Year 11 Core Subjects

Knowledge Organiser

April- July 2023

AMBITION, CONFIDENCE, CREATIVITY,
RESPECT, DETERMINATION

Proud to be part of the GREENSHAW LEARNING TRUST

FIVE ACRES HIGH SCHOOL

Why do we have knowledge organisers?
Knowledge organisers are a collation of the basic essential knowledge for success in each subject area that will underpin your learning for the term.

They are designed to provide the information you will need to be committing to your long term memory through recall exercises in Low Stakes Quizzing.

How do we use knowledge organisers?
You should be using these KOs to create your homework quizzes so that you are practising retrieving information.

1. You can do this by testing yourself on the definition of key terms (both recalling the key term and then swapping to recall the definition), practice labelling diagrams, retrieves reasons and justifications for the main learning points.
2. They can also be used for 'memory dumps' where you try to recall as much of the information about a topic as possible and then use the KP to fill in the gaps.
3. They can also be used in class to assist with retrieval of the core knowledge needed for each subject.

You should have these with you at all times in school and out on your desk in all lessons.

If you lose your KO or it becomes too dishevelled, please purchase a new one from the Head of Year or the School Office.

Contents

KS4 AQA Modern Text Lit Paper 2 Lord of the flies KO

Key characters:

Ralph: Becomes leader, represents democracy, is hunted by the end.
Jack: Leader of the choir and hunters, represents totalitarianism.
Piggy: Supports Ralph, represents intellectualism, tries to create
civilised island.
Simon: A visionary, he represents religion and is killed when others
mistake him for the beast.
Samneric: Twins who lose their individuality, ending by following the
masses .
Roger: One of the choir/hunters, represents sadism.
Littluns: The mass, they follow whoever they think is strongest.

Key Vocabulary

Civilisation: A law-abiding society
Democracy: A government where the leader is voted in
Totalitarianism: A government with one leader with absolute power
Dictatorship: A form of government that has total control
Savagery: Being untamed and ferocious
Microcosm: A small version of the wider world
Sadistic Obtains pleasure from inflicting pain – (Marquis de Sade, who wrote about the pleasure of inflicting pain on others)
Tyrant: An absolute ruler who is cruel and uses force to maintain power.
Oppressive: Cruel and unfair
Furtive: Stealthy, sly, secretive, underhand
Malevolent: Wishing evil on others
Inimical Unfriendly
Taboo:Banned on grounds of morality or taste

Context

William Golding

Part of the British Navy during WWII, Golding was the captain of a ship that assisted the D-Day landings. He said 'before the second World War I believed in the perfectibility of man...after the war I did not because I was unable to. After the war he felt that the breakdown of civilization was inevitable as all 'men' have the capacity for evil.

WWII

Golding had seen the effects of totalitarianism in the form of Hitler and others like him. In the 1950s the world became aware of the ways in which the Soviet Union treated political dissenters. This novel responds to a world that had been destroyed by powerful people through coercion and fear. After WW2, even Everyday' people had been proved capable of great evil through events such as the Holocaust.

Nuclear War

The first use of an atomic weapon in Hiroshima and Nagasaki in 1945. The threat of nuclear war in the Cold War of 1949 showed the world the that civilization could be entirely destroyed by a single conflict. The island is destroyed by the end of the novel, showing how conflicts escalate quickly and can destroy completely.

Charles Darwin/Evolution

Darwin's Theory of Evolution states man evolved from animals. Golding presents the idea that we are all ultimately animals. The only thing that separates us from this is civilization, rules and laws. Take these away and we quickly descend into our animal states.

Context continued:

Religion

The island can be thought of as the Garde Eden. Once man gives in to temptation, quickly destroyed. Simon is portrayed Christ-like figure. He sees the beauty of island, understands the evil of men ar then destroyed by man. Lord of the translates into Beelzebub in Hebrew, ano name for the devil.

The Coral Island/adventure story genre

Lord of the Flies is a parody of The C Island. The Coral Island (R.M. Ballan 1857) tells the story of 3 boys marooned pacific island. They encounter different t of evil, yet their friendship, courage, determination aid their survival. Golding unsatisfied with how it 'espoused myths' sought to invert its meanings. (The ev instead within the boys).

Robinson Crusoe/adventure story genre

A popular nineteenth century genre, ta its name from Defoe's 'Robinson Cruso tale of a shipwrecked sailor who survive several years before returning to Engl Many writers decided to write about faring adventures that pitted man agains elements. Golding subverts the h qualities explored in these novels to shov reality of human nature.

Key themes:

Civilisation vs savagery: Man's conflict between living by rules or giving into their immediate desires, resulting in the breakdown of civilisation

The Beast: The capacity for evil in all of us – the beast is a manifestation of fear and of how fear leads to chaos.

Innocence: The more the boys give in to urges the less innocent they become and the more evil they become.

Order and chaos: Golding explores the balance between discipline and freedom as we see how chaotic 'men' naturally are

Violence: The more the 'rules' are left behind, the more violent the boys become.

Nature versus nurture: We are all predestined to behave in a certain way- society merely masks this. Once society is removed, our natural state (of evil) emerges.

Democracy versus dictatorship: the forces of evil are all around and constantly pushing for power. Golding shows us how evil is more powerful than good and ultimately seeks to overtake and obliterate it.

Psychology of Lord of the Flies

Deindividuation:

The psychological term for when a person's identify and self-awareness is overcome by group and can lead to a mob mentality. This is seen when the boys kill Simon and also when Ralph is pursued at the end of the novel.

Maslow's hierarchy of needs:

Promotes the idea that there are 5 hierarchical levels of human need. In ascending order:

- Physical (e.g. food, shelter, warmth, sleep)
- Safety (security, health, resources, employment)
- Love and belonging (friendship, family, a sense of connection)
- Esteem (respect, strength, freedom)
- Self-actualisation (The dsire to be the most that one can be.)

Without each of these needs being met, the stage above cannot be fulfilled. We see how the boy's society fails to fulfil the basic requirements of food, shelter and warmth and is therefore doomed.

Freud: the id, ego and superego

According to Freud, **the id** is the primitive, instinctive part of the mind that contains aggressive drives. This is best characterised through the character of Jack, who is predatory in nature and assumes the role of hunter.

The ego is the part of the id which is modified by social factors and the world in which we live. and works within reason, considering social realities and behavioural norms when deciding how to behave. The ego is presented through Ralph's character who appears to be rational and logical in his behaviours.

The superego's function is to control the id's impulses, in particular those which are seen as aggressive. It persuades the ego to turn to moralistic goals and to strive for perfection through the ideal self. The superego is presented through Piggy, who is prone to moralistic behaviour e.g. when using the conch.

Chapter	Synopsis
Chapter 1 The Sound of the shell	The boys land on the island. They elect a chief (Ralph) who select Jack to be t leader of the hunters. The boys attempt to replicate the society they have lef behind and find a pig whilst exploring the island.
Chapter 2 Fire on the Mountain	The boys call an assembly. The littluns mention a 'beastie' which sends a fear through the group. Ralph decides to light a fire on the mountain to alert resc The fire burns out of control and kills a littlun.
Chapter 3 Huts on the Beach	Jack becomes obsessed with hunting pigs and procuring meat. Ralph and Jack due to a difference in priorities. Ralph and Simon work on creating huts for sh as Jack becomes more savage. Simon wanders off to find fruit for the littluns.
Chapter 4 Painted Faces and Long Hair	Roger and Maurice bully the littluns on the beach but are controlled by the r civiliation. Jack paints his face and leads the hunters out to kill a pig. Unfortur Jack lets the fire go out. He punches Piggys and breaks Piggy's glasses.
Chapter 5 Beast from the Water	Ralph tries to maintain order and re-establish rules. The arguing continues ar boys make fun of Simon when he says that they are the beast. Jack storms off the hunters and Piggy longs for grownups.
Chapter 6 Beast from the Air	A plane is shot down whilst the boys sleep, ejecting a dead parachutist. The b hunt unsuccessfully for the beast. Ralph notices the fire has gone out but nob cares.
Chapter 7 Shadows and Tall Trees	The hunt for the beast continues. The boys find a pig run and Ralph is involve the hunt and enjoys it. The boys then act out the spectacle of the pig as a gar The hunt for the beast continues- the boys mistake the parachutist for the be run away.
Chapter 8 Gifts for the Darkness	Jack calls a meeting, insults Ralph and says he should no longer be chief. Nob else agrees and Jack is embarrassed. Jack leaves and goes into the forest. Rog Maurice and Bill follow Jack. Simons disappears to his secret spot. The boys tr and hunt a sow, slaughtering her and cuttings its head off as a sacrifice to the Simon arrives afterwards and imagine the pigs head is speaking to him.
Chapter 9 A view to a Death	Simon passes out and whilst semi-conscious, discovers the truth about the be goes to tell the boys. Meanwhile, at the camp many of the boys have left to jc Jack's hunters for a 'feast' . in the ensuing storm and delirium, the boys mista Simon for the beast and murder him, his body is washed out to sea.
Chapter 10 The Shell and the Glasses	Only Ralph, Pigg and Samneric are left. Piggy expresses horror at witnessing Si murder and despairs of ever returning home. Ralph is equally desultory. Jack the hunters are all at the fort. Roger returns and reveals the savage treatmen meted out by Jack. Jack and his hunters raid the camp for fire and steal Piggy' glasses
Chapter 11Castle Rock	Piggy and Ralph go to the fort and demand Jack returns Piggy's glasses with th conch. Ralph and Jack fight and Ralph demands the return of Piggy's glasses. Samneric are tied up by the hunters and Roger sends an enormous rock smas down the hillside. It smashes the conch and knock Piggy off the cliff, killing hir
Chapter 12 Cry of the Hunters	Jack threatens Ralph and he flees but returns at night to speak to Samneric. R hides but is given away by Samneric. He runs for his life pursued by the hunte the Island catches fire. At the last minute, Ralph is saved by a Naval officer, al to the presence of the boys by the fire.

GCSE Mathematics Higher Tier

● Number ● Algebra ● Ratio, proportion and rates of change ● Geometry & measures ● Probability ● Statistics

Listing strategies N5

Product rule for counting:

➔ $4 \times 3 \times 2 \times 1 = 24$ ways to arrange the letters P, I, X and L.

Powers and roots N6, N7

Special indices: for any value a:

$$a^0 = 1$$

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

$$a^{\left(\frac{p}{q}\right)} = \sqrt[q]{a^p}$$

➔ $$3^{-4} = \frac{1}{3^4} = \frac{1}{81}$$

➔ $$8^{\left(\frac{2}{3}\right)} = \sqrt[3]{8^2} = 4$$

Surds N8

Look for the biggest square number factor of the number:

➔ $\sqrt{80} = \sqrt{16 \times 5} = 4\sqrt{5}$

Rationalise the denominator N8

Multiply the numerator and denominator by an expression that makes the denominator an integer:

➔ $$\frac{4}{\sqrt{7}} = \frac{4 \times \sqrt{7}}{\sqrt{7} \times \sqrt{7}} = \frac{4\sqrt{7}}{7}$$

➔ $$\frac{2}{4 + \sqrt{5}}$$

$$= \frac{2}{4 + \sqrt{5}} \times \frac{4 - \sqrt{5}}{4 - \sqrt{5}} = \frac{2(4 - \sqrt{5})}{11}$$

Standard form N9

Standard form numbers are of the form $a \times 10^n$, where $1 \leq a < 10$ and n is an integer.

Error intervals N15

Find the range of numbers that will round to a given value:

➔ $x = 5.83$ (2 decimal places)

$$5.825 \leq x < 5.835$$

➔ $y = 46$ (2 significant figures)

$$45.5 \leq y < 46.5$$

Note use of ≤ and <, and that the last significant figure of each is 5.

Equations and identities A3

An equation is true for some particular value of x...

➔ $2x + 1 = 7$ is true if $x = 3$

...but an identity is true for every value of x

➔ $(x + a)^2 \equiv x^2 + 2ax + a^2$

(note the use of the symbol ≡)

Laws of indices A4

For any value a:

$$a^x \times a^y = a^{x+y}$$

$$\frac{a^x}{a^y} = a^{x-y}$$

$$(a^x)^y = a^{xy}$$

➔ $\left(\frac{2pq^4}{p^3q}\right)^3 = \frac{8p^3q^{12}}{p^9q^3} = \frac{8q^9}{p^6}$ or $8q^9p^{-6}$

Difference of two squares A4

$$a^2 - b^2 = (a + b)(a - b)$$

➔ $x^2 - 25 = (x + 5)(x - 5)$

Rearrange a formula A5

The subject of a formula is the term on its own. Rearrange to

➔ Make x the subject of

$$2x + ay = y - bx$$

$$2x + bx = y - ay$$

$$x(2 + b) = y - ay$$

$$x = \frac{y - ay}{2 + b}$$

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Functions A7

Combining functions:

$$fg(x) = f(g(x))$$

➔ If $f(x) = x + 3$ and $g(x) = x^2$

$$fg(x) = x^2 + 3$$
$$gf(x) = (x+3)^2$$

The inverse of f is f^{-1}

➔ If $f(x) = 2x + 5$ then

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

$y = mx + c$ A9

Equation of straight line $y = mx + c$
m is the gradient; c is the y intercept:

➔ **Find the equation of the line that joins $(0, 3)$ to $(2, 11)$**

Find its gradient...

$$\frac{11-3}{2-0} = \frac{8}{2} = 4$$

...and its y intercept...

Passes through $(0, 3)$, so $c = 3$.

Equation is $y = 4x + 3$.

Transformations of curves A13

Starting with the curve $y = f(x)$:

Translate $\begin{pmatrix} 0 \\ a \end{pmatrix}$ for $y = f(x) + a$

Translate $\begin{pmatrix} -a \\ 0 \end{pmatrix}$ for $y = f(x + a)$

Reflect in x axis for $y = -f(x)$
Reflect y axis for $y = f(-x)$

Velocity - time graph A15

Gradient = acceleration (you may need to draw a tangent to the curve at a point to find the gradient);
Area under curve = distance travelled.

Quadratics A11, A18

If a quadratic equation cannot be factorised, use the formula

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

➔ **Solve $2x^2 + 3x - 7 = 0$**

$$x = \frac{-3-\sqrt{9-(-56)}}{2\times 2} = -2.73$$

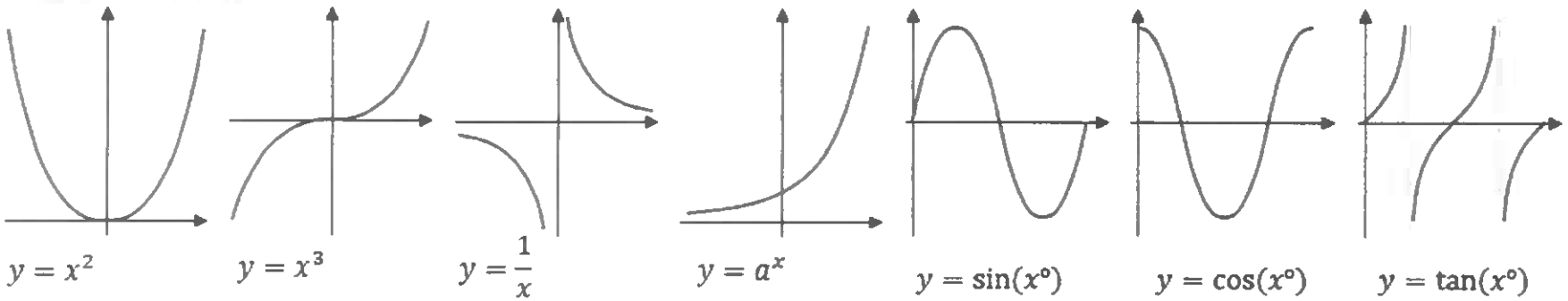
$$\text{or } x = \frac{-3+\sqrt{9-(-56)}}{2\times 2} = 1.23$$

Complete the square to find the turning point of a quadratic graph.

➔
$$y = x^2 - 6x + 2$$
$$y = (x-3)^2 - 9 + 2$$
$$y = (x-3)^2 - 7$$

Turning point is at $(3, -7)$

Standard graphs A12



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Equation of a circle A16

$x^2 + y^2 = r^2$ is a circle with centre $(0, 0)$ and radius r.

➔ $x^2 + y^2 = 25$ has centre $(0, 0)$ and radius 5.

Simultaneous equations A19

One linear, one quadratic;

➔ Solve $\begin{cases} x + 3y = 10 \\ x^2 + y^2 = 20 \end{cases}$

Rearrange the linear, and substitute into the quadratic

$$x = 10 - 3y$$
$$\text{so } (10 - 3y)^2 + y^2 = 20$$

Expand and solve the quadratic

$$100 - 60y + 9y^2 + y^2 = 20$$
$$10y^2 - 60y + 80 = 0$$
$$y = 2 \text{ or } y = 4$$

Finally, substitute into the linear and solve, pairing values...

$x + 3 \times 2 = 10$ so $(x, y) = (4, 2)$

$x + 3 \times 4 = 10$ so $(x, y) = (-2, 4)$

Iteration A20

You will be given the formula to use:

➔ Solve $x^3 + 6x + 4 = 0$ by using the iteration $x_{n+1} = \sqrt[3]{6x_n - 4}$.

Start with $x_1 = -2.8$.

$x_2 = \sqrt[3]{6 \times (-2.8) - 4} = -2.750\ldots$

$x_3 = \sqrt[3]{6 \times (-2.750\ldots) - 4} = \cdots$

Repeat until you know the solution, or you do as many as the question says.

Sequences A24, A25

nth term of an arithmetic (linear) sequence is $bn + c$

➔ nth term of 5,8,11,14,... is $3n+2$ (always increases by 3; first term is $3 \times 1 + 2 = 5$.)

nth term of a quadratic sequence is $an^2 + bn + c$

➔ First three terms of $n^2 + 3n - 1$ are 3, 9, 17, ...

Geometric sequence; multiply each term by a constant ratio

➔ 3, 6, 12, 24, ... (ratio is 2)

Fibonacci sequence; make the next term by adding the previous two ...

➔ 2, 4, 6, 10, 16, 26, 42, ...

Percentages: multipliers R9, R16

Percentage increase or decrease; use a multiplier (powers for repetition)

➔ **Initially there were 20 000 fish in a lake. The number decreases by 15% each year. Estimate the number of fish after 6 years.**

$20\,000 \times 0.85^6 = 7\,500$ (2sf)

Formula for compound interest

$$\text{Total accrued} = P\left(1 + \frac{r}{100}\right)^n$$

➔ **I invest £600 at 3% compound interest. What is my account worth after 5 years?**

$$£600 \times \left(1 + \frac{3}{100}\right)^5 = £695.56$$

Direct & inverse proportion R10

y is directly proportional to x:

$y = kx$ for a constant k

➔ **b is directly proportional to a^2; $a = 6$ when $b = 90$. Find b if $a = 8$.**

$b = ka^2$; $a = 6$ and $b = 90$ for k;

$90 = k \times 6^2$ so $k = 2.5, b = 2.5a^2$

$b = 2.5 \times 8^2 = 160$

y is inversely proportional to x:

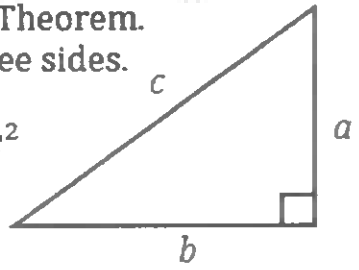
$yx = k$ or $y = \frac{k}{x}$ for a constant k

Right angled triangles

G20

Pythagoras Theorem.
Links all three sides.
No angles.

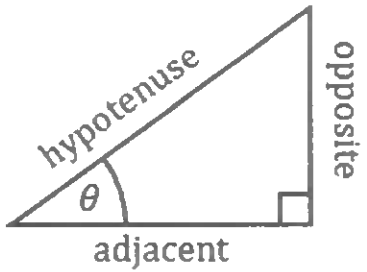
$a^2 + b^2 = c^2$



Trigonometry.
Links two sides and one angle.
SOH | CAH | TOA

$\sin\theta = \frac{\text{opp}}{\text{hyp}}$ $\cos\theta = \frac{\text{adj}}{\text{hyp}}$ $\tan\theta = \frac{\text{opp}}{\text{adj}}$

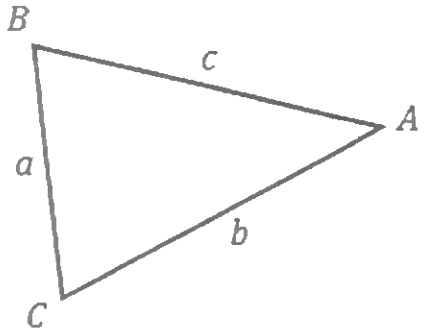
Use "2ndF" or "SHIFT" key to find a missing angle



The longest side of any right angled triangle is the hypotenuse; check that your answer is consistent with this.

Advanced trigonometry

G21, G22



A is opposite a
B is opposite b
C is opposite c

Sine Rule
Use if you are given an angle-side pair

Missing side: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Missing angle: $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

Cosine Rule
Use if you can't use the sine rule

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

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

Special values of sin, cos, tan
Learn (or be able to find without a calculator)...

$\sin 0° = 0$, $\cos 0° = 1$, $\tan 0° = 0$

$\sin 30° = \frac{1}{2}$, $\cos 30° = \frac{\sqrt{3}}{2}$, $\tan 30° = \frac{1}{\sqrt{3}}$

$\sin 45° = \frac{1}{\sqrt{2}}$, $\cos 45° = \frac{1}{\sqrt{2}}$, $\tan 45° = 1$

$\sin 60° = \frac{\sqrt{3}}{2}$, $\cos 60° = \frac{1}{2}$, $\tan 60° = \sqrt{3}$

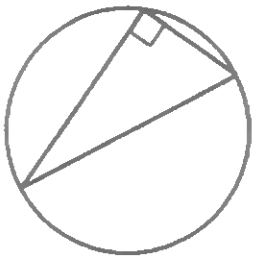
$\sin 90° = 1$, $\cos 90° = 0$

GCSE Mathematics Higher Tier

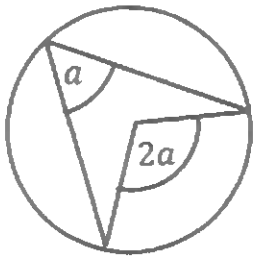
Number · Algebra · Ratio, proportion and rates of change · Geometry & measures · Probability · Statistics

Circle theorems

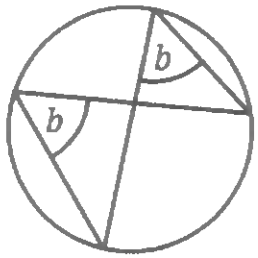
G10



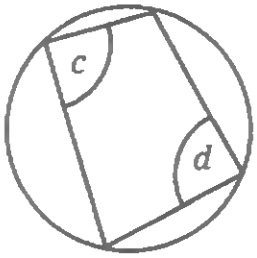
Angle in a semicircle is 90°



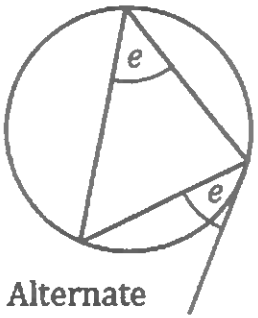
Angle at the centre is double the angle at the circumference



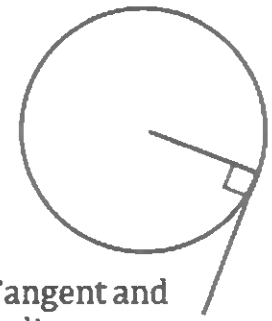
Angles in the same segment are equal



Opposite angles in a cyclic quadrilateral total 180°



Alternate segment theorem



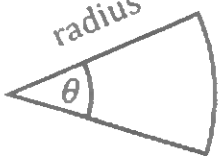
Tangent and radius are perpendicular

Areas and volumes

G16, G17, G18, G23

Circumference of circle = $\pi \times D$

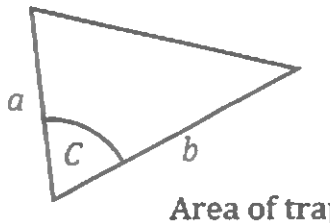
Area of circle = $\pi \times r^2$

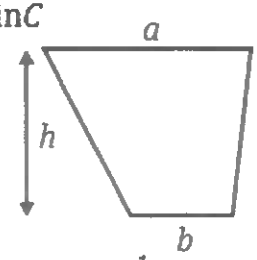


Arc length = $\frac{\theta}{360°} \times \pi \times D$

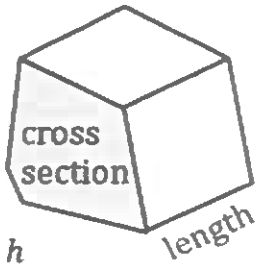
Area of sector = $\frac{\theta}{360°} \times \pi \times r^2$

Area of triangle = $\frac{1}{2}ab\sin C$

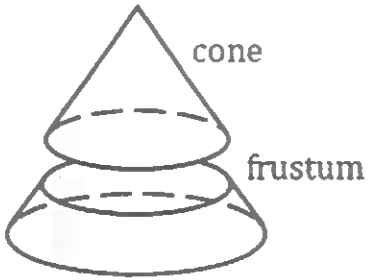




Area of trapezium = $\frac{1}{2}(a+b) \times h$



Volume of prism = area of cross section × length



Volume of cone = $\frac{1}{3}\pi r^2 h$

Volume of frustum is difference between the volumes of two cones

Transformations

G7, G8

Reflection
- Line of reflection

Translation
- Vector

Rotation
- Centre of rotation
- Angle of rotation
- Clockwise or anticlockwise

Enlargement
- Centre of enlargement
- Scale factor (if $-1 < SF < 1$ the shape will get smaller).

Similar shapes

G19

Ratios in similar shapes and solids:

• Length/perimeter	$1:n$	$a:b$
• Area	$1:n^2$	$a^2:b^2$
• Volume	$1:n^3$	$a^3:b^3$

Probability rules P8, P9

Multiply for independent events

➔ P(6 on dice and H on coin)

$$\frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$$

Add for mutually exclusive events

➔ P(5 or 6 on dice)

$$\frac{1}{6} + \frac{1}{6} = \frac{2}{6}$$

Apply these rules to tree diagrams.

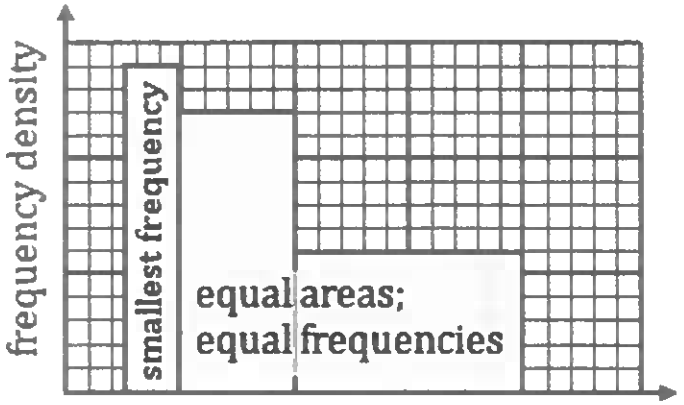
In general,...

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$P(A \text{ and } B) = P(A \text{ given } B) \times P(B)$

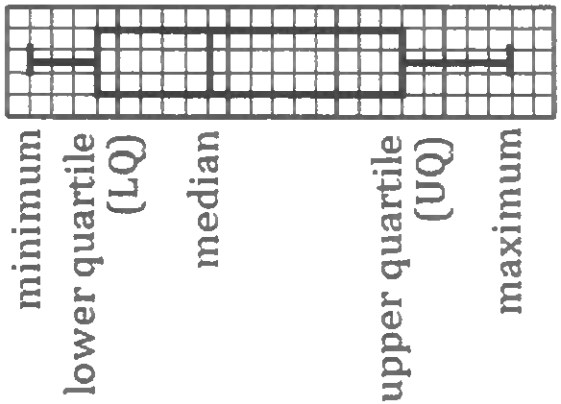
Histograms S3

Frequency = frequency density multiplied by class width. This means that bars with the same frequency have the same area.



Box plots S4

Interquartile range (IQR) = UQ – LQ



GCSE Mathematics Foundation Tier

Number · Algebra · Ratio, proportion and rates of change · Geometry & measures · Probability · Statistics

BIDMAS N3

...or BODMAS. Use the correct order of operations; take care when using a calculator.

- **B**rackets
- **I**ndices (or p**O**wers)
- **D**ivision and **M**ultiplication
- **A**ddition and **S**ubtraction

Types of number N4

Integer: a "whole" number

Factors; the divisors of an integer

➔ **Factors of 12 are 1, 2, 3 ,4, 6, 12**

Multiples; a "times table" for an integer (will continue indefinitely)

➔ **Multiples of 12 are 12, 24, 36 ...**

Prime number: an integer which has exactly two factors (1 and the number itself). Note: 1 is not a prime number.

HCF, LCM N4

Highest Common Factor (HCF)

➔ **Factors of 6 are 1, 2, 3, 6**
Factors of 9 are 1, 3, 9
HCF of 6 and 9 is 3

Lowest Common Multiple (LCM)

➔ **Multiples of 6 are 6, 12, 18, 24, ...**
Multiples of 9 are 9, 18, 27, 36, ...
LCM of 6 and 9 is 18

Prime factors N4

Write a number as a product of its prime factors; use indices for repeated factors:

➔ $720 = 5 \times 3^2 \times 2^4$

Powers and roots N6, N7

Special indices: for any value a:

$$a^0 = 1$$

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

➔ $$3^{-4} = \frac{1}{3^4} = \frac{1}{81}$$

Calculating with fractions N8

Adding or subtracting fractions; use a common denominator...

➔ $$\frac{4}{5} - \frac{1}{3} = \frac{12}{15} - \frac{5}{15} = \frac{7}{15}$$

Multiplying fractions; multiply numerators and denominators...

➔ $$\frac{4}{7} \times \frac{2}{3} = \frac{8}{21}$$

Dividing fractions; "flip" the second fraction, then multiply...

➔ $$\frac{2}{7} \div \frac{5}{6} = \frac{2}{7} \times \frac{6}{5} = \frac{12}{35}$$

Fractions, decimals N10

Fraction is numerator ÷ denominator

➔ $$\frac{5}{8} = 5 \div 8 = 0.625$$

Use place values to change decimals to fractions. Simplify where possible.

➔ $$0.45 = \frac{45}{100} = \frac{9}{20}$$

Learn the most frequently used ones:

$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{10}$	$\frac{1}{5}$	$\frac{3}{4}$
0.5	0.25	0.1	0.2	0.75

Surds N8

Look for the biggest square number factor of the number:

➔ $\sqrt{80} = \sqrt{16 \times 5} = 4\sqrt{5}$

Standard form N9

Standard form numbers are of the form $a \times 10^n$, where $1 \leq a < 10$ and n is an integer.

Standard units N13

1 tonne = 1 000 kilograms
1 kilogram = 1 000 grams

---

1 kilometre = 1 000 metres
1 metre = 100 centimetres
= 1 000 millimetres
1 centimetre = 10 millimetres

---

1 day = 24 hours
1 hour = 60 minutes = 3 600 seconds
1 minute = 60 seconds

Rounding N15

Truncate the number, then use a "decider digit" to round up or down.
Decimal places: use the decimal point

➔ **162.3681 to 2dp;**
162.36 | **81 = 162.37 to 2dp**

Significant figures: use the first non-zero digit.

➔ **162.3681 to 2sf;**
16 | 2.3681 **= 160 to 2sf**

➔ **0.007 039 to 3sf;**
0.007 03 | **9 = 0.007 04 to 3sf**

Error intervals N15

Find the range of numbers that will round to a given value:

➔ $x = 5.83$ **(2 decimal places)**
$5.825 \leq x < 5.835$

➔ $y = 46$ **(2 significant figures)**
$45.5 \leq y < 46.5$

Note use of ≤ and <, and that the last significant figure of each is 5.

GCSE Mathematics Foundation Tier

● Number ● Algebra ● Ratio, proportion and rates of change ● Geometry & measures ● Probability ● Statistics

Algebraic notation A1

$$ab = a \times b$$
$$3y = y + y + y$$
$$a^2 = a \times a$$
$$a^3 = a \times a \times a$$
$$a^2b = a \times a \times b$$
$$\frac{a}{b} = a \div b$$

Equations and identities A3

An equation is true for some particular value of x...

➔ $2x + 1 = 7$ is true if $x = 3$

...but an identity is true for every value of x

➔ $(x + a)^2 \equiv x^2 + 2ax + a^2$

(note the use of the symbol ≡)

Laws of indices A4

For any value a:

$$a^x \times a^y = a^{x+y}$$
$$\frac{a^x}{a^y} = a^{x-y}$$
$$(a^x)^y = a^{xy}$$

➔ $\left(\frac{2pq^4}{p^3q}\right)^3 = \frac{8p^3q^{12}}{p^9q^3} = \frac{8q^9}{p^6}$ or $8q^9p^{-6}$

Expanding brackets A4

$$p(q + r) = pq + pr$$

➔ $5(x - 2y) = 5x - 10y$

$$(x + a)(x + b) = x^2 + ax + bx + ab$$

➔ $(2x - 3)(x + 5)$
$= 2x^2 - 3x + 10x - 15$
$= 2x^2 + 7x - 15$

Reverse of expanding is factorising - putting an expression into brackets.

Quadratics A18

Solve a quadratic by factorising.

➔ Solve $x^2 - 8x + 15 = 0$

Put into brackets (taking care with any negative numbers)...

$$(x - 3)(x - 5) = 0$$

...then either $x - 3 = 0$ or $x - 5 = 0$, so that $x = 3$ or $x = 5$.

Difference of two squares A4

$$a^2 - b^2 = (a + b)(a - b)$$

➔ $x^2 - 25 = (x + 5)(x - 5)$

Simultaneous equations A19

➔ Solve $\begin{cases} 2x + 3y = 11 \\ 3x - 5y = 7 \end{cases}$

Multiply to match a term in x or y

$$\begin{cases} 10x + 15y = 55 \\ 9x - 15y = 21 \end{cases}$$

Add or subtract to cancel...

$$19x = 76, \text{ so } x = 4$$

Finally, substitute and solve...

$$2 \times 4 + 3y = 11, \text{ so } y = 1$$

Rearrange a formula A5

The subject of a formula is the term on its own. Use rules that "balance" the formula to change its subject

➔ Make x the subject of

$$2x + 3y = z$$

Here, subtract $3y$ from both sides...

$$2x = z - 3y$$

...then divide both sides by 2...

$$x = \frac{z - 3y}{2}$$

Sequences A24, A25

Triangular numbers:

1st	2nd	3rd	4th	5th
1	3	6	10	15

Square numbers ($n^2 = n \times n$):

1^2	2^2	3^2	4^2	5^2
1	4	9	16	25

Cube numbers ($n^3 = n \times n \times n$):

1^3	2^3	3^3	4^3	5^3
1	8	27	64	125

nth term of an arithmetic (linear) sequence is $an + d$

➔ **nth term of 5,8,11,14,... is $3n+2$ (always increases by 3; first term is $3 \times 1 + 2 = 5$.)**

Geometric sequence; multiply each term by a constant ratio

➔ **3, 6, 12, 24, ... (ratio is 2)**

Fibonacci sequence; make the next term by adding the previous two ...

➔ **2, 4, 6, 10, 16, 26, 42, ...**

$y = mx + c$ A9

Equation of straight line $y = mx + c$

m is the gradient; c is the y intercept:

➔ **Find the equation of the line that joins (0 , 3) to (2 , 11)**

Find its gradient...

$$\frac{11-3}{2-0} = \frac{8}{2} = 4$$

...and its y intercept...

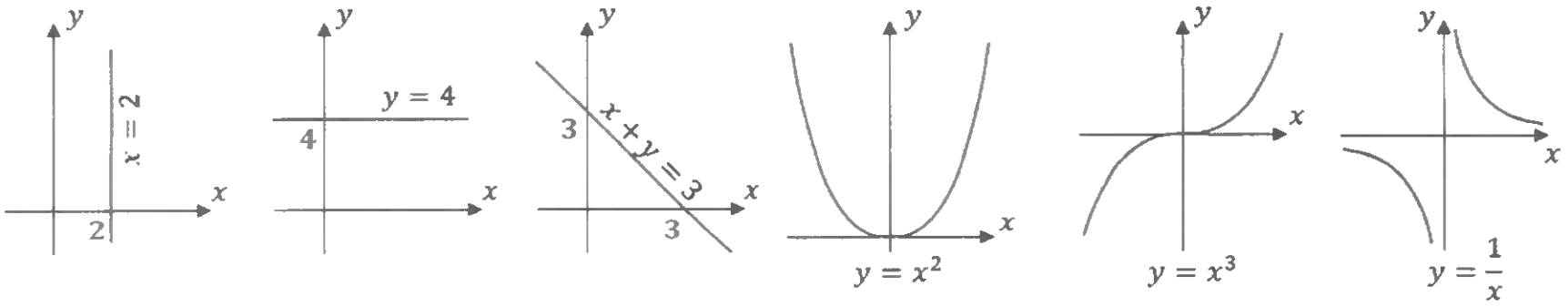
Passes through (0 , 3), so c = 3.

Equation is $y = 4x + 3$.

Parallel lines: gradients are equal;

➔ **$y = 2x + 3$ and $y = 2x - 5$ both have gradient 2, so are parallel.**

Standard graphs A12



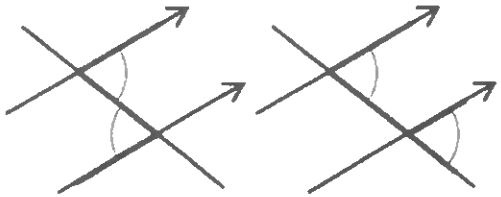
GCSE Mathematics Foundation Tier

Number · Algebra · Ratio, proportion and rates of change · Geometry & measures · Probability · Statistics

Angle facts

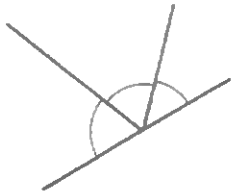
G3

Equal angles in parallel lines: always use correct terminology...

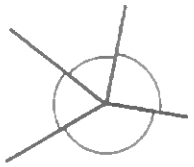


Alternate angles Corresponding angles

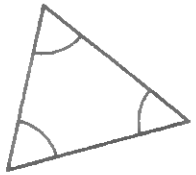
Angles on a straight line total 180°



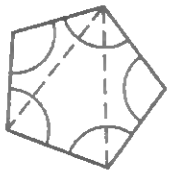
Angles in a full turn total 360°



Interior angles in a triangle total 180°

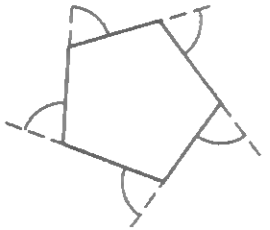


Use this for the interior angles of any polygon...



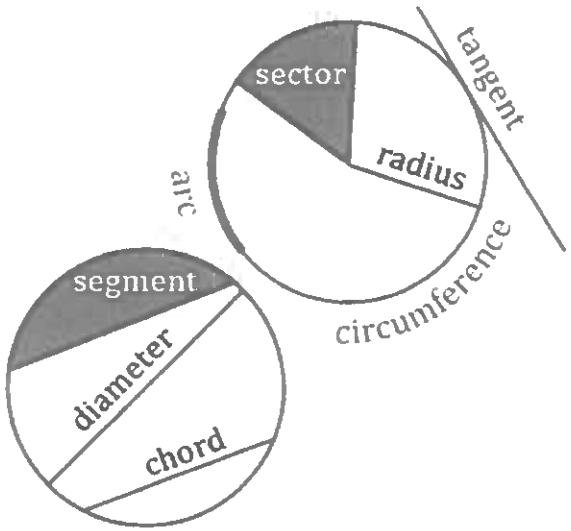
...or $180° \times (n-2)$

Exterior angles always total 360°



Parts of a circle

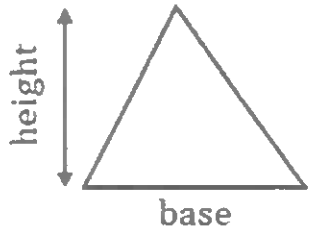
G9



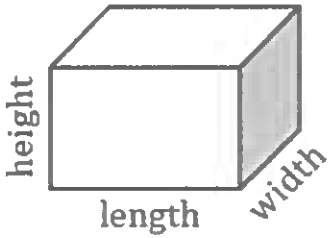
Areas and volumes

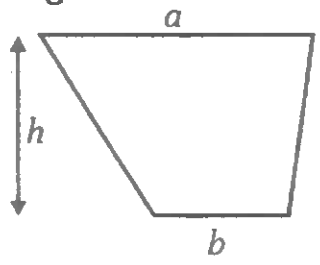
G16, G17, G18, G23

Area of triangle $= \frac{1}{2} \times$ base $\times$ height



Volume of cuboid = length × width × height

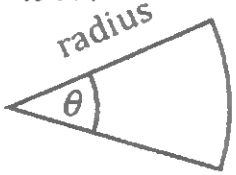




Area of trapezium $= \frac{1}{2}(a+b) \times h$

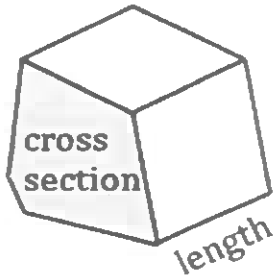
Circumference of circle $= \pi \times D$

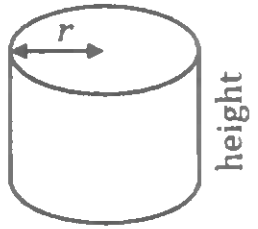
Area of circle $= \pi \times r^2$



Arc length $= \frac{\theta}{360°} \times \pi \times D$

Area of sector $= \frac{\theta}{360°} \times \pi \times r^2$





Volume of cylinder = πr^2 × height

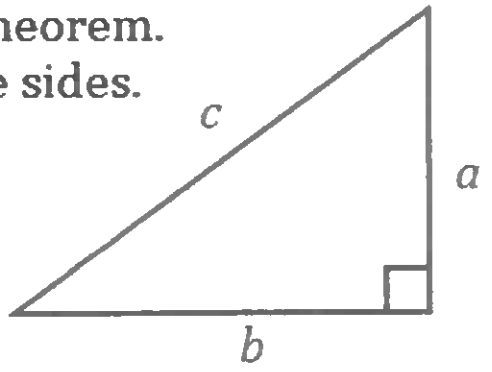
Volume of prism = area of cross section × length

Right angled triangles

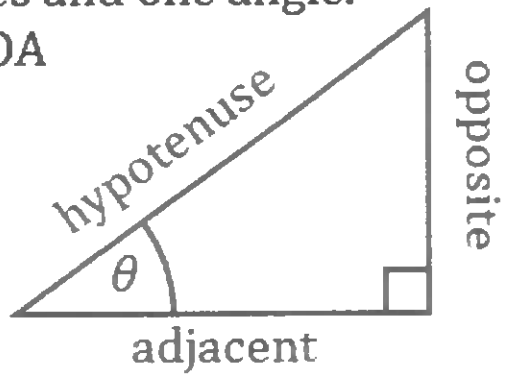
G20, G22

Pythagoras Theorem.
Links all three sides.
No angles.

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



Trigonometry.
Links two sides and one angle.
SOH | CAH | TOA



$\sin\theta = \frac{\text{opp}}{\text{hyp}}$ $\cos\theta = \frac{\text{adj}}{\text{hyp}}$ $\tan\theta = \frac{\text{opp}}{\text{adj}}$

Use "2ndF" or "SHIFT" key to find a missing angle

The longest side of any right angled triangle is the hypotenuse; check that your answer is consistent with this.

Special values of sin, cos, tan
Learn (or be able to find without a calculator)...

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

Transformations

G7, G8

Reflection
- Line of reflection

Translation
- Vector

Rotation
- Centre of rotation
- Angle of rotation
- Clockwise or anticlockwise

Enlargement
- Centre of enlargement
- Scale factor (if SF < 1 the shape will get smaller).

Probability

P8, P9

$$p = \frac{n(\text{equally likely favourable outcomes})}{n(\text{equally likely possible outcomes})}$$

$p = 0$	impossible
$0 < p < 0.5$	unlikely
$p = 0.5$	evens
$0.5 < p < 1$	likely
$p = 1$	certain

Probability rules

P8, P9

Multiply for independent events

➔ **P(6 on dice and H on coin)**

$$\frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$$

Add for mutually exclusive events

➔ **P(5 or 6 on dice)**

$$\frac{1}{6} + \frac{1}{6} = \frac{2}{6}$$

Apply these rules to tree diagrams.

Division using ratio

R5

Use a ratio for unequal sharing

➔ **Divide £480 in the ratio 7 : 5**

7 + 5 = 12, then £480 ÷ 12 = £40

7 × £40 = £280, 5 × £40 = £200

(check: £280 + £200 = £480 ✓)

Ratio and fractions

R8

Link between ratios and fractions

➔ **Boys to girls in ratio 2 : 3**

$\frac{2}{5}$ are boys, $\frac{3}{5}$ are girls.

Percentages

R9

$$y \text{ percent of } x = \frac{y}{100} \times x$$

➔ **Increase £58 by 26%.**

$$\frac{26}{100} \times £58 = £15.08$$

£58 + £15.08 = £73.08

$$y \text{ as a percentage of } x = \frac{y}{x} \times 100\%$$

➔ **The population of a town increases from 3 500 to 4 620. Find the percentage increase.**

$$\frac{1\,120}{3\,500} \times 100\% = 32\%$$

$$\text{Note: fraction} = \frac{\text{increase}}{\text{original}}$$

Speed, distance, time

R11

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

➔ **A car travels 90 miles in 1 hour, 30 minutes. Find its average speed.**

90 miles ÷ 1.5 hours = 60 mph

Averages

S4

Mode: most frequently occurring

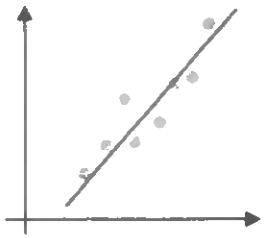
Median: put the data in numerical order, then choose the middle one

$$\text{Mean} = \frac{\text{total of items of data}}{\text{number of items of data}}$$

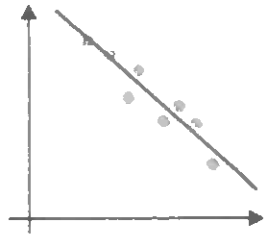
Correlation

S6

Positive correlation



Negative correlation



Higher Tier Formulae Sheet

Perimeter, area and volume

Where a and b are the lengths of the parallel sides and h is their perpendicular separation:

Area of a trapezium $= \frac{1}{2}(a + b)\,h$

Volume of a prism = area of cross section × length

Where r is the radius and d is the diameter:

Circumference of a circle $= 2\pi r = \pi d$

Area of a circle $= \pi r^2$

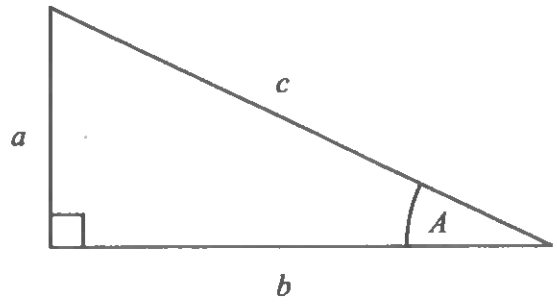
Quadratic formula

The solution of $ax^2 + bx + c = 0$

where $a \neq 0$

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

Pythagoras' Theorem and Trigonometry

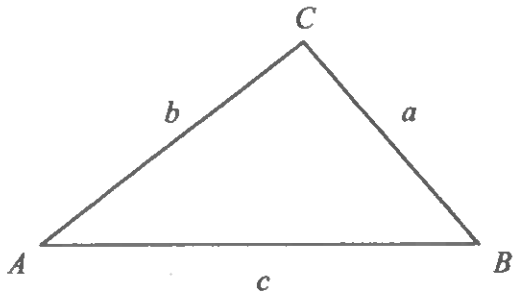


In any right-angled triangle where a, b and c are the length of the sides and c is the hypotenuse:

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

In any right-angled triangle ABC where a, b and c are the length of the sides and c is the hypotenuse:

$$\sin A = \frac{a}{c} \quad \cos A = \frac{b}{c} \quad \tan A = \frac{a}{b}$$



In any triangle ABC where a, b and c are the length of the sides:

sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

Area of triangle $= \frac{1}{2}\,a\,b\sin C$

Compound Interest

Where P is the principal amount, r is the interest rate over a given period and n is number of times that the interest is compounded:

Total accrued $= P\left(1 + \frac{r}{100}\right)^n$

Probability

Where P (A) is the probability of outcome A and P (B) is the probability of outcome B:

P (A or B) = P (A) + P (B) − P (A and B)

P (A and B) = P (A given B) P(B)

END OF EXAM AID

Foundation Tier Formulae Sheet

Perimeter, area and volume

Where a and b are the lengths of the parallel sides and h is their perpendicular separation:

Area of a trapezium $= \frac{1}{2}(a + b)\,h$

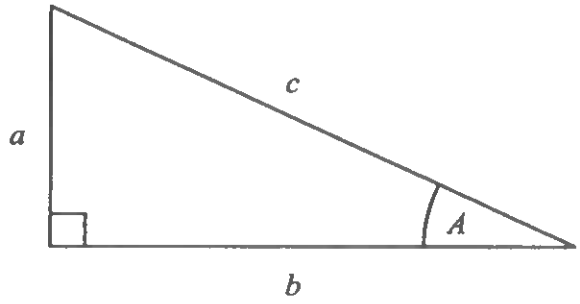
Volume of a prism = area of cross section × length

Where r is the radius and d is the diameter:

Circumference of a circle $= 2\pi r = \pi d$

Area of a circle $= \pi r^2$

Pythagoras' Theorem and Trigonometry



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$$\sin A = \frac{a}{c} \quad \cos A = \frac{b}{c} \quad \tan A = \frac{a}{b}$$

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Probability

Where P (A) is the probability of outcome A and P (B) is the probability of outcome B:

P (A or B) = P (A) + P (B) – P (A and B)

END OF EXAM AID

Y11 Biology Knowledge Organiser - Ecology 1

Box 1 - Interdependence and competition

Ecology is the study of organisms and their interactions with the environment around them.
All the organisms in the ecosystem depend on each other for survival. This is called **interdependence**.
Ecosystems are made up of communities. These are all of the living organisms within that ecosystem. The community is made up of populations. These are groups of organisms of a particular species within that ecosystem.

Organisms will compete with each other for resources within an environment. They will compete with organisms of the same species and organisms of different species.

Animals will compete for:
- Space (territory)
- Food
- Water
- Mates

Plants will compete for:
- Light
- Space
- Water
- Mineral ions

A stable community is one where all the species and the environmental factors are in balance; as a result, population sizes stay relatively constant.

Box 2 - Adaptations

ALL organisms are adapted to survive their natural environment. Adaptations can be:
- **Structural**: adaptations in terms of body form and shape. This would include examples like: streamlined shape for speed; long stem
- **Behavioural**: adaptations of behaviour – for instance, hunting behaviours.
- **Functional**: adaptations in terms of how the body works. For instance: being able to digest a certain food.

Some organisms are adapted to live in extreme environments – for instance, very high temperatures, high pressures, high salt concentration. The organisms that can survive in these kinds of conditions are called **extremophiles**. Bacteria that live in deep sea hydrothermal vents are extremophiles.

Key Terms	Definitions
Ecosystem	Interaction of a community of living organisms (biotic parts) with the non living parts of their environment (abiotic parts).
Community	All of the populations of different species living within a habitat or ecosystem.
Habitat	The place where an organism is adapted to live.
Population	The organisms of one species living in a habitat or ecosystem.
Interdependence	All organisms in a community rely on one another for food, shelter, pollination, seed dispersal, nutrient recycling
Biotic factors	Living factors affecting a community.
Abiotic factors	Non-living factors affecting a community.

Box 3 - Biotic and abiotic factors affecting organisms

These factors may affect the distribution of organisms (i.e. how they are spread out in the environment), their population size, their growth, behaviour or anything else really.

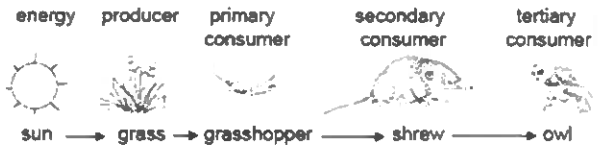
Abiotic factors – non living factors	Biotic factors – living factors
light intensity	food availability
temperature;	new predators arriving
moisture levels	new pathogens
soil pH and mineral content	competition between species
wind intensity and direction	
carbon dioxide level for plants	
oxygen levels dissolved in water for aquatic animals.	

Y11 Biology Knowledge Organiser - Ecology I

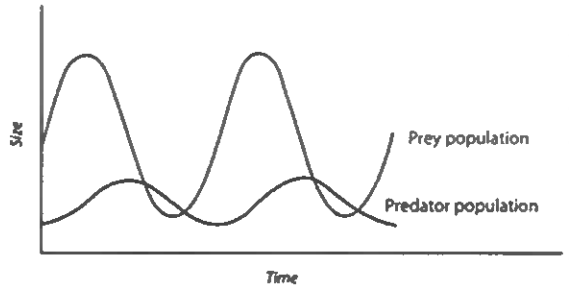
Box 4 - Organisation of ecosystems

Apart from some ecosystems in deep sea vents, ALL biomass on Earth is produced by **photosynthetic** organisms (plants and algae) so these organisms are called **producers**. **Food chains and food webs** represent the feeding relationships in a community..

The producers are eaten by **primary consumers**, which might be eaten by **secondary consumers**.
The secondary consumers may be eaten by **tertiary consumers**.

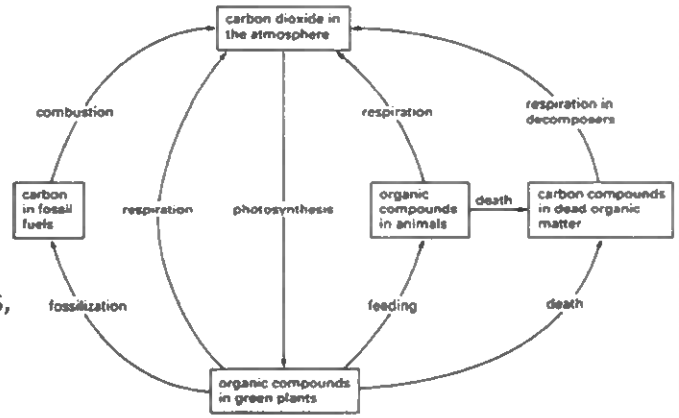


Predators are consumers that kill and eat other animals.
The animals eaten by predators are their **prey**.
In a *stable* community, the population size of predators and their prey rise and fall in Cycles.



Box 5 - Cycling of materials and the carbon cycle

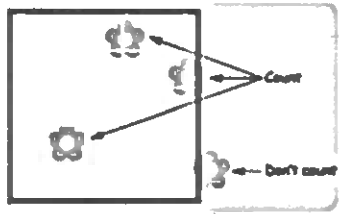
All materials have to be cycled Through the biotic and abiotic components of the ecosystem – e.g. water, carbon, minerals. Microorganisms (bacteria and fungi) play a key role in cycling materials by returning carbon to the atmosphere and mineral Ions to the soil.
Carbon is found in the carbohydrates, Lipids and proteins that living Organisms are built from. Carbon is cycled by the processes below:



- **Photosynthesis** – takes carbon from the atmosphere (in the form of CO_2) and converts it to biomass
- **Respiration** – all living organisms, including plants and microorganisms, respire, which returns carbon dioxide to the atmosphere. While decay is taking place, carried out by microorganisms, they respire, which releases CO_2.
- **Feeding** – when consumers eat other organisms, the carbon in the other organism's biomass is transferred to the consumer.

Key Terms	Definitions
Biomass	The materials that living things are made from: proteins, carbohydrates and lipids.
Distribution	How organisms are spread through an ecosystem.
Quadrat	A square frame of known area used for sampling in an ecosystem.
Transect	Sampling method along a line. This is used to measure the change in distribution of organisms.

Box 6 - Measurements of ecosystems



Sampling techniques are used to measure the population size or distribution of organisms in an ecosystem..

Estimating population size - Quadrat survey.

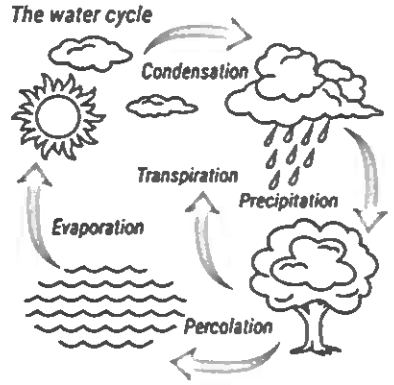
- Measure area being sampled.
- Place quadrat at a number of random positions in the area being sampled. Organisms within the quadrat are counted.
- A mean number organisms is then calculated and then multiplied up by the area being sampled..

Measuring distribution – Transect survey.

- A long tape measure is laid down across the area being surveyed.
- A quadrat is laid at regular intervals along the line and the number of organisms being sampled counted each time.
- Other factors (e.g. light intensity) can be measured along the transect line to look for correlation.

Box 7 - The water cycle

Water is constantly cycled in ecosystems.
Water is released in aerobic respiration by all organisms. Water is constantly evaporated from the surface of land and water and from Plants (transpiration) Water vapour then condenses and precipitates (rain). Water precipitated provides fresh water for organisms on land before draining into the sea.



Y11 Biology Knowledge Organiser - Ecology II

Key Terms	Definitions
Biodiversity	The variety of all the different species of organisms on earth, or within an ecosystem.

Box 1 - Biodiversity

Biodiversity, the variety of all the species of organisms on Earth or within an ecosystem.

A great/high biodiversity increases the stability of ecosystems, because it reduces the dependence of one species on another, for instance for food. So, for example, if a species has only one food source (e.g. pandas and bamboo shoots), it may be easily threatened by environmental changes.

Our future as a species on Earth depends totally on maintenance of a good level of biodiversity. Many human activities threaten biodiversity. Indeed, in many ecosystems, we have already significantly reduced biodiversity and we have only recently taken measure to try and stop this reduction

Box 2 - Land use

Humans reduce the amount of land available for other organisms, which reduces biodiversity as habitats and food sources are removed. They do this by:

- Building
- Quarrying
- Farming
- Dumping waste (e.g. landfill).

Peat Bogs

Peat bogs are made of peat, a type of fossil fuel formed from the very slow dead plants.
Peat can be used as a fuel and is used to produce garden compost, so peat bogs are being destroyed.

Destruction of pest bogs reduced biodiversity.
Using peat as a fuel produces CO_2, so contributing to global warming

There is conflict between our need for cheap, available compost and the need to conserve peat bogs and peatlands for biodiversity and to reduce carbon dioxide emissions.

Box 3 - Waste management

The human population is growing at a rapid rate and people's living standards are going up.
This means humans are using more and more resources and producing more and more waste. Our waste causes pollution, which can occur:

- In water, thanks to sewage, fertilisers running off farmland, or toxic chemicals used in industry. Fertilisers cause algae populations to grow rapidly. This blocks light and causes the death of algae and plants. The subsequent decay of these dead organisms causes the oxygen levels in the water to drop. This causes the death of fish and other freshwater invertebrates and biodiversity decreases.
- In the air, from smoke, waste gases and acidic gases (e.g. sulphur dioxide)
- On land, from landfill (rubbish dumps) and from toxic chemicals.

Pollution kills living organisms so therefore it can reduce biodiversity.

Box 4 - Deforestation

Deforestation is the removal of large areas of forest, particularly in tropical areas.

Large scale deforestation happens in tropical areas to:

- to provide land for raising cattle
- to provide land for rice fields
- to grow crops that can be made into biofuels.

Deforestation significantly reduces biodiversity

Deforestation contributes to global warming because:

- It increases the carbon dioxide released into the atmosphere as trees are burnt to clear the land.
- Micro-organisms break down dead plant material and release carbon dioxide when they respire.
- Less carbon dioxide is taken in, as when there are fewer trees, less photosynthesis occurs.

Y11 Biology Knowledge Organiser - Ecology II

Box 5 - Global warming

Since the industrial revolution, human activities (burning fossil fuels, deforestation) have dramatically increased the levels of greenhouse gases in the atmosphere. The main greenhouse gases are carbon dioxide and methane.
The molecules of these gases absorb infrared (heat) radiation and re-radiate it. More of these molecules means more infrared radiation absorbed and re-radiated. This is causing gradual but measurable increases the atmospheres, and therefore Earth's, temperature.

Global warming as caused by humans used to be controversial; now, thousands of peer-reviewed publications later, the global scientific consensus is that humans are causing global warming and climate change .

The consequences of global warming are:
- Rising sea level leading to habitat loss.
- Changes in the distribution of organisms.
- Changes to migration patterns of organisms.
- Reduction in biodiversity.

Key Terms	Definitions
Breeding programme	Producing offspring, especially of endangered species to protect their population.
Field margin	The area around the edge of a field between the crop and the barrier (fence/hedge/wall.)
Hedgerow	The barrier at an edge of a field made of growing plants, as opposed to a fence or wall.

Box 7 - Conflicting pressures

The following factors are conflicting pressures that make global action to tackle problems difficult:
- Costs
- Political agreement
- Need for food and resources for increasing populations and living standards.
- Complex actions needed.

Box 6 - Maintaining biodiversity

As the scale of our negative influence has become more and more apparent, scientists and concerned citizens have brought in programmes to try to reduce our negative impacts on ecosystems and biodiversity.
Examples include;
- **Breeding programmes** for endangered species. For instance, tigers and pandas are bred in captivity to ensure they do not become extinct.
- **Protection** and **regeneration** of rare habitats. This includes passing laws to ensure people leave certain areas alone (e.g. parts of the Great Barrier Reef). Regeneration means activity trying to bring a habitat back to its more former state, which is usually more diverse.
- **Reintroduction of field margins** and **hedgerows** in agricultural areas where farmers only grow one kind of crop. Field margins and hedgerows provide habitats and food sources for more biodiversity in plant and animal life.
- **Reduction of deforestation and carbon dioxide emissions** by some governments. There have been numerous attempts, not always totally successful, to get governments of countries around the world to agree to specific targets for how much carbon dioxide they emit. e.g. Paris Climate agreement.
- **Recycling** resources rather than dumping in landfill.

Field margin, and hedgerow on the left and crop on the right.

Y11 Biology Knowledge Organiser - Ecology III – Separate Science only

Box 1: Food Production

Below are the factors affecting food security
Enough food is needed to feed a changing population but some people have concerns about the treatment of animals.

- Increasing birth rate
- Changing diets in developing countries
- New pests and pathogens affecting farming
- Environmental changes e.g. famine when rains fail.
- Cost of agriculture input
- Conflicts (war) affecting water of food availability

Food security can be improved by Increasing the efficiency of food production in farming techniques by reducing energy waste, limiting movement, control temperature, high protein diets to increase growth.
Food security can also be improved by making fisheries sustainable due to current fish stocks in ocean declining:

- Maintain/grow fish stocks to a sustainable level where breeding continues or certain species may disappear.
- By controlling net size, fishing quotas.

Biotechnology

- Fungus *Fusarium* to produce mycoprotein. Requires glucose syrup, aerobic conditions. Biomass is harvested and purified.
- GM bacterium produces insulin to treat diabetes.
- GM crops to provide more/nutritional food (golden rice).

Box 2: Global Warming

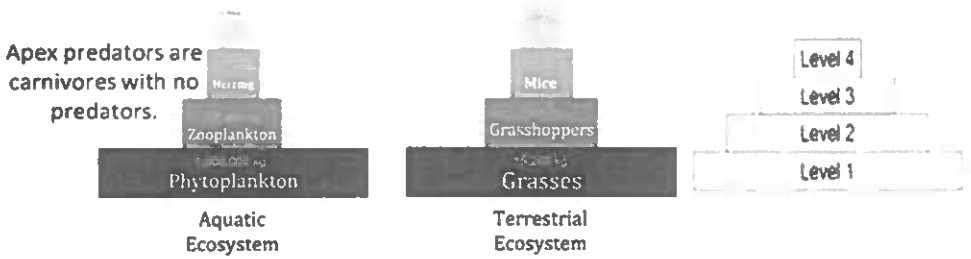
Levels of CO2 and methane in the atmosphere are increasing. Decreased land availability from sea level rise, temperature rise damages delicate habitats, extreme weather events harm populations of plants and animals. There is a global consensus about global warming and climate change based on systematic reviews of thousands of peer reviewed publications.

Box 3: Trophic Levels

Trophic levels can be represented by numbers and biomass in pyramids.

Trophic levels are numbered sequentially according to how far the organisms is along the food chain.

Level 1	Producers	Plants and algae.
Level 2	Herbivores	Primary consumers.
Level 3	Carnivores	Secondary consumers.
Level 4	Carnivores	Tertiary consumers.



Box 4: Maintaining Biodiversity

Human activity can have a positive impact on biodiversity. Scientists and concerned citizens put in place programmes to reduce the negative impacts of humans on ecosystems and biodiversity:

- Breeding programmes for endangered species.
- Protection and regeneration of rare habitats.
- Reintroduction of field margins and hedgerows in agricultural areas where farmers grow only one type of crop.
- Reduction of deforestation and CO_2 emissions by some governments.
- Recycling resources rather than dumping waste in landfill.

Some of the programmes potentially conflict with human needs for land use, food production and high living standards.

Box 5: Transfer of Biomass

Decomposers break down dead plants and animal matter by secreting enzymes. Small soluble food molecules than diffuse into the microorganism.
Biomass is lost between the different trophic levels
Producers transfer about 1% of the incident energy from light for photosynthesis.
Approximately 10% of the biomass from each trophic level is transferred to the level above.
Large amounts of glucose is used in respiration, some material egested as faeces or lost as waste e.g. CO_2, water and urea in urine.

Y11 Chemistry Knowledge Organiser
Chemistry of the Atmosphere

Box 1 - The Atmosphere

For 200 million years, the amount of different gases in the atmosphere have been much the same as they are today:

- 78% nitrogen
- 21% oxygen
- The atmosphere also contains small proportions of various other gases, including carbon dioxide, water vapour and noble gases.

Box 2 - The Evolution of the Atmosphere

Scientists are not sure about the gases in the early atmosphere, as it was so long ago (4.6 billion years) and due to the lack of evidence.
Many scientists believe the early atmosphere was made up of mainly carbon dioxide, water vapour and small amounts of methane, ammonia and nitrogen, released by **volcanoes. There was little or no oxygen around at this time.**

Oceans - The early Earth was very hot, but as it cooled the water vapour in the atmosphere condensed and **formed the oceans.**

Decreasing carbon dioxide - As the oceans formed, carbon dioxide dissolved in the ocean. The carbon dioxide formed carbonates which precipitated out (formed solids). This process reduced the amount of carbon dioxide in the atmosphere.

Decreasing carbon dioxide and increasing oxygen - Approximately 2.7 billion years ago algae evolved and soon after this oxygen appeared in the atmosphere. Over the next billion years plants evolved. This decreased the amount of carbon dioxide in the atmosphere and increased the amount of oxygen in the atmosphere as they carried out photosynthesis

When sea animals evolved they used the carbon dioxide in the ocean to form their shells and bones (which are made of carbonates). When these sea creatures died their shells and bones became limestone (calcium carbonate), which is a sedimentary rock.

Once enough oxygen was in the atmosphere, it allowed animals to evolve.

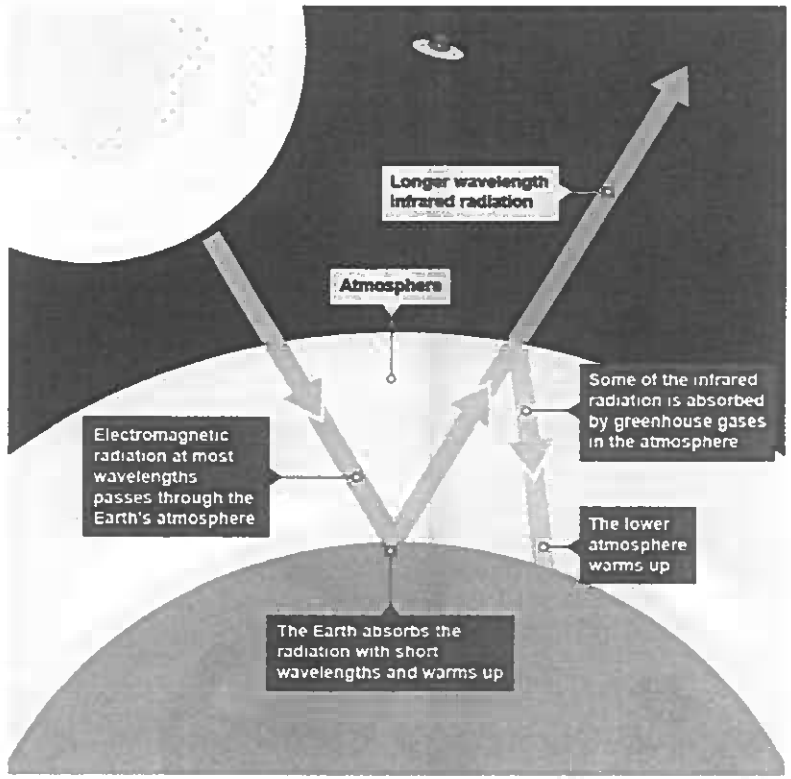
Box 3 - The Greenhouse Effect

The Earth's atmosphere contains greenhouse gases. These gases, which include carbon dioxide, methane and water vapour, maintain the temperature on Earth high enough to support life.

The greenhouse gases allow the short wave infrared radiation emitted by the Sun to pass through it but absorbs the long wave infra red radiation which is emitted by the Earth. This is how it insulates the Earth.

Some human activities increase the amounts of greenhouse gases in the atmosphere. These include:

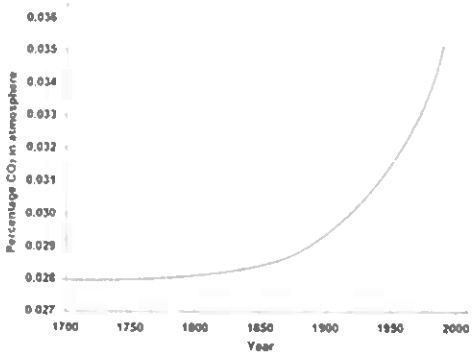
- combustion (burning) of fossil fuels
- deforestation
- methane release from farming and destruction of peat bogs.
- more animal farming (digestion, waste decomposition)

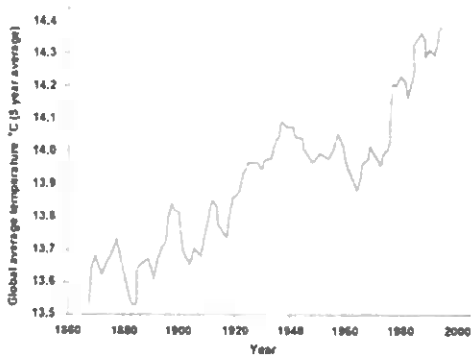


Y11 Chemistry Knowledge Organiser
Chemistry of the Atmosphere

Box 4 - The Enhanced Greenhouse Effect

Humans activities have enhanced the greenhouse effect through combustion of fossil fuels, increased farming and deforestation and destruction of peat bogs.
There is correlation between the increased levels of greenhouse gases in the atmosphere and the global average temperature. Based on peer reviewed evidence, many scientists believe this has lead to a **rise in global temperature.**





However, this is such a complex system and it is very difficult to model. When simplified models are presented, it can lead to **inaccurate or biased** opinions being reported in the media.

Box 5 - Consequences of Climate Change

An increase in average global temperature is a major cause of **climate change.**
The potential effects of global climate change include:

- melting of polar ice caps and sea level rise, which may cause flooding and increased coastal erosion
- more frequent and severe storms
- changes in the amount, timing and distribution of rainfall
- water shortages for humans and wildlife
- changes in the food producing capacity of some regions
- changes to the distribution and migration patterns of wildlife species.

Key Terms	Definitions
Peer reviewed evidence	This is evidence that has been scrutinised by other independent scientists to check for bias, inaccuracy and any flaws in the design of the investigations or data gathering.

Box 7 - Carbon Footprint

The **carbon footprint** is the total amount of carbon dioxide and other greenhouse gases released over the life of a product. Many people or businesses look to reduce their carbon footprint by:

- increased use of alternative energy supplies
- energy conservation
- carbon capture and storage
- carbon taxes and licences

People also try to **offset** their carbon by planting trees.
If something is carbon neutral, this means that there is no net increase in **carbon dioxide in the atmosphere** when it is used.

Box 8 - Other atmospheric pollutants

The combustion of fuels is a major source of atmospheric pollutants. When burning fuels, other pollutants are made. The effects of these pollutants are summarised below.

Gas	How are they made?	What is the affect?
Sulphur dioxide	Fuels contain a small amount of sulphur. This reacts with oxygen to form sulphur dioxide	Respiratory problems and acid rain
Nitrous oxides	Oxygen reacts with nitrogen in the air	Respiratory problems and acid rain
Carbon particulates	Is made during incomplete combustion	Can cause global dimming and health problems
Carbon monoxide	Is made in incomplete combustion of a fuel	Is a toxic gas. It is also colourless and odourless

Y11 Chemistry Knowledge Organiser - Chemical Analysis

Box 1 - Pure and Impure Substances

- In everyday life, a pure substance is something that has nothing added to it, so it is unadulterated – e.g. pure milk, pure honey. In terms of chemistry, these are mixtures.
- In chemistry, pure substance contains only <u>one</u> type of element or compound.
- An impure substance is a mixture.

Box 2 - Melting Point and Boiling point

- A chemically pure substance will melt or boil at a very specific temperature.
- Impurities decrease the melting point and increase the range of temperatures over which a substance will melt.
- Impurities increase the boiling point of a substance and increase the range of temperatures over which a substance will boil.

Box 3 - Formulations

- Formulations are mixtures that are designed as useful products. They are often complex mixtures with lots of different components (parts).
- Formulations are made by mixing the components in carefully measured quantities so the product has the correct properties.
- Examples of formulations include paint, fuels, cleaning agents, medicines, alloys, fertilisers, food.

Box 4 - Gas Tests

:

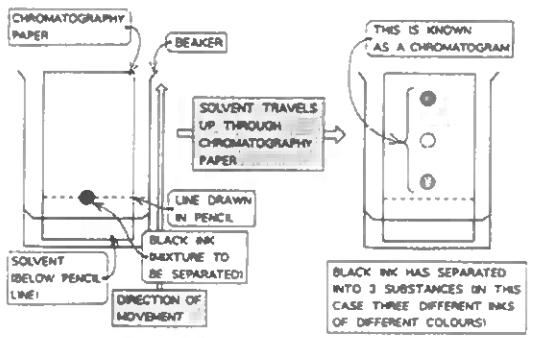
Hydrogen - Place a lit splint into the gas and there is a squeaky pop.

Oxygen – Place a glowing splint in to the gas and the splint relights.

Chlorine – Place damp litmus paper into the gas and the litmus paper bleaches.

Carbon dioxide – Bubble the gas through limewater and the limewater turns cloudy.

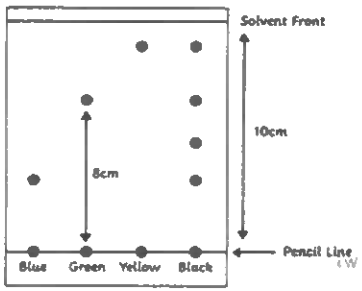
Box 5 – RP: Chromatography



Key Terms	Definitions
Pure substance (chemistry)	A substance made of a single element or compound and not mixed with any other substance.
Melting point	The temperature at which a substance melts or freezes/solidifies.
Boiling point	The temperature at which a substance boils or condenses
Formulations	Complex mixtures that are designed as useful products.
Chromatography	A technique where mixtures can be separated based on their solubility.
Stationary phase	The phase that doesn't move (i.e. the filter paper)
Mobile phase	The solvent (normally water) which moves up through the stationary phase.
Rf value	The ratio between the distance travelled by the substance and the distance travelled by the solvent.

Box 6 - Chromatography and Rf values

- Chromatography can be used to separate mixtures and can be used to identify substances.
- Chromatography involve two phases:
  - stationary phase where particles can't move (the filter paper in most cases).
  - mobile phase - the solvent (for example water) which moves up the paper.
- Separation depends on the distribution of substances between the stationary phase and the mobile phase.
- The ratio of the distance moved by the spot and the distance moved by the solvent is called the Rf value. It is always a value <1
- $Rf = \frac{\textit{Distance travelled by the substance}}{\textit{Distance travelled bu the solvent}}$
- Different compounds will have different R_f values in different solvents.
- A pure substance will produce a single spot in all solvents.



Rf green = 8 ÷ 10 = 0.8

Y11 Chemistry Knowledge Organiser: Using Resources

Box 1 - Water

Water of appropriate quality is **essential for life**. For humans, drinking water should have low levels of dissolved **salts and microbes.** Water that is safe to drink is called **potable water**.

The methods used to produce potable water depend on available supplies of water and local conditions.

In the United Kingdom (UK), rain provides water with low levels of dissolved substances (fresh water) that collects in the ground and in lakes and rivers, and most potable water is produced by:

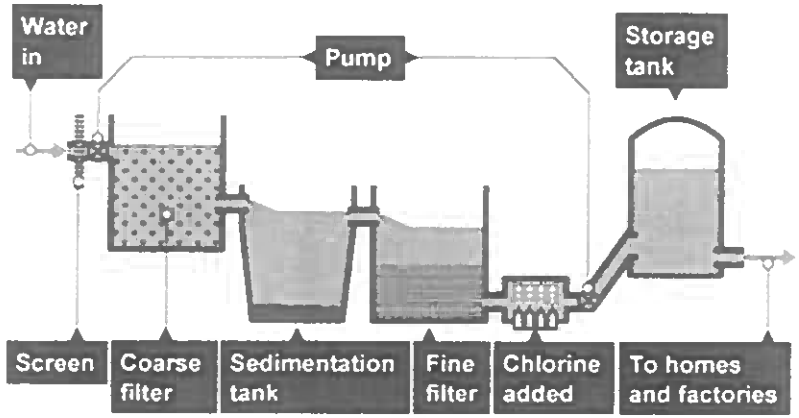
- passing the water through filter beds to remove any solids
- sterilising to kill microbes, using chlorine or UV light

In some parts of the world there is not enough fresh water so the salt has to be removed from water. This process is called **desalination.**

Desalination can be done by distillation or reverse osmosis. This requires a **large amount of energy.**

Box 2 - Waste water and Sewage

Humans are now creating a huge amount of waste water: Water from houses and farming needs to **be treated** before it can be released into rivers and lakes. It is firstly filtered to remove large particles and is then left so that the sediment drops to the bottom. The "sludge," this is the name given to the sediment at the bottom, is then anaerobically digested (broken down by bacteria) to make methane gas. Any remaining **effluent** is broken down by aerobic respiration. The water is then released back into the rivers and lakes.



Key Terms	Definitions
Potable Water	Water which is safe to drink
Phytomining	A copper extraction process using plants
Bioleaching	A copper extraction process using bacteria
Natural resources	Resources that form without human input
Renewable resources	A resource that can be made at the same or similar rate as it is being used
Finite (non-renewable) resource	A resource that isn't being replaced at a quick enough rate to be considered replaceable

Box 3 - Resources

Natural resources form without human input. They include anything that comes from the earth, sea or air. We use them to provide energy for things like heating or travelling, as well as for building materials and food. E.g. , wind is a natural resource used to generate electricity by wind turbines and metals mined from the ground can be used to make metallic objects.

Some of these natural products can be replaced by synthetic products.

e.g.

1. Rubber is extracted from the sap of a tree, but man-made polymers can replace rubber in tyres
2. Wood has been replaced by plastic in many applications e.g. laminate flooring and window frames
3. Cork is produced by trees but has been replaced in wine bottles by a synthetic plastic cork

Agriculture provides conditions where natural resources are enhanced for our needs. E.g. Development of fertilisers has enabled a high yield of crops.

Box 4 - Sustainable development

Sustainable development is an approach to development that takes account of the needs of the present society while not damaging the lives of future generations.

As finite resources run out it is unsustainable to keep using them. Extracting resources uses a great deal of energy and produces large amount of waste. Reducing the use of finite resources, recycling resources and advances in chemistry to develop more sustainable processes in agriculture and industry will preserve more finite resources.

Y11 Chemistry Knowledge Organiser: Using Resources

Box 5 - LCAs

Life cycle assessments (LCAs) are carried out to assess the environmental impact of products in each of these stages of a products life:

1. extracting and processing raw materials
2. manufacturing and packaging
3. use and operation during its lifetime
4. disposal at the end of its useful life, including transport and distribution at each stage.

Some things for example the energy required to make the product are easy to measure. However some things like how much pollution it releases are hard to measure and therefore difficult to give a value to.

Example of an LCA

	Plastic Bag	Paper Bag
Raw Material	Crude Oil	Timber
Manufacturing and Packaging	Made form crude oil by fractional distillation, then cracking and polymerisation, high energy process. Little waste as other fractions are used for other things	Made by pulping timber. Lots of waste, high energy process
Use of product	Has multiple uses, can be reused	Usually only used once
Disposal	Can be recycled but are not biodegradable	Can be recycled and are biodegradable

Key Terms	Definitions
LCA	An evaluation of the environmental impact a product had over its lifetime

Box 6 - Recycling

Many of the Earth's resources are finite: for example, metals and crude oil. It is therefore vital we recycle resources. The processes for extracting these materials are often high energy and damaging to the environment.

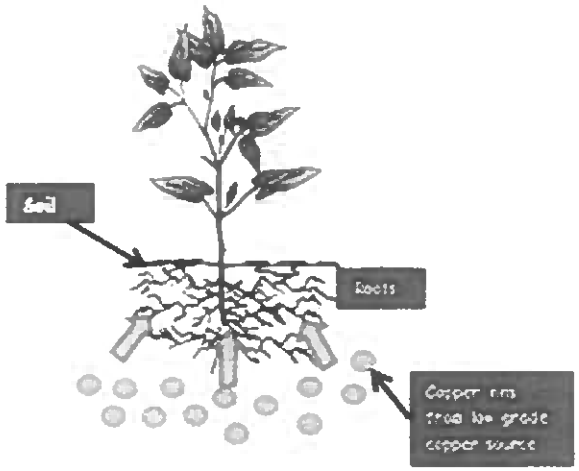
Metals can be recycled by melting and **recasting or reforming** into different products.

Some products, such as glass bottles, can be reused. Glass bottles can be **crushed and melted** to make different glass products. Other products cannot be reused and so are recycled for a different use.

Box 4 - Higher tier: Other methods of copper extraction

There are new methods to extract copper from low grade ores. These are:

Phytomining uses plants to absorb copper from the soil, the plants are then burnt and the copper extracted from the ashes.



Bioleaching involves using bacteria to make a **leachate** that contains metal compounds. Scrap iron can also be used to **displace copper** from a solution. These methods do not require large scale removal of waste rock, like in other extraction processes.

Y11 Physics Knowledge Organiser – Forces II

Box 1 - Speed
Speed is a scalar quantity. It does not involved a direction. The speed of a moving object is rarely constant. The speed a person walks runs or cycles at depends on many factors including age, terrain, fitness and distance travelled.
Typical speeds:
- Walking - ~ 1.5m/s
- Running - ~3.0m/s
- Cycling -~6.0m/s
- Speed of sound in air - ~330m/s

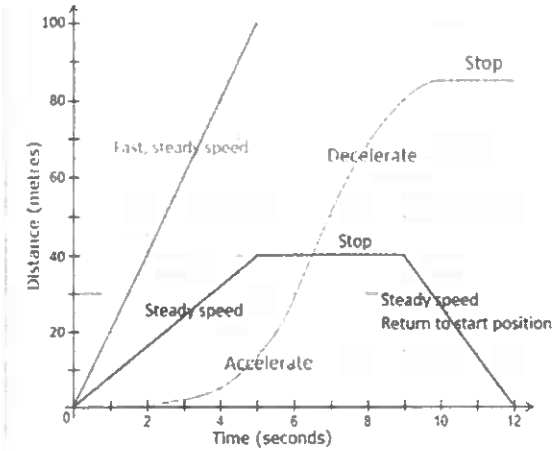
Box 2 - Velocity
Velocity a vector quantity. It is the speed in a given direction, so we can show velocity with an arrow.

Box 3 - Acceleration
Acceleration is the measure of how quickly velocity changes. It is a vector quantity, because direction is included. Acceleration occurs if there is a change of speed and/or a change of direction. Acceleration can be calculated.

Box 4 - Distance-time Graphs

A distance-time (DT) graph shows how far an object has gone from its starting point at a certain time.

Finding the speed of the object = Calculating the gradient (steepness of the slope) tells you the speed of the object.

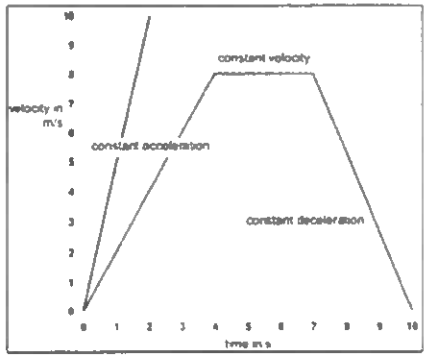


Box 4 - Velocity-time Graphs

A velocity-time (VT) graph shows the velocity of an object at any particular time on its journey.

Finding the acceleration of the object = Calculating the gradient of a slope.

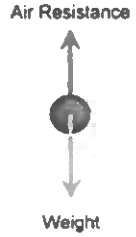
Finding the distance travelled by the object = Calculating the area under the graph.



Key Terms	Definitions
Velocity	Velocity is a vector quantity. Like speed, it is a measure of how quickly distance changes BUT it includes the direction of movement. It is measured in m/s
Gradient	Gradient means slope. The gradient of a line on a graph is found by dividing the vertical (y-axis) change by the horizontal (x-axis) change.
Acceleration	Acceleration is the rate of change in velocity. You must recall that objects in freefall near Earth's surface have an acceleration of 9.8 m/s^2.
Deceleration	A **negative** acceleration – slowing down.

Equation	Meanings of terms in equation and units
$s = vt$	***Distance = Speed x time*** *s = distance (m)* *v = speed (m/s)* *t = time (s)*
$a = \frac{v-u}{t}$	**Acceleration =Final velocity-initial velocity (change in velocity)** **Time taken** *v = final velocity (m/s)* *u = initial (starting) velocity (m/s)* *a = acceleration (m/s^2)* *t=time*

Box 5 - Freefall through a fluid (gas, like air, or a liquid)
A freefalling object initially accelerates due to gravity, but friction (/air resistance) increases with speed until the forces are balanced (resultant force = 0 N). Then, the object is falling at a constant speed called its **terminal velocity.**



Box 6 – Circular motion – Higher tier only
An object that is moving in a circle can have a constant speed, but a constantly changing velocity. This is because even if speed is the same, the object constantly changes direction.

Y11 Physics Knowledge Organiser - Forces II

Box 7- Newton's First Law

Newton's First Law
The law says that if the resultant force on an object is zero:
- Stationary objects stay stationary
- Moving objects keep moving at the same velocity (same speed and direction)

Newton's first law tells us:
- Objects moving at a constant speed in the same direction have a driving (push) force exactly equal to the resistive forces (like friction);
- Velocity (speed and direction) will only change if there is a resultant force acting (so the resultant force is NOT zero).
- If an object changes direction, it must have a resultant force acting upon it (i.e. the resultant force is not zero).

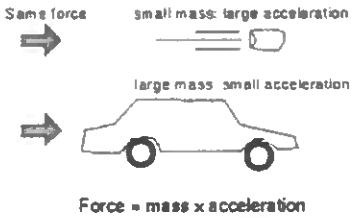
Box 8 - Newton's Second Law

Objects accelerate if there is a resultant force acting on them. The amount of acceleration is proportional to the magnitude of the resultant force and inversely proportional to the mass of the object. (see equation)

This means that when the resultant force on an object increases, the acceleration will increase by the same proportion. E.g. Double the resultant force and the acceleration will double.

When the mass of an object increases, the acceleration of the object decreases.

Newton's second law is summarised by the equation F=ma



Box 9 - HT only: Inertial mass

Inertial mass measures how difficult it is to change the velocity of an object. It is defined as the ratio of force over acceleration.

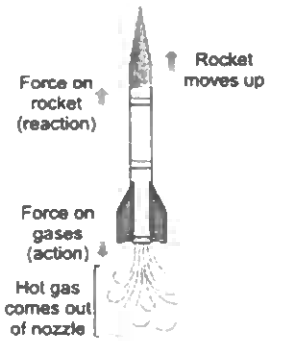
For instance, it requires more force to slow down (change the velocity) a lorry compared to a bike. It also requires more force to make a lorry accelerate compared to a car.

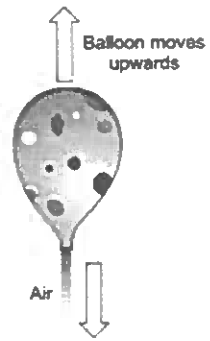
Key Terms	Definitions
Stationary	Not moving. The velocity is 0.
Newton's First Law	The law says that if the resultant force on an object is zero: ➢ Stationary objects stay stationary ➢ Moving objects keep moving at the same velocity (same speed and direction)
HT inertia	Inertia is the tendency of objects to continue in their state of rest or of uniform motion (.i.e. remain stationary or keep moving at a constant speed)
Equation	**Meanings of terms in equation and units**
F=ma	*F = resultant force (N)* *m = mass (kg)* *a = acceleration (m/s^2)*

Box 10 - Newton's Third Law

This law says that when objects interact, the forces they cause to act on each other are equal and opposite.
This law is often written as: 'for every action, there is an equal and opposite reaction'. In this version, action means the force exerted by object A on object B, and reaction means the force exerted by object B on object A.

This law explains why pushing **down** with your legs makes you jump **up** (the ground pushes back with the same size force as your push). It also explains why rockets can fly through space: the gases pushing out the back cause the rocket to move forward.





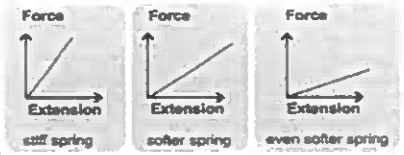
Y11 Physics Knowledge Organiser Topic - Forces II

Box 11 Forces and Elasticity

Elastic objects are objects that return to their original shape when a deforming force is removed.
Elastic potential store is the energy stored by an object that is under **elastic deformation**. Think of a stretched rubber band – it isn't doing anything, but if you release it the stored energy is transferred to kinetic store, so you can fire it at someone.

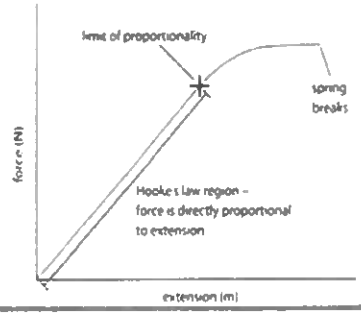
Box 12 - Force and Extension/Compression

The extension of an elastic object, like a spring, is directly proportional to the force applied to it, provided the limit of proportionality of the spring is not exceeded. This also works with the compression of an object –'*e*' just means the amount of compression.
The **spring constant** measures how much extension you get for your force. A large spring constant means it won't stretch far compared to a spring with a small spring constant, if the same force is applied (see examples above). The spring constant can be calculated from the gradient of a graph of force against extension.



When force is applied to a spring, it moves a distance, so **work is done.** In other words, energy is transferred. The energy gets stored in the spring (or elastic object) in the **elastic potential store (E_e)**. The amount of elastic potential energy is calculated by the equation shown on the right. If an object has been elastically deformed, the work done on the object and the energy store by the object are the same.

Box 13 – Limit of Proportionality
On graph showing force against extension, you can see when the limit of proportionality is reached by looking at where the graph starts to curve. (Labelled x on this example).



Key Terms	Definitions
Elastic deformation	Deformation (bending, stretching or compressing an object) is elastic if the object returns to its original shape once the force is removed
Deformation	Bending, stretching or compressing an object
Extension	The change in length of an object such as a spring. Subtract length when NO force is applied from the length when a force is applied.
Directly proportional	This term describes a type of relationship between two variables. It is shown by a straight line on a graph that goes through the origin.
Limit of proportionality	The limit of a directly proportional relationship. It can be shown on a graph if the line is straight to being with (indicating a directly proportional relationship) then curves.
Linear relationship	Simply, a relationship between two variables that is graphed as a straight line.
Non-linear relationship	A relationship between two variables that is shown with a curved line on a graph.
Gradient	The gradient of a graph is how steep it is. Calculate gradient by dividing the change in the variable on the y-axis by the change in the variable on the x-axis.

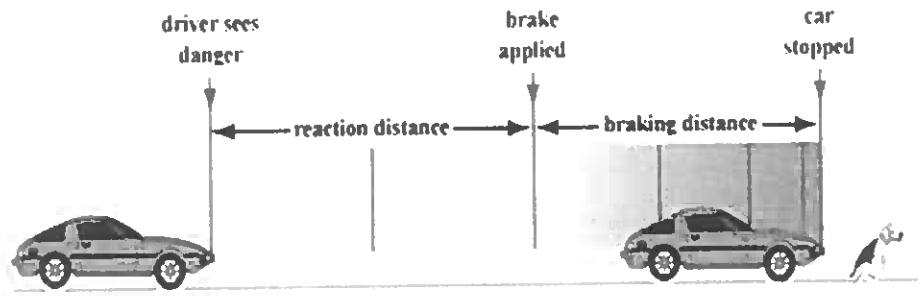
Equation	Meanings of terms in equation
F=ke	*F = force (newtons, N)* *k = spring constant (newtons per metre, N/m)* *e = extension (metres, m)*
$E_e = 0.5ke^2$	*E_e = elastic potential energy (joules, J)* *k = spring constant (newtons per metre, N/m)* *e = extension (metres, m) – this is **squared** in this equation*

Y11 Physics Knowledge Organiser Topic - Forces II

Box 14 - Forces and Braking

.The **stopping distance** of a vehicle depends on two factors, which add up to make the stopping distance. These are the **thinking distance** (distance travelled while the driver reacts also called reaction distance) and the **braking distance** (distance travelled under the braking force).

Stopping distance = Thinking distance + braking distance.



For a particular braking force, the greater the speed of the vehicle, the greater the stopping distance. This is because going from a higher speed to 0 m/s is a bigger change in speed than going from a lower speed to 0 m/s. The thinking distance is longer at a higher speed.
Typical reaction times vary from 0.4 s to 0.9 s.

Different factors affect the thinking and braking distances – these are shown in the table below. Speed is a factor that affects both the thinking distance and the braking distance.

Thinking Distance	Braking Distance
Intoxication (consumption of alcohol or drugs)	**The condition of the vehicle** (worn tyres or poor brakes)
Distractions (e.g. using a mobile phone)	**The condition of the road and weather** (e.g. a wet or icy road)
Tiredness (Reaction times increase when tired)	**The mass of the vehicle** (A heavy vehicle takes longer to stop)

Key Terms	Definitions
Stopping distance	The distance a vehicle travels after the driver spots a danger and decides to stop. It is the sum of the thinking distance and braking distance.
Thinking distance	Distance travelled during a driver's reaction time.
Braking distance	Distance travelled while the driver is applying the brake (i.e. distance travelled under the braking force).
Kinetic energy	The form of energy of any moving object. Since the equation uses speed, not velocity, this is a scalar quantity.
Thermal energy	The form of energy associated with heat. The thermal energy of an object is proportional to its temperature.
System	An object or group of object, and its/their interactions.
Conservation of energy	A fundamental concept in physics. In a system, total energy is always conserved (it cannot be created or destroyed). However, it can be transferred from one store of energy to another.
Equation	**Meanings of terms in equation and units**
$E_p=mgh$	E_p = *gravitational potential energy (joules, J)* m = *mass (kg)* g = *gravitational field strength (newtons per kilogram, N/kg)* h = *height (metres, m)*
$E_k=0.5\ m\ v^2$	E_k = *kinetic energy (joules, J)* m = *mass (kg)* v = *speed (m/s) – this is **squared** in this equation*

Box 15 - Braking Force and Work Done

When force is applied to the brakes, work is done by the friction force between the brake pads and the wheel. The **kinetic energy** of the vehicle is transferred to **thermal energy** – this is why brakes get hot.

To stop a vehicle in a certain distance, the faster the vehicle the larger the force needed, since a larger deceleration is needed ($F = ma$ again). However, this can lead to overheating of the brakes and/or loss of control of the vehicle.

Y11 Physics Knowledge Organiser
Topic : Forces II - All Higher tier only

Box 16 - Momentum – Higher tier only

Momentum is a property that any moving object has. It is defined as the product of mass and velocity of the object. so if the velocity is 0 m/s (stationary), the momentum is also 0.

Momentum = Mass x Velocity

Since momentum is calculated using **velocity**, which has a direction, momentum is a vector quantity. Just like with velocity, you can show the momentum of objects moving in opposite directions by using a '+' sign for one of them and a '–' sign for the other.

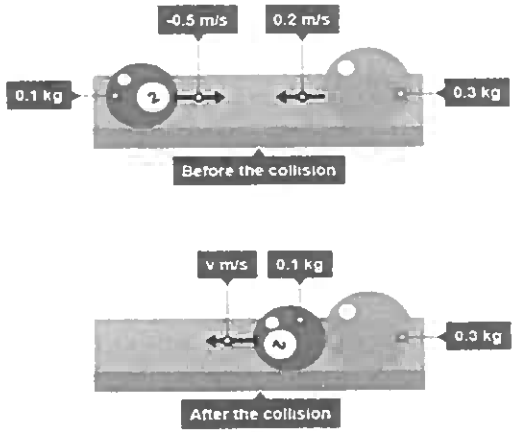
Box 17 - Conservation of Momentum – Higher tier only

Momentum is a property that is conserved in closed systems. Momentum is conserved in collisions , when objects push away from each other and in explosions.
This means the total momentum before an event is exactly equal to the total momentum after the event. This is called **conservation of momentum**.

Conservation of Momentum in a Collision

Look at the diagram far right. The '2' ball has a negative velocity because it is moving in the opposite direction of the other ball. The total momentum before they collide = (0.1 x -0.5) + (0.2 x 0.3) = 0.01 kg m/s. According to the rule of conservation of momentum, the total momentum after the collision is also 0.01 kg m/s. Also, by looking at the diagram, you can see that both balls are now moving to the left, together. The total mass is 0.1 + 0.3 = 0.4 kg.

Rearranging to make velocity the subject, $v = \frac{p}{m}$,
v = 0.01/0.4 = 0.025 m/s is the velocity after the collision.



Key Terms	Definitions
Momentum	A property of any moving object, Momentum = Mass x velocity. Measured in kg m/s.
System	Systems are how physicists divide up the universe. Systems involve an object or objects and their interactions. They can be very simple (e.g. a falling object) or very complicated (e.g. our whole galaxy).
Closed system	A system where objects are not thought to be affected by external forces or other objects outside the system. We only think about the objects inside the system, which means the quantities *momentum* and *energy* are **conserved**.
Conservation	Simply means 'keeping the same.' To add detail, conservation of a quantity means that the total amount of it is the same before and after an event. In any closed system, the total amount of energy and momentum before and after an event is equal.

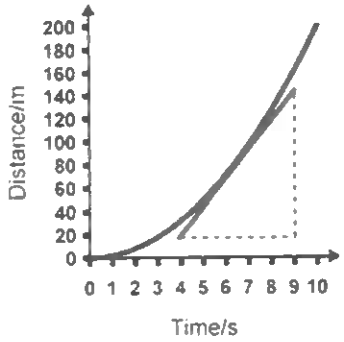
Equation	Meanings of terms in equation and units
p=mv	*p = momentum (kilogram metres per second, kg m/s)* *m = mass (kg)* *v = velocity (m/s)*

Y11 Physics Knowledge Organiser
Topic : Forces II - All higher tier

Box 18 - Using tangents on Distance-Time and Velocity-time graphs

Distance-Time graphs - To be able to calculate the speed at a particular point, draw a tangent on the graph and calculate the gradient of the tangent line.

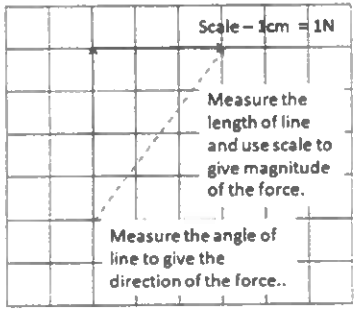
Speed at 7s =
y = distance = 120m
x = time = 5s

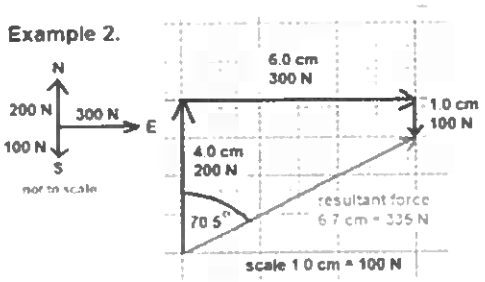


Velocity-time graphs – To be able to calculate the acceleration at a particular time, draw a tangent line on the graph and calculate the gradient.

Box 19 – Resolving forces

- The resultant force is easy to calculate where the individual forces are in the same plane (i.e. individual forces are all horizontal or all vertical): add the forces up, considering the signs of the forces – See section 1, Box 2
- Example 1 and example 2 – The force arrows are drawn tail to tip. The shape is completed by the resultant force (dotted arrow in example on the left and and pink arrow in example 2 on the right)

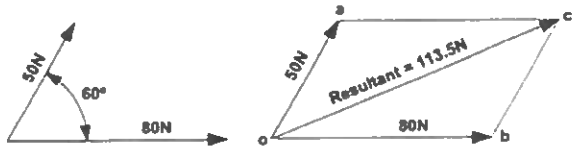




Key terms	Definitions
tangent	A straight line that touches a curve at only one point; tangents tell you the gradient of a curved graph at a particular coordinate
vector	A quantity with both a size (magnitude) and a direction; vectors can be represented with arrows.
force	An interaction between two objects that leads to the objects pushing or pulling on one another
resultant force	The single overall force acting on an object, which has the same effect as all the individual forces combined. Resultant force is the sum of the individual forces.
parallelogram	A quadrilateral with two sets of parallel sides (including rectangles!)
resolve	To carry out the process of splitting a force vector that acts at an angle into vertical and horizontal components

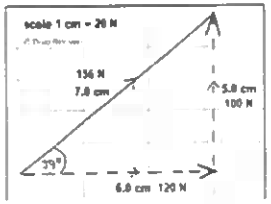
Box 20 – Resolving forces

- If the individual forces are at any angle to each other besides 180°, the **parallelogram rule** is useful: draw a parallelogram using the force arrows; the resultant force is the **diagonal** of that parallelogram.



Parallelogram of Forces

- You can also go the other way: if a resultant force is shown at some angle from the horizontal/vertical, it can be **resolved** into a vertical component and a horizontal component. See example below.



Y11 Physics Knowledge Organiser – Magnetism and Electromagnetism - Magnets and Magnetic Fields

Box 1 - Magnets

Magnets are substances that have a magnetic field. Magnets can be classified as **permanent** or **induced** (temporary).

Permanent magnets: when the magnetic field is always there and doesn't go away.

Induced magnets: are made when a material made of a magnetic metal (iron, nickel or cobalt) is placed in a magnetic field. Induced magnets are always **attracted** to the magnet that turned them into a magnet – this is why you can pick up paper clips or nails with a bar magnet: the paper clip becomes an induced magnet with poles that are aligned so there is a force of attraction. See the poles labelled on the diagram. Induced magnetism is quickly lost when the material is removed from the magnetic field that induced it.

The ends of a magnet are called the **poles** and this is where the magnetic forces are strongest. This is because the magnetic field lines are *most concentrated* at the poles, as you can see on the diagram to the right.

Magnets exert forces on one another when they are brought together – these forces are **non-contact** forces.

- When like (the same) poles (N-N or S-S) are brought together, the force is of repulsion (pushing away).
- When unlike (not the same) poles are brought together (N-S), the force is of attraction (pulling together).

Box 2 - Magnetic fields

Magnetic fields are around all magnets (permanent or induced). The **direction** of the magnetic, as the diagram shows, is from **north** to **south**. The north pole of a magnet is properly defined as: *the pole that causes a force **away** from it, if a north pole is placed at that end.*

Remember that like poles repel. So you can decide which end in north on an 'unknown magnet' by looking at the direction of the force that acts if a north pole (on another magnet) is brought to one end of your magnet. Repulsion (force away) means that end must be a north pole.

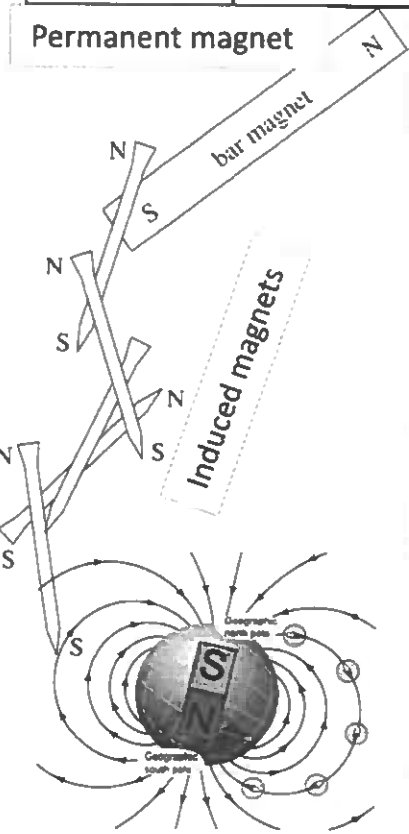
Sometimes the north pole is called the **north seeking pole**, because it will point north on Earth if left freely suspended. The south pole is also called the **south seeking pole**.

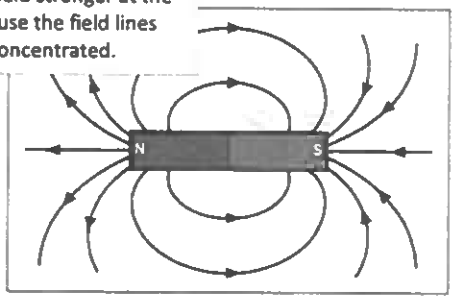
Magnetic fields are *strongest* at the poles and get weaker as the distance from the magnet increases. Using a **magnetic compass** (sometimes called a plotting compass), we can find out the direction of a magnetic field – the diagram shows how to do this.

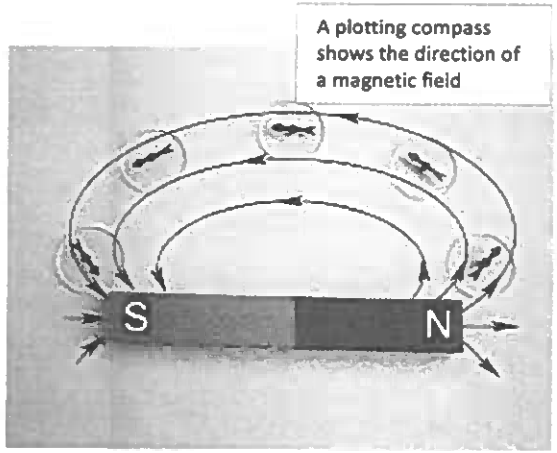
The diagrams opposite show the magnetic field pattern of a bar magnet, showing the direction and strength of the force. The diagram below shows how a plotting compass can be used to identify the magnetic field around a bar magnet. Placing the compass within the magnetic field causes the needle to align with the field. Pencil dots show the position of the compass N and S points, and the compass is moved along, and the process repeated.

Earth has a **magnetic field**. Using a compass, you can tell that the magnetic field points towards the north pole, so this actually means that the geographic north pole of Earth is a south pole of a magnet! See diagram.

Key Terms	Definitions
Permanent magnet	A magnet that always has its own magnetic field. Attracts magnetic materials, and can attract or repel other magnets.
Induced magnet	A temporary magnet: make one by putting a suitable material in a magnetic field.
Poles	The ends of a magnet. Named north and south, based on which way on Earth they'd point if suspended freely. The other name is 'north seeking' or 'south seeking' as a result.
Magnetic field	The region around a magnet where a force acts on other magnets or on magnetic materials. (3D, unlike diagrams usually show)
Magnetic compass	A small bar magnet balanced on a pin so it can spin around. Points towards Earth's magnetic north due to Earth's magnetic field, but can also be used to find the direction of a magnetic field for another magnet.







Y11 Physics Knowledge Organiser – Magnetism and Electromagnetism: Magnets and Magnetic Fields

Box 3 - Electromagnetism – current and magnetic fields

A wire that is carrying a current has a magnetic field around it. No current means no magnetic field; when it is switched on a magnetic field is generated. This is how **electromagnets** are made.

Fleming's Right Hand Rule

Diagram A shows the relationship between the current in the wire and the direction of the magnetic field in a straight wire. In a straight wire, the magnetic field is **circular**. The direction of the magnetic field depends on the direction of the current in the wire. Switching the direction of the current switches the direction of the magnetic field. The magnetic field gets stronger the closer to the wire carrying the current – this is shown by the field lines getting closer together (more concentrated).

Increasing the strength of the magnetic field

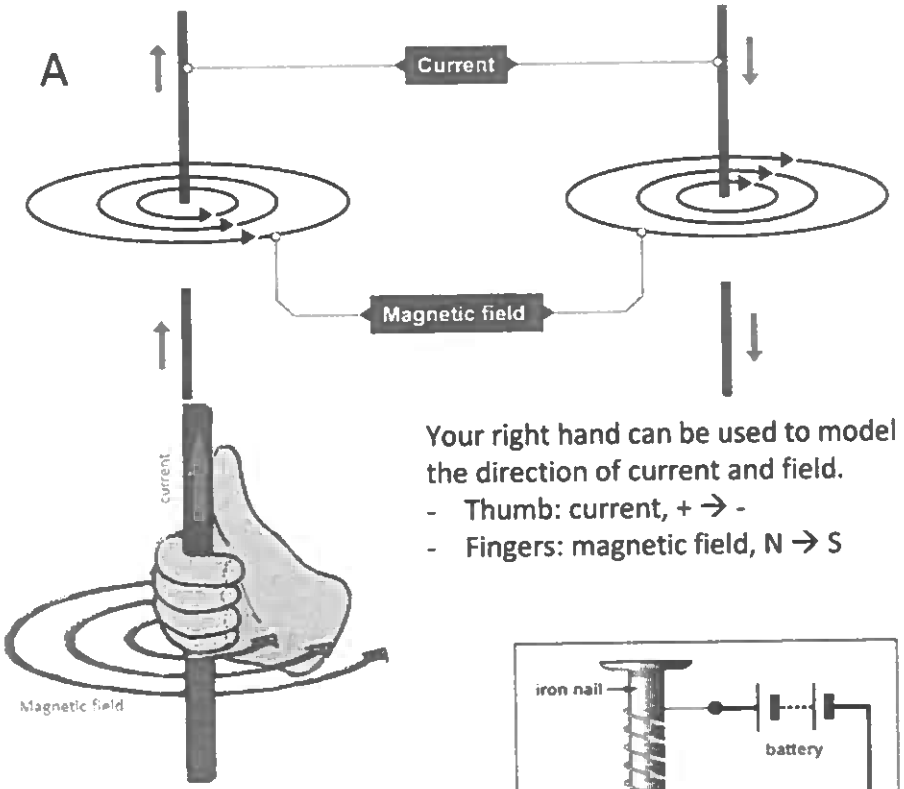
- **increasing the current** increases the strength of the magnetic field.
- **winding the current-carrying wire into a coil** called a **solenoid (diagram B)** - the magnetic field is similar in shape to the magnetic field of a bar magnet – it has a north and south pole, and it strongest at the poles. The magnetic field is also strong *inside* the coil – as the concentrated field lines show.
- putting a magnetic (e.g. iron) **core** in the solenoid – literally a cylinder of iron. This is an **electromagnet** (diagram C)

You can make an electromagnet **stronger** by:

- Increasing the **current** in the wire (probably by increasing the potential difference of the power supply)
- Increasing the **length** of wire in the solenoid – perhaps by adding more turns to the coil of wire.

Key Terms	Definitions
Current	The rate of flow of charges in a circuit. If a current is flowing in a component, charges (e.g. electrons) are flowing through it.
Solenoid	A coil of wire, when current flows the magnetic field is strong and uniform.
Iron core	A piece of iron placed in the middle of a solenoid.
Electromagnet	A coil of wire with an iron core

A

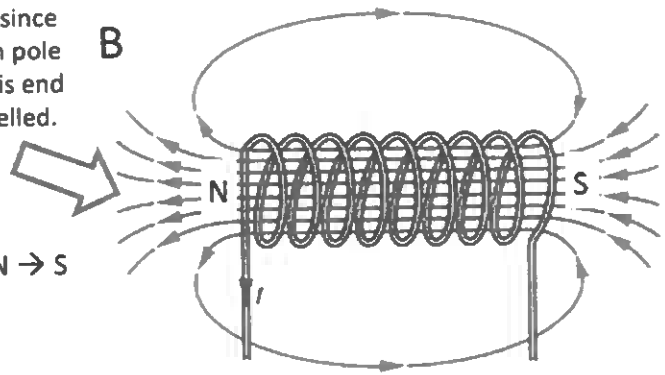


Your right hand can be used to model the direction of current and field.

- Thumb: current, + → -
- Fingers: magnetic field, N → S

A north pole, since another north pole brought to this end would be repelled.

B

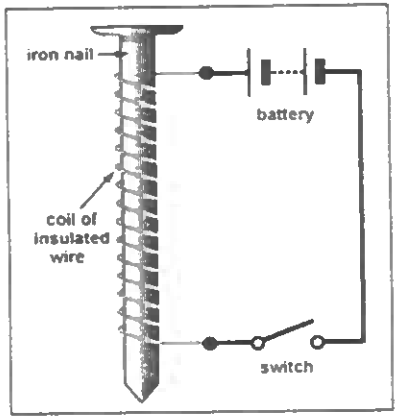


Solenoid

This time the right hand is different:

- Thumb: magnetic field in the coil, N → S
- Fingers: electric current, + → -

C



This practical set up allows us to increase the strength of an electromagnet by increasing the number of coils around the wire and by increasing the current.

Y11 Physics Knowledge Organiser
Electromagnetism (Higher Tier Only Page)

Box 4 - Fleming's left hand rule and the motor effect

If you have a current-carrying wire and a permanent magnet, each have their own magnetic fields. This means that if you put them near each other, they exert a force on each other. This is called **the motor effect**.

You can work out the direction that the force acts if you know the direction of the magnetic field and the direction of the current – we use **Fleming's left hand rule**. Diagram A shows the direction of the Field, Magnetic Field and Current, direct you hand with the values that you position your hand to the know value – be prepared to twist your hand at the wrist to get it right – confirm using the example of the wire cutting through the magnetic field in the diagram – field from N to S with first finger, current with middle finger pointing downwards, meaning force must be out of the page towards you, like the diagram shows.

Now, the size (or *magnitude*) of the force on the conductor (the bit of wire) depends on three factors:

1. The **length** of the wire in the magnetic field, measured in metres
2. The **strength** of the magnetic field (formally, the **magnetic flux density**, in teslas, T)
3. The **size** of the **current** (A, as usual).

As the equation shows, increasing any or all of these factors will increase the size of the force on the conductor, if you need to use this equation in the exam it is found on the equation sheet.

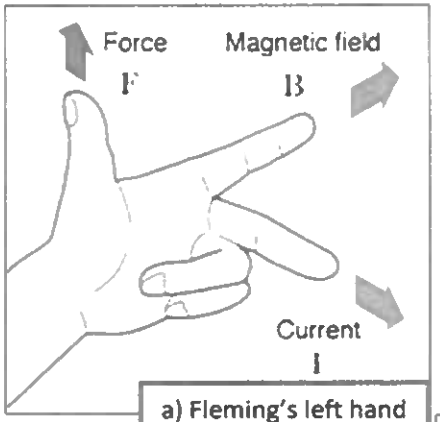
Box 5 - Electric motors

Electric motors make use of the motor effect. A coil of wire carrying a current is placed in a magnetic field; as you know, the magnetic fields interact to exert force on each other. If the coil is set up so it can spin, it most certainly will. In fact, it will spin round and round (**rotate**). This is thanks to the force acting **up** on one side of the coil, and **down** on the other – see the diagram and use Fleming's left hand rule to understand why...

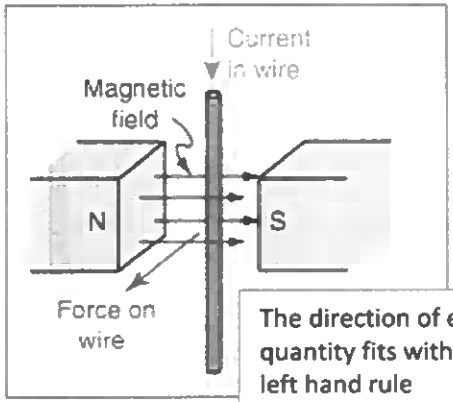
The magnetic field goes from N to S of course, and the arrows on the coil show the direction of the current. So, the left side of the coil has a force **upwards** exerted on it (use the left hand rule). The right side of the coil has a force **downward** exerted on it, so it rotates as shown. The commutator is a ring that has graphite brushes that pass current to the ring, the spinning coil and commutator can move freely as the current passes to the split ring preventing the need for fixed wires which would get tangled. The ring is split into 2, allowing current to flow into the coil rather than flowing to the other side of the ring.

Key Terms	Definitions
Motor effect	The forces exerted on each other by a wire carrying a current and a magnetic field, thanks to the two magnetic fields interacting.
Magnetic flux density	A measure of the strength of a magnetic field – think of it as the number of magnetic field lines going through a set area – see diagram to help explain.
Electric motor	Device that causes rotation of a coil of wire carrying a current when it is placed in a magnetic field.

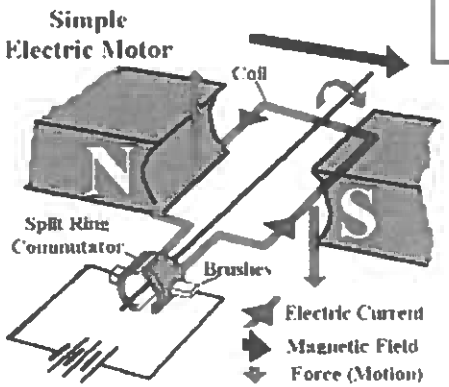
Equation	Meanings of terms in equation
$F = B\,I\,l$	*F = force (newtons, N)* *B = magnetic flux density (tesla, T)* *I = current (amps, A)* *l = length (m)*

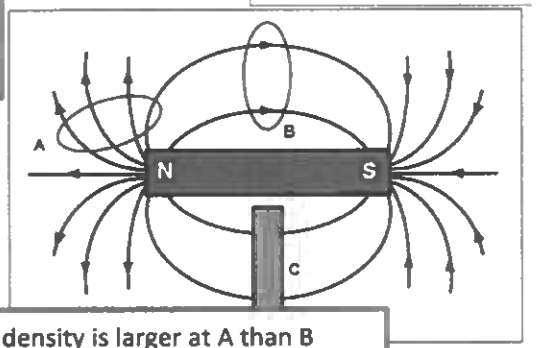


a) Fleming's left hand rule. FBI – easy to remember!



The direction of each quantity fits with the left hand rule





Magnetic flux density is larger at A than B since more magnetic field lines cut through a given area (shown by the oval).

Y11 Physics – Space Topic (Separate Science Only)

Box 1

The Solar System

Our star the sun is orbited by planets, dwarf planets, asteroids and comets. Moons orbit the planets. These are all natural satellites.

The sun was formed from a nebula pulled together by gravity 5 billion years ago.

Order of the Planets
in Our Solar System

1. Mercury
2. Venus
3. Earth
4. Mars
5. Jupiter
6. Saturn
7. Uranus
8. Neptune

Box 2

Life-cycle of a star

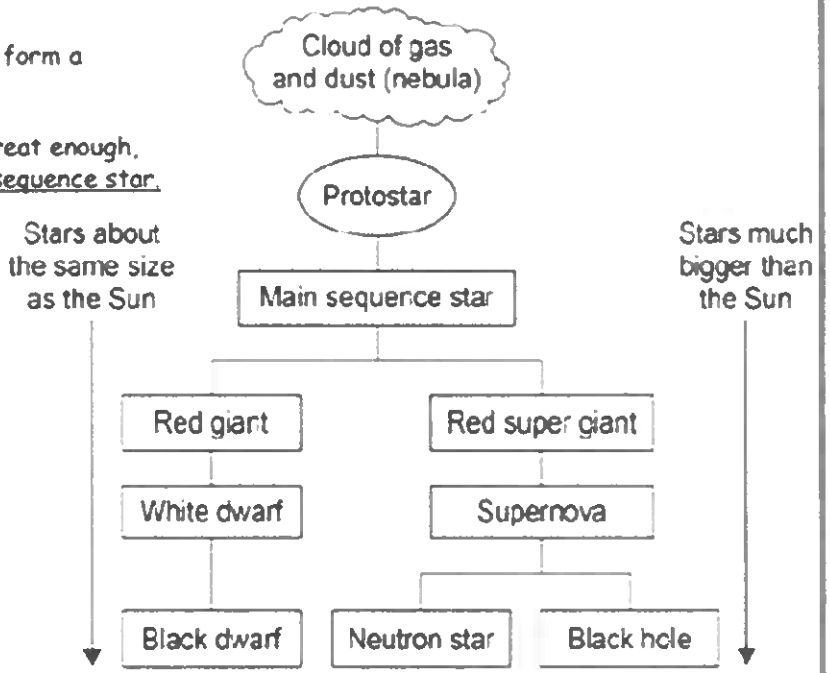
* Gravity pulls dust together in a nebula to form a Protostar.

* When the temperature and pressure is great enough, nuclear fusion begins turning it into a mainsequence star.

* When the hydrogen runs out the star collapses as gravity is greater than the pressure from fusion. Heavier elements start to fuse expanding the star to form a red giant.

* When the heavier elements run out the star becomes either a white dwarf or explodes in a supernova depending on its size.

* The very largest mainsequence stars will eventually become black holes. Slightly smaller stars become neutron stars



Box 3

Making Elements

All elements up to iron are made through the fusion of smaller elements in the cores of stars. The larger and hotter the star the heavier the elements it can fuse.

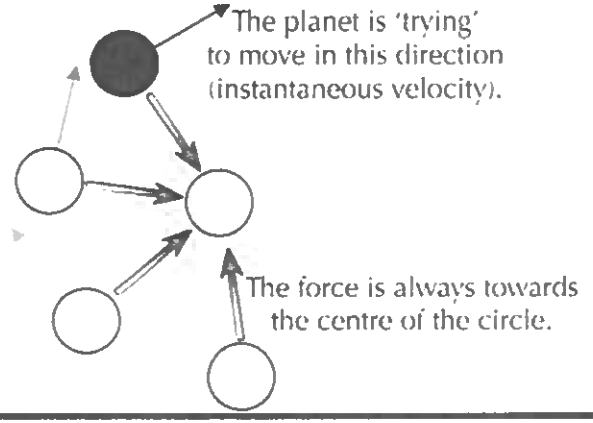
All elements heavier than iron are fused during a supernova explosion. This then distributes these elements across the Universe.

Box 4

Objects in orbit

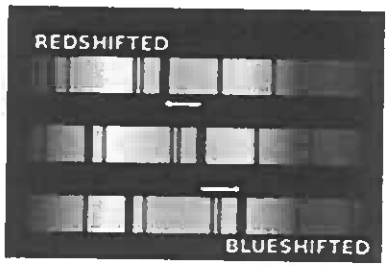
All objects in orbit are accelerating as they are constantly changing direction, however the speed will remain constant. Gravity is the force that causes acceleration, this acts towards the centre of the circle. The instantaneous velocity is at 90 degrees to the force that causes the accerleration.

An object orbiting close to a star or planet experiences a stronger gravitational pull, this means that the object must have a higher speed in order to remain in a stable orbit.



Box 5

Redshift



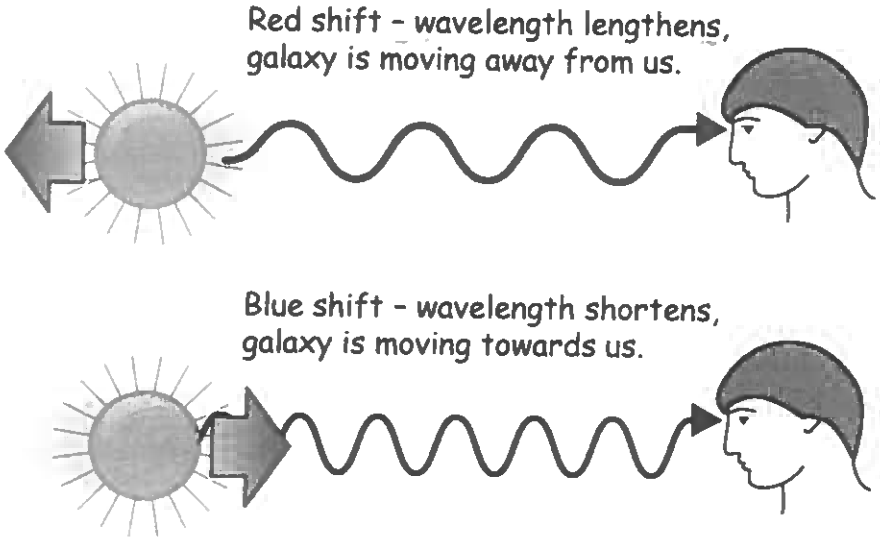
Light from a star or galaxy can be used to produce an absorption spectrum. This includes absorption lines, Which indicate the elements present.

If a star or galaxy is moving towards us then the light from it shows a blueshift

If the star or galaxy is moving away from us then it shows a red-shift.
ALL GALAXIES SHOW RED-SHIFT

The further away a galaxy is the faster it is moving away from us. We know this as it shows more redshift.

This proves that the universe is EXPANDING, this provides evidence for the BIG BANG theory.



Box 6

The Big Bang theory

The Big Bang Theory suggests that the Universe started with a very small hot, dense region and has been expanding ever since.

This is supported by evidence from the red-shift of galaxies, observations of certain types of supernova and CMBR.

Cosmic Microwave Background Radiation (CMBR) is the left over radiation from the Big Bang and provides further evidence for the theory.

Evidence

Measurements have shown that the expansion of the Universe is increasing in speed.

Theories about Dark Mass and Dark Energy help to explain these observations, however more evidence is needed to confirm these ideas.

Key Terms	Definitions
Instantaneous velocity	Velocity at a single moment (remember it is vector quantity, with both direction and magnitude).
Red shift	The observed increase in wavelength of light emitted by objects moving away (receding) from an observer.
Big Bang theory	The theory, which is by far the dominant scientific theory for the origin of the universe, that states that the whole universe was once tiny and very hot and dense.
Recessional velocity	How fast something (like a galaxy) is moving away from an observer.
Dark matter	Aka dark mass. A mysterious type of matter that is known to exist (from observations of other galaxies), but no-one knows what it is made of.
Dark energy	The name given to the mysterious energy driving the acceleration in the expansion of the universe.

Year 11 Short course RE Paper One –Buddhist belief and teaching

Key terms:

Theravada	**Oldest form of Buddhism, found in southern Asia**
Mahayana	**Found in Tibet, China, Taiwan, Japan, Korea, and Mongolia. Mahayana Buddhism is not a single group but a collection of Buddhist traditions: Zen Buddhism, Pure Land Buddhism, and Tibetan Buddhism**
Pure Land	**Mostly found in Japan – a form of Mahayana Buddhism. Based on faith in Amitabha**
Bodhisattva	**An enlightened person who chooses to remain in samsara to teach others**
Arhat	**A 'perfected person' who has overcome the main sources of suffering**
Five Aggregates (Skandha)	**Theravada Buddhists are taught that the human personality is made up of five parts**
Sunyata	**Mahayana Buddhism0 This means 'emptiness'.**
Six perfections	**The practices/characteristics of a Bodhisattva**

KPI 8- To analyse the different features and beliefs amongst schools in Buddhism

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Theravada	**Mahayana**
Theravada Buddhists are taught that the human personality is made up of five parts- **Five Aggregates/ Skandha's** **Form, Sensation, Perception, Mental formation and Consciousness**	**Sunyata** - This means **'emptiness'**. This idea can be understood as meaning that everything depends upon something else. All things lack an intrinsic nature. Basically, everything is empty. Sunyata can be understood as being very similar to **anatta** (one of the Three Marks of Existence).
In Theravada Buddhism, a person who has achieved **nibbana** is known as an **arhat**. A Buddhist who has taken this path will follow the Noble Eightfold Path. They may also join a Buddhist community in order to focus their attention on achieving enlightenment with others who are on the same path.	**Everyone can achieve enlightenment.** Mahayana Buddhists believe that all humans have the nature of the Buddha within them already. **Buddha Nature**
Theravada Buddhism teaches that the ideal Buddhist is an **Arhat** (a 'perfected person'). An Arhat has become free from the three poisons (ignorance, greed and hatred) and will not be reborn when they die. A person becomes and Arhat by following the **Eightfold Path**	Mahayana Buddhism teaches that the ideal Buddhist is a **Bodhisattva**. Bodhisattvas choose to **remain in samsara** to help others become enlightened. A person becomes a bodhisattva by developing the **Six Perfections.**
	Pure Land Buddhists believe it is impossible to become enlightened in this realm and so aim to be reborn into the Pure Land to be taught by Amitabha Buddha. Their main practice is chanting **Amitabha** Buddha's name

KPI6- Explain Buddhist teachings on how to end suffering

The path end suffering is the Middle Way and consists of eight practices (**the Eightfold Path**) that are sometimes grouped into three sections (the Threefold Way).

Ethics- right speech, action, livelihood

Meditation- right effort, mindfulness, concentration

Wisdom- right understanding, intention

KPI7- To describe the different schools in Buddhism

Theravada

Known as the 'lesser vehicle' as only male monks achieve enlightenment.

Oldest form of Buddhism, found in southern Asia

Mahayana

Known as the 'greater vehicle' as anyone can become enlightened.

Teaches sunyata or emptiness – nothing as a separate soul or self

Pure Land

Mostly found in Japan – a form of Mahayana Buddhism.

Based on faith in Amitabha Buddha and his paradise

KPI9- To Explain the importance of the Six perfections

"However innumerable sentient beings are; I vow to save them." Bodhisattva vow

The six perfections give guidelines as a structure for how to live a good life and behave in a morally good way.

Generosity

Morality

Patience

Energy

Meditation

Year 11 RE Short course and Full course Paper 2- Theme D: Religion, Peace and Conflict

Forgiveness	Pardoning someone for wrongdoing	**Peace-making**	Working toward bringing about an end to war and a state of peace
Greed	Going to war to gain land or natural resources such as oil	**Protest**	A public expression of disapproval, often in a big group, can be peaceful or violent
Holy War	A war that is fought for religious reasons, usually backed by a religious leader	**Quakers**	A Christians denomination who worship in silence and are well known pacifists
Just War	A Christian theory that asks whether a war is fought justly	**Reconciliation**	Restoring friendly relationships after a war or conflict
Justice	Bringing about what is right and fair, according to the law or God's will	**Retaliation**	Deliberately harming someone as a response to them harming you
Nuclear Weapon	A weapon using a nuclear reaction to cause massive damage	**Self-Defence**	Protecting yourself or others from harm
Pacifism	A belief that all forms of violence are wrong, commonly held by Quakers	**Terrorism**	Using violence in order to further a political or religious message
Peace	A state of happiness and harmony, an absence of war	**WMD**	Weapons of mass destruction: chemical, nuclear or biological weapons

KPI 1 Terrorism

Examples of terrorism include suicide bombing, mass shootings or using vehicles to injure pedestrians.

The aim of terrorism is to make society aware of a cause or issue and to make people frightened to go about their business.

Christians don't promote political violence + believe terrorism is wrong as it targets innocent people

KPI 5 Nuclear weapons work by a nuclear reaction and devastate huge areas and kill large numbers of people.

- They are a type of WMD (weapons of mass destruction) which also includes chemical and biological weapons.
- All these weapons are not allowed under the Christian Just War Theory and would therefore be rejected by most Christians.
- Some people say their use was justified as it prevented more suffering even though 140,000 people died. Although some Christians justify war with 'an eye for an eye', this cannot be used to justify the use of weapons of mass destruction as they are not a proportionate response.

KPI 2 Protests

The right to gather together and protest is a fundamental democratic **freedom**.

UK law allows for peaceful public protest but sometimes protects can turn violent and become a **riot**.

Christians often **protest unjust laws** or for other forms of justice but would rarely advocate the use of violence in protest.

KPI 4 Just war theory

Just War Theory is a Christian moral theory for working out if a war meets internationally accepted criteria for fairness.

Christian theologians like Augustine and later, Thomas Aquinas came up with a list of conditions which MUST be met before a Christian could fight in a war.

•Jus ad bellum: the conditions under which the use of military force is justified

.•Jus in bello: how to conduct a war in an ethical manner.

These are some of the conditions that must be met in order for a war to be just:

- Just Cause – fought in self-defence or to protect others
- Just Intention – fought to promote good and defeat wrongdoing

KPI 3

Reasons for war

Greed

To gain more land or to control important resources such as oil or gas.

Self-Defence

To defend one's country against invasion or attack or to protect allies who are under attack

Retaliation

To fight against a country that has done something very wrong **or to fight against a country that has attacked you**

Year 11 RE Short course and Full course Paper 2- Theme D: Religion, Peace and Conflict

Essential Texts to learn for the Exam:

In the Old Testament, people are sometimes commanded by God to go to war. In Deuteronomy, Joshua and Judges, God often tells his people to fight and destroy foreign tribes to gain the Promised Land (Israel).	In the New testament Jesus showed a DIFFERENT image of God as one who forgives and Loves all human beings:
•"The lord your God will drive out those nations before you." Deuteronomy 7:22-24 The Old Testament Prophet, Joel, tells the people that God wants them to go and fight,	"While he was still a long way from home his father saw him" (The Lost Son story) Luke 15: God is waiting to forgive us
• "Prepare for war! Rouse the warriors! Let all the fighting men drawn near and attack." Joel 3:9-10	"Blessed are the Peacemakers"
•"The Lord is a warrior." Exodus 15:3	"Those who live by the sword, will die by the sword" (Matthew 26:)
•"There is a time for killing, and a time for healing, a time for war, and a time for peace." Ecclesiastes 3:2-8	'Do not take revenge on those who wrong you' Matthew 5
	"Love Your Enemies and pray for those who persecute you" Matthew 5

Buddhism: As a pacifist religion there are many key quotes which could be used:

"It's better to conquer yourself than to win a thousand battles. Then victory is yours" The Buddha

"In the war of the ego the loser always wins"

"War ends only when people love each other"

1st Moral precept "Do not Harm"

KPI 6

Holy Wars: A Holy War is a war which is fought for religious reasons, often with the backing of religious leaders.

- An example of this was the Crusades fought from the 11th-14th Century by Christians, backed by the Pope.
- Religion can still be a cause for war today such as in Northern Ireland where Protestant and Catholic Christians fought a civil war between 1968-98.

KPI7

Pacifism: Pacifists reject all violence. They do not think that conflict should be dealt with by resorting to war.

- They think that other peaceful methods should be used.
- The early Christian communities were all Pacifist as they followed Jesus' teachings on Non-Violence. "Those who live by the sword will die by the sword"
- Famous Pacifists today such as Martin Luther King Jr and Mahatma Gandhi are examples of non-violence in action.
- Buddhism is a religion of non-violence. The first of the five moral precepts is Ahimsa which means first cause no harm to anyone or anything.
- Pacifism is the idea that all forms of violence are wrong. Pacifists such as Quakers refuse to take part in war and often choose to be a conscientious objector (someone who doesn't go to war for moral reasons) or to assist in medical tasks like ambulance driving.
- Christians try to follow Jesus' teaching that "blessed are the peacemakers"

KPI8

Responses to war:

- Christians try to show mercy and agape to victims of war and provide them with assistance.
- This can be through charity or through welcoming them into their churches. It can be victims in their own country or refugees such as people fleeing from Syria or Yemen.
- This is an example of 'love your neighbour' in action.
- Many Christian charities work around the world in countries affected by war. CAFOD (Catholic Agency for Overseas Development) is an example of a Christian charity that helps people and refugees in countries affected by war and natural disasters.

PCSHEYear 11 Topic 3: Health Choices and Independence

KPI 1 – Wellbeing

Stress: A state of mental or emotional strain or tension resulting from adverse or demanding circumstances.

Some stress is good as it can motivate people however too much can be detrimental, especially if over a long period of time.

Top tips for dealing with exam stress:

1. Always take a moment just to breathe, whether in the exam, before or after.
2. Remember that school does offer support, just reach out and ask!
3. Keep your work balanced. Spend time revising but socialise and relax too.
4. Keep a self-care routine so that your revision is the most productive it can be whilst you feel as good as possible.
5. Break up revision with food and exercise to make sure you stay energised.
6. Remember that results do not define you.
7. Find a revision space and style that works for you
8. Work to your own pace – everyone is different in how they work.
9. If you feel nervous about the time pressure of an exam, practice timing yourself when you revise, or try some test papers.
10. Plan in some treats to reward yourself and celebrate when it's all over!

Importance of exercise:

Exercise increases your overall health and your sense of well-being, which puts more pep in your step every day. But exercise also has some direct stress-busting benefits.

- **It pumps up your endorphins.** Physical activity may help bump up the production of your brain's feel-good neurotransmitters, called endorphins. Although this function is often referred to as a runner's high, any aerobic activity, such as a rousing game of tennis or a nature hike, can contribute to this same feeling.
- **It reduces negative effects of stress.** Exercise can provide stress relief for your body while imitating effects of stress, such as the flight or fight response, and helping your body and its systems practice working together through those effects. This can also lead to positive effects in your body—including your cardiovascular, digestive and immune systems—by helping protect your body from harmful effects of stress.
- **It's meditation in motion.** After a fast-paced game of racquetball, a long walk or run, or several laps in the pool, you may often find that you've forgotten the day's irritations and concentrated only on your body's movements.
- As you begin to regularly shed your daily tensions through movement and physical activity, you may find that this focus on a single task, and the resulting energy and optimism, can help you stay calm, clear and focused in everything you do.
- **It improves your mood.** Regular exercise can increase self-confidence, improve your mood, help you relax, and lower symptoms of mild depression and anxiety. Exercise can also improve your sleep, which is often disrupted by stress, depression and anxiety. All of these exercise benefits can ease your stress levels and give you a sense of command over your body and your life.

KPI 2 - Blood Transfusions:

A blood transfusion involves taking blood from one person (a donor), processing it, then giving it to someone else (a patient).

Why might a blood transfusion be needed?

A blood transfusion may be needed if you have a shortage of red blood cells.
This may be because your body's not making enough red blood cells or because you have lost blood.
For example, you may need a blood transfusion if you have:

- a condition that affects the way your red blood cells work – such as sickle cell disease or thalassemia
- a type of cancer or cancer treatment that can affect blood cells – including leukemia, chemotherapy or stem cell transplants
- severe bleeding – usually from surgery, childbirth or a serious accident
- A blood transfusion can replace blood you have lost, or just replace the liquid or cells found in blood (such as red blood cells, plasma or cells called platelets).

Donation:

- For **blood** and **stem cell donation**, an **opt-in system** is in place. Individuals must volunteer to give blood or sign up to the stem cell register.
- For **organ donation**, an **opt-out system** is in place. All adults will be considered to have **agreed to donate their organs** when they die unless they have **recorded a decision not to donate** or are in an excluded group. Families will still be consulted about organ donation and the **donor's faith, beliefs** and **culture** will be **respected**.

KPI 3 – Self-screening information

Breast Cancer – Self-screening

- know what's normal for you
- look at your breasts and feel them
- know what changes to look for
- report any changes to a GP without delay

Look at your breasts and feel each breast and armpit, and up to your collarbone. You may find it easiest to do this in the shower or bath, by running a soapy hand over each breast and up under each armpit. You can also look at your breasts in the mirror. Look with your arms by your side and also with them raised.

See a GP if you notice any of the following changes:

- a change in the size, outline or shape of your breast
- a change in the look or feel of the skin on your breast, such as puckering or dimpling, a rash or redness
- a new lump, swelling, thickening or bumpy area in one breast or armpit that was not there before
- a discharge of fluid from either of your nipples
- any change in nipple position, such as your nipple being pulled in or pointing differently
- a rash (like eczema), crusting, scaly or itchy skin or redness on or around your nipple
- any discomfort or pain in one breast, particularly if it's a new pain and does not go away (although pain is only a symptom of breast cancer in rare cases)

Testicular Cancer – Self-screening

From puberty onwards, it is important to check your testicles regularly. Testicular cancer is usually always cured but it is easier to treat when it is diagnosed early. Checking for testicular cancer is sometimes called testicular self-examination. Doing this regularly means you soon get to know what feels normal for you. A normal testicle should feel smooth and firm, but not hard.
Hold your scrotum in the palm of your hand. Use your fingers and thumb to examine each testicle. You should feel for:

- lumps or swellings
- anything unusual
- differences between your testicles.

It is normal for the testicles to be slightly different in size. It is also normal for one to hang lower than the other. The epididymis (tube that carries sperm) is behind the top of each testicle. It feels like a soft, coiled tube. It is common to get harmless cysts or benign lumps in the epididymis. Treatment for these may vary. Other conditions can cause lumps or swellings, and most lumps are not cancer. But it is important you get your doctor to check anything unusual as soon as possible.

If you need further support...

Home and school support:

- A friend
- A teacher
- Your tutor
- Parents/carers
- Mr Ogden
- Mrs Loveridge
- Mrs Jones
- Mrs Hayward
- Miss Brooke

Reputable Organisations:

- www.childline.org.uk/info-advice/you-your-body/my-body
- www.nhs.uk/change4life
- www.nhs.uk/live-well
- www.tomkerridge.com/full-time-meals (for family friendly meal ideas, including cooking healthy food within a limited kitchen).
- Young Minds: www.youngminds.org.uk
- Contact your GP
- Contact Orchid: https://orchid-cancer.org.uk/testicular-cancer/ (0808 802 0010)
- Visit trekstock: https://www.trekstock.com/ (a resource for young people affected by cancer which provides counselling and support
- Breast Cancer Now – https://breastcancernow.org
- Teenage Cancer Trust - www.teenagecancertrust.org

PCSHE Year 11 Topic 4 – Families

KPI 1 – Key Terms

- **Pregnancy**: The term used to describe the period of time in which a foetus develops inside the uterus (typically 40 weeks)
- **Fertility**: The ability to produce offspring
- **Abortion**: A procedure to end a pregnancy, sometimes known as a termination of pregnancy.
- **Miscarriage**: The loss of a pregnancy.
- Reproductive health:
- Contraception: Methods that are used to prevent pregnancy from occurring during sexual activity.
- Hormonal methods: Contraceptive methods which use hormones to prevent pregnancy usually used by women only.
- Barrier methods: Contraceptive methods which prevent pregnancy by stopping the sperm from reaching the egg.
- Combination methods: Contraceptive methods which use both hormonal and barrier methods to prevent pregnancy.
- Natural methods: Contraceptive methods which do not use hormones or barriers, mostly focused on fertility awareness.
- **STIs**: Sexually transmitted infections that are passed on mainly through sexual contact both vaginally, anally and orally.
- **Marriage**: legal union between a man and a woman or between a same-sex couple (in England, Wales and Scotland and, from January 2020, in Northern Ireland).
- **Civil partnership**: A relationship which can be registered by two people of the same sex (to be extended to opposite-sex couples in 2020).
- **Cohabitation**: Living together as a couple without being married/civil partners.
- **Forced Marriage**: A marriage where one or both people do not consent to the marriage and pressure or abuse is used
- **Arranged Marriage**: A marriage planned and agreed by the families or guardians of the couple concerned, to which both individuals consent.
- **Illegal/Void marriage**: A marriage that is invalid from its inception and cannot be made valid.
- **Ceremony**: A formal religious or public occasion, especially one celebrating a particular event, achievement, or anniversary.

KPI 2 – Routes to Parenthood

- Natural conception – pregnancy achieved through sexual intercourse
- Intrauterine insemination (IUI) – Also known as artificial insemination, this involves inserting sperm into the uterus via a thin plastic tube passed through the cervix.
- In vitro fertilisation (IVF) – Fertility medicine is taken to encourage the ovaries to produce more eggs than usual. Eggs are then removed and fertilised with sperm in a laboratory. A fertilised egg (embryo) is then returned to the uterus to grow and develop.
- Co-parenting – When two or more people decide to conceive and parent children together
- Adoption – The legal process by which a child who cannot be bought up within their birth family becomes full, permanent, legal members of their new family.
- Fostering – Providing a child with a home while they are unable to live with their own family (the child remains the legal responsibility of the council and/or their birth parents.
- Surrogacy – When someone carries and gives birth to a child for a couple who cannot biologically have a child themselves.

KPI 3 – Fertility

How does fertility change?

- Females: fertility gradually decreases with age and declines in the 30s, particularly after 35 years old.
- Males: Fertility decreases with age, but to a lesser extent

What factors affect fertility?

1. Sexually transmitted infections
2. Smoking
3. Alcohol
4. Anabolic steroids
5. Other drugs or medicines
6. Weight
7. Age
8. Environmental factors (e.g. exposure to pesticides, solvents and metals)
9. Stress

KPI 4 – Maintaining a healthy pregnancy

- Do not smoke or drink alcohol
- Avoid certain medicines
- Have an STI check
- Ensure a healthy diet is followed
- Do some safe pregnancy exercise
- Attend medical appointments.

If you need further support...

- Home/School Support: Parent, Tutor, Mrs Hayward, Mrs Aston, Mrs Loveridge, Mrs Jor

Organisations:

- NSPCC: Helpline 0808 800 5000 (24 hours, ev day) www.nspcc.org.uk
- Childline: Helpline 0800 1111 (24 hours, ever day) https://www.childline.org.uk
- Your Doctor, Community Nurse, School Nurse (Ask at reception for appointment), NHS Onlir www.helathforteens.co.uk
- www.brook.co.uk
- CEOPS - https://www.ceop.police.uk/safety-centre/
- Childline - 0800 1111 - Online chat available a www.childline.org.uk
- Relate Relationships Advice - 0300 100 1234 - Online chat
- www.healthforteens.co.uk
- Advice on fertility, pregnancy and abortion: www.brook.org.uk/topics/pregnancy or www.nhs.uk/pregnancy-and-baby or www.nhs.uk/conditions/infertility or www.nhs.uk/conditions/abortion
- Advice on infertility - Visit www.nhs.uk/conditions/infertility
- Advice on miscarriage – visit www.miscarriageassociation.org.uk or www.nhs.uk/conditions/miscarriage

For further guidance on marriage, civil partnerships and cohabitation or forced marriage visit:

- www.gov.uk/stop-forced-marriage — for information about reporting forced marriage
- www.childline.com — for general information and guidance on reporting forced marriage
- www.freedomcharity.org.uk — for informatio and support regarding forced marriage.

KPI 5 - Options for Unplanned Pregnancy

Keep the Baby	When deciding if to keep the baby the people involved need to consider not just the financial implications such as the cost of raising a child but also the impact on income if one parent has to stay home to care for the child. They also need to consider the support that they have around them in terms of friends and family.
Adoption	Adoption is the least common choice for unplanned pregnancy in the UK. It means that the birth parents give up all legal rights to the child and allow other people to raise their child. Adoption are arranged through social services and adoption agencies, but they are made legal by court order. Once an adoption order is made legal it cannot be undone and the level of contact between birth parents and adoptive parents are settled by those involved. An adoption order cannot be issued until the baby is at least 6 weeks old. No one can force you to put a baby up for adoption even if you are under 18, and the father's permission is only needed if he is named on the birth certificate. However, a court can decide the adoption can go ahead without your consent if it thinks the child would be put at risk if they were not or if it is determined that you're incapable of giving consent, for example due to a mental disability.
Abortion	Abortions are quite common and about 1/3 of women will have had an abortion by the time they are 45. If you live in **England, Wales** or **Scotland**, two doctors need to agree that continuing the pregnancy will cause you significant physical or mental distress. Once they have agreed, you have until 24 weeks into the pregnancy to have an abortion. A GP will not perform the abortion but will refer you to a specialist service like the Marie Stropes Clinic. You do not need the permission of the father in order to have an abortion nor do you need the permission of your parents if you are under 16 and are considered mature enough to make medical decisions. A woman can change her mind at any point in the process. If your GP does not agree with abortion and refuses to refer you for the procedure, you have the right to go to another Doctor for the referral. There are two ways of ending an unwanted pregnancy; a medical abortion or a surgical abortion. Which you have depends on many factors, including how far along in the pregnancy you are. • **Up to 10 weeks: Early medical abortion – sometimes known as 'the abortion pill'** - Early medical abortion can involve two visits to a clinic and is performed in the first ten weeks of pregnancy. This method involves taking two medicines which end a pregnancy. It's not the same as emergency contraception. • **Up to 15 weeks: Vacuum aspiration – sometimes known as 'the suction method'** - For this procedure either a general (asleep) or local (awake) anaesthetic would be given. The procedure only takes about 5-10 minutes and there is no wound or stitches. The cervix is gently stretched to allow a thin tube to pass through it into the womb. Once the tube is inserted the pregnancy is removed by suction. Most people only take an hour or so to recover and go home the same day. • **Abortions after 15 weeks** Abortion after 15 weeks is less common and most abortions happen in the first 13 weeks of pregnancy.

KPI 6 - Sexual Health

A sexually healthy person is someone who understands that sex can have various outcomes, ranging from pleasure to transmission of sexually transmitted infections (STIs).

	Types of Contraception			
	Birth control	**How to use**	**Prescription Needed**	**Protects against STIs**
Hormonal	Oral Contraceptive (the pill)	Take one pill every day as directed	Yes	No
	Patch	Apply to the skin and change weekly	Yes	No
	Vaginal ring	Insert monthly and leave in place for 21 days	Yes	No
	Hormonal intrauterine contraceptive (IUC)	Inserted into the uterus and can remain for up to three or five years	Yes, IUC inserted in the healthcare providers office	No
	Injection	Get injections every three months	Yes, injection given in health care providers office	No
	Implantable hormonal contraceptive	Implanted under the skin of the arm and can remain for up to three years	Yes, inserted in the healthcare providers office	No
Barrier	Female condom	Insert every time before sex	No	Yes
	Male condom	Partner must wear every time during sex	No	Yes

KPI 7 – Forced Marriage

A forced marriage is where one or both people do not (or in cases of people with learning disabilities or reduced capacity, cannot) consent to the marriage as they are pressurised, or abuse is used, to force them to do so. It is recognised in the UK as a form of domestic or child abuse and a serious abuse of human rights. The pressure put on people to marry against their will may be:

- physical: for example, threats, physical violence or sexual violence
- emotional and psychological: for example, making someone feel like they are bringing 'shame' on their family
- Financial abuse, for example taking someone's wages, may also be a factor.

The Anti-social Behaviour, Crime and Policing Act 2014 made it a criminal offence in England, Wales and Scotland to force someone to marry. This includes:

- taking someone overseas to force them to marry (whether or not the forced marriage takes place)
- marrying someone who lacks the mental capacity to consent to the marriage (whether they are pressured to or not)