation	Growth of food poisoning in food preparation area / cross contamination of ready to eat and high-risk foods / using out of date food.	Use colour coded chopping boards. Wash hands to prevent cross-contamination. Check dates of food regularly. Mark dates on containers.
Cooking foods	Contamination of physical / microbiological and chemical such as hair, bleach, blood etc. High risk foods may not be cooked properly.	Good personal hygiene and wearing no jewellery. Use a food probe to check core temperature is 75°C. Surface area & equipment cleaned properly.
Serving food	Hot foods not being held at correct temperature / foods being held too long and risk of food poisoning. Physical / cross-contamination from servers.	Keep food hot at 63°C for no more than 2 hours. Make sure staff serve with colour coded tongs or different spoons to handle food. Cold food served at 5°C or below. Food covered when needed.

Level 1/2 Hospitality and Catering – Unit 1-1.4.1:
Hospitality and catering and the law

There are several food legislations and laws that you need to be aware of, which are food labelling laws, food safety legislation and food hygiene.

Food labelling laws

By law, the following must be shown on food packaging and labels:

- name of the food
- list of ingredients
- allergen information noted clearly and in bold on the packaging or label
  - ◊ The 14 possible allergens include: celery, cereals containing gluten (e.g. wheat, oats and barley), crustaceans (e.g. lobster, prawns and crab), eggs, fish, lupin, milk, molluscs (e.g. oysters and mussels), mustard, peanuts, sesame, soybeans, tree nuts (e.g. almonds, hazelnuts, walnuts, Brazil nuts, cashews, pecans, pistachios and macadamia nuts) and sulphur dioxide and sulphites (information from www.food.gov.uk).
- storage instructions
- name and address of manufacturer
- nutrition information
- cooking instructions
- weight of ingredients
- use by dates and/or best before dates.

The label must not be misleading and must be clear and easy to understand.

Food safety legislation

Under the Food Safety Act 1990, any businesses that prepare, cook and sell food must meet the following criteria:

- make sure the food is safe to eat
- the food packaging or label must not be misleading in any way, e.g. if the packaging states the product is suitable for vegetarians it must not contain any meat
- the food product is what the consumer expects it to be.

Food hygiene

The Food Hygiene Regulations 2006 ensures that food at any time of production, apart from primary production (e.g. catching fish, milking animals, etc.), is handled and sold in a hygienic way.

These regulations also aim to do the following:

1. identify potential food safety hazards
2. enables to identify where exactly in the process that things could go wrong
   – these are called **critical control points**
3. put controls in place to prevent food safety risks from happening
4. ensure that the control measures that exists are always followed and are reviewed frequently.

Level 1/2 Hospitality and Catering: Unit 1:
Food related causes of ill health (AC4.1)

Food related causes of ill health

Ill health could be caused by any of the following:

- **bacteria**
- **allergies**
- **intolerances**
- **chemicals** such as:
  - detergent and bleach
  - pesticides and fertilisers.

Intolerances

Some people feel unwell when they eat certain foods. Common foods that cause intolerance include:

- milk (lactose)
- cereals (gluten)
- artificial sweeteners (Aspartame)
- flavour enhancers (MSG).

Food poisoning bacteria

The main causes of food poisoning bacteria are:

- **Bacillus cereus:** found in reheated rice and other starchy foods.
- **Campylobacter:** found in raw and undercooked poultry and meat and unpasteurised milk.
- **Clostridium perfringens:** found in human and animal intestines and raw poultry and meat.
- **E-coli:** found in raw meat, especially mince.
- **Listeria:** found in polluted water and unwashed fruit and vegetables.
- **Salmonella:** found in raw meat, poultry and eggs.
- **Staphylococcus aureus:** found in human nose and mouth.

Food and the law

Food can cause ill-health if it is stored, prepared and/or cooked incorrectly or if a person unknowingly eats a food that they are allergic or intolerant to. All hospitality and catering provision need to follow laws that ensure food is safe to eat. They are:

- **Food Labelling Regulations (2006):** A label must show all ingredients including allergens, how to store and prepare the food, where it came from, the weight of the food and a use-by or best-before date.
- **Food Safety (General Food Hygiene Regulations) 1995:** This law makes sure that anyone who handles food - from field to plate – does so in a safe and hygienic way. The **HACCP** system is used throughout the hospitality and catering sector.
- **Food Safety Act 1990:** This law makes sure that the food people it is safe to eat, contains ingredients fit for human consumption and is labelled truthfully.

Food allergies

An allergy is a reaction to something found in food. In the case of a severe allergy, the reaction can lead to death.

Common allergens include:

Cereals	Eggs	Seeds
Soya	Fish and shellfish	Strawberries
Peanuts	Wheat	Milk and dairy
Celery	Tree nuts	Mustard

Level 1/2 Hospitality and Catering:
Unit 1: Symptoms and signs of food-induced of ill-health (AC.4.2)

Symptoms and signs of food-induced ill-health:

An “upset tummy” is a familiar symptom for someone who thinks they might have food poisoning; this is known as a non-visible symptom. There are many other signs and symptoms that could show that a person might be suffering from ill-health due to the food they have eaten. Some of the symptoms can be seen (visible symptoms) such as a rash. It is important to be able to recognise visible and non-visible symptoms to help someone suffering from food-induced ill-health.

Visible symptoms

Visible symptoms of food poisoning, chemical poisoning, allergic reaction and food intolerance include:

- **Diarrhoea:** a common symptom of most types of food poisoning bacteria and can also be a symptom of lactose intolerance.
- **Vomiting:** a common symptom of most types of food poisoning bacteria, but may could also be caused by taking in chemicals accidently added to food.
- **Pale or sweating/chills:** a high temperature is a common symptom of E-coli and Salmonella.
- **Bloating:** a symptom of lactose intolerance.
- **Weight loss:** a symptom of gluten intolerance (coeliac disease).

Allergic/anaphylactic reaction

- **Visible symptoms:** red skin, a raised rash, vomiting, swelling of lips and eyes and difficulty breathing.
- **Non-visible symptoms:** swelling of tongue and throat, nausea (feeling sick) and abdominal pain.
- **Anaphylaxis:** a severe reaction to eating an allergen that can lead to death. An injection of adrenaline (for example, an EpiPen) is the treatment for an anaphylactic reaction.

Non-visible symptoms

Non-visible symptoms of food poisoning, chemical poisoning, allergic reaction and food intolerance include:

- **Nausea (feeling sick):** the most common symptom for all types of food-induced ill-health.
- **Stomach-ache/cramps:** abdominal pain is common symptom of lactose intolerance as well as a sign of an allergic reaction. Cramps may happen at the same time as diarrhoea.
- **Wind/flatulence:** a common symptom of lactose intolerance.
- **Constipation:** a symptom of Listeria food poisoning.
- **Painful joints:** a symptom of E-coli food poisoning.
- **Headache:** a symptom linked to Campylobacter, E-coli and Listeria.
- **Weakness:** non-stop vomiting, and diarrhoea can leave a person feeling weak. Gluten intolerance (coeliac disease) can leave a person feeling tired because their bodies can’t absorb the correct amount of nutrients.

Level 1/2 Hospitality and Catering:
Unit 1-1.4.3: Preventative control measures of food-induced of ill-health

Preventing cross-contamination

Food poisoning bacteria can easily be transferred to high-risk foods. This is called cross-contamination. It can be controlled by:

- washing hands before and after handling raw meat and other high-risk foods.
- using colour-coded chopping boards and knives when preparing high-risk foods.
- washing hands after going to the toilet, sneezing, or blowing your nose and handling rubbish.

Preventing physical contamination

Physical contamination is when something which is not designed for eating ends up in your food. Physical contaminants include hair, seeds, pips, bone, plastic packaging, plasters, broken glass, flies and other insects, tin foil and baking paper, soil, and fingernails.

Physical contamination can be controlled by:

- food workers following personal hygiene rules
- keeping food preparation and serving areas clean
- checking deliveries for broken packaging
- thoroughly washing fruits and vegetables before preparation
- using tongs or gloves for handling food.

Temperature control

Delivery	Storage	Preparation	Service
The temperature of high-risk foods must be checked before a delivery is accepted. The food should be refused if the temperatures are above the safe range. Refrigerated foods = **0-5°C** Frozen foods = **-22°C to -18°C**	High-risk foods must be covered and stored at the correct temperature. Temperatures must be checked daily. Refrigerator = **0-5°C** Freezer = **-22°C to -18°C** Unwashed fruit and vegetables must be stored away from other foods.	High risk-foods need to be carefully prepared to avoid cross-contamination. A food probe can be used to make sure that high-risk foods have reached a safe core (inside) temperature, which needs to be held for a minimum of two minutes. Core temperature = **70°C**	Food needs to be kept at the correct temperature during serving to make sure it is safe to eat. Hot food needs to stay hot and cold food needs to stay chilled. Hot holding = **63°C minimum** Cold holding = **0-5°C**

Level 1/2 Hospitality and Catering:
Unit 1-1.4.4: The Environmental Health Officer

Role of the Environmental Health Officer (EHO)

The role of the Environmental Health Officer (EHO) is to protect the health and safety of the public. They are appointed by local authorities throughout the UK. In the hospitality and catering industry, they are responsible for enforcing the laws linked to food safety. They inspect all businesses where food is prepared and served to members of the public, advise on safer ways of working and can act as enforcers if food safety laws are broken.

EHO inspections

The EHO can carry out an inspection of any hospitality and catering premise at any time during business hours – they do not need to make an appointment. During an inspection, the EHO will check to make sure that:

- the premises are clean
- equipment is safe to use
- pest control measures are in place
- waste is disposed properly
- all food handlers have had food hygiene and safety training
- all food is stored and cooked correctly
- all food has best-before and use-by dates
- there is a HACCP plan to control food hazards and risks.

The EHO is allowed to:

- take photographs of the premises
- take food samples for analysis
- check all record books, including fridge and freezer temperatures, cleaning schedules and staff training
- offer advice on improving food hygiene and safety in the business.

EHO and the law

If the EHO discovers problems with the food safety and hygiene in the premise, they are allowed by law to:

- remove any food that may be hazardous so it can't be sold
- tell the owners to improve hygiene and safety within a set time and then come back and re-inspect
- close the premises if there is a risk to health of the public
- give evidence in a court of law if the owners are prosecuted for breaking food hygiene and safety laws.

Complaints by the public

The EHO will immediately investigate any complaints of suspected food poisoning linked to a particular premise.

Hygiene ratings

When an inspection has been carried out, the EHO will give the business a food hygiene rating. The ratings are published on the Food Standards Agency website as well as on stickers displayed at the business. A rating of 5, or very good, represents the highest standard of food hygiene.

Level 1/2 Hospitality and Catering:
Unit 2-2.2.1: Factors affecting menu planning

Factors affecting menu planning

You need to be aware of the following factors when planning menus:

- **cost** (ingredients as well as business costs)
- **portion control** (value for money without waste)
- **balanced diets/current national advice**
- **time of day** (breakfast, lunch, and dinner menus as well as small plates and snacks)
- **clients/customers** (a menu with prices that will suit the people who visit your establishment).

Equipment available

You need to know and understand the type of equipment needed to produce a menu. The choice of dishes will be influenced by the equipment available to the chef.

This includes kitchen equipment such as:

- hobs, ovens, and microwaves
- fridge, freezer and/or blast chiller
- specialist equipment, for example a *sous vide* or pizza oven
- hand-held equipment, for example electric whisks or hand-blenders
- other electric equipment, for example food processors.

Skills of the chef

The skills of the chef must be suited to the type of provision and the menu offered.

A Michelin starred restaurant will require a chef who has complex skills in preparation, cooking and presentation of dishes.

A café will require a chef who has a range of medium and complex skills to produce a suitable menu.

A large restaurant will normally have a full kitchen brigade while a smaller establishment may only have a single chef with one or two assistants.

Time available

The type of provision will influence the amount of time a customer may be willing to wait for their dish to be prepared. Can the chef prepare, cook, and present more than one dish at the same time? Can some items be made in advance?

Time of year

The time of year can affect menu choices. Light and cold dishes such as salads are better suited to the summer months. Hearty dishes such as stews are more suited to the winter. Special dishes linked to holidays such as Christmas and Valentine's Day may also be included. The availability of **seasonal** produce can also affect menu choices as certain commodities, for example strawberries, are less expensive when in season.

Environmental issues

The chef will need to think about environmental issues when planning a menu. Can the chef **reduce** the amount of ingredients bought as well as reducing food waste? Can the chef **reuse** ingredients to create new dishes for example stale bread made into bread-and-butter pudding? Can the kitchen **recycle** waste wherever possible? Running the kitchen sustainably will save money.

Organoleptic properties

Organoleptic properties are the sensory features of a dish (**appearance**, **aroma**, **flavour**, and **texture**).

The chef will need to think about how the dish will look and taste. Is there a range of colours? Do the flavours go well together? Are there a variety of textures?

Level 1/2 Hospitality and Catering:
Unit 2-2.3.1: Practical skills and techniques

Skills and techniques

You need to be able to identify the different types of skills you need to produce your selected dishes. Some dishes will require the use of more complex skills. You will need to demonstrate a range of skills when producing your chosen dishes.

Preparation and cooking skills are categorised as follows: **basic**, **medium**, and **complex**.

Presentation

You should know and understand the importance of using the following appropriate presentation techniques during the production of dishes:

- creativity
- garnish and decoration
- portion control
- accompaniments.

Basic preparation skills and techniques

Blending, beating, chopping, grating, hydrating, juicing, marinading, mashing, melting, peeling, proving, sieving, tenderising, trimming, and zesting.

Medium preparation skills and techniques

Baton, *chiffonade*, creaming, dehydrating, deseeding, dicing, folding, kneading, measuring, mixing, puréeing, rub-in, rolling, skinning, slicing, spatchcocking, toasting (nuts/seeds) and weighing.

Complex preparation skills and techniques

Brunoise, crimping, de-boning, filleting, *julienne*, laminating (pastry), melting using *bain-marie*, mincing, piping, and segmenting, shaping, unmoulding and whisking (aeration).

Basic cooking skills and techniques

Basting, boiling, chilling, cooling, dehydrating, freezing, grilling, skimming, and toasting.

Medium cooking skills and techniques

Baking, blanching, braising, deglazing, frying, griddling, pickling, reduction, roasting, sautéing, steaming, stir-frying, and using a *sous vide* (water bath).

Complex cooking skills and techniques

Baking blind, caramelising, deep fat frying, emulsifying, poaching, and tempering.

Year 11 BTEC Dance- Spring Subject Term Knowledge Organiser

Component 3: Responding to a Brief

Objective

- Understand how to respond to a brief
- Select and develop skills and techniques in response to a brief Apply skills and techniques in a workshop performance in response to a brief
- Evaluate the development process and outcome in response to a brief

Responding to a brief

- Starting points that can be investigated and explored practically to generate ideas to
- inform the response to the brief and the given stimulus:
- a theme: concept such as distance or a key word such as discovery
- an issue: social, health or safety issues
- a prop: an umbrella, an apple, a dustbin
- time and place: a beach in winter, night time in a hospital, early morning in the park
- existing repertoire: a play, a composition, choreography, that can be investigated and
- explored to inform the response.

Students will be given a brief and stimulus to create performance material as a performer. In groups consisting of a minimum of three and a maximum of seven performers, will respond to the stimulus and create a workshop performance that communicates ideas and creative intentions to a target audience of their choice.

Key words

Improvisation
Movement techniques
Solo or small-group
Ensemble
Stimulus
Intention
Target audience

Skills and techniques, such as:

o physical
o vocal
o musicality
o interpretative
o stylistic
o interaction with the group
o interaction in performance
o refining ideas
o communicating design ideas e.g. pitch, presentation.

Success

The contribution made by students has a significant impact on the group dynamic and the delivery and communication of ideas through performance. Students are able to reflect on and review the process and outcome with awareness and insight.

Year 10 HT3 Knowledge Organiser for BTEC Sport— Component 3

Exercise Intensity

Aerobic endurance = It is the ability of the cardio-respiratory system to efficiently supply nutrients and oxygen to working muscles during sustained physical activity.
Muscular strength = The maximum force a muscle or muscle group can produce. (Measured in N or KG)
Muscular endurance = It is the ability of a muscle or group of muscles to keep contracting over a period of time against light to moderate load.
Flexibility = Having an adequate range of motion in all joints of the body. It is the ability to move a joint through its complete range of movement.
Speed = The ability to perform a movement or cover a distance in a short period of time = distance/time taken.
Body composition = This is the relative ratio of fat mass to fat free mass (vital organs, muscle, bone) in the body

Components of Fitness — Skill

Balance = The ability to maintain your centre of mass over a base of support. A performer may need static or dynamic balance.
Agility = The ability of a sports performer to quickly and precisely move or change direction without losing their balance.
Coordination = The smooth flow of movement needed to perform a task efficiently and accurately. It often involves being able to use 2 or more body parts together.
Reaction Time = The time taken for a sports performer to respond to a stimuli and the start their response.
Power = The work done in a unit of time. It is the ability to apply a combination of strength and speed. Power = Force (kg) x Distance (m)/time (min or s)

Keywords

Cardio-Respiratory = The heart and blood vessels working with the lung and the airways to carry oxygen to the muscle.
Contracting = This is when the muscles shortens to create a movement Accelerative
Speed = Gradually increasing your speed Pure Speed = Your maximum speed.
Endurance = The ability to prolong the amount of time near maximum speed Static
Balance = Balancing without moving Dynamic Balance = Balancing when moving
Stimuli = Something which causes a response or movement

Year 10 HT3 Knowledge Organiser for BTEC Sport—
Unit 1 Fitness for Sport and exercise

Exercise Intensity

Measuring Heart Rate

1. Sit Down
2. Locate your radial with your index and middle finger
3. Don't use your thumb—it has its own pulse
4. Count the beats from 30 seconds and times it by 2 to find your BPM

Training Zones

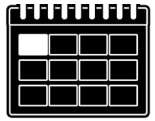
Speed Zone = 95% to 100% of MHR
Anaerobic Training Zone = 85% to 95% of MHR
Aerobic Training Zone = 60% to 85% of MHR

The Borg Scale - Rate of Perceived Exertion (RPE)

The Borg scale is used to predict or estimate the Heart Rate of an individual.
Practice by the individual is needed to make their predictions as accurate as possible
The individual rates themselves from 7 to 20 on the scale.
They then times this by 10 to get an estimated HR
RPE x 10 = HR (BPM)

Basic Principles of Training

We apply principles of training to our training programmes so that we make it affective and make sure it aids progression.



The Basic Principles of Training

Frequency = How often we train Increasing the number of days
Intensity = How hard we train Increasing the number or reps
Time = How long we train Increasing the time we train
Type = How we train selecting the correct training method

The FITT principle is part of the Additional Principle of PROGREESIVE OVERLOAD.

This is the gradual increase of a training load, when done correctly it will progressively increase Frequency, Intensity, Time and Type to develop fitness gains

Key terms

Heart Rate (HR) = The amount your heart beats in 1 minute (BPM)
Maximum Heart Rate (MHR) = The maximum your heart will beat in 1 minute, 220 - Age = MHR
RPE = Rate of Perceived Exertion (How hard we think we have worked)

Les directions	***Directions***
Où est le/la/l' …? / Où sont les …?	*Where is the …? / Where are the …?*
Pour aller au/à la/à l'/aux …?	*How do I get to the …?*
Va/Allez tout droit.	*Go straight on.*
Tourne/Tournez à gauche/droite.	*Turn left/right.*
Prends/Prenez la première/deuxième/troisième rue à gauche/droite.	*Take the first/second/third street on the left/right.*
Traverse/Traversez le pont/la place.	*Cross the bridge/square.*
Descends/Descendez la rue.	*Go down the street.*
C'est près/loin?	*Is it near/far?*
C'est tout près/assez loin.	*It's very near/quite far.*

Qu'est-ce qu'il y a dans ta région?	***What is there in your region?***
Dans ma région, il y a …	*In my region there is/are …*
un lac	*a lake*
un port de pêche	*a fishing port*
une rivière/un fleuve	*a river*
des champs	*fields*
des collines	*hills*
des fermes	*farms*
des forêts	*forests*
des stations de ski	*ski resorts*
des vignobles	*vineyards*
En Bretagne, il y a …	*In Brittany there is/are …*
un beau château	*a beautiful castle*
une belle cathédrale	*a beautiful cathedral*
des villes historiques	*historical towns*
de vieilles maisons	*old houses*
de vieux bâtiments	*old buildings*
On peut …	*You can …*
faire de la voile	*go sailing*
faire des randonnées à vélo	*go for bike rides*

Le meilleur …	***The best …***
le meilleur climat	*the best climate*
la meilleure équipe de football	*the best football team*
le plus beau paysage	*the most beautiful countryside*
les plus belles plages	*the most beautiful beaches*
le plus long fleuve	*the longest river*
la plus longue piste de ski	*the longest ski slope*
la plus haute tour	*the highest tower*
le musée le plus populaire	*the most popular museum*
la région la plus historique	*the most historical region*
les stations de ski les plus populaires	*the most popular ski resorts*
les monuments les plus célèbres	*the most famous monuments*

Visiter une ville	***Visiting a town***
Je voudrais visiter/voir …	*I would like to visit/see …*
Je ne voudrais pas rater …	*I wouldn't like to miss …*
l'aquarium	*the aquarium*
l'exposition sur …	*the exhibition on …*
le spectacle son et lumière	*the sound and light show*
Je voudrais louer des vélos.	*I would like to hire bikes.*
J'aimerais …	*I would like to …*
faire une promenade en bateau	*go on a boat trip*
monter à la tour de l'horloge	*climb the clock tower*

Les renseignements touristiques	***Tourist information***
(Le château) est ouvert quels jours de la semaine?	*On which days is (the castle) open?*
C'est ouvert (tous les jours/tous les jours sauf le dimanche).	*It's open (every day/every day except Sundays).*
Quels sont les horaires d'ouverture?	*What are the opening hours?*
C'est ouvert de (9h) à (17h).	*It's open from (9 a.m.) until (5 p.m.).*
C'est combien, l'entrée?	*How much is the entrance fee?*
Ça coûte … pour les adultes et … pour les enfants.	*It costs … for adults and … for children.*
Est-ce qu'il y a un restaurant ou une cafétéria?	*Is there a restaurant or a cafeteria?*
Avez-vous un dépliant/un plan de la ville?	*Do you have a leaflet/a map of the town?*
Où est-ce qu'on peut acheter des billets?	*Where can we buy tickets?*
la durée	*duration*
les tarifs	*prices*
gratuit	*free*
accessible aux personnes handicapées	*accessible to disabled people*
les chiens sont acceptés	*dogs are welcome*

Le temps/La météo	***The weather/ The weather forecast***
Quel temps fait-il?	*What is the weather like?*
Il fait beau.	*The weather is good.*
Il fait mauvais.	*The weather is bad.*
Il fait chaud.	*It's hot.*
Il fait froid.	*It's cold.*
Il y a du soleil.	*It's sunny.*
Il y a du brouillard.	*It's foggy.*
Il y a du vent.	*It's windy.*
Il y a un orage.	*There's a storm.*
Il pleut.	*It's raining.*
Il neige.	*It's snowing.*
près de la Manche	*near the Channel*

Vocabulaire

(Pages 90–91)

Où habites-tu?	***Where do you live?***
J'habite …	*I live …*
dans une ville/un village	*in a town/village*
au centre-ville	*in the town centre*
au bord de la mer	*at the seaside*
à la campagne/montagne	*in the countryside/mountains*
en ville	*in town*
à Londres/Manchester, etc.	*in London/Manchester, etc.*
dans le nord/le sud/l'est/ l'ouest …	*in the north/south/east/west …*
dans le centre …	*in the centre …*
de l'Angleterre/Écosse/Irlande (du Nord)	*of England/Scotland/ (Northern) Ireland*
de la France	*of France*
du pays de Galles	*of Wales*

Qu'est-ce qu'on peut faire?	***What can you do?***
On peut …	*You can …*
aller à un match de foot	*go to a football match*
aller au cinéma	*go to the cinema*
faire du cheval	*go horse-riding*
faire du ski	*go skiing*
faire du snowboard	*go snowboarding*
faire des promenades	*go for walks*
faire les magasins	*go shopping*
se baigner dans la mer	*swim/bathe in the sea*
se détendre sur la plage	*relax on the beach*
visiter le château	*visit the castle*
visiter les musées	*visit the museums*

Dans ma ville/mon village	***In my town/village***
Dans ma ville/mon village, il y a …	*In my town/village there is/are …*
un bureau de poste/une poste	*a post office*
un centre de loisirs	*a leisure centre*
un château	*a castle*
un marché	*a market*
un musée	*a museum*
un parc/jardin public	*a park*
un stade	*a stadium*
un supermarché	*a supermarket*
une bibliothèque	*a library*
une église	*a church*
une gare (SNCF)	*a (railway) station*
une mosquée	*a mosque*
des hôtels	*some hotels*
des restaurants	*some restaurants*
Il n'y a pas de …	*There isn't a/aren't any …*

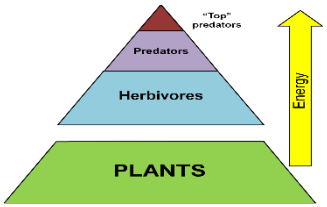
Sustaining Ecosystems

What is an Ecosystem?

An ecosystem is a system in which organisms interact with each other and with their environment.

Ecosystem's Components

Abiotic	These are non-living, such as air, water, heat, rock.	
Biotic	These are living, such as plants, insects, and animals.	
	Flora	**Plant life** occurring in a particular region or time.
	Fauna	**Animal life** of any particular region or time.



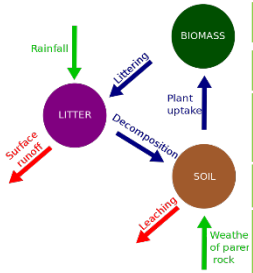
Food Chains

Food chains are useful in explaining the basic principles behind ecosystems. They show only one species at a particular level from where energy is transferred up to the next.

Nutrient cycle

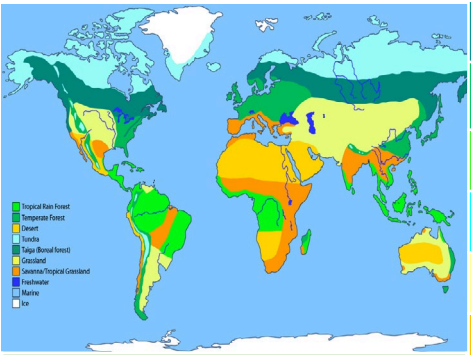
Plants take in those nutrients where they are built into new organic matter. Nutrients are taken up when animals eat plants and then returned to the soil when animals die and the body is broken down by decomposers.

Litter	This is the surface layer of vegetation, which over time breaks down to become humus.
Biomass	The total mass of living organisms per unit area.



Biomes

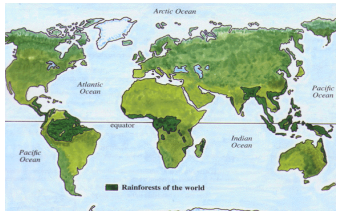
A biome is a large geographical area of distinctive plant and animal groups, which are adapted to that particular environment. The climate and geography of a region determines what type of biome can exist in that region.



- Coniferous forest
- Deciduous forest
- Tropical rainforests
- Tundra
- Temperate grasslands
- Tropical grasslands
- Hot deserts.

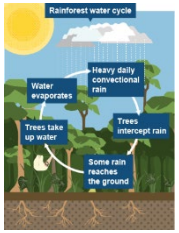
The most productive biomes – which have the greatest biomass- grow in climates that are hot and wet.

Tropical Rainforest Biome



Distribution of Tropical Rainforests

Tropical rainforests are centred along the Equator between the Tropic of Cancer and Capricorn. Rainforests can be found in South America, central Africa and South-East Asia. The Amazon is the world's largest rainforest and takes up the majority of northern South America, encompassing countries such as Brazil and Peru.



Convectional rainfall

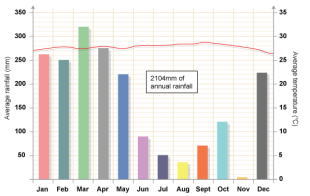
1. The roots of plants take up water from the ground and the rain is **intercepted** as it falls.
2. As the rainforest heats up, the water evaporates into the atmosphere.
3. Finally, the water condenses and forms clouds to make the next day's rain.

Rainforest nutrient cycle

The hot, damp conditions on the forest floor allow for the rapid decomposition of dead plant material. This provides plentiful nutrients that are easily absorbed by plant roots. However, as these nutrients are in high demand from the many fast-growing plants, they do not remain in the soil for long and stay close to the surface. If vegetation is removed, the soils quickly become infertile

Climate of Tropical Rainforests

- Evening temperatures rarely fall below 22°C
- Due to the presence of clouds, temperatures rarely rise above 32°C
- Most afternoons have heavy showers
- At night with no clouds insulating, temperature drops

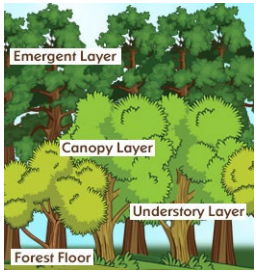


Interdependence in the rainforest

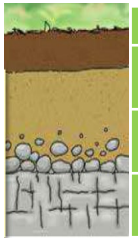
A rainforest works through interdependence. This is where the plants and animals depend on each other for survival.

Layers of the Rainforest

Emergent	Highest layer with tree reaching 50 metres.
Canopy	Most life is found here as It receives high level of rainfall and sunlight.
U-Canopy	Consists of trees that reach 20 metres high.
Shrub Layer	Lowest layer with small trees that have adapted to living in the shade.



Rainforest soil profile



Leaf Litter	Thin litter layer rapidly decomposes in heat.
Top Soil	Shallow topsoil is a mixture of decomposed organic matter and minerals.
Sub Soil	The sub-soil is deep due to weathering of rocks below.
Rock	Underlying rock weathers quickly at high temperatures to form sub-soil.

Biome's climate and plants

Biome	Location	Temperature	Rainfall	Flora	Fauna
Tropical rainforest	Centred along the Equator.	Hot all year (25-30°C)	Very high (over 200mm/year)	Tall trees forming a canopy; wide variety of species.	Greatest range of different animal species. Most live in canopy layer
Tropical grasslands	Between latitudes 5°- 30° north & south of Equator.	Warm all year (20-30°C)	Wet + dry season (500-1500mm/year)	Grasslands with widely spaced trees.	Large hoofed herbivores and carnivores dominate.
Hot desert	Found along the tropics of Cancer and Capricorn.	Hot by day (over 30°C) Cold by night	Very low (below 300mm/year)	Lack of plants and few species; adapted to drought.	Many animals are small and nocturnal: except for the camel.
Temperate forest	Between latitudes 40°-60° north of Equator.	Warm summers + mild winters (5-20°C)	Variable rainfall (500-1500m /year)	Mainly deciduous trees; a variety of species.	Animals adapt to colder and warmer climates. Some migrate.
Tundra	Far Latitudes of 65° north and south of Equator	Cold winter + cool summers (below 10°C)	Low rainfall (below 500mm/ year)	Small plants grow close to the ground and only in summer.	Low number of species. Most animals found along coast.
Coral Reefs	Found within 30° north – south of Equator in tropical waters.	Warm water all year round with temperatures of 18°C	Wet + dry seasons. Rainfall varies greatly due to location.	Small range of plant life which includes algae and sea grasses that shelters reef animals.	Dominated by polyps and a diverse range of fish species.

Tropical Rainforest Biome

Adaptations to the rainforest

Sloths	Are camouflaged to forest environment.
Buttress Roots	Support tall trees & absorb nutrients.
Drip Tips	Allows heavy rain to run off leaves easily
Lianas & Vines	Climbs trees to reach sunlight at canopy.

Rainforest inhabitants

Many tribes have developed sustainable ways of survival, such as shifting cultivation.
The forest provides inhabitants with…

- Food through hunting and gathering.
- Natural medicines from forest plants.
- Homes and boats from forest wood.

Effects of Human Activity on the Rainforest

Logging

- Most widely reported cause of destructions to biodiversity.
- Timber is harvested to create commercial items such as furniture and paper.
- Has lead to violent confrontation between indigenous tribes and logging companies.

Agriculture

- Large scale 'slash and burn' of land for ranches and palm oil.
- Increases carbon emission.
- River saltation and soil erosion increasing due to the large areas of exposed land
- Increase in palm oil is making the soil infertile.

Mineral Extraction

- Precious metals are found in the rainforest.
- Areas mined can experience soil and water contamination.
- Indigenous people are becoming displaced from their land due to roads being built to transport products.

Tourism

- Mass tourism is resulting in the building of hotels in extremely vulnerable areas.
- Has caused negative relationships between the government and tribes
- Tourism has affected wildlife (apes) by exposing them to human diseases.

Benefits of the rainforest

Raw Materials	Commonly used materials such as timber and rubber are found here.
Water	Controls the flow of water to prevent floods/droughts regions..
Food	Important foods such as bananas, pineapples and coffee are grown there.
Health	25% of modern medicines are sourced from rainforest ingredients.
Energy	Large dams generate 2/3 of Brazil's energy needs.
Climate	Acts as carbon sinks by storing 15% of carbon emissions.

Case Study: Sustainable Rainforest Management in Costa Rica

Location & Background

Costa Rica is a small country in Central America.
It is home to 6% of the world's biodiversity.
The country attracts 6 million tourists a year.

Ecotourism

Ecotourism is tourism that is directed towards the natural environments & conservation. Monteverde is a popular ecotourism destination in the country.

Advantages

- 80 new businesses have open in Monteverde.
- 400 full-time and 140 part-time jobs directly related to tourism in Monteverde.

Disadvantages

- Land prices have increased.
- Deforestation to clear areas for tourism industry.

Threats to the Costa Rican Rainforest

- Cattle Ranching and agricultural development by clearing land through slash & burn methods.
- Gold and other metal mining meant large scale soil and rock removing. This meant areas were deforested and chemicals entered water systems.
- By 1990, 32,000 hectors of forest were cut down each year – devastating the fragile ecosystem.

Rainforest Management

- Government created 28 National Parks with 24% of the country's land protect.
- Laws and enforcement meant that deforestation had fallen from 1.8 to almost zero by 2005.
- Agroforestry encourages growing trees and crops together to create better farming conditions.
- Afforestation has led to the replanting of trees to replace original forest that have been lost.

Polar/Tundra Regions Biome

Distribution of Polar Regions

Arctic	Antarctic
Is the region north of latitude 60°N around the North Pole.	**A continent south of latitude 60°S around the South Pole.**

Climate

Polar areas are very cold with temperatures rarely reaching above 0 °C. Winters average below -40 °C with summers a maximum of only 10 °C. Rainfall is low throughout the year.

Land & Sea Features

Arctic

Large areas are permafrost. At sea, most of the region is frozen over.

Antarctic

Large and thick ice sheets. A mountain range crosses the continent.

Flora (Plants)

There are very few plants in polar areas – some lichens, mosses and grasses along the coastal areas.

Fauna (Animals)

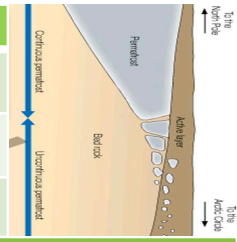
Relatively few species of animals. Polar Bears, Penguins and marine mammals like whales, seals and walrus are examples.

Climate Change on Polar Regions

Scientific reports outline the effect global warming is having on these regions. Ice sheets and glaciers are melting at an alarming rate leading to fears of rising sea levels. Thawing of permafrost is increasing methane emissions and the decline of Arctic ice is creating waves that are capable of causing unseen coastal erosion.

Arctic soil profile

Active Layer	Thaws in the summer. Becomes deeper towards pole.
Permafrost	Permanently frozen all year. Layer Increases further north.
Bed Rock	Low temperatures weathers rock slowly = less nutrients.



Effects of Human Activity in Polar Regions

Oil & Gas exploration

- Arctic holds a large amount of untapped oil and gas.
- Oil spills would threaten ecosystems as clean up operations would be slow.

Whaling

- Hunting of whales is a major industry – this led to a rapid decline in whale populations.
- Many countries have banned whaling, but some still continue

Fishing

- Has made area possible to fish large untapped stocks.
- The polar areas are difficult to police due to harsh conditions.
- Collapse of the fish stocks might damage ecosystems.

Tourism

- The tourism industry is steadily growing within polar regions.
- Travel by tourists have increase emissions further.
- Wildlife may become disturbed by tourists getting up close.

Case Study: Small Scale Sustainable Management: Union Glacier, Antarctica

Location & Background

Located in the southern Ellsworth Mountains and is a key logistic hub for expeditions and research.

Features and Activities

- The locations has good facilities such as a dining room, electricity supply and transport.
- Tourists and can enjoy several activities such as ski tours, wildlife viewing and mountaineering.

Sustainable Management

- Strict guidelines on how tourists should behave are enforced to respect the natural environment.
- Solar panels used to reduce carbon emissions.
- All waste is carefully contained and removed.

Case Study: Global Scale Sustainable Management: The Antarctic Treaty System

Background

Signed by 50 nations in 1961, the Treaty sets aside Antarctica as a scientific reserve, establishes freedom of scientific investigation and bans military activity.

Basic Principles of the Antarctic Treaty

- Bans mining and resource extraction.
- Prevents territorial disputes of the continent.
- Promotes scientific research and co-operation.
- Protects the fragile environments and its wildlife by preventing and managing waste/pollution.

Successful?

Stayed in place for 50 years with more countries signing up to enforce strict controls and improve its stability.

GCSE History Paper 2: Early Elizabethan England KT1: Queen, government and religion 1558-69

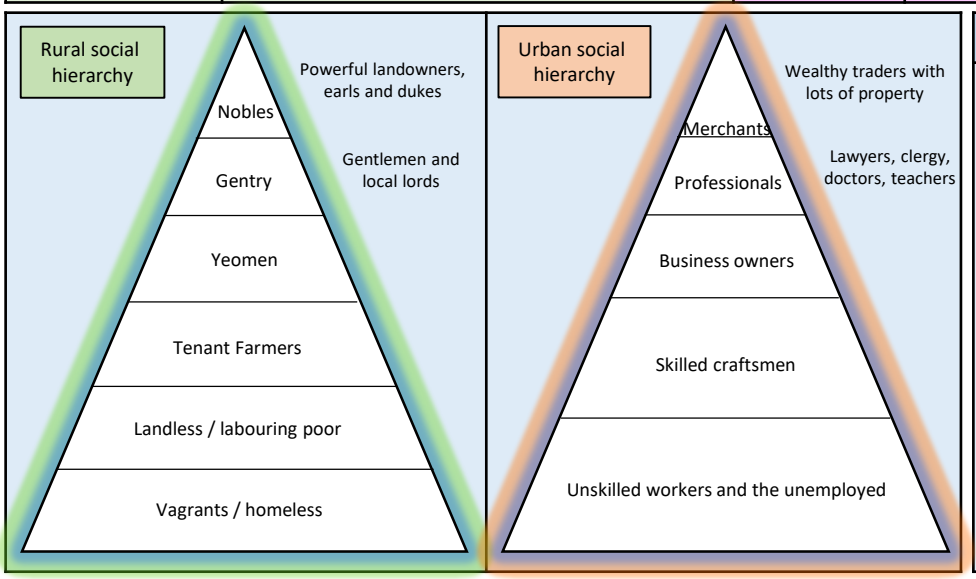
Key Terms			
Elizabethan Society		Patron	Someone who provides encouragement or financial support
Social hierarchy	See table below	Crown	With a capital 'C' – the monarch and government
Yeomen	Men who held a small amount of land	**Roman Catholic Church**	
Craftsmen	Skilled employees including apprentices	Papacy	The system of Church government ruled by the pope
The Government		Heretics	Held religious beliefs different to those accepted by society
Monarch	A king or queen – had the right to rule by the 'grace of God'	Martyr	Someone killed for his/her beliefs
Secretary of State	Head of the Privy Council, monarch's closest advisor	**Religion**	
Privy Council	Leading courtiers and advisers, who advised the monarch	Mass	Catholic service involving the miracle of the bread and wine
Court	The inner social circle of the queen, based in her palaces	Reformation	Challenge to the teachings and power of the Catholic church
Parliament	Senior political figures whose duty was to advise queen	Sacraments	Special Church ceremonies
Lord Lieutenants	Maintained monarch's power and England's defences	Holy Communion	Another name for mass, often used in Protestant churches
JPs	Justices of the Peace kept law and order	Clergy	Religious leaders, such as bishops and priests
Courtiers	Members of the nobility who attended court (see above)	Diocese	An area looked after by a bishop
Militia	A military force of ordinary people, rather than soldiers	Ecclesiastical	Things to do with the Church
The Monarch		Royal Supremacy	When the monarch is head of the Church
Divine Right	Belief that the monarch's right to rule came from God	Recusants	Catholics who were unwilling to attend church services

Question types

'Describe two features of…' [4]
(2 x 2 = 4 marks total)
Identify 2 features and support with evidence.
Useful phrases: "One feature was…"
"For example …."

'Explain why…' [12]
3 PEE paragraphs about the reasons for an event/change/threat. The paragraphs must show a link to the question.
Useful phrases: "This shows that…because…"
"Another reason is…this is because…"

'How far do you agree..' [16]
A balanced answer discussing both sides of the argument with an overall conclusion.
Useful phrases: "It is debatable whether…"
"Some might agree that…"
"This is shown by…"



Sample exam questions

'Describe two features of Elizabethan society in 1558'. [4]
'Describe two features of the Elizabethan social hierarchy'. [4]
'Describe two features of the Privy Council'. [4]
'Describe two features of Catholic beliefs about the organisation of the Church'. [4]
'Describe two features of the Religious Settlement of 1559'. [4]
'Describe two features of Puritan challenges to the Religious Settlement of 1569'. [4]

'Explain why religion was a problem for Elizabeth when she became queen in 1558'. [12]
'Explain why Catholics abroad were a problem for Elizabeth 1558-1569'. [12]
'Explain why Catholics challenged the Religious Settlement of 1569'. [12]
'Explain why Mary Queen of Scots created a problem for Elizabeth upon her arrival in 1568'. [12]

"Financial issues were the main cause of Elizabeth's domestic challenges between 1558-69". How far do you agree? [16]
"The threat of invasion was the main problem Elizabeth faced when she became queen in 1558". How far do you agree? [16]
"Elizabeth was successful in dealing with the problems she faced between 1558-69". How far do you agree? [16]
"English Catholics represented the most significant threat to Elizabeth's Religious Settlement". How far do you agree? [16]

GCSE History Paper 2: Early Elizabethan England KT1: Queen, government and religion 1558-69

Elizabeth's problems in 1558

Legitimacy:
In the view of the Catholics, Elizabeth was illegitimate as Henry VIII's divorce from Catherine of Aragon was never agreed by the pope.

Financial weakness:
The Crown was £300,000 in debt due to the expensive war with France that Mary I had fought. This was a huge sum in 1558.

Gender & marriage:
Most people thought women were not capable of ruling alone. Women were seen as the weaker sex. Elizabeth was being pushed to marry by her advisers.

Foreign threat:
England was isolated, surrounded by Catholic enemies in both France (who they had been at war with) and Spain (who Elizabeth had refused a marriage proposal from).

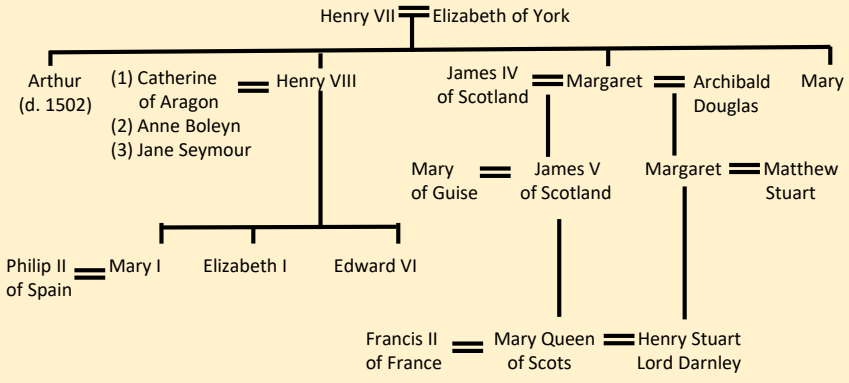
Religion
England was in a period of religious instability since Henry VIII's break with Rome. Mary I, Elizabeth's sister had been Catholic and had heavily persecuted Protestants.

Mary Queen of Scots:
Claimed that she was the legitimate Catholic heir to the throne and was married to the Catholic king of France.

Comparison between Catholicism and Protestantism	
Roman Catholic	**Protestant**
The pope is the head of the Church	There should be no pope
The Bible and church services should be in Latin	The Bible and church services should be in your own language
The Church can forgive sins	Sins can only be forgiven by God
During mass a miracle occurs when the bread and wine become the body and blood of Christ	The bread and wine simply represent the Last Supper in the Bible. There is no miracle
Priests are special and should wear special clothing (vestments)	Priests are not special and should not wear special clothing
Churches should be highly decorated in honour and glory of God	Churches should be plain and simple so as not to distract from worshipping God
Priests are forbidden to marry	Priests are permitted to marry if they wished

The Religious Settlement	
The Act of Uniformity	Established what churches should look like. Moderate decoration was allowed. Hymns could be sung. All services, bibles and prayers books were in English. Miracle at Communion left ambiguous. Priests still wore vestments.
The Act of Supremacy	Elizabeth was named Supreme Governor of the Church of England. All clergy members swore an oath of allegiance to her.
Royal Injunctions	Set of instructions on how to reinforce the acts of Uniformity and Supremacy. Included instructions on how people should worship God.

Mary Queen of Scots' claim to the throne



Challenges to the Religious Settlement

Puritan challenge:
Fell into two categories 1. The crucifix controversy (as Puritans did not believe the image of Christ dying on the cross should be present in churches). 2. The vestment controversy (as Puritans did not believe that priests should wear any special clothing.

Foreign challenge:
Both France and Spain were Catholic powers abroad and were not supportive of Elizabeth's Protestant rule.

The Catholic challenge:
Although the papacy did not offer direct leadership to England's Catholics, the pope did issue instructions forbidding Catholics from attending Church of England services. Many of the ancient families in England were Catholic, most notably the Dukes of Norfolk and a number continued to worship in their own homes.

GCSE History Paper 2: Early Elizabethan England KT2: Challenges at Home and Abroad

Key Terms

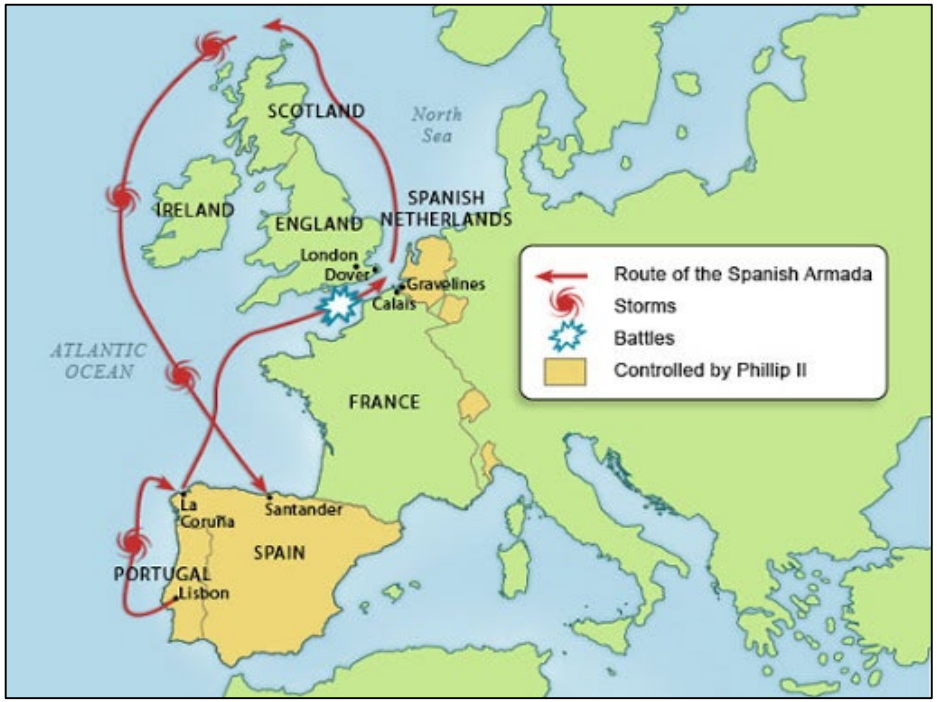
Revolt of the Northern Earls		Privateers	Pirates whose activities are legal and in service of the Crown
Revolt	An uprising or rebellion against the monarch	**The Spanish Armada**	
Earl	A senior noble who played an important role in governing England	Gravelines	A town on the border of France and the Spanish Netherlands
Mass	A Catholic church service	Galleon	Large but slow fighting ships used by the Spanish
The Catholic Plots		Fleet	The group of ships
Plot	A planned rebellion or attack – normally one which is not carried out	Fire Ships	Unmanned ships loaded with explosives and sent into the Spanish fleet
Double Agent	Someone who pretends to be on one side but is actually on the other	**Reasons for the Failure of the Armada**	
Spymaster	Francis Walsingham, Elizabeth's chief spy responsible for her security	Cadiz	Spain's main western port – the site of much of the Armada preparations
Jesuits	Extreme Catholics carrying out the wishes of the Pope	Tilbury	The south-eastern port from where Elizabeth spoke and inspired her fleet
Incriminate	To find evidence of someone's involvement in a crime	Admiral	The most senior commander of a fleet
Reasons for the Spanish Armada		Comptroller	Someone who supervises the financing and organisation of a project
New World	The continents of North and South America – dominated by Spain	Gloriana	The image of Elizabeth as divine, powerful and in control

Question types

'Describe two features of…' [4]
(2 x 2 = 4 marks total)
Identify 2 features and support with evidence.
Useful phrases: "One feature was…"
"For example …."

'Explain why…' [12]
3 PEE paragraphs about the reasons for an event/change/threat. The paragraphs must show a link to the question.
Useful phrases: "This shows that…because…"
"Another reason is…this is because…"

'How far do you agree..' [16]
A balanced answer discussing both sides of the argument with an overall conclusion.
Useful phrases: "It is debatable whether…"
"Some might agree that…"
"This is shown by…"



Sample exam questions

'Describe two features of the Revolt of the Northern Earls in 1569'. [4]
'Describe two features of the Ridolfi Plot of 1571'. [4]
'Describe two features of the Throckmorton Plot of 1583'. [4]
'Describe two features of the Babington Plot of 1586'. [4]
'Describe two features of the Walsingham's methods of catching Catholic plotters'. [4]
'Describe two features of the execution of Mary, Queen of Scots in 1587'. [4]
'Describe two features of English involvement in the Spanish Netherlands'. [4]
'Describe two features of Spanish preparations for the Armada'. [4]
'Describe two features of Drake's raid on Cadiz'. [4]
'Describe two features of the Spanish plan to invade England in 1588'. [4]
'Describe two features of the English defence against the Armada in 1588'. [4]
'Describe two features of the leadership of the English fleet in 1588'. [4]
'Describe two features of the Spanish fleet in 1588'. [4]

'Explain why the Revolt of the Northern Earls took place in 1569'. [12]
'Explain why the Ridolfi Plot of 1571 increased tension between Protestants and Catholics.' [12]
'Explain why the Throckmorton Plot of 1583 was a threat to Elizabeth'. [12]
'Explain why Sir Francis Walsingham was effective at dealing with Catholic plots between 1573 and 1586'. [12]
'Explain why Philip II ordered the invasion of England in 1588'. [12]
'Explain why Elizabeth authorised intervention in the Netherlands between 1578 and 1588'. [12]
'Explain why the Spanish Armada was defeated in 1588'. [12]

'"Political grievances were the main cause of the Revolt of the Northern Earls in 1569". How far do you agree? [16]
"The Babington Plot was the greatest threat to Elizabeth's rule in the period 1569-86". How far do you agree? [16]
"The execution of Mary, Queen of Scots was the main reason for the Spanish Armada in 1588". How far do you agree? [16]
"Effective leadership was the main reason for English victory over the Spanish Armada in 1588". How far you do you agree? [16]

GCSE History Paper 2: Early Elizabethan England KT2: Challenges at Home and Abroad

Lord Charles Howard

Lord Howard was a cousin of Queen Elizabeth and Earl of Nottingham. Through his family connections he achieved the rank of Lord High Admiral of the English fleet. However, he was a natural born leader with an excellent tactical mind, and was a deserving leader of the English defence. His most notable contribution to the defeat of the Armada was the decision to send fire ships towards the Spanish fleet. He was responsible for the larger part of England's fleet.

Sir Francis Drake

Sir Francis Drake was the greatest sailor alive. He was the first captain to successfully circumnavigate the globe in 1580, and inspired such terror in the Spanish that they nicknamed him 'El Draque' – the Dragon. He had been very successful in stealing Spanish treasure and had made Elizabeth lots of money – one notable capture paid off England's entire national debt. He was born to humble origins but rose up the ranks through his talent. His men adored him. He was second in command of England's forces.

Duke of Medina Sidonia

Medina Sidonia was not a natural choice to lead an invasion fleet. He had never fought at sea before and complained of seasickness and colds. His own mother wrote a letter to the king complaining of the appointment. However, he was very wealthy and powerful, and proved to be an excellent planner – his preparations for the Armada were superb. Ultimately, his inexperience in battle proved to be costly as a number of mistakes and missed opportunities helped contribute to the Spanish defeat.

Factors leading to the Armada

Trade and Piracy

Execution of Mary Queen of Scots in 1587

Religious Factors

Political and diplomatic rivalry

English interference in the Netherlands

Reasons for defeat of the Spanish Armada

English

- Excellent leadership
- Drake's actions in Cadiz causing disruption and delay
- Innovative English tactics such as fire ships
- Home advantage – knowledge of the local area
- More effective weapons

Spanish

- Poor leadership – lack of experience and lack of flexibility
- Complicated plan
- Lack of communication
- Impractical tactics and weapons

Neither

- The wind and stormy seas

Reasons for the Revolt of the Northern Earls

Political

Elizabeth had weakened many northern nobles by removing land and power. The Council of the North, not traditional nobility, had taken over government of the north. They also demanded Elizabeth remove her 'evil councillors'.

Religious

The Catholic Northern Earls began the rebellion with a mass. They wore Catholic emblems and demanded a return to Catholicism and an end to Mary, Queen of Scots' imprisonment, planning to marry her to the Catholic Duke of Norfolk.

Personal

Many nobles were facing financial hardship as a result of their loss of land. They also feared punishment for planning the Norfolk wedding so rebelled out of desperation. Many of the rebels acted rashly and without thinking.

Reasons for the failure of the Revolt of the Northern Earls

Lack of strong leadership	The Earls of Northumberland and Westmorland were not capable leaders, and panicked.
Lack of clear plan	The earls couldn't decide if they wanted Mary to immediately replace Elizabeth, or just be named as her heir.
Lack of domestic support	The leaders' appeal to other Catholic nobles was ineffective.
Lack of foreign support	The three key Catholic powers – Spain, France, and the Pope, failed to offer their support for the revolt.
Decisive response	Elizabeth raised a large army commanded by Sussex.

The Catholic Plots against Elizabeth 1571-1586

The Ridolfi Plot 1571

Plan:
Mary, Queen of Scots used an Italian banker called Roberto Ridolfi to attempt to coordinate an invasion of England by the Pope and Philip II of Spain. An invasion from the Netherlands led by the Spanish Duke of Alva would restore Catholicism, and the Catholic Duke of Norfolk would marry Mary, who would become queen.

What happened?
Ridolfi met with Alva but Spain wouldn't commit to supporting the plan until Elizabeth had already been overthrown. Elizabeth's spies found details of the plot and arrested the Duke of Norfolk. The plot fell apart.

Outcome:
The Duke of Norfolk was executed. The plot increased fears of Catholic interference in Elizabeth's reign and she came under pressure to take a tougher stance.

The Throckmorton Plot 1583

Plan:
The plan, probably concocted by an English Catholic called Francis Throckmorton, was for a simultaneous Catholic uprising in England and an invasion by the French Duke of Guise, all financed with Spanish money. The plot would put Mary on the throne, restore Catholicism and potentially kill Elizabeth.

What happened?
Throckmorton's house was searched by Elizabeth's spies. A list of English Catholic sympathisers was found, including some in Elizabeth's court. The plot never got anywhere as expected Spanish funding never arrived.

Outcome:
Elizabeth's advisors began to actively search for Mary's involvement in plots, as they felt that they would never stop while she lived. Spanish ambassador was expelled.

The Babington Plot 1586

Plot:
Sir Anthony Babington wrote to Mary, who was unaware she was under surveillance, with a plan for a foreign Catholic invasion of England, the installation of Mary on the throne, and crucially, the murder of Elizabeth.

What happened?
Mary responded to the letters, and Elizabeth's spies allowed the correspondence to continue. Eventually, Mary wrote in a letter details of Elizabeth's assassination. Satisfied she could no longer deny her guilt, Elizabeth's spies arrested Mary for treason.

Outcome:
Most of the plotters were rounded up and immediately executed. After months of delay, Elizabeth signed Mary's death warrant and she too was executed.

GCSE History Paper 2: Early Elizabethan England KT3: Elizabethan Society in the Age of Exploration

Key Terms			
Sport and Leisure		Parish/petty schools	A place where children aged 4-7 could learn to read and write
'Fourth sort'	Nickname for the lower classes – the commoners	Public schools	Elite fee-paying schools for the children of the gentry
Bear-baiting	An activity where a bear was tied up and made to fight dogs	**Poverty and Vagabondage**	
Feast days	Public celebrations, a day off and a chance to feast or dance	Enclosure	Using land to raise sheep rather than grow crops, to make money
The Theatre		Rack-renting	When landowners increased rent fees on land rented to farmers
Minstrels	Travelling singers and entertainers	Inflation	When goods rise in price, and become harder to afford
Vagabonds	Often homeless, petty criminals – a social nuisance	Deserving poor	Those who wanted to work but had good reasons why they couldn't
Travelling company	A group of actors who travelled to perform their shows	Idle poor	Those without a good reason not to work
Groundlings	The poorer people who had standing tickets on the ground	**Exploration**	
Playwrights	People who wrote plays, such as Marlowe	Virginia	A territory on the east coast of America, named for the Virgin Queen
Master of Revels	The person responsible for ensuring plays were appropriate	New World	The newly discovered lands of North and South America
Black comedy	Performances that find humour in serious or sad situations	Colony	An overseas territory that belonged to another country, i.e. England
Education		Circumnavigation	Sailing around the whole world– Drake was first captain to do this
Literacy rate	The percentage of the population who could read and write	Roanoke	A failed settlement in North America
Grammar schools	Schools where mostly middle classes got a basic education	Mutiny	An uprising against the leaders by the crew of a boat
Scholarship	Where particularly talented people had their school fees paid	Garrison	A small group of soldiers left to protect an area

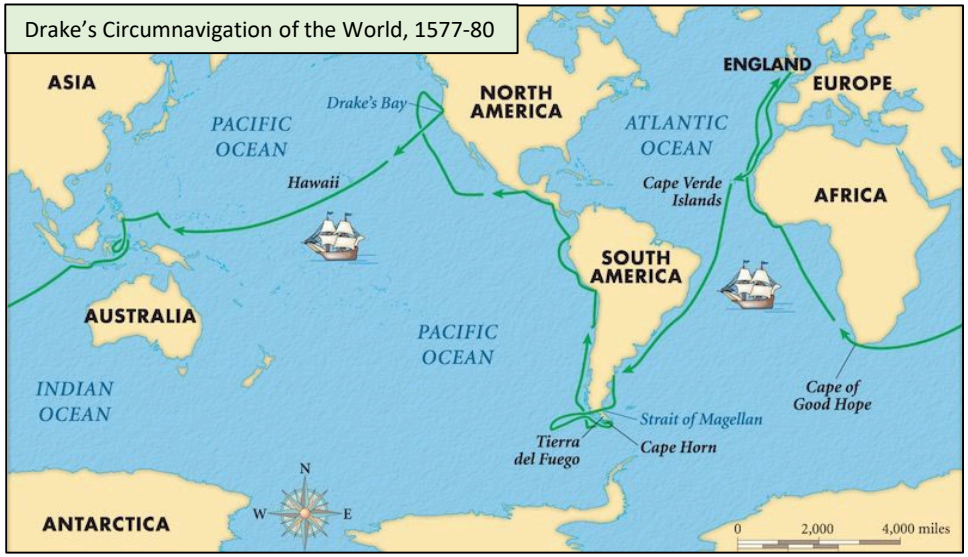
Question types

'Describe two features of…' [4]
(2 x 2 = 4 marks total)
Identify 2 features and support with evidence.
Useful phrases: "One feature was…"
"For example …."

'Explain why…' [12]
3 PEE paragraphs about the reasons for an event/change/threat. The paragraphs must show a link to the question.
Useful phrases: "This shows that…because…"
"Another reason is…this is because…"

'How far do you agree..' [16]
A balanced answer discussing both sides of the argument with an overall conclusion.
Useful phrases: "It is debatable whether…"
"Some might agree that…"
"This is shown by…"

Drake's Circumnavigation of the World, 1577-80



Sample exam questions

'Describe two features of Elizabethan pastimes'. [4]
'Describe two features of improvements to living standards between 1558 and 1588'. [4]
'Describe two features of theatre in Elizabethan England'. [4]
'Describe two features of Elizabethan grammar schools'. [4]
'Describe two features of Elizabethan universities'. [4]
'Describe two features of Elizabethan vagabondage'. [4]
'Describe two features of actions to deal with poverty in Elizabethan England'. [4]
'Describe two features of Drake's circumnavigation of the globe in 1577-80'. [4]
'Describe two features of Raleigh's Virginia settlement'. [4]

'Explain why theatre increased in popularity in the Elizabethan era'. [12]
'Explain why education became more widespread in Elizabethan England'. [12]
'Explain why poverty increased in the Elizabethan era'. [12]
'Explain why Raleigh's New World colony was unsuccessful'. [12]
'Explain why overseas exploration increased in the Elizabethan era'. [12]

'"The main reason the theatre increased in popularity was the quantity of new plays produced". How far do you agree? [16]
"Poor harvests were the main cause of poverty in Elizabethan England." How far do you agree? [16]
"Economic factors were the main reason for overseas voyages in the Elizabethan era." How far do you agree? [16]
"Poor location was the main reason for the failure of the Roanoke colony." How far do you agree? [16]

GCSE History Paper 2: Early Elizabethan England KT3: Elizabethan Society in the Age of Exploration

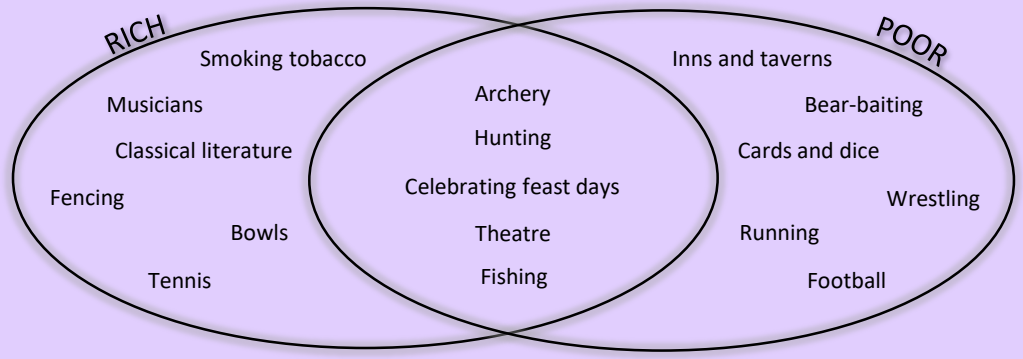
Theatre had not been popular entertainment for a thousand years in England – when Elizabeth became queen in 1558, there were no theatres in England at all, and actors were seen by some as vagabonds. However, in London, plays slowly became more popular, and the **first theatre 'the Theatre' was built in 1576**. It was soon followed by 'the Curtain' in 1577 and 'the Rose' in 1587. All of these theatres had **an open roof** – you would often get very wet in the pits!

On stage, there were strict rules. Men played all roles, including the women. Companies of actors had to have a royal licence. Plays were censored, and those seen to have critical religious or political messages were banned – each play had to be submitted to the 'Master of Revels' for approval.

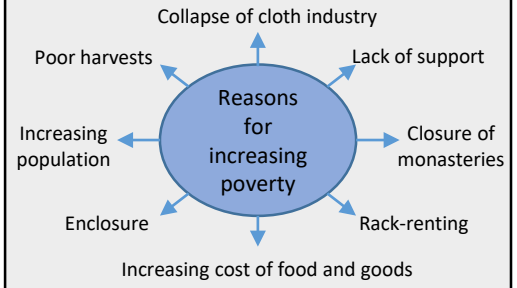
'Groundlings' were people who **stood in the pit** around the stage – things were crowded, sweaty, and could get messy, but **tickets only cost a penny** and there was always a new show on – theatres put on **new shows every couple of days**.

Wealthier theatre-goers could buy more luxurious **seats in the galleries for two or three pence**. This kept them away from the rowdy commoners in the pits, and allowed them to enjoy the performance. The upper classes sat in **stools upon the stage**, where they would have the best view. However, the super elite, such as the queen, never visited the theatre – instead having **private performances by travelling companies** in one of her palaces.

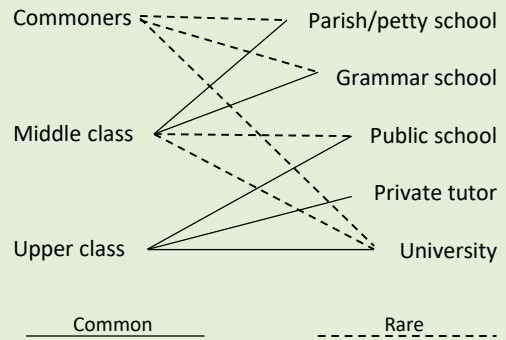
Popular sports and pastimes



Acts dealing with poverty
Vagabonds Act 1572
Act for Relief of the Poor 1576



Education in Elizabethan England



Voyages of Sir Walter Raleigh			
Advantages of a North American colony for England	**Attractions of North Carolina / Virginia for settlement**	**Problems faced by the colony of Roanoke**	**Could the voyages still be considered successful?**
A permanent colony in the New World would give England a base from which to attack Spanish interests in the area	Fertile land – people had heard that the land of North America was perfect for growing crops	Lack of food – food supplies did not survive the journey and seeds were planted at the wrong time of year to grow	Led to further, more successful colonisation of North America over the following century
It would make it more difficult for future Spanish and French settlements in the area to succeed	Lots of animals – there were many stories about animals that could be hunted, meaning access to food was plentiful	Lack of support – the colonists received no support or fresh supplies from England, which they had expected	Was profitable – raids on Spanish ships had yielded lots of treasure
It gave the poor in England the opportunity of a fresh start and a better life	Civilised Native Americans –scouting expeditions suggested positive relationships could be developed with the locals	Native Americans – the relationship with the Native Americans became strained and led to conflict	New goods were discovered and brought back to trade, such as the potato
To exploit the resources and valuable goods available there	Gold – Native Americans told Ralph Lane, the commander of the 1585 expedition, about gold mines nearby.	Disease – the colonists were weary and close to starvation, making them vulnerable to disease	Increased knowledge of the continent – plants, animals, landscape, resources and native tribes
To expand the territory of the Crown and increase the prestige of queen and country.	Convenient location – Chesapeake Bay had a strategic location, providing a passage for boats to the east	Location – the Roanoke settlement lacked a good natural harbour, meaning it was unsuitable as a long-term base	The voyages helped increase Elizabeth's prestige and large areas of land were claimed in her name

THEMES: Islamic Practises

Key terms

Eid Ul Fitr	The feast that marks the end of Ramadan.
Ashura	Very important to Shi'a. To remember the death of Ali's grandson, Husayn.
Greater Jihad	The struggle to be a good Muslim. (Life is a test, which is personal & difficult).
Halal	All that is permitted in their lives.
Nature of…	Things people do.
Sunnah	Examples of things Muhammad did.
Ummah	The worldwide community of Muslims.
Islamic education	Khums.
Eid Ul Adha	Where Muslims celebrate Abraham's dedication to God.

Crucial Commands:

Describe:Say in detail what something or someone is like, and the impact it has. E.g. Describe the meaning of the word Omnibenevolent.

Explain: Say why something or someone is important, and the impact it has. E.g. Explain why Jesus' death is important to Christians.

Discuss: Write about at least two points of view and explain why these points of view are valuable or not. E.g. "The most important Christian belief is Jesus' resurrection" (15 marks)

Sunni vs Shi'a

Similarities	Differences
• Tawhid. • The Qur'an is the Holy Book of Islam. • Practise the Five Pillars. • Prophets (Risalah) • Angels (Malaikah) • Afterlife (Akhirah)	• Shi'a argue only descendants of M can be caliphs. • Sunni argue caliphs do not have to be descendants of M. • Five Pillars vs Ten Acts • Six Articles vs Five Roots

5 Pillars of Islam

Duty

A duty is something a person has an obligation to perform. For a Sunni Muslim, these duties include the Five Pillars of Islam including charity, prayer and worship, and pilgrimage. You should be able to define these concepts without any support!

Shi'a Muslims perform many of the same duties as Sunni Muslims, however rather than performing Five Pillars they will perform Ten Acts. Two of the additional acts performed by the Shi'a include actively encouraging people to perform good deeds, and giving additional money to support Islamic education, which is called Khums.

Festivals

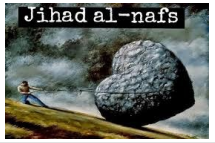
We will look in detail at the festival of Eid Ul Fitr, which is the feast that marks the end of Ramadan, and the festival of Eid Ul Adha, where Muslims remember Abraham's dedication to God. Our third festival is Ashura. This festival is very important to the Shi'a, who will remember the death of Ali's grandson, Husayn, on this day.

Greater Jihad

Muslims believe that this life is a test, and that the test is personal and difficult.

Being a good Muslim is considered the **greatest** struggle of all, because Muslims believe that YOU ALONE are responsible for your actions in this life. We have proof of this belief because the Qur'an says that:

'No bearer of burdens will bear the burden of another'



PEE paragraph structure

Point – "Some people argue…"

Example – "Evidence for this can be found in…"

Explain – "This is significant because…"

***You also need to include quotes with Sources of Authority, discuss strong/ weak arguments and most importantly evaluate the IMPACT your point has on individuals, groups or societies!**

LAS FIESTAS

Special events

Christmas in Spain

Festivals

Christmas and New Year

Mi cumpleaños – my birthday **El cumpleaños de mi madre…** – my mum's birthday **Navidad/ (el) día de Navidad** – Christmas/(on) Christmas day **La Nochebuena** – Christmas Eve **La Nochevieja** – New year's Eve **Pascua/ El Domingo de Pascua** – Easter/ Easter Sunday **El día de Reyes** – 6th January	**abro/abrimos/abren regalos** – I/we/they open presents **busco/buscamos/buscan huevos de chocolate** – I/we/they look for chocolate eggs **canto/cantamos/cantan villancicos** – I/we sing Christmas carols **como/comemos/comen dulces navideños/ doce uvas/ pavo** – I/we eat Christmas sweets/ 12 grapes/ turkey **me acuesto/nos acostamos/se acuestan muy tarde** – I/we/they stay up very late **me levanto/nos levantamos/se levantan muy temprano** –I/we/they get up very early **rezo/rezamos/rezan** – I/we/they pray **voy/vamos/van a la iglesia/mezquita** – I/we/they go to church/mosque
En España – In Spain	**Santa no es tan popular como en Inglaterra** – Santa isn't as popular as in England **los Reyes Magos traen los regalos el 6 de enero** – the 3 kings bring the presents on 6th January **mucha gente va a la Misa de Gallo la Nochebuena** – lots of people go to midnight mass on Christmas Eve **la gente come las doce uvas a medianoche la Nochevieja para tener buena suerte** – people eat 12 grapes at midnight on NYE for good luck **se come la cena de Navidad en Nochebuena** – they eat Christmas dinner on Christmas eve

Pavo trufado de Navidad – turkey stuffed with truffles

Polvorones – almond biscuits

Turrón – nougat usually containing almonds

Roscón de Reyes – traditional cake. Usually contains a coin

La fiesta que me interesa más es el Día de los Muertos	The festival that interests me most is the Day of the Dead
que se celebra en México en noviembre.	which is celebrated in Mexico in November.
Es una fiesta para recordar los seres queridos muertes	It's a festival to remember dead loved ones
y la gente decora las tumbas y las casas	and the people decorate graves and houses
con altares, velas y flores.	with altars, candles and flowers.
La gente ve desfiles y lleva disfraces y	People watch processions and wear costumes
me parece una fiesta con mucha tradición.	and it seems like a very traditional festival.
Además, siempre he soñado con ir a España	Also, I've always dreamed of going to Spain
para ver una corrida de toros	to watch a bullfight
sin embargo pienso que es un poco anticuado	however I think that it's a bit old fashioned
y mucha gente dice que es una tradición cruel.	And lots of people say it's a cruel tradition

A model text on festivals

Festivals

La fiesta de… – the festival of… **Esta tradición antigua** – this old tradition	**se celebra en…** – is celebrated in…	**España** – Spain **México** – Mexico **muchos países hispanohablantes** – in lots of Spanish speaking countries **Inglaterra** – English	**donde** – where	**se queman figuras de madera** – wooden figures are burnt **se construyen hogueras** – bonfires are built **se disparan fuegos artificiales** – fireworks are set off **se lanzan huevos/tomates** – eggs/tomatoes are thrown

las calles se llenan de… – the streets are filled with…	**niños** – children **jóvenes** – young people **familias** – families
la gente – the people	**come manzanas de caramelo** – eat toffee apples **decora las casas/las tumbas** – decorate houses/graves **con flores/velas** – with flowers/candles **prepara linternas/áltares** – prepare lanterns/altars **ve desfiles** – watch processions **lleva disfraces** – wear costumes **lleva un pañuelo rojo** – wear a red scarf **huye de un grupo de toros** – run away from a group of bulls
un hombre – a man	**lucha contra un toro** – fights a bull

LAS FIESTAS

It's a great idea to know about these festivals as it's a common topic in all exams! (They're also really interesting!)

El Día de Muertos

31st October - 2nd November: Mexico

Día de Muertos is a festival that celebrates the memory of deceased loved ones. It isn't a day of sadness but a day of remembrance and celebration. The people believe the spirits come and join them to celebrate.

The people create altars to invite the spirits to come back for a visit and graves are decorated with brightly painted skulls, candles, flowers and food such as sugar skulls or "pan de muerto".

Sometimes there are parades and people dress as brightly coloured skeletons.

ofrendas - altars	pan de muerto - sweet bread bun
calacas - skeletons	las tumbas - graves
calaveras - skulls	velas - candles

A video explaining Día de Muertos

La Tomatina

Last Wednesday in August: Buñol, Spain

La Tomatina is basically a big tomato fight! On the last Wednesday in August, at around 10am, a large ham is hung at the top of a tall greased pole and the objective it to be the first person to get to the top, usually while also being blasted with water.

As soon as the ham is retrieved, the first pistol goes off and the tomato fight starts! Approximately 150,000 tomatoes are thrown and the fight must stop as soon as the second pistol fires.

It's said to have originated in 1945 when two farmers got into an argument at the mark and started throwing tomatoes at each other.

El palo jabón - greased pole	
Un jamón - a ham	
Una lucha - a fight	

A video explaining La Tomatina

Los sanfermines

6th July - 14th July: Pamplona, Spain

This week long festival commemorates the patron saint of Pamplona, Saint Fermín.

The most famous part of the festival is the running of the bulls which takes place every day at 8am. The route is only 825 metres and usually lasts around 4 minutes and ends at the town's bull ring. There have been 16 deaths since 1910.

Every afternoon there is a bullfight with 6 of the bulls from the running in the morning. Despite debate across Spain about the ethics of bullfights, these are usually sold out every day.

El encierro - the bullrun	la corrida - the bullfight
El torero - the bullfighter	peligroso - dangerous
Un pañuelo - a scarf	

A video explaining the festival

Inti Raymi

24th June: Cusco, Peru

Inti Raymi is a festival from Peru's Inca history, worshipping their sun god "Inti" and to celebrate the new year in the Andes. Originally it was filled with colourful parades and processions and also animal sacrifices to ensure a good harvest for the following year but it was banned by the Spanish after Peru was conquered as it wasn't a Catholic festival.

It was reinstated in 1944 and now indigenous actors play the roles of Sapa Inca (the Sun King) and his wife. The Sun King delivers a speech praising the sun before being carried by pallbearers with woven aya huma masks in a golden chariot to the ruinous temple of Sacsayhuamán. A procession follows the chariot, with actors playing the roles of Incan nobles, priests and town folk. Local women layer the path with exotic flowers and sweep the route to keep it free of evil spirits. There is a fake sacrifice of a llama (no animals are hurt) and the future of the next season's crop is read in the (fake) blood by the Sun King.

Colorido - colourful	una procesión - a procession
Indígena - indigenous	un dios - a god
Un sacrificio - a sacrifice	un discurso - a speech
Fue prohibido - it was banned	la cosecha - the harvest
Católico - Catholic	el templo - the temple

A video showing Inti Raymi

Key questions

¿Has experimentado algún fiesta española/latina? - Have you experienced a Spanish/Latin American festival?

¿Qué piensas de las fiestas españolas/latinas? - What do you think of Spanish/Latin American festivals?

¿Qué fiesta española/hispánica te interesa más? - Which Spanish/Latin American festival interests you most?

¿Qué pasa durante...? - What happens during...?

1.3 1.3.1 Networks and topologies Network types

What is a network?

A network is a group of interconnected devices that share an internet connection.

How is a networked computer different to a standalone computer?

A stand-alone computer is a device that is not connected to a network.

Network types:

- LAN (Local Area Network)
- WAN (Wide Area Network)

LAN	WAN
What does it stand for? Local Area Network	**What does it stand for?** Wide Area Network
How does it work? It's a network that covers a small geographical area.	**How does it work?** It's a network that covers a large geographical area.
Infrastructure It uses network hardware and cables owned by the individual/organisation	**Infrastructure** It uses additional transmission media owned by other companies such as telephone lines.
Who uses a LAN? Schools, homes and any business that works in a small building or site.	**Who uses a WAN?** It can be a collection of different LAN's. The best example is the Internet.

1.3 1.3.1 Networks and topologies Network models

Network models:

- Client-server network
- Peer-to-peer network.

Factors that affect network performance:

- Number of users using the network. It uses more bandwidth.
- Distance from the router.
- Interference from physical objects.
- Choice of transmission cable (e.g. fibre optic)
- Streaming videos in HD.
- The use of a VPN (Virtual Private Network)
- Wi-Fi frequency may need to be changed.

Client-server	Peer-to-peer
Where are files stored? In a centralised location such as the server.	**Where are the file stored?** It's decentralised. Stored on the individual's computer.
Backing up data All data is backed up in a centralised location. (i.e. a server)	**Backing up data** Peer-to-peer may need to perform their own backups.
Updates/Installation Upgrades can be done centrally and not on individual computers.	**Updates/Installation** Upgrades would need to be performed on each computer.
Hardware File servers to store/retrieve files. Web servers to access the world wide web.	**Hardware** Router to connect to the network and access the internet,

1.3 1.3.1 Networks and topologies Network protocols

What is a standard?

We communicate with each other in our native language and this is exactly how computers communicate with each other and this is known as standards.

What is a network protocol?

- When standards are used by computers to communicate over a network, it has to follow a number of protocols.
- Each protocol is responsible for transmitting data in a different way.

Network protocols

HTTP
Used to access web pages.

HTTP
Used to access web pages that require communications to be encrypted.

FTP
Used to transfer files between client and server.

TCP
Breaking down data into packets ready to be transmitted.

IP
Identifying the IP address of the source and the receiver of the data packets.

SMTP
Used to send email messages over a network.

IMAP
Used to receive emails that are stored on the server.

POP
Used to receive emails that are stored on a device, deleted from the server.

1.3 1.3.1 Networks and topologies Network protocols

What is the TCP/IP stack?

It's a model that describes how data is transmitted over networks. The TCP/IP stack uses a four-layer model.

How do layers work?

- Each layer builds on the functionality provided by the layers below it, and provides a set of services to the layers above it.
- For example, the TCP is provided with the data that allows the Internet layer to assign the IP addresses required.

Why use layers?

- Each layer is it's own module (like a subprogram) which makes it easier to add, modify, or replace individual protocols without affecting the entire system.
- Allows for the expansion of networks to accommodate more users and devices, and to handle increased traffic.
- Any errors that occur will only be exclusive that that layer and will not interrupt any other layers.

TCP/IP Stack

Application layer
HTTP/HTTPS
SMTP/IMAP/POP
FTP

Transport layer
TCP

Internet layer
IP

Data link layer
Wi-Fi/Ethernet

1.6.1 1.6.1 Ethical, legal, cultural and environmental impact
CS41: Legal issues

Software licences

Proprietary licence
Software that comes with a licence agreement and can only be used by that registered user.
Source code is hidden so it cannot be modified.

Open-source software
Software that is open for use and modification. The source code is accessible.

Legislation

Data Protection Act
Legislation that is design to manage the data of individuals responsibly.

What does it allow/prohibit?
To keep data secure.
To keep data to the minimum required.
To keep data up-to-date.
To keep data that is required.

Computer Misuse Act
Legislation to prevent unauthorised access to computer material.

What does it allow/prohibit?
It prohibits unauthorised access to computer material whether that is for personal gain, to facilitate/commit a crime or for modification.

Copyright, Designs and Patents Act
Legislation to protect the original work or idea.

What does it allow/prohibit?
It allows material such as books, plays, music etc to be protected by Copyright law.

Use of copyright material without permission.
Use of copyright material that is not for commercial purposes.

1.6.1 1.6.1 Ethical, legal, cultural and environmental impact
CS42: Environmental issues

What is meant by environmental issues?
It's the way we measure the impact technology is having on the environment.

Other environmental issues:
- Recycling – The use of e-waste to recycle and re-use (i.e. refurbished mobile phones)
- Smart technology to control irrigation systems in agriculture.
- Innovative technologies to cut down on food waste and sent correct waste to landfill.

Impact	
Positive	**Negative**
Internet of Things (IoT) Use of IoT devices to regulate use of energy in households and businesses.	**E-Waste (Electronic Waste)** The disposal of obsolete devices.
Nuclear fusion Hydrogen atoms heated to create a fusion reaction which leads to Helium, Neutron and energy being released.	**Energy Consumption** The increased use of electricity to charge our devices and reliance on data centres.
Digital downloads Many developers are creating digital copies of software to reduce the use of packaging such as plastic as well as fuel for transportation.	**Pollution** The manufacturing and operation of technology products contribute to pollution.

1.6 1.6.1 Ethical, legal, cultural and environmental impact
CS43: Ethical issues

What is the difference between ethical and moral?
Moral is what is considered as right or wrong whereas Ethical is what is considered right by a group of people.

Example
- For example, animal testing is seen as morally wrong by some groups because of the harm it has on animals.
- The companies who create these products see it as ethical because they're testing on animals to ensure its safe to be consumed by humans.

Context
- The concept of morals and ethics can be applied to how we and other use technology and what they use it for.

Ethical issues

Privacy and security

The storage of data by organisations who are legallty bound to keep it secure.

Cookies

Small text files designed to remember information such as certain items that are in your checkout.

Monitoring of individuals

The use of software to monitor employees and what they do or the use of facial recognition cameras.

Impact of data loss or damage

The impact this has on the organisation's reputation or individuals' sales/revenue.