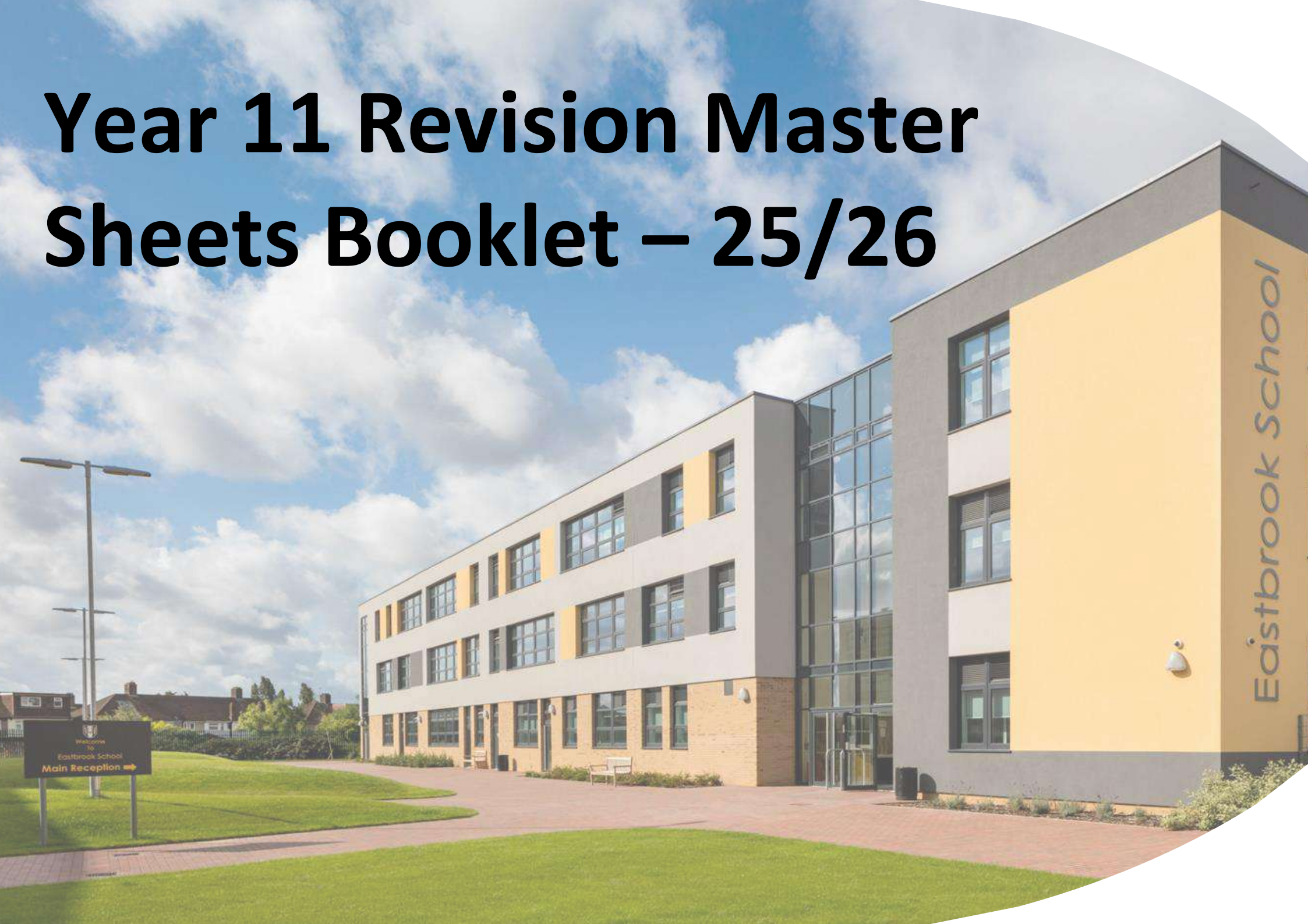
Year 11 Revision Master Sheets Booklet – 25/26



Contents Page

GCSE English Language Revision Master Sheet

Reading	Writing
Paper 1 Question 1	**Paper 1 Question 5**
Know the difference between explicit and implicit information	Use personification to describe an old car
Paper 1 Question 2	Use a simile to describe the feeling of embarrassment
Learn the definitions of each of these key terms: adjective, adverb, figurative language, personification, simile, metaphor, verb, semantic field	Write four sentences about a busy leisure centre based on the following senses: a. sight b. sound c. touch d. smell and/or taste
Read an extract from a past paper and identify five language rich quotations – annotate these for effects, including multiple connotations (connotation chains)	Describe an ordinary day in London using show and not tell – list five details you would zoom in on and describe in detail to show an ordinary day
Summarise the strategy that you should follow when answering Paper 1 Question 2	Write a description of a train and a character sitting in a carriage using the external to internal description method
Use a past paper and write an answer to Paper 1 Question 2, highlighting where you have made comments about the effects of language choices	Write a description of a car driving through a desert using the camera-eye method: aerial shot – long shot – close-up – extreme close-up
Paper 1 Question 3	List the different reasons to start a new paragraph
Memorise what 'structure' means for Paper 1 Question 3: linking a beginning, a middle and an end; shifts in what the writer focuses on, such as a place, time or perspective; the order in which key events are presented; how a coherent picture is created and how everything links together – for example through repetition or building mood	Learn the following possible ways of structing a descriptive or narrative response: echoes, repetition, withholding information, focus shift, flash back, flash forward, tension, climax (see knowledge organiser)
Learn the definitions of these words: exposition, development, complication, climax, ending and tension	Memorise the vocabulary lists on your knowledge organiser for describing negative and positive atmosphere
Summarise the strategy that you should follow when answering Paper 1 Question 3	Plan a description of a lake as suggested by this picture 
Read an extract from a past paper and annotate where there are changes in mood and tone – and if there a clear turning point	Write a description of a street as suggested by this picture 
Read an extract from a past paper and complete Paper 1 Question 3, highlighting where you have made comments about the effects of the structural decisions	Plan the opening to a story about somebody that goes camping
Learn these useful phrases: the writer develops/builds, the focus shifts, the action moves, the scene switches, the focus narrows down, the focus widens, the writer returns to, the pact increases/slows, the writer contrasts	Write a story that takes place in a misty setting
Paper 1 Question 4	Create three possible characters that might be able to feature in question 5
Write a definition for these key terms: argument, evaluate, opinion	**Paper 2 Question 5**
Learn these useful phrases: the writer makes, this makes the reader, we are shocked by, as we read this part we feel, the impact of this is	Learn the conventions that you should include if you are asked to write in the following forms: newspaper articles, speeches, letters, blogs
Summarise the strategy that you should follow when answering Paper 1 Question 4	Memorise different opening methods that you can use in argumentative writing, including rhetorical questions, string of assertions, anecdote, humour, speech

Read an extract from a past paper and complete Paper 1 Question 4, highlighting where you have evaluated the effects on the reader, shown a clear understanding of method, made clear and relevant responses to the focus of the statement and selected a range of textual references	Use one of these opening methods to write an introduction for the following task: 'Going on a big holiday every year is as waste of money. People should make the most of the life they have at home instead of trying to find excitement elsewhere.' Write an article for a broadsheet newspaper in which you argue for or against this statement.
Paper 2 Question 1	Brainstorm arguments for and against the above task
Know what you should do if you make a mistake and shade the wrong box	Use *the Introduction, Because, Because, But, So* model to plan an answer for the above task.
Paper 2 Question 2	Learn possible tones of voice that you could use in your writing
Know the definition of these key terms: summary and synthesis	Memorise a rage of persuasive language devices that you could use in your writing.
For this question you must interpret your evidence: write a paragraph using interpretation / inference about the writer who wrote this: 'I have always loved children and had a natural ability to connect with them at ease, no matter their gender, nationality of character.'	Answer this exam-style question: 'Active hobbies, such as sports, are falling by the wayside because of the popularity of tablets and smartphones. Being constantly glued to our screens is bad for our nation's health.' Write an article for a newspaper in which you argue for or against this statement.
Write a second paragraph using interpretation / inference about the writer who wrote this, explaining how they different to the writer above: 'Sometimes I wish I could escape the children. They are constantly with me and exhausting me, and more riotous, perverse, unmanageable cubs I never knew.'	Answer this exam-style question: 'It's worrying that many people today place so much importance on their 'friends' from social media platforms. Real friendships can only be made face-to-face.' Write a speech in you argue for or against this statement.
Summarise the strategy that you should follow when answering Paper 2 Question 2	**General**
Paper 2 Question 3	Know the definition of these key terms: purpose and audience
Learn the definitions of these key terms: rhetorical question, assertions, imperatives, triple emphasis, direct address, irony	Revise the different sentence types, including simple, complex and compound sentences
Read an extract from a past paper and identify five language rich quotations – annotate these for effect, including multiple connotations (connotation chains)	Learn the different uses of punctuation, including full stop, comma, colon, semi-colon, ellipsis and question mark
Summarise the strategy that you should follow when answering Paper 2 Question 3	Learn the different narrative perspectives, including first person and third person (paper 2 question 5 is likely to be 1st person)
Use a past paper and write an answer to Paper 2 Question 3, highlighting where you have made comments about the effects of language choices	Learn the different tenses, including past and present
Paper 2 Question 4	
Explain the ways in which Paper 2 Question 4 is different from Paper 2 Question 2	
Learn the following useful phrases: the writer thinks, the writer feels, the writer believes, the writer argues	
Summarise the strategy that you should follow when answering Paper 2 Question 4	
Use a past paper and write an answer to Paper 2 Question 4, highlighting where you have compared the writer's different views and perspectives, used phrases such as 'the writer thinks / feels/ believes', analysed how the writer has used language or structural methods to effectively present their viewpoint, supported your arguments with quotations	
Learn comparative discourse markers, such as however / in contrast / but / likewise / similarly	

GCSE English Literature Revision Master Sheet

Macbeth	The Strange Case of Dr Jekyll and Mr Hyde	An Inspector Calls	Power and Conflict Poetry	Unseen Poetry
Summarise the plot, dividing it into the five acts	Know the conventions of a Victorian Gothic novel	Explain the differences between Right Wing and Left Wing political ideologies	Know how Shelly uses irony and juxtaposition to mock Ozymandias	Read a poem and identify the speaker
Generate three Big Ideas about the theme of loyalty and betrayal in the play	Explain the use of duality in Chapter One: Utterson, Utterson and Enfield's friendship and the setting	Explain the differences between Capitalism and Socialism	Explain the significance of the 'mind - forged manacles' metaphor in *London*	Read a poem and identify the addressee – who is being spoken to in a poem
Explain the ways is which ambition features in the play	Explain the concept of atavism and the Victorian belief in degeneration	Describe the British Social Class system in 1912	Analyse Wordsworth's use of contrasting imagery in *Extract From The Prelude*	Describe the story of an unseen poem
Generate three Big Ideas about Kingship, linking to contextual information about James1st	Analyse the language used by Enfield and Utterson to describe Hyde in Chapters One and Two	Explain how the opening stage directions establish character, setting and mood	Generate three Big Ideas to describe the narrative persona of the Duke in *My Last Duchess*	Explain the mood and tone of an unseen poem
Assess which characters are good and which are evil and compare the balance of good and evil in each character	Know the expectations of a Victorian Gentleman – and consider how Utterson does and does not fit into this type	Explain how Arthur Birling is presented in the opening (before Inspector Goole arrives), making references to his speeches	Explain how Tennyson uses imagery to show how dangerous the battlefield was in *The Charge of the Light Brigade*	Read an unseen poem and generate a Big Idea about the theme
Explain why the quotation 'false face must hide what the false heart does know' is a key quotation in the play	Describe Utterson's nightmare in Chapter Two – and the similarities and differences between this and Enfield's story in Chapter One	Analyse Arthur Birling's use of persuasive language in his speeches	Analyse the ways in which Owen presents nature as an enemy in *Exposure*	Learn different structural techniques that can be used in a poem, including rhyme and rhythm
Explain how visions are supernatural signs of guilt in the play	Describe how Jekyll is presented in Chapter Three, and how he reacts when questioned about Hyde	Understand how Arthur Birling sees his daughter's engagement as a business opportunity	Describe how Heaney uses images of war to describe the storm in *Storm on the Island*	Analyse the structure of an unseen poem, identifying any changes
Explain how in the opening of the play, Macbeth is presented as a brave and effective solider	Explain the maid's account of the murder of Carew and how Hyde was identified as the culprit	Explain how Artur Birling's treatment of Eva Smith reveals his Capitalist ideology	Explain how Hughes uses imagery to convey the horrors of the battlefield and the loss of patriotism in *Bayonet Charge*	Learn different language techniques that can be used in a poem
Analyse Lady Macbeth's soliloquy in Act 1 Scene 5 and explain what it tells us about her	Analyse the language used to describe the murder of Carew, including violent verbs and animal and weather imagery	Explain how Arthur tries to protect his own daughter but treats Eva Smith – a young woman of a similar age – with contempt	Explain the significance of the title of the poem *Remains*.	Analyse the language of an unseen poem
Explain the persuasive methods that Lady Macbeth uses to convince Macbeth to kill Duncan in Act 1 Scene 7	Summarise Chapter Five, explaining the letters and use of graphology	Describe Sheila's treatment of Eva Smith – what did she do and why?	Explain how *Poppies* is different to many of the other war poems in the anthology.	Learn the conventions of different poetic forms, including sonnets and ballads
Re-read Act 2 Scene 2 and analyse the reactions of Lady Macbeth and Macbeth following the murder and the power dynamic at this point	Compare the description of Dr Lanyon in Chapter Six with the description of him in Chapter Two, explaining how and why he has changed	Generate three Big Ideas about Gerald based on his treatment of Eva Smith / Daisy Renton and his behaviour at other points in the play	Analyse the use of rhyme and enjambment in *War Photographer*	Find two poems about the theme of love and create a table summarising the similarities and differences
Summarise the strange things that have been happening in nature that we learn about in Act 2 scenes 3 and 4	Analyse the use of pathetic fallacy in the opening of Chapter Eight, evaluating what mood is created and why	Assess the importance of the character Alderman Meggarty	Explain how Dharker presents paper as powerful in *Tissue*	Research past papers and answer the unseen poetry questions
Explain how the Macbeths are feeling insecure in Act 3 Scene 2	Explain how Utterson behaves in Chapter Eight – from condescending Poole, to taking action	Describe Sybil Birling's treatment of Eva Smith	Explain how Rumens use similes and metaphors to present the speaker's memories of her city in *The Emigree*	Read some poems for fun
Re-read Banquo's soliloquy in Act 3 Scene 1 and explain the extent to which he now is a threat to Macbeth	Generate five Big Idea about Hyde throughout the novel, also considering	Generate three Big Ideas about Sybil based on her treatment of Eva Smith	Explain how the metaphor 'I carving out me identity' is a key quotation in *Checking Out Me History*	Annotate some poems for meaning, language and structure

	how he seems more vulnerable in Chapter Eight	and her behaviour at other points in the play		
Describe the ghost scene in Act 3 Scene 4 and analyse three quotations from it	Generate five Big Ideas about Utterson based on his presentation throughout the whole novel	Describe how Dramatic Irony is used at the end of Act 2 and at other points in the play	Analyse how the father is presented in *Kamikaze*	Know the question style of the exam paper
Summarise the new predictions made by the witches in Act 4 Scene 1and explain how these make Macbeth feel invincible	Know what is meant by an epistolary novel	Critically analyse Eric's treatment of Eva Smith and explain how problematic his behaviour is	Create flashcards for each poem, including at least three quotations for each	
Describe the methods used by Malcolm to test Macduff's loyalty in Act 4 Scene 3	Describe the 'revelation' scene in Chapter Nine, when Lanyon realises that Hyde and Jekyll are the same person	Explain the Inspector's message in his parting speech	Create a table of all of the themes in the poetry cluster and decide which poems explore these themes	
Write about how Lady Macbeth's character has changed from the beginning of the play to Act 5 Scene 1	Analyse the language used by Lanyon to describe the transformation – and how it makes it seem both exciting and terrifying	Analyse Inspector Goole's use of language in his parting speech	Explain which poems feature violence in them and provide examples	
Re-read Macbeth's soliloquy in Act 5 Scene 5 and critically assess his mood at this point in the play	Know about scientific developments in the Victorian era and possible conflicts with religious beliefs	Compare Arthur Birling and Inspector Goole's different attitudes towards social responsibility	Know the relevant contextual information for each poem	
Explain how the ending of the play links to the beginning	Summarise Jekyll's letter in Chapter Ten explaining why he began his experiments, the obstacles he faced and what went wrong in the end	Explain how the characters realise that Inspector Goole and Eva Smith aren't what they initially seemed	Create a table of all of the poems that focus on oppression, making notes about content, methods and comparison	
Generate three Big Ideas about each of the main characters	Explain why Dr Jekyll decided to 'create' Hyde	Explain how each character reacts when they think they have been hoaxed	Generate three Big Ideas about the power of memory in two of the poems	
Identify quotations linked to different symbols and imagery, including light and dark, nature and health, blood and water	Generate five Big Ideas based on the character of Dr Jekyll, considering his duality	Critically assess the function / purpose of Inspector Goole	Plan an essay about strong emotions in *Poppies* and one other poem	
Know what is meant by blank verse, and identify any times when characters switch between the two	Generate three Big Ideas about the theme of repression and restraint in the novel	Critically assess the extent to which each character has developed or changed throughout the play	Generate three Big Ideas about authority in *Checking Out Me History* and one other poem	
Complete some example essays	Understand the importance of the peripheral characters in the novel	Generate three Big Ideas about Sheila and her character development in the play	Write the thesis statement for an essay about victims in *London* and one other poem	
Plan some example essays, including thesis statements and Big Ideas	Identify examples of secrecy and hiding within the novel	Generate three Big Ideas that compare the older and younger generations in the play	Generate three Big Ideas about the power of nature in *Storm on the Island* and one other poem	
Know the assessment objectives for this unit	Generate three Big Ideas about the theme of fear in the novel	Explain the significance of the character Eva Smith and what she represents	Choose two poems which deal with the effects of conflict and make a diagram comparing and contrasting these effects	
Generate three Big Ideas about gender in the play, linking to the context	Generate three Big Ideas about the theme of crime and violence in the novel	Generate three Big Ideas about the theme of social responsibility in the play	Make a list of the ways in which identity is explored throughout the cluster	
Know the conventions of tragedy	Generate three Big Ideas about the theme of loyalty in the novel	Generate three Big Ideas about the theme of social class in the play	Plan an essay about how strong voices are presented in *Remains* and *My Last Duchess*	
Understand the Great Chain of Being and the Divine Right of kings	Explain how Stevenson's own life may have influenced his writing	Explain how Priestley's own political and social views may have influenced his writing	Create a mind-map of the different ways that the poems focusing on war present this theme	
Learn a range of quotations	**Learn a range of quotations**	**Learn a range of quotations**	**Learn a range of quotations**	

GCSE Mathematics Foundation Tier

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

Here is pretty much all the Foundation Tier content we could fit onto an A3 sheet of paper, including all the formulae you are required to know for GCSE. An ➔ points to an illustrative example. The codes refer to the DfE subject content. Pin this to a wall, keep it on your desk, carry it in your bag, make notes on it (sorry, don't take it into the examination)…

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 **C**ommon **F**actor (HCF)
➔ **Factors of 6 are 1, 2, 3, 6**
Factors of 9 are 1, 3, 9
HCF of 6 and 9 is 3
Lowest **C**ommon **M**ultiple (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 $1 \le a < 10$ and n is an integer.

Standard units N13

1 tonne = 1000 kilograms
1 kilogram = 1000 grams

1 kilometre = 1000 metres
1 metre = 100 centimetres
= 1000 millimetres
1 centimetre = 10 millimetres

1 day = 24 hours
1 hour = 60 minutes = 3600 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)**
$5.825 \le x < 5.835$
➔ $y = 46$ **(2 significant figures)**
$45.5 \le y < 46.5$
Note use of ≤ and <, and that the last significant figure of each is 5

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 ≡)

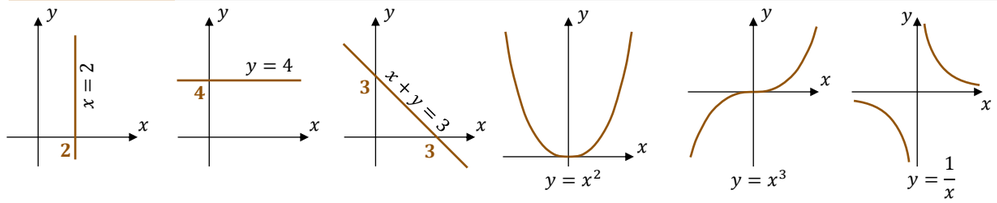
Laws of indices A4

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 $8q^9p^{-6}$

Standard graphs A12



$y = mx + c$ 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.**

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…
$19x = 76$, **so $x = 4$**
Finally, substitute and solve…
$2 \times 4 + 3y = 11$, **so $y = 1$**

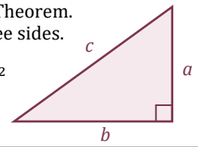
Rearrange a formula A5

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

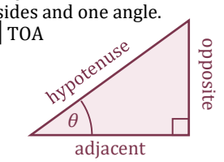
$$x = \frac{z - 3y}{2}$$

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

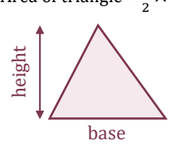
The longest side of any right angled triangle is the hypotenuse; check that your answer is consistent with this.

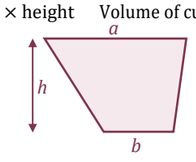
Special values of sin, cos, tan
Learn (or be able to find without a calculator)…

$\theta°$	$\sin\theta°$	$\cos\theta°$	$\tan\theta°$
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	

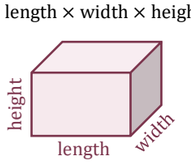
Areas and volumes G16, G17, G18, G23

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



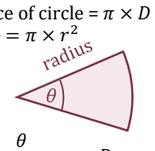


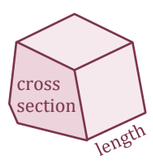
Volume of cuboid = length × width × height

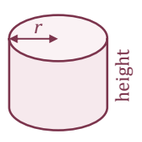


Area of trapezium = $\frac{1}{2}(a + b) \times h$

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 = $\pi r^2 \times$ height

Volume of prism = area of cross section × length

Transformations G7, G8

Reflection
- Line of reflection

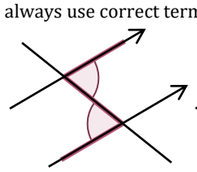
Translation
- Vector

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

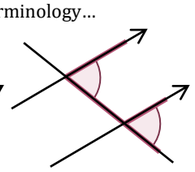
Enlargement
- Centre of enlargement
- Scale factor (if SF < 1 the shape will get smaller).

Angle facts G3

Equal angles in parallel lines: always use correct terminology…

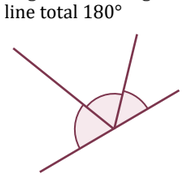


Alternate angles

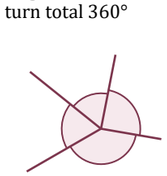


Corresponding angles

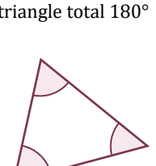
Angles on a straight line total 180°



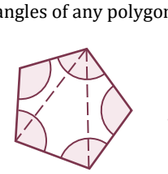
Angles in a full turn total 360°



Interior angles in a triangle total 180°

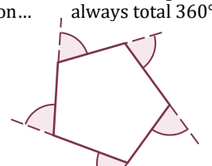


Use this for the interior angles of any polygon…



…or $180° \times (n - 2)$

Exterior angles always total 360°



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, …**

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)**

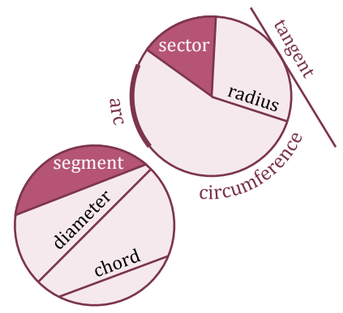
$$\frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$$

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.

Parts of a circle G9



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 3500 to 4620**
Find the percentage increase.

$$\frac{1120}{3500} \times 100\% = 32\%$$

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

Learn the most frequently used ones:

$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{10}$	$\frac{1}{5}$	$\frac{1}{100}$
50%	25%	10%	20%	1%

Speed, distance, time R11

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

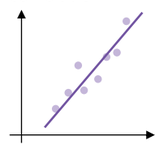
➔ **A car travels 90 miles in 1 hour, 30 minutes. Find its average speed.**
90 miles ÷ 1.5 hours = 60 mph

Averages S4

Mode: most frequently occurring
Median: put the data in numerical order, then choose the middle one
Mean = $\frac{\text{total of items of data}}{\text{number of items of data}}$

Correlation S6

Positive correlation



Negative correlation

GCSE Mathematics Higher Tier

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

Here is pretty much all the Higher Tier content we could fit onto an A3 sheet of paper, including all the formulae you are required to know for GCSE. An ➔ points to an illustrative example. The codes refer to the DfE subject content. Pin this to a wall, keep it on your desk, carry it in your bag, make notes on it (sorry, don't take it into the examination)…

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 $1 \le a < 10$ and n is an integer.

Recurring decimals N10

Make a recurring decimal a fraction:
➔ $n = 0.2\dot{3}6$
(two digits are in the recurring pattern, so multiply by 100)
$100n = 23.\dot{6}$
(this is the same as $23.6\dot{3}6\dot{)}$
$99n = 23.6\dot{3}6 - 0.2\dot{3}6 = 23.4$
$n = \frac{23.4}{99} = \frac{234}{990} = \frac{13}{55}$

Error intervals N15

Find the range of numbers that will round to a given value:
➔ **$x = 5.83$ (2 decimal places)**
$5.825 \le x < 5.835$
➔ **$y = 46$ (2 significant figures)**
$45.5 \le y < 46.5$
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**

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

Functions A7

Combining functions:
$\mathrm{fg}(x) = \mathrm{f}(\mathrm{g}(x))$
➔ **If $\mathrm{f}(x) = x + 3$ and $\mathrm{g}(x) = x^2$**
$\mathrm{fg}(x) = x^2 + 3$
$\mathrm{gf}(x) = (x+3)^2$

The inverse of f is f^{-1}
➔ **If $\mathrm{f}(x) = 2x + 5$ then**
$\mathrm{f}^{-1}(x) = \frac{x-5}{2}$

$y = mx + c$ 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 $y = 4x + 3$

Parallel lines: gradients are equal; perpendicular lines: gradients are "negative reciprocals".
➔ **$y = 2x + 3$ and $y = 2x - 5$ are parallel to each other; $y = 2x + 3$ and $y = -\frac{1}{2}x + 3$ are perpendicular**

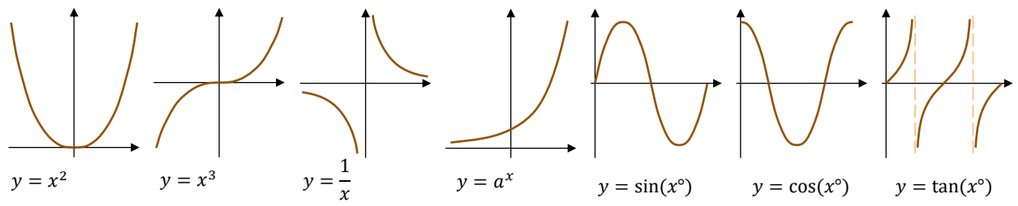
Transformations of curves A13

Starting with the curve $y = \mathrm{f}(x)$:
Translate $\begin{pmatrix}0\\a\end{pmatrix}$ for $y = \mathrm{f}(x) + a$
Translate $\begin{pmatrix}-a\\0\end{pmatrix}$ for $y = \mathrm{f}(x + a)$
Reflect in x axis for $y = -\mathrm{f}(x)$
Reflect y axis for $y = \mathrm{f}(-x)$

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.

Standard graphs A12



Quadratics A11, A18

If a quadratic equation cannot be factorised, use the formula

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

➔ **Solve $2x^2 + 3x - 7 = 0$**

$x = \frac{-3-\sqrt{9-(-56)}}{2\times2} = -2.73$

or $x = \frac{-3+\sqrt{9-(-56)}}{2\times2} = 1.23$

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 (3 , –7)

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

Sequences A24, A25

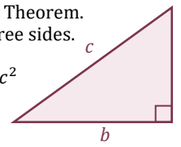
nth term of an arithmetic (linear) sequence is $bn + c$
➔ **nth term of 5, 8, 11, 14, … is $3n+2$ (always increases by 3 first term is $3 \times 1 + 2 = 5$)**
nth term of a quadratic sequence is $an^2 + bn + c$
➔ **First three terms of $n^2 + 3n - 1$ are 3, 9, 17, …**
Geometric sequence; multiply each 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, …**

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.

Right angled triangles G20

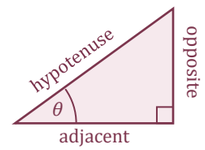
Pythagoras Theorem.
Links all three sides.
No angles.
$a^2 + b^2 = c^2$



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

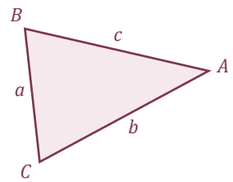
$\sin\theta = \frac{\text{opp}}{\text{hyp}}$ $\cos\theta = \frac{\text{adj}}{\text{hyp}}$ $\tan\theta = \frac{\text{opp}}{\text{adj}}$

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

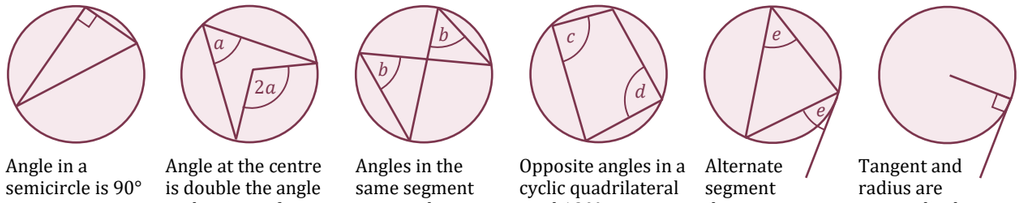
Sine Rule
Use if you are given an angle-side pair
Missing side: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
Missing angle: $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

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)…

$\theta°$	$\sin\theta°$	$\cos\theta°$	$\tan\theta°$
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	

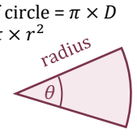
Circle theorems G10



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

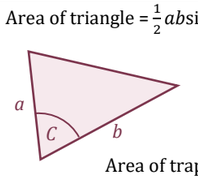
Circumference of circle = $\pi \times D$
Area of circle = $\pi \times r^2$



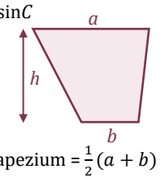
Arc length = $\frac{\theta}{360°} \times \pi \times D$

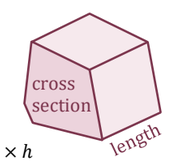
Area of sector = $\frac{\theta}{360°} \times \pi \times r^2$

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

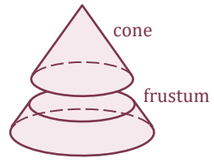


Area of trapezium = $\frac{1}{2}(a+b) \times h$





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	$1:n^3$	$a^3:b^3$

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.**
$20\,000 \times 0.85^6 = 7500$ (2sf)

Formula for compound interest
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

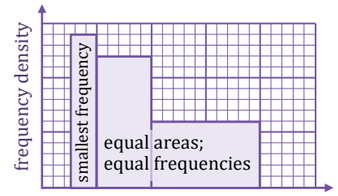
Probability rules P8, P9

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

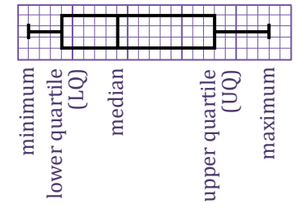
Histograms S3

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



AQA Combined Science: Biology

Paper 1 Revision Sheet

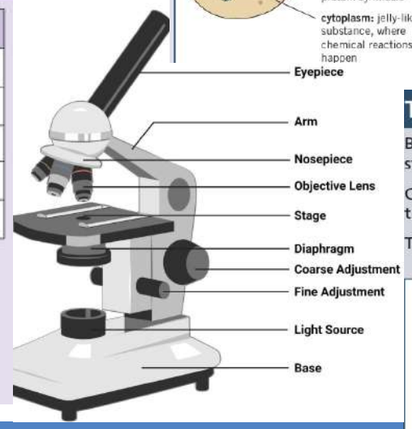
Microscopes

Light microscope	Electron microscope
uses light to form images	uses a beam of electrons to form images
living samples can be viewed	samples cannot be living
relatively cheap	expensive
low magnification	high magnification
low **resolution**	high resolution

Electron microscopes allow you to see sub-cellular structures, such as ribosomes, that are too small to be seen with a light microscope.

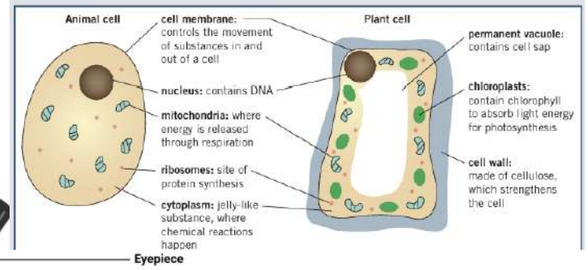
To calculate the **magnification** of an image:

$$\text{magnification} = \frac{\text{image size}}{\text{actual size}}$$



Eukaryotic cells

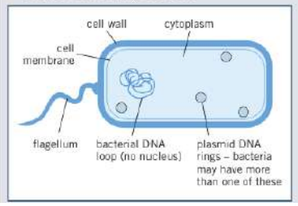
Animal and plant cells are eukaryotic. They have genetic material (DNA) that forms **chromosomes** and is contained in a **nucleus**.



Prokaryotic cells

Bacteria have the following characteristics:

- single-celled
- no nucleus – have a single loop of DNA
- have small rings of DNA called **plasmids**
- smaller than eukaryotic cells.

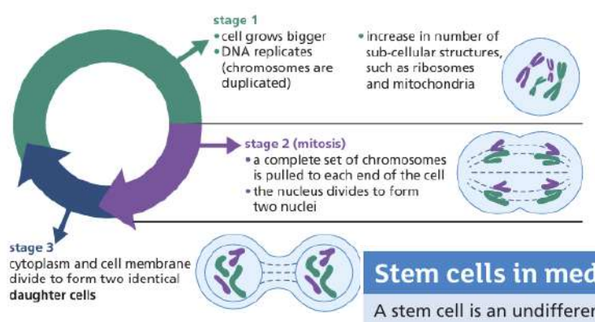


The cell cycle

Body cells divide to form two identical **daughter cells** by going through a series of stages known as the **cell cycle**.

Cell division by **mitosis** is important for the growth and repair of cells, for example, the replacement of skin cells. Mitosis is also used for asexual reproduction.

There are *three* main stages in the cell cycle:



Specialised cells

Cells in animals and plants differentiate to form different types of cells. Most animal cells differentiate at an early stage of development, whereas a plant's cells differentiate throughout its lifetime.

Specialised cell	Function	Adaptations
sperm cell	fertilise an ovum (egg)	• tail to swim to the ovum and fertilise it • lots of mitochondria to release energy from respiration, enabling the sperm to swim to the ovum
red blood cell	transport oxygen around the body	• no nucleus so more room to carry oxygen • contains a red pigment called haemoglobin that binds to oxygen molecules • flat bi-concave disc shape to increase surface area-to-volume ratio
muscle cell	contract and relax to allow movement	• contains protein fibres, which can contract to make the cells shorter • contains lots of mitochondria to release energy from respiration, allowing the muscles to contract
nerve cell	carry electrical impulses around the body	• branched endings, called dendrites, to make connections with other neurones or effectors • myelin sheath insulates the axon to increase the transmission speed of the electrical impulses
root hair cell	absorb mineral ions and water from the soil	• long projection speeds up the absorption of water and mineral ions by increasing the surface area of the cell • lots of mitochondria to release energy for the active transport of mineral ions from the soil
palisade cell	enable photosynthesis in the leaf	• lots of chloroplasts containing chlorophyll to absorb light energy • located at the top surface of the leaf where it can absorb the most light energy

Comparing diffusion, osmosis, and active transport

	Diffusion	Osmosis	Active transport
Definition	The spreading out of particles, resulting in a net movement from an area of higher **concentration** to an area of lower concentration. Factors that affect the rate of diffusion include: difference in concentration, temperature, and surface area of the membrane.	The diffusion of water from a **dilute** solution to a concentrated solution through a **partially permeable membrane**.	The movement of particles against a concentration gradient – from a more dilute solution to a more concentrated solution – using energy from respiration.
Movement of particles	Particles move down the concentration **gradient** – from an area of *high* concentration to an area of *low* concentration.	Water moves from an area of *lower* solute concentration to an area of *higher* solute concentration.	Particles move against the concentration gradient – from an area of *low* concentration to an area of *high* concentration.
Energy required?	no – **passive process**	no – passive process	yes – energy released by respiration
Examples	**Humans** • Nutrients in the small intestine diffuse into the **capillaries** through the **villi**. • Oxygen diffuses from the air in the **alveoli** into the blood in the capillaries. Carbon dioxide diffuses from the blood in the capillaries into the air in the alveoli. • **Urea** diffuses from cells into the blood for excretion in the kidney. **Fish** • Oxygen from water passing over the gills diffuses into the blood in the **gill filaments**. • Carbon dioxide diffuses from the blood in the gill filaments into the water. **Plants** • Carbon dioxide used for photosynthesis diffuses into leaves through the **stomata**. • Oxygen produced during photosynthesis diffuses out of the leaves through the stomata.	**Plants** • Water moves by osmosis from a dilute solution in the soil to a concentrated solution in the **root hair cell**.	**Humans** • Active transport allows sugar molecules to be absorbed from the small intestine when the sugar concentration is higher in the blood than in the small intestine. **Plants** • Active transport is used to absorb mineral ions into the root hair cells from more dilute solutions in the soil.

Key terms

Make sure you can write a defin

cell membrane cell wall chlo
cytoplasm dilute DNA
magnification mitochondria
passive process permane
resolution riboso

Factors affecting the rate of transpiration

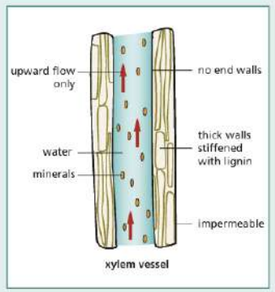
Factor	Effect on transpiration	Because...
temperature	higher temperatures *increase* the rate of transpiration	water evaporates faster in higher temperatures
humidity	lower humidity levels *increase* the rate of transpiration	the drier the air, the steeper the concentration gradient of water molecules between the air and leaf
wind speed	more wind *increases* the rate of transpiration	wind removes the water vapour quickly, maintaining a steeper concentration gradient
light intensity	higher light intensity *increases* the rate of transpiration	stomata open wider to let more carbon dioxide into the leaf for photosynthesis

Transpiration

Description: Water is lost through the stomata by evaporation. This is known as transpiration and causes water to be pulled up from the roots through the **xylem**. The constant movement of water up the plant is called the **transpiration stream**.

Importance:
- provides water to cells to keep them **turgid**
- provides water to cells for photosynthesis
- transports mineral ions to leaves

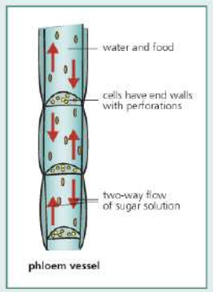
Specialised tissues:



Translocation

The movement of dissolved sugars from the leaves to the rest of the plant through the **phloem** is known as translocation.

- moves dissolved sugars made in the leaves during photosynthesis to other parts of the plant
- this allows for respiration, growth, and glucose storage



Q: Evaluate the use of stem cells in medicine

Q: Describe how you would use a microscope to look at a specimen cell

Q: Describe the differences between transpiration and translocation

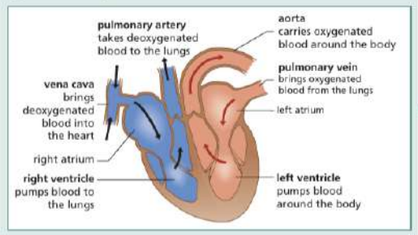
Stem cells in medicine

A stem cell is an undifferentiated cell that can develop into one or more types of specialised cell.
There are two types of stem cell in mammals: **adult stem cells** and **embryonic stem cells**.
Stem cells can be **cloned** to produce large numbers of identical cells.

Type of stem cell	Where are they found?	What can they differentiate into?	Advantages	Disadvantages
adult stem cells	specific parts of the body in adults and children – for example, bone marrow	can only differentiate to form certain types of cells – for example, stem cells in bone marrow can only differentiate into types of blood cell	• fewer ethical issues – adults can consent to have their stem cells removed and used • an already established technique for treating diseases such as leukaemia • relatively safe to use as a treatment and donors recover quickly	• requires a donor, potentially meaning a long wait time to find someone suitable • can only differentiate into certain types of specialised cells, so can be used to treat fewer diseases
embryonic stem cells	early human embryos (often taken from spare embryos from fertility clinics)	can differentiate into any type of specialised cell in the body – for example, a nerve cell or a muscle cell	• can treat a wide range of diseases as can form any specialised cell • may be possible to grow whole replacement organs • usually no donor needed as they are obtained from spare embryos from fertility clinics	• ethical issues as the embryo is no longer viable and each embryo is a potential human life • risk of transferring viral infections to the patient • newer treatment so relatively under-researched – not yet clear if they can cure as many diseases as thought
plant meristem	meristem regions in the roots and shoots of plants	can differentiate into all cell types – they can be used to create clones of whole plants	• rare species of plants can be cloned to prevent extinction • plants with desirable traits, such as disease resistance, can be cloned to produce large numbers of identical plants • fast and low-cost production of large numbers of plants	cloned plants are genetically identical, so a whole crop is at risk of being destroyed by a single disease or genetic defect

The heart

The heart is the organ that pumps blood around your body. It is made from **cardiac** muscle tissue, which is supplied with oxygen by the **coronary arteries**.



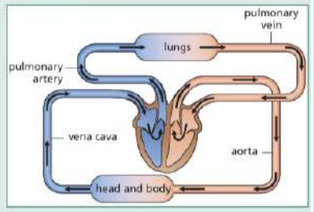
Heart rate is controlled by a group of cells in the right atrium that generate electrical impulses, acting as a pacemaker.

Artificial pacemakers can be used to control irregular heartbeats.

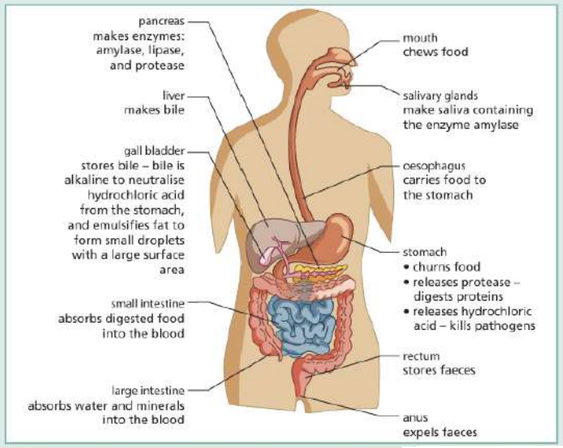
Double circulatory system

The human circulatory system is described as a **double circulatory system** because blood passes through the heart twice for every circuit around the body:

- the right ventricle pumps blood to the lungs where gas exchange takes place
- the left ventricle pumps blood around the rest of the body.



Digestive system



Q: What is the difference between communicable and non-communicable disease?

Q: Explain how the heart is involved in the double circulatory system.

Q: Explain how you could help treat the coronary heart disease (CHD) and outline the risk factors that could cause CHD

Describe the similarities between the effect of temperature on enzymes and the effect of temperature in photosynthesis

Risk factors and non-communicable diseases

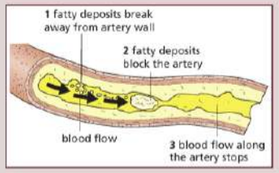
A **risk factor** is any aspect of your lifestyle or substance in your body that can increase the risk of a disease developing. Age, genetics, ethnicity, and other pre-existing conditions can all be risk factors for different diseases.

Some risk factors cause specific diseases, and other diseases are caused by factors interacting. When scientists have found a link between a risk factor and a disease, this is known as a **causal mechanism**. For example, smoking tobacco is a causal mechanism for lung cancer.

Main risk factor(s)	Disease	Effects of risk factor
poor diet, low amount of exercise, and obesity	Type 2 diabetes	body does not respond properly to the production of insulin, so blood glucose levels cannot be controlled
	cardiovascular diseases	increased blood **cholesterol** can lead to **coronary heart disease**
alcohol	liver cirrhosis (scarring)	long-term alcohol use impairs liver function, meaning the liver cannot remove toxins from the body or produce sufficient bile
	impaired brain function	damages the brain and can cause anxiety and depression
	affected development of unborn babies	alcohol can pass through the placenta, risking miscarriages, premature births, and birth defects
smoking	lung disease and cancers	cigarettes contain carcinogens, which can cause cancers tar build up can break down alveoli and reudce the surface area of gas exchange, leading to COPDs like emphysema
	cardiovascular disease	chemicals in tobacco can increase heart rate and break down the lining of the arteries, increasing the risk of heart attacks and strokes
	affected development of unborn babies	chemicals can pass through the placenta, risking premature births and birth defects
carcinogens, such as ionising radiation, and genetic risk factors	cancers	tar in cigarettes and ultraviolet rays from the Sun can cause cancers some genetic factors make an individual more likely to develop certain cancers

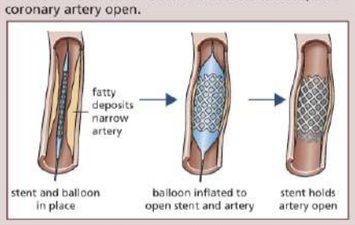
Coronary heart disease

Coronary heart disease is caused by a build up of fatty material in the coronary arteries, making them narrow, and reducing blood flow.



Stents

A blockage in the coronary artery restricts blood flow to the heart muscles. This can cause pain, a heart attack, or even death. Stents can be used to keep the coronary artery open.



Treating coronary heart disease

Patients with heart failure often have to use artificial hearts before a donor heart becomes available for a heart transplant.

People with faulty heart **valves** may feel symptoms of breathlessness as valves do not fully open, making the heart less efficient. These can be replaced with biological valves (from animals), or mechanical valves (made from titanium and polymers).

Communicable diseases

Communicable diseases can be spread from one organism to another. A **pathogen** is any microorganism that causes disease. There are four types of pathogen: **viruses, bacteria, fungi,** and **protists.**

Non-specific defences of the human body

Skin
- physical barrier to infection
- produces antimicrobial secretions
- microorganisms that normally live on the skin prevent pathogens from growing

Nose
Cilla and mucus trap particles from the air, preventing them from entering the lungs.

Trachea and bronchi produce mucus, which is moved to the back of the throat by the cilla, then expelled.

Stomach
Produces strong acid (pH 2) that destroys pathogens in mucus, food, and drinks.

Controlling the spread of communicable disease

There are a number of ways to help prevent the spread of communicable diseases from one organism to another.

Hygiene
Hand washing, disinfecting surfaces and machinery, keeping raw meat separate, covering mouth when coughing/sneezing, etc.

Isolation
Isolation of infected individuals – people, animals, and plants can be isolated to stop the spread of disease.

Controlling vectors
Destroying or controlling the population of the vector can limit the spread of disease.

Vaccination
Vaccination can protect large numbers of individuals against diseases.

Viruses

Viruses live and reproduce rapidly inside an organism's cells. This can damage or destroy the cells.

	Spread by	Symptoms
measles	inhalation of droplets produced by infected people when sneezing and coughing	• fever • red skin rash • complications can be fatal – young children are vaccinated to immunise them against measles
HIV (human immunodeficiency virus)	• direct sexual contact • exchange of body fluids (e.g., blood when drug users share needles)	• flu-like symptoms at first • virus attacks the body's immune cells, which can lead to AIDS – where the immune system is so damaged that it cannot fight off infections or cancers
TMV (tobacco mosaic virus – plants)	• direct contact of plants with infected plant material • animal and plant vectors • soil: the pathogen can remain in soil for decades	• mosaic pattern of discolouration on the leaves – where chlorophyll is destroyed • reduces plant's ability to photosynthesise, affecting growth

Metabolism

Metabolism is the sum of all the reactions in a cell or the body.

The energy released by respiration in cells is used for the continual enzyme-controlled processes of metabolism that produce new molecules.

Enzyme	Sites of production	Reaction catalysed
amylase	salivary glands pancreas small intestine	starch → glucose
proteases	stomach pancreas small intestine	proteins → amino acids
lipases	pancreas small intestine	lipids → fatty acids and glycerol

Aerobic respiration

glucose + oxygen → carbon dioxide + water

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

Anaerobic respiration in muscles

glucose → lactic acid

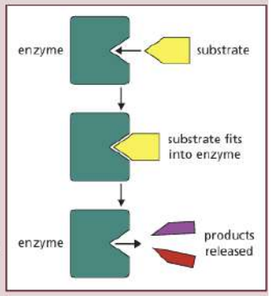
$C_6H_{12}O_6 \rightarrow 2C_3H_6O_3$

Type of respiration	Oxygen required?	Relative amount of energy transferred
aerobic	✓	complete **oxidation** of glucose – large amount of energy is released
anaerobic	✗	incomplete oxidation of glucose – much less energy is released per glucose molecule than in aerobic respiration

Q: Compare and contrast Aerobic respiration, anaerobic respiration, fermentation and Photosynthesis

Enzymes

Enzymes are large proteins that **catalyse** (speed up) reactions. Enzymes are not changed in the reactions they catalyse.



Lock and key theory

This is a simple model of how enzymes work:

1. The enzyme's **active site** (where the reaction occurs) is a specific shape.
2. The enzyme (the lock) will only catalyse a specific reaction because the **substrate** (the key) fits into its active site.
3. At the active site, enzymes can break molecules down into smaller ones or bind small molecules together to form larger ones.
4. When the products have been released, the enzyme's active site can accept another substrate molecule.

Response to exercise

During exercise the human body reacts to the increased demand for energy.

To supply the muscles with more oxygenated blood, heart rate, breathing rate, and breath volume all increase.

If insufficient oxygen is supplied, anaerobic respiration takes place instead, leading to the build-up of **lactic acid**.

During long periods of vigorous exercise, muscles become fatigued and stop contracting efficiently.

Bacteria

Bacteria reproduce rapidly inside organisms and may produce **toxins** that damage tissues and cause illness.

	Spread by	Symptoms	Prevention and treatment
Salmonella	bacteria in or on food that is being ingested	*Salmonella* bacteria and the toxins they produce cause • fever • vomiting • abdominal cramps • diarrhoea	• poultry are vaccinated against *Salmonella* bacteria to control spread • cooking food properly and washing hands before food preparation
Gonorrhoea	direct sexual contact – gonorrhoea is a **sexually transmitted disease (STD)**	• thick yellow or green discharge from the vagina or penis • pain when urinating	• treatment with antibiotics (many antibiotic-resistant strains have appeared) • barrier methods of contraception, such as condoms

Treating diseases

Antibiotics

- **Antibiotics** are medicines that can kill bacteria in the body.
- Specific bacteria need to be treated by specific antibiotics.
- Antibiotics have greatly reduced the number of deaths from infectious bacterial diseases, but antibiotic-resistant strains of bacteria have started to emerge.

Treating viral diseases

- Antibiotics *do not* affect viruses.
- Drugs that kill viruses often damage the body's tissues.
- Painkillers treat the symptoms of viral diseases but do not kill pathogens.

Photosynthetic reaction

Photosynthesis is a chemical reaction in which energy is transferred from the environment as light from the Sun to the leaves of a plant. This is an **endothermic** reaction.

Chlorophyll, the green pigment in **chloroplasts** in the leaves, absorbs the light energy. Leaves are well-adapted to increase the rate of photosynthesis when needed.

carbon dioxide + water $\xrightarrow{\text{light}}$ glucose + oxygen

$6CO_2 + 6H_2O \xrightarrow{\text{light}} C_6H_{12}O_6 + 6O_2$

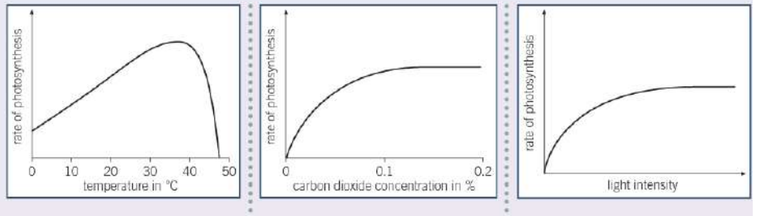
Rate of photosynthesis

A **limiting factor** is anything that limits the rate of a reaction when it is in short supply.

The limiting factors for photosynthesis are
- temperature
- light intensity
- carbon dioxide concentration
- amount of chlorophyll.

Less chlorophyll in the leaves reduces the rate of photosynthesis. More chlorophyll may be produced by plants in well-lit areas to increase the photosynthesis rate.

Limiting factors and photosynthesis rate (HT only)

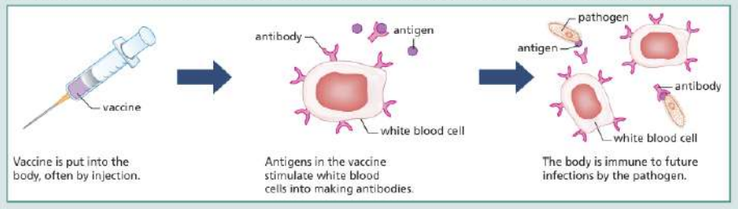


- At low temperatures the rate of photosynthesis is low because the reactant molecules have less kinetic energy.
- Photosynthesis is an enzyme-controlled reaction, so at high temperatures the enzymes are denatured and the rate quickly decreases.
- Carbon dioxide is used up in photosynthesis, so increasing carbon dioxide concentration increases the rate of photosynthesis.
- At a certain point, another factor becomes limiting.
- Carbon dioxide is often the limiting factor for photosynthesis.
- Light energy is needed for photosynthesis, so increasing light intensity increases the rate of photosynthesis.
- At a certain point, another factor becomes limiting.
- Photosynthesis will stop if there is little or no light.

Vaccinations

Vaccines involve injecting small quantities of dead or inactive forms of a pathogen into the body. This stimulates lymphocytes to produce the correct antibodies for that pathogen.

If the same pathogen re-enters the body, the correct antibodies can be produced quickly to prevent infection. If a large proportion of the population is vaccinated against a disease, it is less likely to spread. This is called **herd immunity**.



AQA Combined Science: Biology

Paper 2 Revision Sheet

Homeostasis

Homeostasis is the regulation of internal conditions (of a cell or whole organism) in response to internal and external changes, to maintain optimum conditions for functioning.

This maintains optimum conditions for all cell functions and enzyme action.

In the human body, this includes control of

- blood glucose concentration
- body temperature
- water levels

Nervous system responses

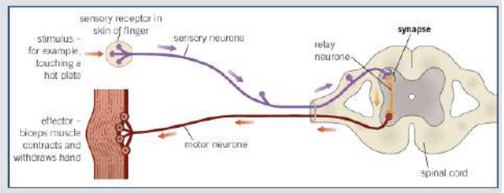
Stimulus	Receptor	Coordinator	Effector	Response
a change in the environment (**stimulus**) is detected by **receptors**	information from receptors passes along cells (**neurones**) to the CNS as electrical impulses	the CNS coordinates the body's response to the stimulus	effectors bring about a response, such as glands secreting hormones or muscles contracting	the body responds to the stimulus

Reflex arcs

The nervous system is made up of the **central nervous system** (CNS) and a network of nerves. The CNS comprises the brain and spinal cord.

Reflex actions of the nervous system are automatic and rapid – they do not involve the conscious part of the brain.

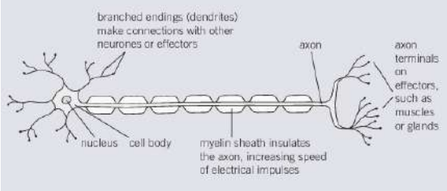
Reflex actions are important for survival because they help prevent damage to the body.



Reflex arc structures

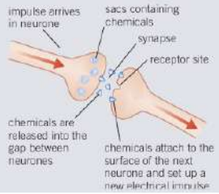
Neurones

Neurones carry electrical impulses around the body – relay neurones connect sensory neurones to motor neurones



Synapses

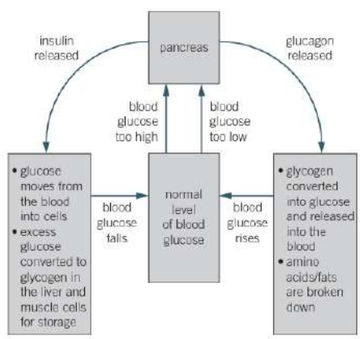
Synapses are gaps between neurones, which allow electrical impulses in the nervous system to cross between neurones



Control of blood glucose levels

Blood glucose (sugar) concentration is monitored and controlled by the **pancreas**.

This is an example of negative feedback control, as the pancreas switches production between the hormones **insulin** and **glucagon** to control blood glucose levels.



Diabetes

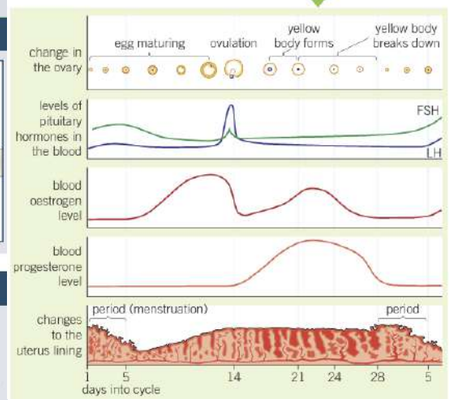
Diabetes is a non-communicable disease where the body either cannot produce or cannot respond to insulin, leading to uncontrolled blood glucose concentrations.

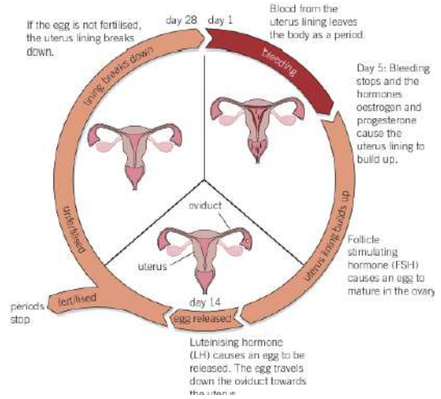
Type 1 diabetes	Type 2 diabetes
early onset	usually later onset, obesity is a risk factor
pancreas stops producing sufficient insulin	body doesn't respond to the insulin produced
commonly treated through insulin injections, also diet control and exercise	commonly treated through a carbohydrate-controlled diet and exercise

Endocrine gland	Role of the hormones
Pituitary	• controls growth in children • stimulates the thyroid gland to make thyroxine to control the rate of metabolism • in females – stimulates the ovaries to produce and release eggs, and make oestrogen • in males – stimulates the testes to make sperm and testosterone
Thyroid	• controls the rate of metabolism in the body
Pancreas	• controls blood glucose levels
Adrenal	• prepares the body for stress • involved in the 'fight or flight' response
Ovaries	• controls the development of female secondary sexual characteristics • controls the menstrual cycle
Testes	• controls the development of male secondary sexual characteristics • involved in the production of sperm

The menstrual cycle

Hormone	Released by	Function
follicle stimulating hormone (FSH)	pituitary gland	• causes eggs to mature in the ovaries • stimulates ovaries to produce oestrogen
luteinising hormone (LH)	pituitary gland	• stimulates the release of mature eggs from the ovaries (**ovulation**)
oestrogen	ovaries	• causes lining of uterus wall to thicken • inhibits release of FSH • stimulates release of LH
progesterone	ovaries	• maintains thick uterus lining • inhibits release of FSH and LH





Selective breeding

Selective breeding (artificial selection) is the process by which humans breed plants and animals for particular genetic characteristics.

Process of selective breeding:

1. choose parents with the desired characteristic from a mixed population
2. breed them together
3. choose offspring with the desired characteristic and breed them
4. continue over many generations until all offspring show the desired characteristic

The characteristic targeted in selective breeding can be chosen for usefulness or appearance, for example:

- disease resistance in food crops
- animals that produce more meat or milk
- domestic dogs with a gentle nature
- larger or unusual flowers.

Disadvantages of selective breeding:

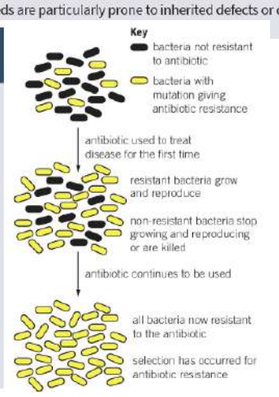
- can lead to **inbreeding**, where some breeds are particularly prone to inherited defects or diseases

Emergence of antibiotic resistance

The development of new antibiotics is expensive and slow, so is unlikely to keep up with the emergence of new antibiotic-resistant bacteria strains.

To reduce the rise of antibiotic-resistant strains

- doctors should only prescribe antibiotics for serious bacterial infections
- patients should complete their courses of antibiotics so all bacteria are killed and none survive to form resistant strains
- the use of antibiotics in farming and agriculture should be restricted.



Sexual reproduction
two parents
cell division through **meiosis**
joining (fusion) of male and female sex cells (**gametes**) – sperm and egg in animals, pollen and ovule in plants
produces non-identical offspring that are genetically different to parents
results in wide variation within offspring and species

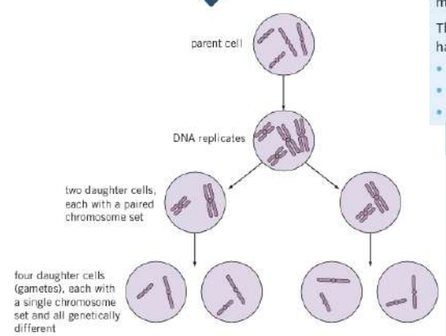
Asexual reproduction
one parent
cell division through **mitosis**
no fusion of gametes
produces offspring that are genetically identical to parent (**clones**)
no mixing of genetic information

Meiosis

Meiosis is a type of cell division that makes gametes in the reproductive organs.

Meiosis halves the number of chromosomes in gametes, and **fertilisation** (joining of two gametes) restores the full number of chromosomes.

The fertilised cell divides by mitosis, producing more cells. As the embryo develops, the cells differentiate.



DNA and the genome

Genetic material in the nucleus of a cell is composed of **DNA**.

DNA is made up of two strands forming a **double helix**.

DNA is contained in structures called **chromosomes**.

A **gene** is a small section of DNA on a chromosome that codes for a specific sequence of amino acids, to produce a specific protein.

The **genome** of an organism is the entire genetic material of that organism.

The whole human genome has been studied, and this has allowed scientists to

- search for genes linked to different diseases
- understand and treat inherited disorders
- trace human migration patterns from the past.

Inherited disorders

Some disorders are due to the inheritance of certain alleles:

- Polydactyly (extra fingers or toes) is caused by a **dominant** allele.
- Cystic fibrosis (a disorder of cell membranes) is caused by a **recessive** allele.

Embryo screening and gene therapy may alleviate suffering from these disorders, but there are ethical issues surrounding their use.

Genetic crosses

A **genetic cross** is when you consider the offspring that might result from two known parents. **Punnett squares** can be used to predict the outcome of a genetic cross, for both the genotypes the offspring might have and their phenotypes.

For example, the cross bb (brown fur) × BB (black fur) in mice:

		mother	
		B	B
father	b	Bb	Bb
	b	Bb	Bb

offspring genotype: 100% Bb

offspring phenotype: all black fur (B is dominant)

Sex determination

Normal human body cells contain 23 pairs of chromosomes – one of these pairs determines the sex of the offspring.

In human females the sex chromosomes are the same (XX, homozygous), and in males they are different (XY, heterozygous).

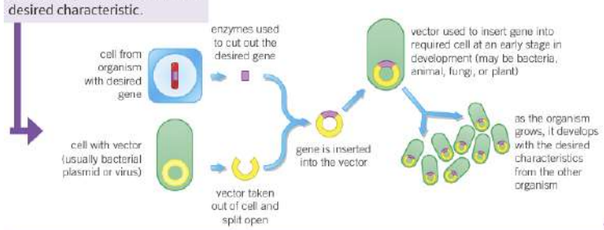
A Punnett square can be used to determine the probability of offspring being male or female. The probability is always 50% in humans as there are two XX outcomes and two XY outcomes.

		mother	
		X	X
father	X	XX	XX
	Y	XY	XY

Genetic engineering (HT only)

Genetic engineering is a process that involves changing the genome of an organism by introducing a gene from another organism, to produce a desired characteristic.

- Bacterial cells have been genetically engineered to produce useful substances, such as human insulin to treat diabetes.
- Plant crops have been genetically engineered to be resistant to diseases, insects, or herbicides, or to produce bigger and better fruits and higher yields. Crops that have undergone genetic engineering are called **genetically modified** (GM).



Benefits	Risks
• potential to overcome some inherited human diseases	• genes from GM plants and animals may spread to other wildlife, which could have devastating effects on ecosystems
• can lead to higher value of crops as GM crops have bigger yields than normal	• potential negative impacts on populations of wild flowers and insects
• crops can be engineered to be resistant to herbicides, make their own pesticides, or be more resistant to environmental conditions	• ethical concerns, for example, in the future people could manipulate the genes of children to ensure certain characteristics
	• some believe the long-term effects on health of eating GM crops have not been fully explored

Q: Justify the use of selective breeding and genetic engineering to produce offspring with specific characteristics.

Adaptations of organisms

Organisms have features – **adaptations** – that enable them to survive in the conditions in which they live. The adaptations of an organism may allow it to outcompete others, and provide it with an evolutionary advantage.

Structural adaptations

The physical features that allow an organism to successfully compete:

- sharp teeth to hunt prey
- colouring that may provide camouflage to hide from predators or hunt prey
- a large or small body-surface-area-to-volume ratio.

Behavioural adaptations

The behaviour of an organism that gives it an advantage:

- making nests to attract a mate
- courtship dances to attract a mate
- use of tools to obtain food
- working together in packs.

Functional adaptations

Adaptations related to processes that allow an organism to survive:

- photosynthesis in plants
- production of poisons or venom to deter predators and kill prey
- changes in reproduction timings.

You can work out how an organism is adapted to where it lives when given information on its environment and what it looks like.

For example, without the following adaptations the organisms below would be at a disadvantage in their environment.

Organism	Example adaptations
	• white fur for camouflage when hunting prey • feet with large surface area to distribute weight on snow • small ears to reduce heat loss • thick fur for insulation
	• feet with large surface area to distribute weight on sand • hump stores fat to provide energy when food is scarce • tough mouth and tongue to allow camel to eat cacti • long eyelashes to keep sand out of eyes
	• spines instead of leaves to reduce surface area and therefore water loss, and to deter predators • long roots to reach water underground • large, fleshy stem to store water

Some organisms are **extremophiles**, which means they live in environments that are very extreme where most other organisms could not survive. For example, areas with:

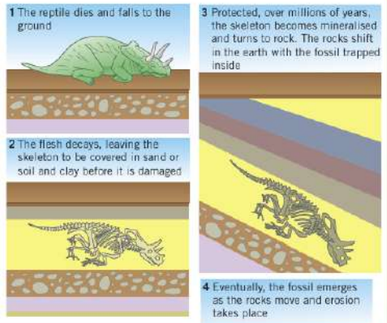
- very high or low temperatures
- extreme pressures
- high salt concentrations
- highly acidic or alkaline conditions
- low levels of oxygen or water.

Bacteria that live in deep sea vents are extremophiles.

Deep sea vents are formed when seawater circulates through hot volcanic rocks on the seafloor. These environments have very high pressures and temperatures, no sunlight, and are strongly acidic.

Fossils

Benefits of the fossil record	Problems with the fossil record
• can tell scientists how individual species have changed over time • fossils allow us to understand how life developed over Earth's history • fossils can be used to track the movement of a species or its ancestors across the world	• many early organisms were soft-bodied, so most decayed before producing fossils • there are gaps in the fossil record as not all fossils have been found and others have been destroyed by geological or human activity – this means scientists cannot be certain about how life began on Earth



Extinction

Extinction is when there are no remaining individuals of a species still alive.

Factors that may contribute to a species' extinction include

- new predators
- new diseases or pathogens
- increased competition for resources or mates

Theory of evolution

Evolution is the gradual change in the inherited characteristics of a population over time.

Evolution occurs through the process of **natural selection** and may result in the formation of new species

Process of natural selection

The theory of evolution by natural selection states that

- organisms within species show a wide range of variation in phenotype
- individuals with characteristics most suited to the environment are more likely to survive and breed successfully
- these characteristics are then passed on to their offspring.

Evidence for evolution

The theory of evolution by natural selection is now widely accepted because there are lots of data to support it, such as

- it has been shown that characteristics are passed on to offspring in in genes
- evidence from the fossil record
- the evolution of antibiotic resistance in bacteria.

Ecosystem organisation

Individual organisms

Population
the total number of organisms of the same species that live in one specific geographical area

Community
group of two or more populations of different species living in one specific geographical area

Ecosystem
the interaction of a community of living organisms with the non-living parts of their environment

A stable community is one where all the species and environmental factors are in balance so that population sizes remain fairly constant.

An example of this is the interaction between predator and prey species, which rise and fall in a constant cycle so that each remains within a stable range.

Competition

To survive and reproduce, organisms require a supply of resources from their surroundings and from the other living organisms there.

This can create competition, where organisms within a community compete for resources.

There are two types of competition – **interspecific competition** is between organisms of different species and **intraspecific competition** is between organisms of the same species.

Animals often compete for:

- food
- mates
- territory.

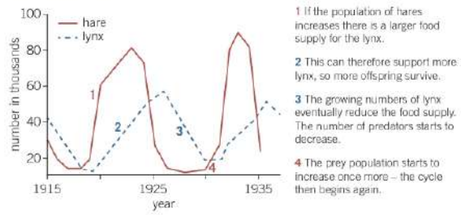
Plants often compete for:

- light
- space
- water and mineral ions from the soil.

Interdependence

Within a community each species **interacts** with many others and may depend on other species for things like food, shelter, pollination, and seed dispersal.

If one species is removed it can affect the whole community – this is called **interdependence**.



Abiotic factors

Abiotic factors are non-living factors in the ecosystem that can affect a community.

Too much or too little of the following abiotic factors can negatively affect the community in an ecosystem:

- carbon dioxide levels for plants
- light intensity
- moisture levels
- oxygen levels for animals that live in water
- soil pH and mineral content
- temperature
- wind intensity and direction.

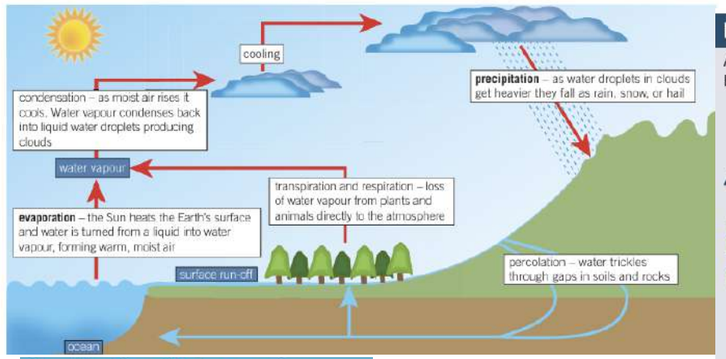
Biotic factors

Biotic factors are living factors in the ecosystem that can affect a community.

For example, the following biotic factors would all negatively affect populations in a community:

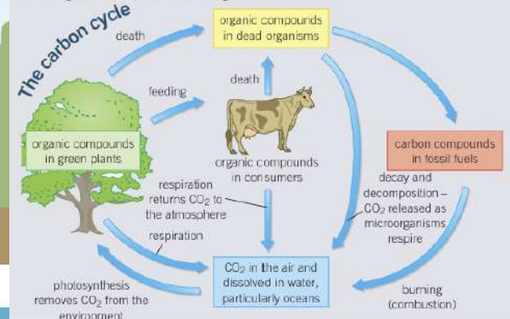
- decreased availability of food
- new predators arriving
- new pathogens
- competition between species, for example, one species outcompeting another for food or shelter, causing a decline in the other species' population.

The water cycle



How materials are cycled

All materials in the living world are recycled, which provides the building materials for future organisms.

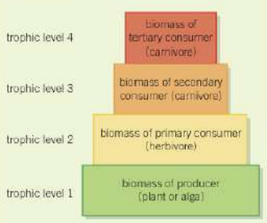


Pyramids of biomass

The **trophic level** of an organism is the number of steps it is from the start of its food chain.

Pyramids of biomass represent the relative amount of biomass at each trophic level of a food chain.

Biomass is the amount of living or recently dead biological matter in an area. Biomass is transferred from each trophic level to the level above it in the food chain.

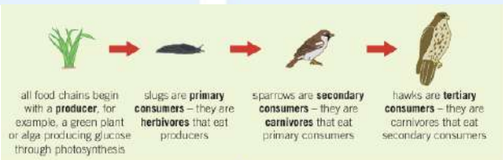


Producers transfer about 1% of the incident light energy used for photosynthesis to produce biomass.

Approximately 10% of the biomass from each trophic level is transferred to the level above it.

This loss of biomass moving up the food chain is due to several factors:

- use in life processes, such as respiration
- not all of the matter eaten is digested, some is egested as waste products
- some absorbed material is lost as waste
- energy is used in movement and to keep animals warm.



Consumers that kill and eat other animals are predators, and those that are eaten are **prey**.

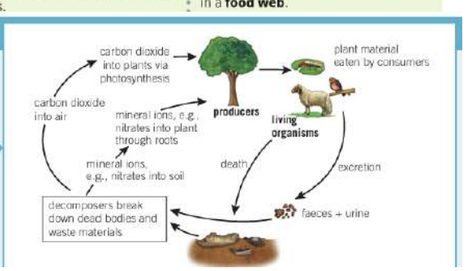
Apex **predators** are carnivores with no predators.

Organisms usually have more complex feeding relationships, with more than one predator or more than one food source. These can be shown in a **food web**.

Decomposition

Decomposers, such as bacteria and fungi, break down dead plant and animal matter by secreting enzymes into the environment. The small soluble food molecules produced then diffuse into the decomposer.

These materials are cycled through an ecosystem by decomposers returning carbon to the atmosphere as carbon dioxide and mineral ions to the soil.



Classification of living organisms

Carl Linnaeus developed a system to classify living things into groups, based on their structure and characteristics.

New models of classification were proposed as understanding of biochemical processes developed and improvements in microscopes led to discoveries of internal structures.

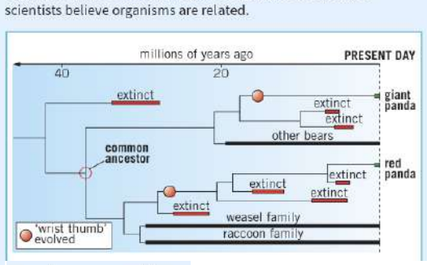
There is now a **three-domain system** developed by Carl Woese, dividing organisms into

- Archaea (primitive bacteria usually living in extreme environments)
- Bacteria (true bacteria)
- Eukaryota (including protists, fungi, plants, and animals).

kingdom
phylum
class
order
family
genus
species

Evolutionary trees

Evolutionary trees use current classification data for living organisms and fossil data for extinct organisms to show how scientists believe organisms are related.



organisms are named by the **binomial system** of genus and species

Q: Why is it important for the Earth's resources such as water and carbon to be recycled?

Q: Explain how decomposers recycle nutrients back to the earth.

Q: Explain what happens to organisms that are not able to adapt to their environment.

Q Explain the trends in a predator prey graph

AQA GCSE Combined Science: Chemistry Paper 1 Revision Sheets

Development of the model of the atom

Dalton's model

John Dalton thought of the **atom** as a solid sphere that could not be divided into smaller parts. His model did not include **protons**, **neutrons**, or **electrons**.

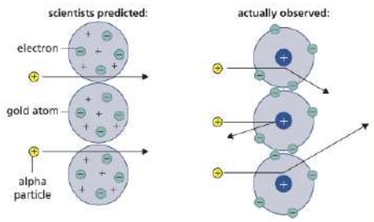
The plum pudding model

Scientists' experiments resulted in the discovery of sub-atomic charged particles. The first to be discovered were electrons – tiny, negatively charged particles.

The discovery of electrons led to the plum pudding model of the atom – a sphere of positive charge with negative electrons embedded in it. Protons and neutrons had not yet been discovered.

Alpha scattering experiment

1. Scientists fired small, positively charged particles (called alpha particles) at a piece of gold foil only a few atoms thick.
2. They expected the alpha particles to travel straight through the gold foil.
3. They were surprised that some of the alpha particles bounced back and many were deflected (alpha scattering).
4. To explain why the alpha particles were repelled, the scientists suggested that the positive charge and mass of an atom must be concentrated in a small space at its centre. They called this space the **nucleus**.



Nuclear model

Scientists replaced the plum pudding model with the nuclear model and suggested that the electrons **orbit** the nucleus, but not at set distances.

Electron shell (Bohr) model

Niels Bohr calculated that electrons must orbit the nucleus at fixed distances. These orbits are called **shells** or **energy levels**.

The proton

Further experiments provided evidence that the nucleus contained smaller particles called protons. A proton has an opposite charge to an electron.

The neutron

James Chadwick carried out experiments that gave evidence for a particle with no charge. Scientists called this the neutron and concluded that the protons and neutrons are in the nucleus, and the electrons orbit the nucleus in shells.

Relative mass

One property of protons, neutrons, and electrons is **relative mass** – their masses compared to each other. Protons and neutrons have the same mass, so are given a relative mass of 1. It takes almost 2000 electrons to equal the mass of a single proton – their relative mass is so small that we can consider it as 0.

Size

The atom has a radius of 1×10^{-10} m. Nuclei (plural of nucleus) are around 10000 times smaller than atoms and have a radius of around 1×10^{-14} m.

Atoms and particles

	Relative charge	Relative mass	
Proton	+1	1	= **atomic number**
Neutron	0	1	= mass number – atomic number
Electron	–1	0 (very small)	= same as the number of protons

All atoms have equal numbers of protons and electrons, meaning they have no overall charge:
total negative charge from electrons = total positive charge from protons

Isotopes

Atoms of the same element can have a different number of neutrons, giving them a different overall mass number.

Atoms of the same element with different numbers of neutrons are called **isotopes**.

The **relative atomic mass** is the average mass of all the atoms of an element:

$$\text{relative atomic mass} = \frac{(\textbf{abundance of isotope 1} \times \text{mass of isotope 1}) + (\textbf{abundance of isotope 2} \times \text{mass of isotope 2})\ldots}{100}$$

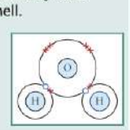
Covalent bonding

Atoms can share or transfer electrons to form strong chemical bonds.

A **covalent bond** is when electrons are *shared* between **non-metal** atoms.

The number of electrons shared depends on how many extra electrons an atom needs to make a full outer shell.

If you include electrons that are shared between atoms, each atom has a full outer shell. **Single bond** = each atom shares one pair of electrons. **Double bond** = each atom shares two pairs of electrons.



Group 1 elements

Group 1 elements are metals, and react with oxygen, chlorine, and water:

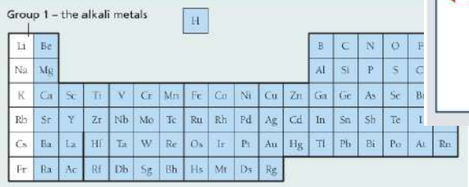
metal + oxygen → metal oxide

metal + chlorine → metal chloride

metal + water → metal hydroxide + hydrogen

Group 1 elements are called **alkali metals** because they react with water to form an alkali (a solution of their metal hydroxide).

Group 1 – the alkali metals



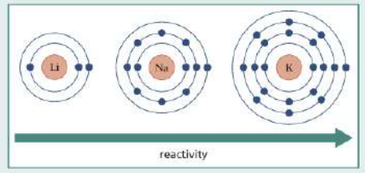
Group 1 properties

Group 1 elements all have one electron in their outer shell.

Reactivity increases down Group 1 because as you move down the group:

- the atoms increase in size
- the outer electron is further away from the nucleus, and there are more shells shielding the outer electron from the nucleus
- the electrostatic attraction between the nucleus and the outer electron is weaker so it is easier to lose the one outer electron.

The melting point and boiling point decreases down Group 1.



Group 7 elements

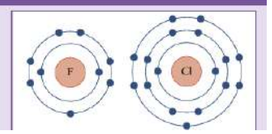
Group 7 elements are called the **halogens**. They are non-metals that exist as molecules made up of pairs of atoms.

Name	Formula	State at room temperature	Melting point and boiling point	Reactivity
fluorine	F_2	gas	increases down the group	decreases down the group
chlorine	Cl_2	gas		
bromine	Br_2	liquid		
iodine	I_2	solid		

Group 7 reactivity

Reactivity decreases down Group 7 because as you move down the group:

- the atoms increase in size
- the outer shell electrons are further away from the nucleus, and there are more shells shielding the outer shell from the nucleus
- the electrostatic attraction from the nucleus to the outer shell electrons is weaker, so it is harder to gain one electron to fill the outer shell.



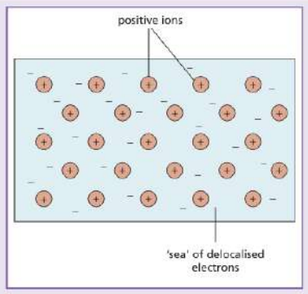
Metals: structure and properties

The atoms that make up metals form layers. The electrons in the outer shells of the atoms are **delocalised** – this means they are free to move through the whole structure, leaving behind layers of positive metal ions.

These ions are then attracted to the delocalised electrons by the electrostatic force of attraction.

Some important properties of metals are:

- pure metals are soft and **malleable** because the layers of ions can slide over each other
- they are good **conductors** of electricity and of thermal energy because delocalised electrons are free to move through the whole structure
- they have high melting and boiling points because the electrostatic force of attraction between metal ions and delocalised electrons is strong, so lots of energy is needed to break it.



Covalent structures

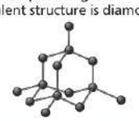
There are three main types of covalent structure:

Structure and bonding

Giant covalent

Many billions of atoms, each one with a strong covalent bond to a number of others.

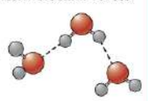
An example of a giant covalent structure is diamond.



Small molecules

Each molecule contains only a few atoms with strong covalent bonds between these atoms. Different molecules are held together by weak **intermolecular forces**.

For example, water is made of small molecules.



Large molecules

Many repeating units joined by covalent bonds to form a chain.

The small section is bonded to many identical sections to the left and right. The '*n*' represents a large number.

Separate chains are held together by intermolecular forces that are stronger than in small molecules.

Polymers are examples of long molecules.

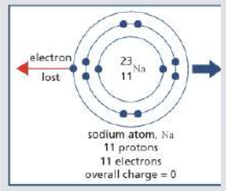
Properties

High melting and boiling points because the strong covalent bonds between the atoms must be broken to melt or boil the substances. This requires a lot of energy. Solid at room temperature.	Low melting and boiling points because only the intermolecular forces need to be overcome to melt or boil the substances, not the bonds between the atoms. This does not require a lot of energy as the intermolecular forces are weak. Normally gaseous or liquid at room temperature.	Melting and boiling points are low compared to giant covalent substances but higher than for small molecules. Large molecules have stronger intermolecular forces than small molecules, which require more energy to overcome. Normally solid at room temperature.

Most covalent structures do not conduct electricity because they do not have **delocalised** electrons or ions that are free to move to carry charge.

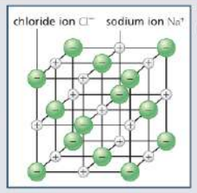
Ions

Atoms can gain or lose electrons outer shell. This causes the numb differ from the number of proto particle has a charge and is calle



Giant ionic lattice

Oppositely charged ions are attracted to each other and held together by the strong **electrostatic force of attraction**. This is called ionic bonding.



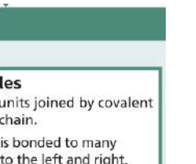
These ionic bonds result in a regular structure of alternatin positive and negative ions called a **giant ionic lattice.**

The electrostatic force of attraction works in all directions, so many billions of ions can be bonded together in a 3D structure.

Formulae

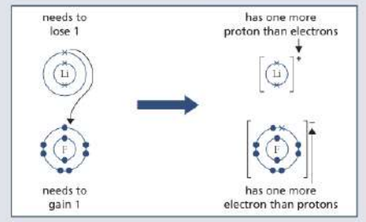
The formula of an ionic substance can be worked out

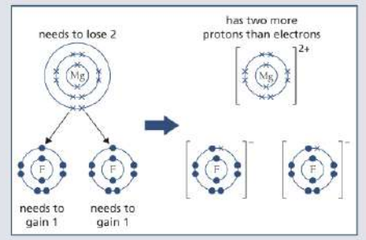
1. from its bonding diagram:
   for every one magnesium ion there are two fluoride ions – so the formula for magnesium fluoride is MgF_2
2. from a lattice diagram:
   there are nine Fe^{2+} ions and 18 S^- ions – simplifying this ratio gives a formula of FeS_2



Ionic bonding

When metal atoms react with non-metal atoms they **transfer** electrons to the non-metal atom.





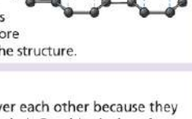
Metal atoms lose electrons to become positive ions.
Non-metal atoms gain electrons to become negative ions.

Graphite

Graphite is a giant covalent structure, but is different to other giant covalent substances.

Structure

Made only of carbon – each carbon atom bonds to three others, and forms hexagonal rings in layers. Each carbon atom has one spare electron, which is delocalised and therefore free to move around the structure.



Hardness

The layers can slide over each other because they are not covalently bonded. Graphite is therefore softer than diamond, even though both are made only of carbon, as each atom in diamond has four strong covalent bonds.

Conductivity

The delocalised electrons are free to move through graphite, so can carry charge and allow an electrical current to flow. Graphite is therefore a conductor of electricity.

Graphene

Graphene consists of only a single layer of graphite. Its strong covalent bonds make it a strong material that can also conduct electricity. It could be used in composites and high-tech electronics.

Fullerenes

- hollow cages of carbon atoms bonded together in one molecule
- can be arranged as a sphere or a tube (called a **nanotube**)
- molecules held together by weak intermolecular forces, so can slide over each other
- conduct electricity

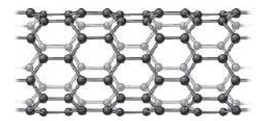
Spheres

Buckminsterfullerene was the first fullerene to be discovered, and has 60 carbon atoms.

Other fullerenes exist with different numbers of carbon atoms arranged in rings that form hollow shapes.

Fullerenes like this can be used as lubricants and in drug delivery.

Nanotubes



The carbon atoms in nanotubes are arranged in hollow cylindrical tubes.
Their conductivity and high **tensile strength** (they are difficult to break when pulled) makes them useful in high-tech electronics.

Atomic mass

The masses of single atoms are so tiny that it would be impractical to use them in experiments or calculations. Instead, we use the relative masses of atoms, also called relative atomic masses, A_r. For all relative atomic masses, carbon-12 is used as the reference point against which other atoms are compared.

Some elements have different isotopes (atoms with different numbers of neutrons). For these elements, the relative atomic mass is given as the mean (average) relative mass for all the naturally occurring isotopes of that element.

The relative atomic mass of an element can be found in the Periodic Table. It is the larger number, usually found above the chemical symbol:

Relative atomic mass
Atomic (proton) number

Formula mass

Every substance has a **formula mass**, M_r.

formula mass M_r = sum of the relative atomic masses of all the atoms in the formula

Avogadro's constant (H)

One mole of a substance contains 6.02×10^{23} atoms, ions, or molecules. This is **Avogadro's constant.**

One mole of a substance has the same mass as the M_r of the substance.

For example, the M_r (H_2O) = 18, so 18 g of water molecules contains 6.02×10^{23} molecules, and is called one mole of water.

You can write this as: moles = $\frac{\text{mass}}{M_r}$ (mol is the unit of moles)

Balancing symbol equations

When writing symbol equations you need to ensure that the number of each atom on each side is equal.

$H_2 + O_2 \rightarrow H_2O$ — unbalanced

there are 2 hydrogen atoms on each side, but 2 oxygen atoms in the reactants and 1 in the product

$2H_2 + O_2 \rightarrow 2H_2O$ — balanced

there are 4 hydrogen atoms on each side, and 2 oxygen atoms on each side

State symbols

A balanced symbol equation should also include state symbols.

State	Symbol
solid	(s)
liquid	(l)
gas	(g)
aqueous or dissolved in water	(aq)

Concentration

Concentration is the amount of solute in a volume of solvent.

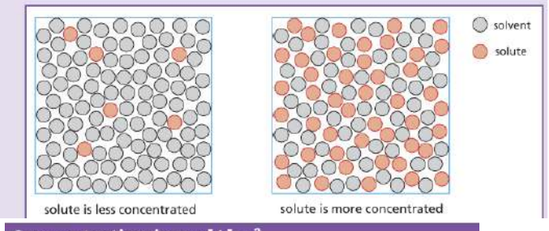
The unit of concentration is g/dm³. Concentration can be calculated using:

$$\text{concentration (g/dm}^3\text{)} = \frac{\text{mass (g)}}{\text{volume (dm}^3\text{)}}$$

Sometimes volume is measured in cm³, and you can convert it to dm³ using:

$$\text{volume (dm}^3\text{)} = \frac{\text{volume (cm}^3\text{)}}{1000}$$

- lots of solute in little solution = high concentration
- little solute in lots of solution = low concentration



Concentration in mol/dm³

Concentration can also be measured in mol/dm³.

concentration of solution (mol/dm³)

$$= \frac{\text{number of moles of solute (mol)}}{\text{volume of solution (dm}^3\text{)}}$$

You can use this formula and mass = moles × M_r to calculate the mass of solute dissolved in a solution.

- The greater the mass of solute in solution, the greater the number of moles of solute, and therefore the greater the concentration.
- If the same number of moles of solute is dissolved in a smaller volume of solution, the concentration will be greater.

Using balanced equations (H)

In a balanced symbol equation the sum of the M_r of the reactants equals the sum of the M_r of the products.

If you are asked what mass of a product will be formed from a given mass of a specific reactant, you can use these steps to calculate the result:

1 balance the symbol equation
2 calculate moles of the substance with a known mass using: moles = $\frac{\text{mass}}{M_r}$
3 using the balanced symbol equation, work out the number of moles of the unknown substance
4 calculate the mass of the unknown substance using mass = moles × M_r

If you are asked to balance an equation, given the masses of reactants and products you can use these steps to work out the answer:

1 work out M_r of all the substances
2 calculate the number of moles of each substance in the reaction using: moles = $\frac{\text{mass}}{M_r}$
3 convert to the simplest whole-number ratio
4 balance the symbol equation

Excess and limiting reactants

In a chemical reaction between two or more reactants, often one of the reactants will run out before the others. You then have some of the other reactants left over. The reactant that is left over is in **excess**. The reactant that runs out first is the **limiting reactant**.

To work out which reactants are in excess and which is the limiting reactant, you need to:

1 write the balanced symbol equation for the reaction
2 pick one of the reactants and its quantity as given in the question
3 use the ratio of the reactants in the balanced equation to see how much of the other reactant you need
4 compare this value to the quantity given in the question
5 determine which reactant is in excess and which is limiting.

Salts

When acids react with metals or metal compounds, they form salts. A salt is a compound where the hydrogen ion in an acid has been replaced by a metal ion. For example nitric acid, HNO_3, reacts with sodium to form $NaNO_3$. The H in nitric acid is replaced with Na.

The table shows how to name salts.

Acid	hydrochloric acid	sulfuric acid	nitric acid
Formula	HCl	H_2SO_4	HNO_3
Ions formed in solution	H^+ and Cl^-	$2H^+$ and SO_4^{2-}	H^+ and NO_3^-
Type of salt formed	metal chloride	metal sulfate	metal nitrate
Sodium salt example	sodium chloride, NaCl	sodium sulfate, Na_2SO_4	sodium nitrate, $NaNO_3$

Reactions of acids with metals

Acids react with some metals to form a salt and hydrogen gas. For example:

magnesium + hydrochloric acid → sodium chloride + hydrogen

Neutralisation Reactions

Reactions of acids with metal hydroxides

Acids react with metal hydroxides to form a salt and water.

hydrochloric acid + sodium hydroxide → sodium chloride + water

Reactions of acids with metal oxides

Acids react with metal oxides to form a salt and water.

hydrochloric acid + sodium oxide → sodium chloride + water

Reactions of acids with metal carbonates

Acids react with metal carbonates to form a salt, water, and carbon dioxide.

hydrochloric acid + sodium carbonate → sodium chloride + water + carbon dioxide

Alkalis and bases

Bases neutralise acids to form water in **neutralisation** reactions. Some metal hydroxides are alkalis, as they dissol in water to form alkaline solutions (above pH 7).

Some metal oxides and metal hydroxides do not dissolve in water. These are still **bases**, but are not alkalis.

The ionic equation for the reaction between an acid and an alkali is always:

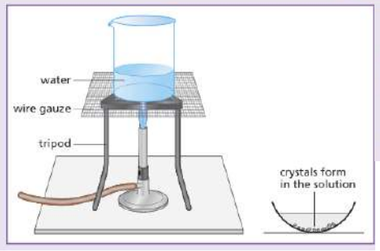
$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

Crystallisation

You can produce a solid salt from an insoluble base by **crystallisation**.

The experimental method is:

1 Choose the correct acid and base to produce the salt.
2 Put some of the dilute acid into a flask. Heat gently with a Bunsen burner.
3 Add a small amount of the base and stir.
4 Keep adding the base until no more reacts – the base is now in excess.
5 Filter to remove the unreacted base.
6 Add the remaining solution to an evaporating dish.
7 Use a water bath or electric heater to evaporate the water. The salt crystals will be left behind.



Electrolysis of aqueous solutions

Solid ionic compounds can also undergo electrolysis when dissolved in water.

- It requires less energy to dissolve ionic compounds in water than it does to melt them.
- However, in the electrolysis of solutions, the pure elements are not always produced. This is because the water can also undergo ionisation:

$H_2O(l) \rightarrow H^+(aq) + OH^-(aq)$

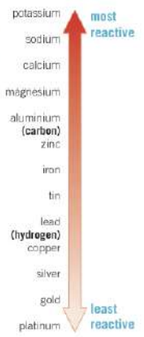
Products at the anode

In In the electrolysis of a solution, if the non-metal contains oxygen then oxygen gas is formed at the anode:

- The $OH^-(aq)$ ions formed from the ionisation of water are attracted to the anode.
- The $OH^-(aq)$ ions lose electrons to the anode and form oxygen gas.
- $4OH^-(aq) \rightarrow O_2(g) + 2H_2O(l) + 4e^-$

If the non-metal ion is a halogen, then the halogen gas is formed at the anode.

- $2Cl^-(aq) \rightarrow Cl_2(g) + 2e^-$



Products at the cathode

In the electrolysis of a solution, if the metal is *more* **reactive** than hydrogen then hydrogen gas is formed at the cathode:

- The $H^+(aq)$ ions from the ionisation of water are attracted to the cathode and react with it.
- The $H^+(aq)$ ions gain electrons from the cathode and form hydrogen gas.
- $2H^+(aq) + 2e^- \rightarrow H_2(g)$
- The metal ions remain in solution.

Bonds (HT only)

Atoms are held together by strong chemical bonds. In a reaction, those bonds are broken and new ones are made between different atoms.

- Breaking a bond requires energy so is endothermic.
- Making a bond releases energy so is exothermic.

Breaking bonds

If a lot of energy is released when making the bonds and only a little energy is required to break them, then overall energy is released and the reaction as a whole is exothermic.

Making bonds

If a little energy is released when making the bonds and a lot is required to break them, then overall energy is taken in and the reaction as a whole is endothermic.

Bond calculations

Different bonds require different amounts of energy to be broken (their **bond energies**). To work out the overall energy change of a reaction, you need to:

1 work out how much energy is required to break all the bonds in the reactants
2 work out how much energy is released when making all the bonds in the products.

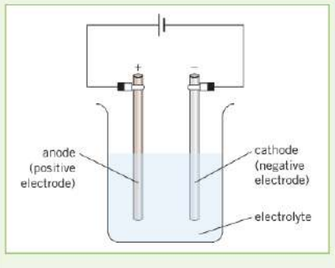
overall energy transferred = energy required to break bonds – energy required to make bonds

- A positive number means an endothermic reaction.
- A negative number means an exothermic number.

Reaction with water	Reaction with acid	Reactivity series: Metal	Reactivity series: Reactivity	Extraction method
fizzes, gives off hydrogen gas	explodes	potassium	high reactivity	electrolysis
		sodium		
		lithium		
reacts very slowly	fizzes, gives off hydrogen gas	calcium		
		magnesium		
		aluminium (carbon)		
		zinc		reduction with carbon
		iron		
no reaction	reacts slowly with warm acid	tin		
		lead (hydrogen)		
	no reaction	copper		mined from the Earth's crust
		silver		
		gold	low reactivity	

Electrolysis

In the process of **electrolysis**, an electric current is passed through an **electrolyte**. An electrolyte is a liquid or solution that contains ions and so can conduct electricity. This causes the ions to move to the **electrodes**, where they form pure elements.



Electrolysis of molten compounds

Solid ionic compounds do not conduct electricity as the ions cannot move. To undergo electrolysis they must be molten or dissolved, so the ions are free to move.

When an ionic compound is molten:

- The positive metal ions are *attracted* to the **cathode**, where they will *gain* electrons to form the pure metal
- The negative non-metal ions are *attracted* to the **anode**, where they will *lose* electrons and become the pure non-metal.

For example, molten sodium chloride, NaCl, can undergo electrolysis to form sodium at the cathode and chlorine at the anode.

Half equations (HT only)

sodium chloride → sodium + chlorine

$2NaCl(l) \rightarrow 2Na(s) + Cl_2(g)$

- at the cathode:

$2Na^+(l) + 2e^- \rightarrow 2Na(s)$

- at the anode:

$2Cl^-(l) \rightarrow Cl_2(g) + 2e^-$

Questions:

1. Draw the three states of matter
2. Create a step by step guide to explain how to balance equations with examples
3. Use the reactivity series to justify using electrolysis to extract aluminium.
4. Write a method to make pure dry crystals of copper sulphate.
5. Describe the differences between an alkali, an acid and a base.
6. Explain the process of electrolysis
7. Describe the development of the periodic table
8. Compare and contrast the structure and bonding in diamond and graphite
9. Compare ionic and covalent bonding
10. Explain why the overall charge of an atom is neutral (=0)

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Rates of reaction

The **rate of a reaction** is how quickly the reactants turn into the products.

To calculate the rate of a reaction, you can measure:

- how quickly a reactant is used up

$$\text{mean rate of reaction} = \frac{\text{quantity of reactant used}}{\text{time taken}}$$

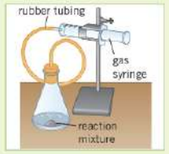
- how quickly a product is produced.

$$\text{mean rate of reaction} = \frac{\text{quantity of product formed}}{\text{time taken}}$$

For reactions that involve a gas, this can be done by measuring how the mass of the reaction changes or the volume of gas given off by the reaction.

Volume of gas produced

The reaction mixture is connected to a gas syringe or an upside down measuring cylinder. As the reaction proceeds the gas is collected.



The rate for the reaction is then:

$$\text{rate} = \frac{\text{volume of gas produced}}{\text{time taken}}$$

Volume is measured in cm^3 and time in seconds, so the unit for rate is cm^3/s.

Change in mass

The reaction mixture is placed on a mass balance. As the reaction proceeds and the gaseous product is given off, the mass of the flask will decrease.

The rate for the reaction is then:

$$\text{rate} = \frac{\text{change in the mass}}{\text{time taken}}$$

The mass is measured in grams and time is measured in seconds. Therefore, the unit of rate is g/s.

Calculating rate from graphs (HT only)

The results from an experiment can be plotted on a graph.

- A steep gradient means a high rate of reaction – the reaction happens quickly.
- A shallow gradient means a low rate of reaction – the reaction happens slowly.

Mean rate at specific time

Collision theory

For a reaction to occur, the reactant particles need to collide. When the particles collide, they need to have enough energy to react or they will just bounce apart. This amount of energy is called the **activation energy**.

You can increase the rate of a reaction by:

- increasing the **frequency of collisions**
- increasing the energy of the particles when they collide.

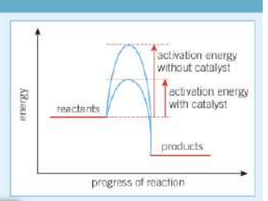
Factors affecting rate of reaction

Condition that increases rate	How is this condition caused?	Why it has that effect
increasing the temperature	Heat the container in which the reaction is taking place.	1 particles move faster, leading to more frequent collisions 2 particles have more energy, so more collisions result in a reaction note that these are two *separate* effects
increasing the concentration of solutions	Use a solution with more solute in the same volume of solvent.	there are more reactant particles in the reaction mixture, so collisions become more frequent
increasing the pressure of gases	Increase the number of gas particles you have in the container or make the container smaller.	less space between particles means more frequent collisions
increasing the surface area of solids	Cut the solid into smaller pieces, or grind it to create a powder, increasing the surface area. Larger pieces decrease the surface area.	only reactant particles on the surface of a solid are able to collide and react; the greater the surface area the more reactant particles are exposed, leading to more frequent collisions

Catalysts

Some reactions have specific substances called **catalysts** that can be added to increase the rate. These substances are not used up in the reaction.

A catalyst provides a different reaction pathway that has a lower activation energy. As such, more particles will collide with enough energy to react, so more collisions result in a reaction.



Electrolysis

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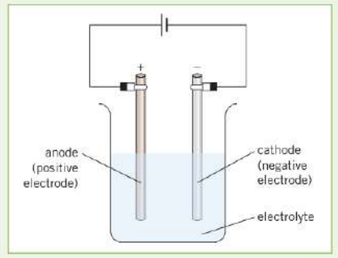

Electrolysis of molten compounds

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For example, molten sodium chloride, NaCl, can undergo electrolysis to form sodium at the cathode and chlorine at the anode.

Half equations (HT only)

sodium chloride → sodium + chlorine

$2NaCl(l) \rightarrow 2Na(s) + Cl_2(g)$

- at the cathode:

$2Na^+(l) + 2e^- \rightarrow 2Na(s)$

- at the anode:

$2Cl^-(l) \rightarrow Cl_2(g) + 2e^-$

Electrolysis of aqueous solutions

Solid ionic compounds can also undergo electrolysis when dissolved in water.

- It requires less energy to dissolve ionic compounds in water than it does to melt them.
- However, in the electrolysis of solutions, the pure elements are not always produced. This is because the water can also undergo ionisation:

$$H_2O(l) \rightarrow H^+(aq) + OH^-(aq)$$

Products at the anode

In In the electrolysis of a solution, if the non-metal contains oxygen then oxygen gas is formed at the anode:

- The $OH^-(aq)$ ions formed from the ionisation of water are attracted to the anode.
- The $OH^-(aq)$ ions lose electrons to the anode and form oxygen gas.
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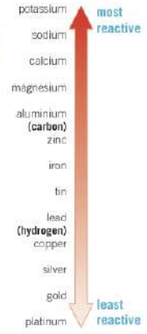


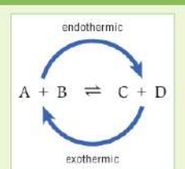
Products at the cathode

In the electrolysis of a solution, if the metal is *more* **reactive** than hydrogen then hydrogen gas is formed at the cathode:

- The $H^+(aq)$ ions from the ionisation of water are attracted to the cathode and react with it.
- The $H^+(aq)$ ions gain electrons from the cathode and form hydrogen gas.
- $2H^+(aq) + 2e^- \rightarrow H_2(g)$
- The metal ions remain in solution.

Reversible reactions

In some reactions, the products can react to produce the original reactants. This is called a **reversible reaction**. When writing chemical equations for reversible reactions, use the ⇌ symbol.



In this reaction:

- A and B can react to form C and D – the forward reaction
- C and D can react to form A and B – the reverse reaction.

The different directions of the reaction have opposite energy changes.

If the forward reaction is *endothermic*, the reverse reaction will be *exothermic*.

The same amount of energy is transferred in each direction.

Equilibrium

In a **closed system** no reactants or products can escape. If a reversible reaction is carried out in a closed system, it will eventually reach **dynamic equilibrium** – a point in time when the forward and reverse reactions have the same rate.

At dynamic equilibrium:

- the reactants are still turning into the products
- the products are still turning back into the reactants
- *the rates of* these two processes are *equal*, so overall the amount of reactants and products are constant.

Dynamic equilibrium

At dynamic equilibrium the amount of reactant and product are constant, but not necessarily equal.

You could have a mixture of reactants and products in a 50:50 ratio, in a 75:25 ratio, or in any ratio at all. The **conditions** of the reaction are what change that ratio.

Reaction conditions

The conditions of a reaction refer to the external environment of the reaction. When the reaction occurs in a closed system, you can change the conditions by:

- changing the concentration of one of the substances
- changing the temperature of the entire reaction vessel
- changing the pressure inside the vessel.

Le Châtelier's principle (HT only)

At equilibrium, the amount of reactants and products is constant. In order to change the amounts of reactant and product at equilibrium the *conditions* of the reaction must be changed. The closed system will then counteract the change by favouring either the forward reaction or the reverse reaction. This is known as **Le Châtelier's principle**.

For example, lowering the concentration of the product in the system causes the forward reaction to be **favoured** to increase the concentration of the product.

Changing concentrations (HT only)

Change	Effect	Explanation
decrease concentration of product	favours the forward reaction	opposes the change by making *less* reactant and *more* product
increase concentration of product	favours the reverse reaction	opposes the change by making *more* reactant and *less* product
decrease concentration of reactant	favours the reverse reaction	opposes the change by making *more* reactant and *less* product
increase concentration of reactant	favours the forward reaction	opposes the change by making *less* reactant and *more* product

Changing temperature (HT only)

Change	Effect	Explanation
increase temperature of surroundings	favours the endothermic reaction	opposes the change by decreasing the temperature of the surroundings
decrease temperature of surroundings	favours the exothermic reaction	opposes the change by increasing the temperature of the surroundings

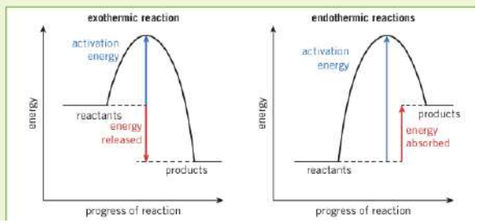
Changing pressure (HT only)

Change	Effect	Explanation
increase the pressure	favours the reaction that results in fewer molecules	decreasing the number of molecules within the vessel opposes the change because it decrease pressure
decrease the pressure	favours the direction that results in more molecules	increasing the number of molecules within the vessel opposes the change because it increase pressure

Reaction profiles

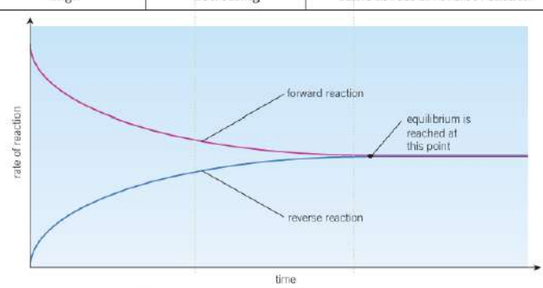
A **reaction profile** shows whether a reaction is exothermic or endothermic.

The **activation energy** is the minimum amount of energy that particles must have to react when they collide.



How dynamic equilibrium is reached

Progress of reaction	start of reaction	middle of reaction	at dynamic equilibrium
Amount of A + B	high	decreasing	constant
Frequency of collisions A + B	high	decreasing	constant
Rate of forward reaction	high	decreasing	same as rate of reverse reaction



Amount of C + D	zero	increasing	constant
Frequency of collisions C + D	no collisions	increasing	constant
Rate of reverse reaction	zero	increasing	same as rate of forward reaction

Crude oil

Crude oil is incredibly important to our society and economy. It is formed from the remains of ancient biomass – living organisms (mostly plankton) that died many millions of years ago.

Raw crude oil is a thick black liquid made of a large number of different compounds mixed together. Most of the compounds are **hydrocarbons** of various sizes. Hydrocarbons are molecules made of carbon and hydrogen only.

Combustion

Hydrocarbons are used as **fuels**. This is because when they react with oxygen they release a lot of energy. This reaction is called **combustion**. Complete combustion is a type of combustion where the only products are carbon dioxide and water.

Properties

Whether or not a particular hydrocarbon is useful as a fuel depends on its properties:

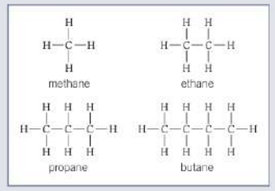
- **flammability** – how easily it burns
- **boiling point** – the temperature at which it boils
- **viscosity** – how thick it is

Its properties in turn depend on the length of the molecule.

Chain length	Flammability	Boiling point	Viscosity
long chain	low	high	high (very thick)
short chain	high	low	low (very runny)

Alkanes

One family of hydrocarbon molecules are called **alkanes**. Alkane molecules only have single bonds in them. The first four alkanes are:



The different alkanes have different numbers of carbon atoms and hydrogen atoms. You can always work the molecular formula of an alkane by using C_nH_{2n+2}.

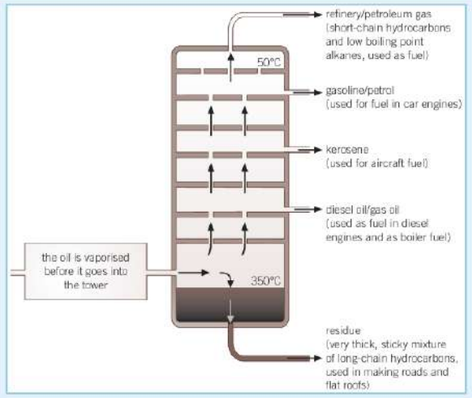
Fractional distillation

The different hydrocarbons in crude oil are separated into fractions based on their boiling points in a process called **fractional distillation**. All the molecules in a fraction have a similar number of carbon atoms, and so a similar boiling point.

The process takes place in a fractionating column, which is hot at the bottom and cooler at the top.

The process works like this:

1. crude oil is vapourised (turned into a gas by heating)
2. the hydrocarbon gases enter the column
3. the hydrocarbon gases rise up the column
4. as hydrocarbon gases rise up the column they cool down
5. when the different hydrocarbons reach their boiling point in the column they condense
6. the hydrocarbon fraction is collected.



Products from fractional distillation

Many useful products come from the separation of crude oil by fractional distillation.

Fuels	Feedstock	Useful materials produced
petrol, diesel oil, kerosene, heavy fuel oil, and liquefied petroleum gases	fractions form the raw material for other processes and the production of other substances	solvents, lubricants, polymers, and detergents

Cracking

Not all hydrocarbons are as useful as each other. Longer molecules tend to be less useful than shorter ones. As such, there is a higher demand for shorter-chain hydrocarbons than longer-chain hydrocarbons.

A process called **cracking** is used to break up longer hydrocarbons and turn them into shorter ones.

Cracking produces shorter alkanes and **alkenes**.

Two methods of cracking are:

- catalytic cracking – vaporise the hydrocarbons, then pass them over a hot catalyst
- steam cracking – mix the hydrocarbons with steam at a very high temperature

Alkenes

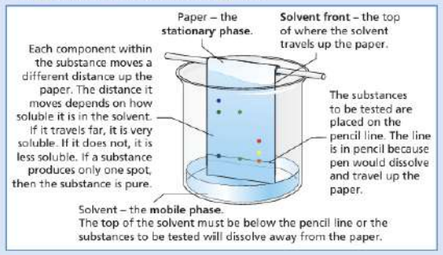
Alkenes are a family of hydrocarbons that contain double bonds between carbon atoms.

Alkenes are also used as fuels, and to produce polymers and many other materials.

They are much more reactive than alkanes. When mixed with bromine water, the bromine water turns from orange to colourless. This can be used to tell the difference between alkanes and alkenes.

Chromatography

Chromatography is a method to separate different components in a mixture. It is set up as shown here, with a piece of paper in a beaker containing a small amount of **solvent**.



Calculating R_f values

The **R_f value** is a ratio of how far up the paper a certain spot moves compared to how far the solvent has travelled. It can be calculated using the equation:

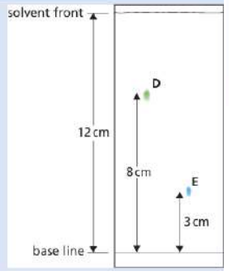
$$R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$

It will always be a number between 0 and 1.
The R_f value depends on the solvent and the temperature, and different substances will have different R_f values.
The R_f values for particular solvents can be used to identify a substance.

Using the equation for calculating the R_f of a substance, you can calculate the R_f values for compounds **D** and **E** as follows:

the R_f value for compound **D** is $\frac{8\,\text{cm}}{12\,\text{cm}} = 0.67$

the R_f value for compound **E** is $\frac{3\,\text{cm}}{12\,\text{cm}} = 0.25$



Testing gases

Common gases can be identified using the follow tests:

Gas	What you do	Observation
hydrogen	hold a lighted splint near the gas	hear a squeaky pop
oxygen	hold a glowing splint near the gas	splint re-lights
carbon dioxide	bubble the gas through limewater	the limewater turns milky (cloudy white)
chlorine	hold a piece of damp litmus near the gas	bleaches the litmus white

Pure and impure

In chemistry, a **pure** substance is a single element or compound that is not mixed with any other substance.

Pure substances melt and boil at specific temperatures.

An **impure** substance contains more than one type of element or compound in a **mixture**.

Impure substances melt and boil at a range of temperatures.

Formulations

Formulations are examples of mixtures. They have many different components (substances that make them up) in very specific proportions (amounts compared to each other).

Scientists spend a lot of time trying to get the right components in the right proportions to make the most useful product.

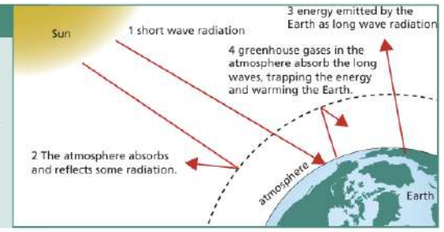
Formulations include fuels, cleaning agents, paints, alloys, fertilisers, and foods.

Greenhouse gases

Greenhouse gases, such as carbon dioxide, methane, and water vapour, absorb radiation and maintain temperatures on the Earth to support life.

However, in the last 150 years, more greenhouse gases have been released due to human activities.

- carbon dioxide – combustion of fossil fuels, deforestation
- methane – planting rice fields, cattle farming



Global warming

Scientists have gathered peer-reviewed evidence to demonstrate that increasing the amount of greenhouse gases in the atmosphere will increase the overall average temperature of the Earth. This is called **global warming**.

However, it is difficult to make predictions about the atmosphere as it is so big and complex. This leads some people to doubt what scientists say.

Global climate change

Global warming leads to another process called **global climate change** – how the weather patterns over many years and across the entire planet will change.

There are many different effects of climate change, including:

- sea levels rising
- extreme weather events
- changes in the amount and timing of rainfall
- changes to ecosystems and habitats
- polar ice caps melting.

Other pollutants released in combustion of fuels

Pollutant	Origin	Effect
carbon monoxide	incomplete combustion of fuels	colourless and odourless toxic gas
particulates (soot and unburnt hydrocarbons)	incomplete combustion of fuels, especially in diesel engines	**global dimming**, respiratory problems, potential to cause cancer
sulfur dioxide	**sulfur impurities** in the **fuel** reacting with **oxygen** from the **air**	**acid rain** and respiratory problems
oxides of nitrogen	nitrogen from the **air** being heated near an engine and reacting with oxygen	acid rain and respiratory problems

Potable water

Water is a vital resource for life. **Potable water** is water that is safe to drink. However, most water on Earth is not potable.

Type of water	What it has in it
pure water	only water molecules
potable water	water molecules, low levels of salts, safe levels of microbes
salty water (sea water)	water molecules, dangerously high levels of salt, can have high levels of harmful microbes
fresh water (from rivers, lakes, or underground)	water molecules, low levels of salt, often has high levels of harmful microbes

Salty water

Some countries do not have lots of fresh water available. Desalination is the process to turn saltwater into potable water. This requires a lot of energy and can be done by:

- **distillation**
- **reverse osmosis.**

Reverse osmosis involves using membranes to separate the salts dissolved in the water. The water needs to be pressurised and the salty water corrodes the pumps. As such, it is an expensive process.

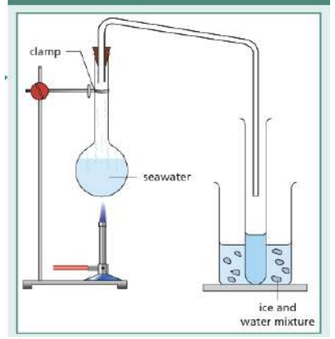
Fresh water

In the UK, potable water is produced from rain water that collects in lakes and rivers.

To produce potable water:

1. Choose an appropriate source of fresh water.
2. Pass the water through filters to remove large objects.
3. **Sterilise** the water to kill any microbes using ozone, chlorine, or UV light.

Distillation



Questions:

1. Explain how the different alkanes of crude oil can be separated. Compare and contrast this with the process of cracking.
2. Explain how Potable water is produced from waste water
3. Use the collision theory to describe how increasing the temperature of a reaction increases the rate of reaction
4. Write a method to investigate the rate of reaction using different sized marble chips.
5. Describe in detail the process of electrolysis inclusive of ionic equations
6. Compare and contrast endothermic and exothermic reactions with examples.
7. Describe the development of the early atmosphere.

AQA GCSE Combined Science: Physics

Paper 1 Revision Sheets

Energy stores

chemical	the energy transferred during any chemical reaction e.g. fuels, foods, chemicals in batteries
kinetic	energy an object has because it is moving e.g. a ball rolling down a hill
gravitational potential	the energy stored in an object because of its position e.g. an object above the ground
elastic potential	the energy stored in a springy object when you stretch or squash it e.g. a stretched rubber band or a compressed spring
thermal	the energy a substance has because of its temperature e.g. a hot drink

Energy transfers

Energy can be transferred to and from different stores by:

Heating

Energy is transferred from one object to another object with a lower temperature.

Waves

Waves (e.g., light and sound) can transfer energy.

Electricity

An electric current transfers energy.

Forces (mechanical work)

Energy is transferred when a force moves or changes the shape of an object.

Calculating the energy in an energy store

When an object is raised or lowered, the increase or decrease in its gravitational potential energy store is given by:

change of gravitational potential energy store, ΔE_p (J) = mass, m (kg) × gravitational field strength, g (N/kg) × change of height, Δh (m)

$$E_p = m g h$$

An object's kinetic energy store depends only on its mass and speed.

kinetic energy, E_k (J) = $\frac{1}{2}$ × mass, m (kg) × speed^2, v^2 (m/s)^2

$$E_k = \frac{1}{2} m v^2$$

The elastic potential energy store of a stretched spring can be calculated using:

elastic potential energy, E_e (J) = $\frac{1}{2}$ × spring constant, k (N/m) × extension^2, e^2 (m)^2

$E_e = \frac{1}{2} k e^2$ (assuming the limit of proportionality has not been exceeded)

Power is how much work is done (or how much energy is transferred) per second. The unit of power is the watt (W).

1 watt = 1 joule of energy transferred per second

power, P (W) = energy transferred to the appliance, E (J) / time taken for energy to be transferred, t (s)

$$P = \frac{E}{t}$$

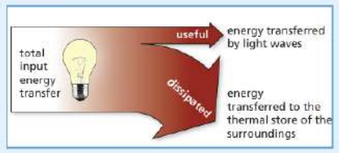
or

power, P (W) = work done, W (J) / time, t (s)

$$P = \frac{W}{t}$$

Useful and dissipated energy

Energy cannot be created or destroyed – it can only be transferred usefully, stored, or dissipated (wasted).



Energy is never entirely transferred usefully – some energy is always dissipated, meaning it spreads out and gets transferred to less useful stores.

All energy eventually ends up transferred to the thermal energy store of the surroundings.

In machines, work done against the force of friction usually causes energy to be wasted, because energy is transferred to the thermal store of the machine and its surroundings.

H **Lubrication** is a way of reducing unwanted energy transfer due to friction.

H **Streamlining** is a way of reducing energy wasted due to air resistance or drag in water.

H Use of thermal insulation is a way of reducing energy wasted due to heat dissipated to the surroundings.

Efficiency is a measure of how much energy is transferred usefully. You must know the equation to calculate efficiency as a *decimal*:

efficiency = useful energy output (J) / total input energy (J)

To give efficiency as a *percentage*, just multiply the result from the above calculation by 100 and add the % sign to the answer.

Specific heat capacity

When a substance is heated or cooled, the temperature change depends on:

- the substance's mass
- the type of material
- how much energy is transferred to it.

Every type of material has a **specific heat capacity**, which is the amount of energy needed to raise the temperature of 1 kg of the substance by 1 °C.

The energy transferred to the thermal store of a substance can be calculated from the substance's mass, specific heat capacity, and temperature change:

change in thermal energy (J) = mass (kg) × specific heat capacity (J/kg °C) × temperature change (°C)

$$\Delta E = m c \Delta\theta$$

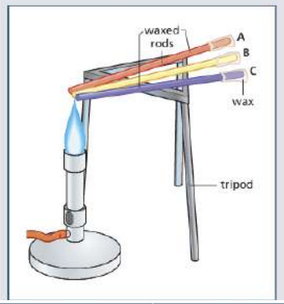
This equation will be given to you on the equation sheet, but you need to be able to select and apply it to the correct questions.

Thermal conductivity

The **thermal conductivity** of a material tells you how quickly energy is transmitted through it by thermal conduction.

You can test the thermal conductivity of rods made of different metals using this experimental set-up. Each rod must have the **same diameter** and length, and the same temperature difference between its ends.

One end of each rod is covered in wax and the other ends are heated equally. The faster the wax melts, the higher the thermal conductivity of the metal.



Insulating buildings

Heating bills can be expensive so it is important to reduce the rate of heat loss from buildings.

Some factors that affect the rate of heat loss from a building include:

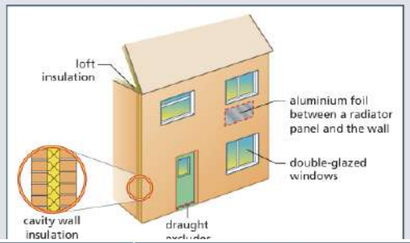
1 the thickness of its walls and roof
2 the thermal conductivity of its walls and roof. (lower thermal conductivity = lower rate of heat loss)

The thermal conductivity of the walls and roof can be reduced by using **thermal insulators**.

A **thermal insulator** is a material that has a low thermal conductivity. The rate of energy transfer through an insulator is low.

The energy transfer per second through a material depends on:

1 the material's thermal conductivity
2 the temperature difference between the two sides of the material
3 the thickness of the material.

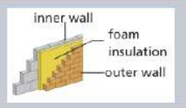


Loft insulation

Fibreglass has a low thermal conductivity so reduces the rate of energy transfer to the roof.

The greater the number of layers of insulation, the thicker the insulation will be, so the rate of energy transfer through the roof will be less.

Cavity wall insulation



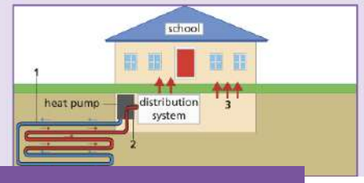
Wall insulation reduces the rate of energy transfer through the outer wall of the house. The cavity is the space between the two layers of brick that make up the wall. In new home builds the insulation is included as the wall is built. In older buildings, insulation can be pumped into the cavity.
It is a better insulator than the air it replaces. It traps the air in small pockets, reducing the rate of energy transfer by conduction.

Double glazing

Double glazing has two glass panes with dry air or a vacuum between the panes. The thicker the glass and the lower its thermal conductivity is, the slower the rate of transfer of energy through it by conduction will be.
Dry air is a good insulator, so it reduces the rate of energy transfer by conduction. A vacuum also prevents energy transfer by convection. Triple glazing where a third pane of glass is added is even more efficient.

Heat pumps

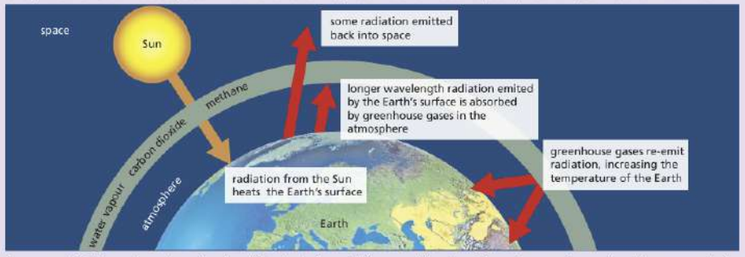
1 Liquid pumped into the ground absorbs thermal energy.
2 Inside the heat pump, the warmed water is transferred to the building's heating system.
3 The thermal energy is distributed through the building using radiators or underfloor heating.



Radiation and the Earth's temperature

The temperature of the Earth depends on lots of factors, including the rate at which visible light and infrared radiation are reflected, absorbed, and emitted by the Earth's atmosphere and surface.

Greenhouse gases absorb infrared radiation emitted by the surface of the Earth and prevent it escaping into space. They then re-emit the infrared radiation back towards the surface of the Earth, increasing the Earth's temperature. Greenhouse gases in the Earth's atmosphere include water vapour, methane, and carbon dioxide.



Human activities such as burning fossil fuels, deforestation, and livestock farming are increasing the amount of greenhouse gases in the Earth's atmosphere. This is causing the Earth's temperature to increase – a major cause of climate change.

Non-renewable energy resources

- not replaced as quickly as they are used
- will eventually run out

For example, fossil fuels and nuclear fission.

Renewable energy resources

- can be replaced at the same rate as they are used
- will not run out

For example, solar, tidal, wave, wind, geothermal, biofuel, and hydroelectric energies.

Renewable energy resources

Resource	Main uses	Source	Advantages	Disadvantages
solar energy	generating electricity	sunlight transfers energy to solar cells	• can be used in remote places • very cheap to run once installed • no pollution/greenhouse gases produced	• supply depends on weather • expensive to buy and install • cannot supply large scale demand
	heating	sunlight transfers energy to solar heating panels		
hydroelectric energy	generating electricity	water flowing downhill turns generators	• low running cost • no fuel costs • reliable and supply can be controlled to meet demand • no pollution/greenhouse gases produced	• expensive to build hydroelectric dams • floods a large area behind the dam, destroying habitats and resulting in greenhouse gas production from rotting vegetation
tidal energy	generating electricity	turbines on tidal barrages turned by water as the tide comes in and out	• predictable supply as there are always tides • can produce large amounts of electricity • no fuel costs • no pollution/greenhouse gases produced	• tidal barrages: – change marine habitats and can harm animals – restrict access and can be dangerous for boats – are expensive to build and maintain • cannot control supply • supply varies depending on time of month
wave energy	generating electricity	floating generators powered by waves moving up and down	• low running cost • no fuel costs • no pollution/greenhouse gases produced	• floating generators: – change marine habitats and can harm animals – restrict access and can be dangerous for boats – are expensive to build, install, and maintain • dependent on weather • cannot supply large scale demand
wind energy	generating electricity	turbines turned by the wind	• low running cost • no fuel costs • no pollution/greenhouse gases produced	• supply depends on weather • large amounts of land needed to generate enough electricity for large scale demand • can produce noise pollution for nearby residents
geothermal energy	generating electricity heating	radioactive substances deep within the Earth transfer heat energy to the surface	• low running cost • no fuel costs • no pollution/greenhouse gases produced	expensive to set up only possible in a few suitable locations around the world
biofuels	generating electricity transport	fuel produced from living or recently living organisms, for example, plants and animal waste	• can be **carbon neutral** – the amount of carbon dioxide released when the fuel is burnt is equal to the amount of carbon dioxide absorbed when the fuel is grown • reliable and supply can be controlled to meet	• expensive to produce biofuels • growing biofuels requires a lot of land and water that could be used for food production • can lead to deforestation – forests are cleared for growing biofuel crops

Non-renewable energy resources

Resource	Main uses	Source	Advantages	Disadvantages
coal	generating electricity	extracted from underground	• enough available to meet current energy demands • reliable – supply can be controlled to meet demand • relatively cheap to extract and use	• release carbon dioxide when burned – one of the main causes of climate change • release other polluting gases, such as sulfur dioxide (from coal and oil) which causes acid rain • oil spills in the oceans kill marine life • will eventually run out
oil	generating electricity transport heating			
natural gas	generating electricity heating			
nuclear fission	generating electricity	mining naturally occurring elements, such as uranium and plutonium	• no polluting gases or greenhouse gases produced • enough available to meet current energy demands • large amount of energy transferred from a very small mass of fuel • reliable – supply can be controlled to meet demand	• produces nuclear waste, which is: – dangerous – difficult and expensive to dispose of – stored for centuries before it is safe to dispose of. • nuclear power plants are expensive to: – build and run – decommission (shut down).

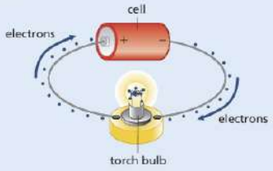
Electric current

Electric **current** is when **charge** flows. The charge in an electric circuit is carried by electrons.
The unit of current is the ampere (amp, A).

1 ampere = 1 coulomb of charge flow per second

charge (C) = current (A) × time (s)

In circuit diagrams, current flows from the positive terminal of a cell or battery to the negative terminal. This is known as conventional current.
In a single closed loop, the current has the same value at any point in the circuit.
Metals are good conductors of electricity because they contain delocalised electrons, which are free to flow through the structure.



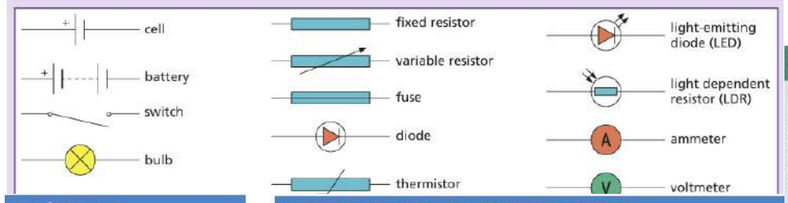
Potential difference

Potential difference (p.d.) is a measure of how much energy is transferred between two points in a circuit. The unit of potential difference is the volt (V).
- The p.d. across a component is the work done on it by each coulomb of charge that passes through it.
- The p.d. across a power supply or battery is the energy transferred to each coulomb of charge that passes through it.

For electrical charge to flow through a circuit, there must be a source of potential difference.

$$\text{potential difference (V)} = \frac{\text{energy transferred (J)}}{\text{charge (C)}}$$

Circuit components



Resistance

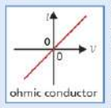
When electrons move through a circuit, they collide with the ions and atoms of the wires and components in the circuit. This causes **resistance** to the flow of charge.
The unit of resistance is the ohm (Ω).
A long wire has more resistance than a short wire because electrons collide with more ions as they pass through a longer wire.
The resistance of an electrical component can be found by measuring the current and potential difference:

$$\text{potential difference (V)} = \text{current (A)} \times \text{resistance (Ω)}$$

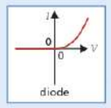
$$V = IR$$

Current–potential difference graphs

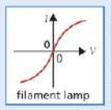
A graph of current through a component against the p.d. across it (I–V graph), is known as the component characteristic.



Current is directly proportional to the p.d. in an ohmic conductor at a constant temperature. The resistance is constant.



The current through a diode only flows in one direction (the forward direction). There needs to be a minimum voltage before any current will flow.



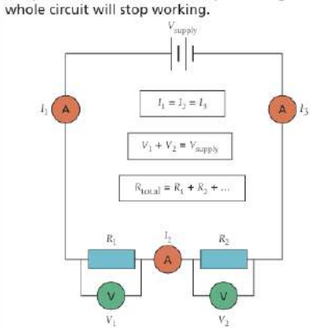
As more current flows through the filament, its temperature increases. The atoms in the wire vibrate more, and collide more often with electrons flowing through it, so resistance increases as temperature increases. The resistance of a thermistor decreases as temperature increases. The resistance of a light dependent resistor (LDR) decreases as light intensity increases.

The resistance of an ohmic conductor can be found by calculating the gradient of the *I*–*V* graph and taking the inverse:

$$\text{resistance} = \frac{1}{\text{gradient}}$$

Series circuits

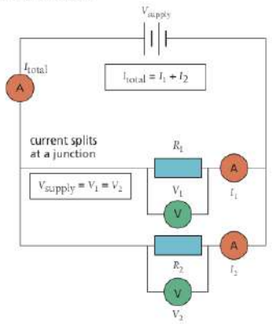
In a series circuit, the components are connected one after the other in a single loop. If one component in a series circuit stops working the whole circuit will stop working.



Components with a higher resistance will transfer a larger share of the total p.d. because $V = IR$ (and current is the same through all components).

Parallel circuits

A parallel circuit is made up of two or more loops through which current can flow. If one branch of a parallel circuit stops working, the other branches will not be affected.



The total resistance of two or more components in parallel is always less than the smallest resistance of any branch. Adding more resistors in parallel decreases the total resistance of a circuit.

Changes of state

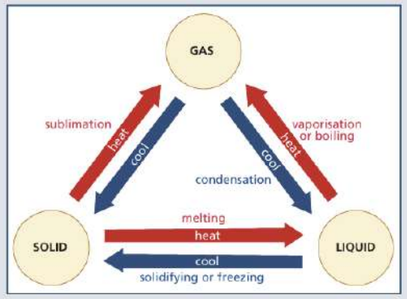
Changes of state and conservation of mass

Changes of state are physical changes, because no new substances are produced. The mass always stays the same because the number of particles does not change.

Particles and kinetic energy

When the temperature of a substance is increased, the kinetic energy store of its particles increases and the particles move faster.

If the kinetic store of a substance's particles increases or decreases enough, the substance may change state.



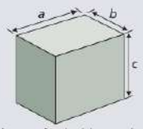
Density

You can calculate the density of an object if you know its mass and volume:

$$\text{density (kg/m}^3\text{)} = \frac{\text{mass (kg)}}{\text{volume (m}^3\text{)}}$$

$$\rho = \frac{m}{V}$$

To find the volume of a regular solid use the equation $a \times b \times c$.

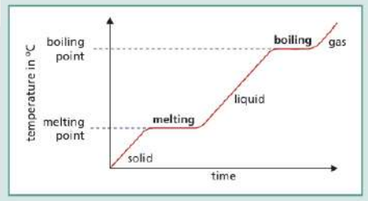


volume of cuboid = $a \times b \times c$

For a small irregular solid, lower it on a thread into a measuring cylinder partially filled with water. The change in water level is the volume of the object.

Latent heat

In a graph showing the change in temperature of a substance being heated or cooled, the flat horizontal sections show when the substance is changing state.
The energy transfers taking place during a change in state do not cause a change in temperature, but they do change the internal energy of the substance.



The energy transferred when a substance changes state is called the **latent heat**.

Specific latent heat – the energy required to change the state of 1 kg of a substance with no change in temperature.

Specific latent heat of fusion – the energy required to melt 1 kg of a substance at its melting point , with no change in temperature.

Specific latent heat of vaporisation – the energy required to evaporate 1 kg of a substance at its boiling point, with no change in temperature.

The energy needed to change the state of a substance can be calculated using the equation:

$$\text{thermal energy for a change in state (J)} = \text{mass (kg)} \times \text{specific latent heat (J/kg)}$$

$$E = m \times l$$

The relationship between temperature and pressure in gases

Gas temperature

The particles in a gas are constantly moving in random directions and with random speeds.
The temperature of a gas is related to the average kinetic energy of its particles.
When a gas is heated, the particles gain kinetic energy and move faster, so the temperature of the gas increases.

Gas pressure

The pressure a gas exerts on a surface, such as the walls of a container, is caused by the force of the gas particles hitting the surface.
Millions of these impacts happen every second, resulting in a steady pressure against any given surface.

If the temperature of a gas in a sealed container is increased, the pressure increases because
- the particles move faster, so they hit the surfaces with more force
- the number of these impacts per second increases, exerting more force overall.

If a gas is compressed quickly, for example, in a bicycle pump, its temperature can increase. This is because
- compressing the gas requires a force to be applied to the gas – this results in work being done to the gas, since work done = force × distance
- the energy transferred to the internal store of the gas cannot be dissipated quickly enough to the surroundings.

Radioactive decay

Radioactive decay is when nuclear radiation is emitted by unstable atomic nuclei, so that they become more stable. It is a *random* process. This radiation can knock electrons out of atoms in a process called **ionisation**.

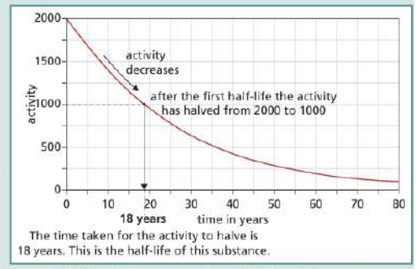
Type of radiation	Change in the nucleus	Ionising power	Range in air	Stopped by	Decay equation
α alpha particle (two protons and two neutrons)	nucleus loses two protons and two neutrons	highest Ionising power	travels a few centimetres In air	stopped by a sheet of paper	${}^{A}_{Z}\text{X} \rightarrow {}^{(A-4)}_{(Z-2)}\text{Y} + {}^{4}_{2}\alpha$
β beta particle (fast-moving electron)	a neutron changes Into a proton and an electron	high Ionising power	travels ≈ 1m In air	stopped by a few millimetres of aluminium	${}^{A}_{Z}\text{X} \rightarrow {}^{A}_{(Z+1)}\text{Y} + {}^{0}_{-1}\beta$
γ gamma radiation (short-wavelength, high-frequency EM radiation)	some energy Is transferred away from the nucleus	low ionising power	virtually unlimited range in air	stopped by several centimetres of lead or metres of concrete	${}^{A}_{Z}\text{X} \rightarrow {}^{A}_{Z}\text{X} + {}^{0}_{0}\gamma$

Half-life

The **half-life** of a radioactive source is the time taken for
- half the number of unstable nuclei in a sample to decay
- the count rate or activity of a source to halve.

The half-life of a source can be found from a graph of its count rate or activity against time.

To find the activity of a source after a given amount of time:
1 calculate *n*, the number of half-lives that have passed, by dividing the total time passed by the duration of one half-life.
2 Determine the fraction of unstable nuclei remaining using $\frac{1}{2^n}$
3 Multiply this fraction by the initial activity.



The time taken for the activity to halve is 18 years. This is the half-life of this substance.

For example, the radioactive source described by the graph has a half-life of 18 years and an initial activity of 2000. After 54 years:

$$n = \frac{54}{18} = 3$$

$$\text{Fraction of remaining nuclei} = \frac{1}{2^3} = \frac{1}{8}$$

$$\text{Activity} = 2000 \times \frac{1}{8} = 250$$

Net decline can be given as a ratio: $\text{net decline} = \frac{\text{reduction in activity}}{\text{original activity}}$

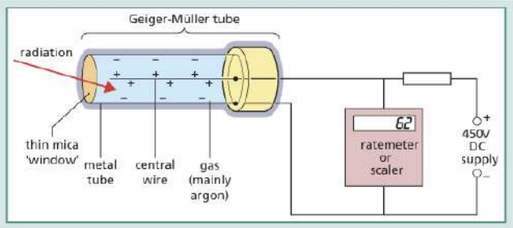
Activity and count rate

The **activity** of a radioactive source is the rate of decay of an unstable nucleus, measured in becquerel (Bq).

1 Bq = 1 decay per second

Detectors (e.g. **Geiger-Müller tubes**) record a **count rate** (number of decays detected per second).

$$\text{count rate after } n \text{ half-lives} = \frac{\text{initial count rate}}{2^n}$$



Questions:

1. Create a method to calculate the density of an irregular shaped object
2. Compare and contrast the different types of radiation
3. Explain how non-renewable resources can contribute to global warming.
4. Link specific heat capacity to insulation materials in the home
5. Compare and contracts specific heat capacity and specific latent heat
6. Write a method to investigate the resistance in a wire.
7. Explain, using your knowledge of particles why there isn't a chang eof temperature when changing state of a heating/cooling curve

AQA GCSE Combined Science: Physics Paper 2 Revision Sheets

Scalars and vectors

Scalar quantities only have a magnitude (e.g., distance and speed).

Vector quantities have a magnitude as well as a direction (e.g., velocity and displacement).

Forces

A **force** can be a push or pull on an object caused by an interaction with another object. Forces are vector quantities.

Contact forces occur when two objects are touching each other.

For example, friction, air-resistance, and tension are contact forces.

Non-contact forces act at a distance (without the two objects touching).

For example, gravitational force, electrostatic force, and magnetic force.

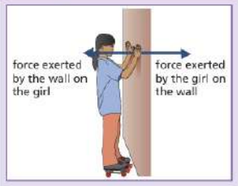
Newton's third law

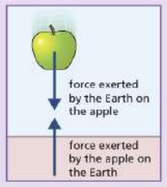
Newton's third law states that when two objects interact with each other, they exert equal and opposite forces on each other.

This means that forces always occur in pairs. Each pair of forces:

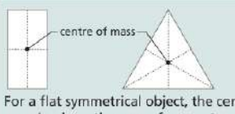
- act on separate objects
- are the same size as each other
- act in opposite directions along the same line
- are of the same type, for example, two gravitational forces or two electrostatic forces.

Force pairs





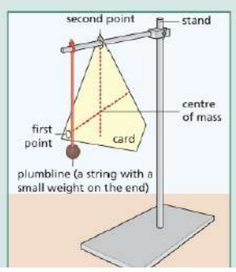
Centre of mass



For a flat symmetrical object, the centre of mass is where the axes of symmetry meet.

The point through which the weight of an object can be considered to act is called **its centre of mass.**

For a flat, irregularly shaped object, find the centre of mass by suspending the object from different points and drawing a vertical line down. The centre of mass always lies beneath the point of suspension, so it will be where these vertical lines meet.



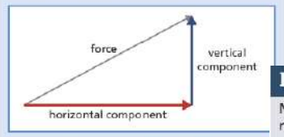
Newton's first law

Newton's first law states that if the forces acting on an object are balanced, the resultant force on the object is zero, and:

- if the object is at rest, it stays stationary
- if the object is moving, it keeps moving with the same speed and in the same direction.

Resolving forces

A single force can always be resolved (split) into two component forces, at right angles to each other:



The two component forces added together give the same effect as the single force.

Force and acceleration

If the velocity of an object changes, it must be acted on by a **resultant force.** The acceleration is always in the same direction as the resultant force.

Gravity

The force of **gravity** close to the Earth is due to the planet's **gravitational field strength.**

Weight is the force acting on an object due to gravity.

The weight of an object

- can be considered to act at the object's **centre of mass**
- can be measured using a calibrated spring-balance (newtonmeter).

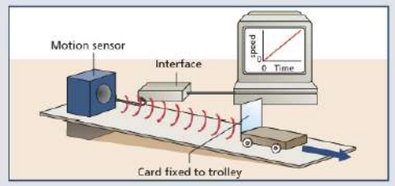
weight, W (N) = mass, m (kg) × gravitational field strength, g (N/kg)

$$W = mg$$

Weight and mass are directly proportional to each other, which can be written as $W \propto m$. So, for example, as the mass of an object doubles, its weight doubles.

Investigating acceleration

Motion sensors that are attached to a computer can be used to record how the velocity of an object changes.



As the trolley accelerates down the runway, the velocity increases with time. The trolley accelerates at a constant rate down the ramp, which is shown by a straight line on the speed–time graph.

Making the runway steeper would make the trolley accelerate faster, and the line on the graph would be steeper.

Speed

Distance, **speed** and time are linked by the equation:

distance travelled, s (m) = speed, v (m/s) × time, t (s)

$$s = v \times t$$

In reality, objects rarely move at a constant speed. So it can be useful to calculate average speed:

$$\text{average speed (m/s)} = \frac{\text{total distance travelled (m)}}{\text{total time taken (s)}}$$

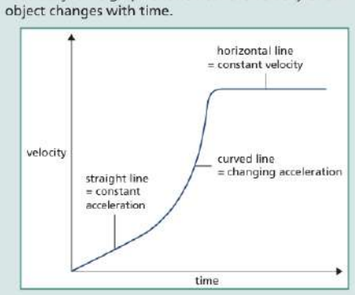
These are typical average speeds for everyday movement:

- walking ≈ 1.5 m/s
- running ≈ 3 m/s
- cycling ≈ 6 m/s

The speed of sound in air is typically given as 300 m/s. This is an average speed, as the actual speed will change based on temperature, weather conditions, etc.

Velocity–time graphs

A velocity–time graph shows how the velocity of an object changes with time.



The gradient of the line in a velocity–time graph is equal to the object's acceleration.

Newton's Second Law

Newton's Second Law says that the acceleration a of an object:

- is proportional to the resultant force on the object

$$a \propto F$$

- is inversely proportional to the mass of the object

$$a \propto \frac{1}{m}$$

Resultant force, mass, and acceleration are linked by the equation:

resultant force, F (N) = mass, m (kg) × acceleration, a (m/s²)

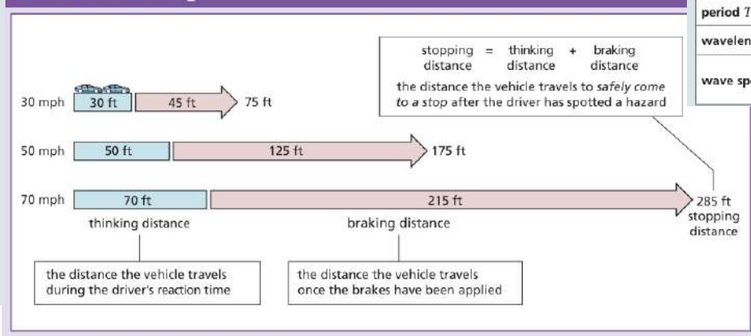
$$F = ma$$

The **inertial mass** of an object is a measure of how difficult it is to change the velocity of an object. It can be found using:

$$\text{inertial mass (kg)} = \frac{\text{force (N)}}{\text{acceleration (m/s}^2\text{)}}$$

$$m = \frac{F}{a}$$

Forces and braking



Factors affecting braking distance:

- speed of the car
- road conditions
- conditions of the brakes and the tyres

Factors affecting thinking distance:

- speed of the car
- tiredness
- drugs
- alcohol
- distraction

Deceleration

Deceleration of a vehicle can be calculated using the equation

$$v^2 = u^2 + 2as$$

where v is the final speed, u is the initial speed, a is the acceleration, and s is the distance travelled.

You can investigate how easily a material or a spring stretches by hanging weights from it.

The increase in length from the original is called the extension.

The measurements can be plotted on a graph of force against extension.

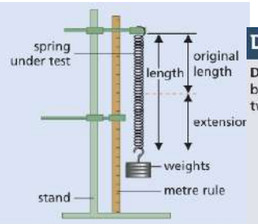
The spring constant can be calculated using the equation:

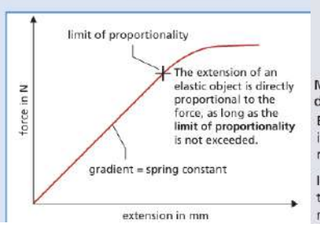
force applied, F (N) = spring constant, k (N/m) × extension, e (m)

$$F = ke$$

This relationship also applies to compressing an object, where e would be compression instead of extension.

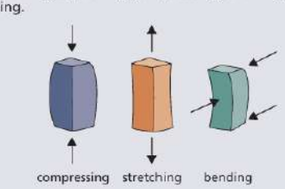
The spring constant of an object can be found by calculating the gradient of the straight section in a graph of force against extension.





Deformation

Deformation is a change in the shape of an object caused by stretching, squashing (compressing), bending, or twisting.



More than one force has to act on a stationary object to deform it, otherwise the force would make it move.

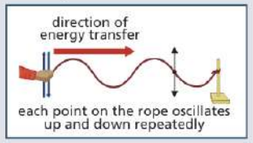
Elastic deformation – the object can go back to its original shape and size when the forces are removed.

Inelastic deformation – the object does not go back to its original shape or size when the forces are removed.

Transverse waves

The oscillations of a transverse wave are *perpendicular* (at right angles) to the direction in which the waves transfer energy.

Ripples on the surface of water are an example of transverse waves.

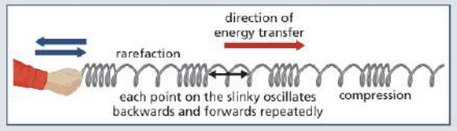


Longitudinal waves

The oscillations of a longitudinal wave are *parallel* to the direction in which the waves transfer energy.

Longitudinal waves cause particles in a substance to be squashed closer together and pulled further apart, producing areas of **compression** and **rarefaction** in the substance.

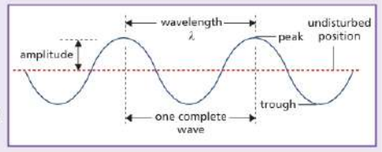
Sound waves in air are an example of longitudinal waves.



Properties of waves

Frequency and period are related by the equation:

$$\text{period (s)} = \frac{1}{\text{frequency (Hz)}} \qquad T = \frac{1}{f}$$



All waves obey the wave equation:

wave speed (m/s) = frequency (Hz) × wavelength (m)

$$v = f\lambda$$

Wave motion is described by a number of properties.

Property	Description	Unit
amplitude A	maximum displacement of a point on a wave from its undisturbed position	metre (m)
frequency f	number of waves passing a fixed point per second	hertz (Hz)
period T	time taken for one complete wave to pass a fixed point	second (s)
wavelength λ	distance from one point on a wave to the equivalent point on the next wave	metre (m)
wave speed v	distance travelled by each wave per second, and the speed at which energy is transferred by the wave	metres per second (m/s)

Ray diagrams

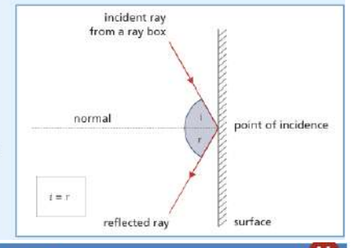
Ray diagrams can be used to show what happens when a wave is reflected at a surface.

To correctly draw a ray diagram for reflection:

1. use a ruler to draw all lines for the rays
2. draw a single arrow on the rays to show the direction the wave is travelling
3. draw a dotted line at right angles to the surface at the point of **incidence** (this line is normal to the surface)
4. label the normal, angle of incidence (*i*), and angle of reflection (*r*).

When reflection happens at a surface, the angle of incidence is always equal to the angle of reflection:

$$i = r$$



Reflection of waves

When waves arrive at the boundary between two different substances, one or more of the following things can happen:

Absorption – the energy of the waves is transferred to the energy stores of the substance they travel into (for example, when food is heated in a microwave)

Reflection – the waves bounce back

Refraction – the waves change speed and direction as they cross the boundary

Transmission – the waves carry on moving once they've crossed the boundary, but may be refracte

Momentum (H)

Momentum is a property of moving objects. It is a vector quantity.

Momentum depends on the mass and velocity of an object, and is defined by the equation:

momentum, p (kg m/s) = mass, m (kg) × velocity, v (m/s)

$$p = mv$$

Law of Conversion Momentum (H)

The **Law of Conservation of Momentum** says that in a closed system, the total momentum before an event (a collision or an explosion) is *equal* to the total momentum after the event.

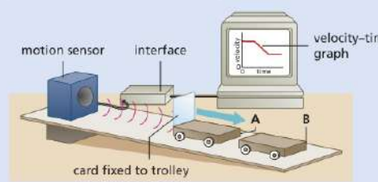
If two moving objects collide, the law of conservation can be written as:

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

m_1 = mass of object 1 — m_2 = mass of object 2

u_1 = initial velocity of object 1 — u_2 = initial velocity of object 2

v_1 = final velocity of object 1 — v_2 = final velocity of object 2



You can use a computer and a motion sensor to investigate a collision between two trolleys.

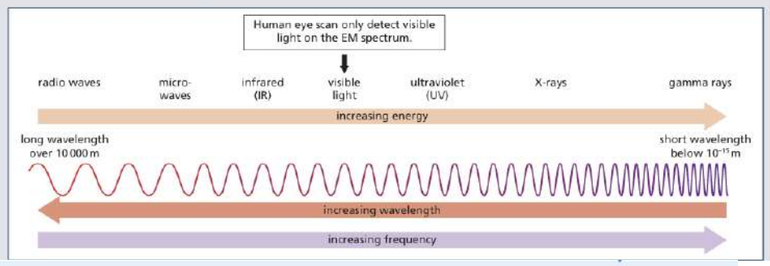
The computer gives the velocity of trolley A before the collision and the velocity of both trolleys after the collision.

The electromagnetic spectrum

Electromagnetic (EM) waves are **transverse** waves that transfer energy from their source to an absorber. For example, infrared waves emitted from a hot object transfer thermal energy.

EM waves form a continuous **spectrum**, and are grouped by their wavelengths and frequencies.

EM waves all travel at the same velocity through air or a vacuum. They travel all at a speed of 3×10^8 m/s through a vacuum.



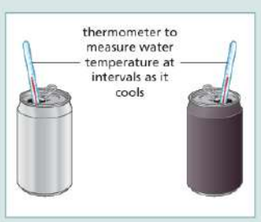
Type of EM wave	Use	Why is it suitable for this use? H	Hazards
radio waves	television and radio signals	• can travel long distances through air • longer wavelengths can bend around obstructions to allow detection of signals when not in line of sight	can penetrate the body and cause internal heating
microwaves	satellite communications and cooking food	• can pass through Earth's atmosphere to reach satellites • can penetrate into food and are absorbed by water molecules in food, heating it	
infrared	electrical heaters, cooking food, and infrared cameras	• all hot objects emit infrared waves – sensors can detect these to turn them into an image • can transfer energy quickly to heat rooms and food	can damage or kill skin cells due to heating
visible light	fibre optic communications	• short wavelength means visible light carries more information	can damage the retina
ultraviolet (UV)	energy efficient lights and artificial sun tanning	• carries more energy than visible light • some chemicals that are used inside light bulbs can absorb UV and emit visible light	can damage skin cells, causing skin to age prematurely and increasing the risk of skin cancer, and can cause blindness
X-rays	medical imaging and treatments	• pass easily through flesh, but not denser materials like bone • high doses kill living cells, so can be used to kill cancer cells – gamma rays can also be used to kill harmful bacteria	form of ionising radiation – can damage or kill cells, cause mutation of genes, and lead to cancers
gamma rays			

Infrared radiation

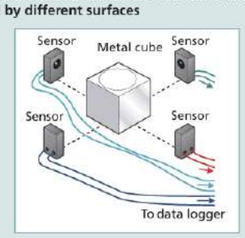
This practical investigates the rates of absorption and radiation of infrared radiation from different surfaces.

You should be able to plan a method to determine the rate of cooling due to emission of infrared radiation, and evaluate your method.

Monitoring the rate of cooling in cans with different surfaces



Using infrared detectors to measure the radiation emitted by different surfaces



To be accurate and precise in your investigation you need to:

- use an infrared detector with a suitable meter, where possible
- ensure that you always put the detector the same distance from the surface
- repeat measurements and calculate an average.

Reflection and refraction H

Different substances may absorb, transmit, **refract**, or **reflect** EM waves in ways that vary with their wavelength.

Refraction occurs when there is a difference in the velocity of an EM wave in different substances.

Magnets

Magnets have a north (N) and a south (S) pole.

When two magnets are brought close together, they exert a non-contact force on each other.

Repulsion – If the poles are the same (N and N or S and S), they will repel each other.

Attraction – If the poles are different (N and S or S and N), they will attract each other.

The force between a magnet and a magnetic material (iron, steel, cobalt, or nickel) is always attractive.

Magnetic fields

A **magnetic field** is the region around a magnet where another magnet or magnetic material will experience a force due to the magnet.

A magnetic field can be represented by magnetic field lines.

Field lines show the direction of the force that would act on a north pole at that point.

Field lines always point from the north pole of a magnet to its south pole.

A magnetic field's strength is greatest at the poles and decreases as distance from the magnet increases.

The closer together the field lines are, the stronger the field.

Induced and permanent magnets

A **permanent** magnet produces its own magnetic field, which is always there.

An **induced** magnet is an object that becomes magnetic when it is placed in a magnetic field.

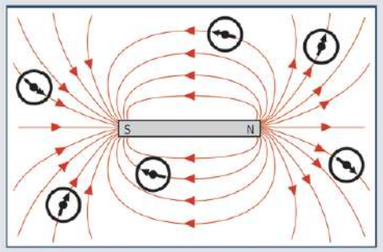
The force between an induced magnet and a permanent magnet is *always attractive* (it doesn't matter which pole of the permanent magnet the induced magnet is near).

If the induced magnet is removed from the magnetic field, it will quickly lose most or all of its magnetism.

Plotting magnetic fields

A magnetic compass contains a small bar magnet that will line up with magnetic field lines pointing from north to south.

A compass can be used to plot the magnetic field around a magnet or an **electromagnet**:



If it is not near a magnet, a compass will line up with the Earth's magnetic field, providing evidence that the Earth's core is magnetic.

As a compass points towards a south pole, the magnetic pole near the Earth's geographic North Pole is actually a south pole.

Electromagnetism

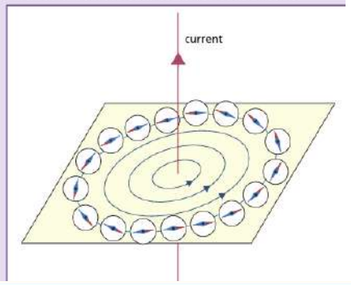
If an electric current flows through a wire (or other conductor), it will produce a magnetic field around the wire.

The field strength increases:
- with greater current
- closer to the wire.

Reversing the direction of the current reverses the direction of the field.

If the wire was gripped by someone's right hand so that the thumb pointed in the direction of the current, the fingers would curl in the direction of the magnetic field.

The field around a straight wire takes the shape of concentric circles at right angles to the wire:

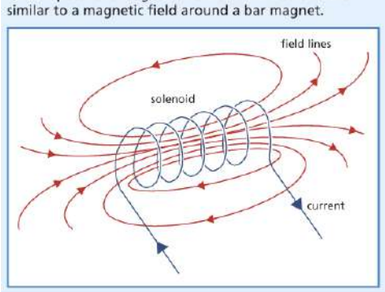


Solenoids

A **solenoid** is a cylindrical coil of wire.

Bending a current-carrying wire into a solenoid increases the strength of the magnetic field produced.

The shape of the magnetic field around a solenoid is similar to a magnetic field around a bar magnet.



Inside a solenoid the magnetic field is *strong* and *uniform*, which means it has the same strength and direction at all points.

The strength of the magnetic field around a solenoid can be increased by putting an iron core inside it.

If the wire was gripped by someone's right hand so that the fingers curl in the direction of the current in the coil, the thumb will point towards the north pole of the field.

Electromagnets are often solenoids with an iron core.

The motor effect H

When a current-carrying wire (or other conductor) is placed in a magnetic field, it experiences a force.

The force is due to the interaction between the field created by the current in the wire and the magnetic field in which the wire is placed.

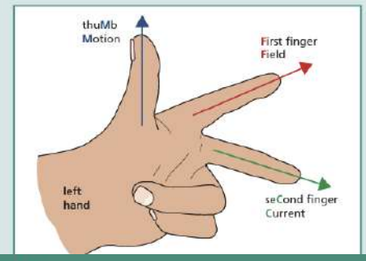
The magnet producing the field will experience an equal-sized force in the opposite direction.

The direction of the force is reversed if the current is reversed or if the direction of the magnetic field is reversed.

Fleming's left-hand rule H

The direction of the force/motion of the wire is always at right angles to both the current and the direction of the magnetic field it is within.

It can be worked out using Fleming's left-hand rule:



Magnetic flux density H

The **magnetic flux density** of a field is a measure of the strength of the magnetic field.

For a current-carrying wire at right angles to a magnetic field, the size of the force on it is given by the equation:

force = magnetic flux density × current × length

$$F = BIl$$

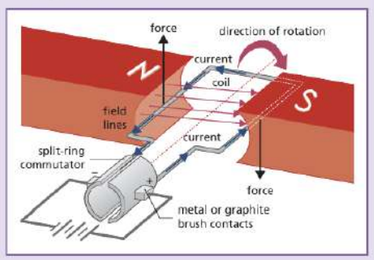
F is force in newtons (N)
B is magnetic flux density in tesla (T)
I is current in amperes (A)
l is length in metres (m)

Electric motors

A current-carrying coil of wire in a magnetic field will tend to rotate.

This is the basis of an electric motor.

The diagram below shows a simple motor made of one rectangular piece of wire.



When there is a current in the wire, it spins because:
- each side of the coil experiences a force due to being a current-carrying conductor in a magnetic field
- the forces on each side of the coil are in opposite directions.

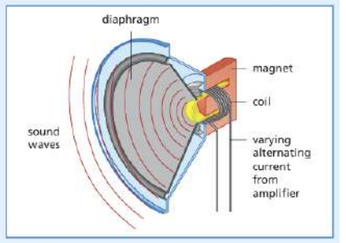
The **split-ring commutator** keeps the motor spinning in the same direction.

The ends of the wire swap contacts with the power supply every half turn, so current always flows in the same direction relative to the magnetic field.

The motor can be made to spin
- *faster* – by increasing the current in the coil or increasing the strength of the magnetic field
- *in the opposite direction* – by reversing the direction of the current or reversing the direction of the magnetic field.

Loudspeakers H

Moving-coil loudspeakers and headphones use the **motor effect** to convert changes of current in a coil of wire to changes of pressure in sound waves.



A coil of wire is placed inside a permanent magnet (so it is inside a magnetic field) and is attached to a diaphragm.

When a current flows through the coil, it experiences a force due to the motor effect.

This causes the diaphragm to move.

When the current changes direction, the force on the coil also changes direction, causing the diaphragm to move in the opposite direction.

Variations in the current make the coil and diaphragm vibrate.

These vibrations create variations of pressure in the air, which form a sound wave.

The frequency of the sound wave produced is the same as the frequency of the alternating current supplied to the coil.

Questions:

1. Create a method to investigate wave speed using a ripple tank
2. Compare and contrast the magnetic field found in a magnet, an electromagnet and a solenoid
3. Explain how factors that affect stopping and thinking distance affect the overall braking distance
4. Explain why scientists may state that microwaves used in mobile phones are dangerous to humans
5. Compare and contrast the use of electromagnets in electric motors and loudspeakers

AQA GCSE GEOGRAPHY REVISION MASTER SHEET

Paper 1: Living with the physical environment	Paper 2: Challenges in the human environment	Paper 3: Geographical applications
1hr 30mins, 35% of the total grade	*1hr 30mins, 35% of the total grade*	*1hr 30mins, 30% of the final grade*
*ANSWER all Q1 (Section A) on the challenge of natural hazards, all of Q2 (Section B) on the living world choosing COLD environments NOT hot, answer Q3 (coasts) and Q4 (rivers) in section C **DO NOT ANSWER** Q5 (glaciation)*	Answer all Q1 (Section A) on urban issues and challenges, all of Q2 (Section B) on the changing economic world, answer Q3 (Section C) on the challenge of resource management and then Q6 (Energy). **DO NOT ANSWER** Q4 (food) or Q5 (water)	Answer **ALL** questions
Section A: The Challenge of Natural Hazards o Define a natural hazard and give examples o The different factors affecting hazard risk **Tectonic hazards** o The distribution of earthquakes and volcanoes (plate tectonics) o The differences between destructive, constructive, and conservative plate boundaries o Contrasting case studies of a tectonic hazard in HICs (Chile 2010) and LICs (Nepal 2015): causes, primary and secondary effects, immediate and long-term responses o Reasons for people choosing to live in areas at risk from tectonic hazards o 3Ps (Prediction, Planning and Protection) for tectonic hazards	**Section A: Urban Issues and Challenges** o Rates of urbanisation around the world and factors affecting (migration and natural increase) o Distribution and characteristics of megacities **Urban World** o Case study of a NEE city (Rio de Janeiro, Brazil): location, importance, reasons for growth o Opportunities- access to healthcare, education, water supply, energy and economic development in urban industrial areas o Challenges- growth of favelas, lack of clean water, sanitation, informal employment, crime, waste disposal, air/ water pollution, traffic congestion o Urban planning to improve the quality of life for the urban poor (Favela Bairro Project) o Case study of a HIC city (London, UK): location, importance, reasons for growth (international	**Section A: Issue Evaluation** • Using figures to make a decision about a relevant geographical issue: Pre-release booklet material to be released in March before examination **Section B: Fieldwork (Familiar and unfamiliar fieldwork)** • Setting up a suitable enquiry question - Southend. • Physical Geography fieldwork: • Human Geography fieldwork: • Selecting, measuring, and recording appropriate data (primary/ secondary data methods, sampling methods) • Processing and presenting fieldwork data (visual, graphic and cartographic methods

AQA GCSE GEOGRAPHY REVISION MASTER SHEET

Weather hazards

o Global atmospheric circulation (Hadley, Ferrell and Polar cells) and links to weather around the world

o The distribution of tropical storms (locations and why)

o The formation of tropical storms (what do they need to form?)

o Case study of a tropical storm (Typhoon Haiyan 2013): primary and secondary effects, immediate and long-term responses

o The effect of global warming on future tropical storms

o 3P's (Prediction, Planning and Protection) for tropical storms

o Causes of extreme weather in the UK

o Case study of UK extreme weather event (Somerset Levels Floods 2014): causes, impacts (social, environmental, and economic), immediate and long-term responses

o Causes of increasing extreme weather in the UK (climate change etc)

Climate change

o Evidence for climate change (e.g. ice cores, tree rings)

o Natural causes of climate change (Orbital changes- Milankovitch cycles, sunspots, volcanoes)

and natural migration changing the city's characteristics)

o Opportunities- cultural mix, recreation, entertainment, employment, integrated transport systems, urban greening

o Challenges- inequalities in housing, education, employment, urban deprivation, dereliction of buildings, greenfield/ brownfield sites, water disposal, urban sprawl (commuter towns)

o Regeneration to improve the city (London Olympics)

o Example of urban sustainability (BedZED, London): conserving water and energy, recycling waste, creating green space, urban transport strategies

Section B: The Changing Economic World

o Different ways of classifying parts of the world according to their level of development.

o Identify different economic and social measures of development and their limitations.

o Demographic Transition Model

o Causes and consequences of uneven development (physical, economic, wealth, health)

o Strategies to reduce the development gap and one example case study

- Describing, analysing, and explaining fieldwork data (making links, using statistical techniques)

Physical fieldwork:

AIM: To investigate the effectiveness of coastal management strategies along Southend Sea front

HYPOTHESIS: Hard engineering along Southend Sea front has led to a decreased in rates of coastal erosion

Human fieldwork:

AIM: To investigate the impact of tourism along Southend Sea front

HYPOTHESIS: Tourism development along Southend Sea front has led to a decline in the area's unique character and increase in negative environmental impacts

Section C: Geographical skills

- Latitude and longitude
- OS maps (4/6 figure grid references, scale & distance, relief)
- Graph skills (bar graphs, histograms, pie charts, pictograms, scatter graphs)
- Numerical/ statistical skills (mean, mode, range, median)

AQA GCSE GEOGRAPHY REVISION MASTER SHEET

o Human causes of climate change (enhanced greenhouse gas effect) o Managing climate change- mitigation (carbon capture, afforestation etc) o Managing climate change- adaptation (building flood barriers etc) **Section B: The Living World** **Ecosystems** o Define what an ecosystem/ biome is (food webs, nutrient cycle, biotic/ abiotic factors) o Example of a UK ecosystem (Epping Forest) and its interdependence o Distribution and characteristics of global biomes **Tropical Rainforest** o Characteristics (climate, soils, vegetation) o Plant adaptations (drip tips, buttress roots) o Case study of a tropical rainforest (Malaysian, Asia): causes and impacts of deforestation, management (international agreements, ecotourism, selective logging) **Cold Environments** o Characteristics (climate, soils, vegetation) o Plant and animal adaptations (bearberry plant, polar bears, arctic fox) o Case study of a cold environment (Svalbard): opportunities and challenges o Cold environments under threat	o Case Study of NEE: Nigeria o Location and importance of the country regionally and globally o Nigeria's political, social, cultural and environmental context o Nigeria's changing industrial structure (manufacturing industry boosts economy) o Role of transnational corporations (TNC) in Nigeria (Shell and Unilever) o Types of aid o The effects of economic development on quality of life for the population **Section C: The Challenge of Resource Management** o Importance of food, energy and water to social and economic wellbeing o Distribution of resources around the world (uneven distribution) **UK resources** o Distribution of UK's resources o Food- changing demand for different food (seasonal food and organic produce), food miles, agribusiness o Water- changing demand for water, water quality and pollution, supply and demand (areas of deficit and surplus), ways to manage water o Energy- changing energy mix, reducing reliance on fossil fuels, issues with exploitation of	

AQA GCSE GEOGRAPHY REVISION MASTER SHEET

o Managing cold environments

<u>Section C: UK Physical Landscapes</u>

o Relief of land across the UK (upland/ lowland areas)

Coasts

o Characteristics of constructive and destructive waves

o Coastal processes of erosion (hydraulic action, abrasion, attrition, solution), transportation (longshore drift) and deposition

o Subaerial processes (weathering and mass movement)

o Concordant and discordant coastlines

o Erosional landforms (wave-cut platforms, crack, cave, arch, stack, stump)

o Depositional landforms (beaches, spits, bars)

o Hard and soft engineering- costs and benefits of each

o Case study of a UK coastline (Swanage, Lyme Regis, Southend): landforms, management

Rivers

o The difference between the long profile (upper, middle lower course) and cross profile

o Processes of erosion, transportation, deposition in a river

energy sources

Energy management

o Global distribution of energy resources (surplus and deficit)

o Impacts of energy insecurity

o Strategies to increase energy supply – renewable v non renewable

o Gas – a non-renewable resource: advantages and disadvantages

o Sustainable energy use

o Example of a local sustainable energy scheme – The Chambamontera micro-hydro scheme

o Upper course landforms and their formation (waterfalls, gorges, V-shaped valleys)

o Middle course landforms and their formation (meanders, oxbow lakes)

o Lower course landforms and their formation (levees, floodplains, estuaries)

o Hydrographs- river discharge and lag time

o Hard and soft engineering for flooding-

GCSE History Revision Master Sheet

Revision Tick List -- Paper 1 Section A: The historic environment: Whitechapel

1. Explain the local context of Whitechapel, including the problems of housing and overcrowding, attempts to improve housing: the Peabody Estate.

2. Explain the links between the environment and crime: the significance of Whitechapel as an inner-city area of poverty, provision for the poor in the Whitechapel workhouses, The lack of employment and level of poverty.

3. Explain the prevalence of lodging houses and pubs creating a fluctuating population without ties to the community; the tensions arising from the settlement of immigrants from Ireland and Eastern Europe, increase in Jewish immigration during the 1880s and the tendency towards segregation, the growth of socialism and anarchism in Whitechapel.

4. Describe the organisation of policing in Whitechapel. The work of H division and the difficulties of policing the slum area of Whitechapel, the rookeries, alleys and courts. Assess the problems caused by alcohol, prostitution, protection rackets, gangs, violent demonstrations and attacks on Jews.

5. Critically asses Investigative policing in Whitechapel: developments in techniques of detective investigation, including the use of sketches, photographs and interviews; the impact of dealing with the crimes of Jack the Ripper.

6. Working with source:
   a. Knowledge of local and national sources relevant to the period.
   b. Recognise the strengths and weaknesses of different types of source for specific enquiries.
   c. Frame questions relevant to the pursuit of a specific enquiry.
   d. Select appropriate sources for specific investigations.

Paper 1 Section 2: Thematic section- crime, policing and punishment c.1000-presen day

7. Medieval England: c.1000-1500.
   Describe the nature of crime and changing definitions of criminal activity, including crimes against the person, property and authority e.g poaching as an example of 'social' crime, William I's Forest Laws.

8. Explain The nature of law enforcement and punishment: The role of the authorities and local communities in law enforcement in Anglo-Saxon, Norman and later medieval England, including tithings, the hue and cry, and the parish constable. The emphasis on deterrence and retribution, the use of fines, corporal and capital punishment. The use and end of the Saxon Wergild.

9. Medieval case studies:
   - The influence of the Church on crime and punishment in the early thirteenth century:
   - the significance of Sanctuary and Benefit of Clergy;
   - the use of trial by ordeal and reasons for its ending

10. Early Modern England c1500–c1700.
    Describe continuity and change in the nature of crimes against the person, property and authority, including heresy and treason. New definitions of crime in the sixteenth century:
    - Vagabondage
    - Witchcraft.

Revision Tick List -- Paper 2 Section A: Elizabethan England'

1. Describe key features of England in 1558
   a. government on Elizabeth's accession: structure and features
   b. Society on Elizabeth's accession: social hierarchy in the towns and countryside,
   c. Virgin Queen: legitimacy, gender and marriage: problems facing Elizabeth when she became queen- personal, religious etc

2. Evaluate the Challenges facing Elizabeth as new Queen
   a. Virgin Queen- character and strengths, reinvention of her role, propaganda.
   b. Challenges at home: financial weaknesses, what Elizabeth could do to raise finances, effects of her policies
   c. Challenges abroad: France, Scotland and Spain- relationships with these countries and how Elizabeth dealt with these problems.

3. Describe key features of The religious settlement:
   a. Religious divisions in England in 1558: why religion important, how divided, differences between Catholics, Protestants and Puritans.
   b. Elizabeth's religious settlement: key features of the settlement in 1559, aims of the settlement, impact, Royal Injunctions
   c. Church of England and its role in society: role in national government, town and village life, role of parish clergy in village/town life

4. Explain the causes and impact of the Religious challenges:
   a. The Puritan challenge: who were the Puritans, the nature of the challenge, the extent of the Puritan challenge?
   b. The Catholic challenge at home: The Counter Reformation, the nature of the threat at home, the extent of the Catholic threat.
   c. The Catholic challenge abroad: extent of Catholic challenge from abroad in 1570- France, the Papacy, Spain.

5. Assess the threat of Mary Queen of Scots:
   a. Mary's claim to the throne and arrival in England: why she was important, details surrounding Mary's exit from Scotland, Mary's imprisonment in Scotland, 1568.
   b. Mary Vs Elizabeth: Elizabeth's options with Mary, 1568-69, the casket Letters Affair, why Elizabeth did not make Mary heir.
   c. The execution of Mary: why she was executed, involvement in plots and dangers she posed, why the execution was significant.

6. Evaluate the causes, events and outcomes of the Plots and revolt at home:
   a. The revolt of the Northern Earls: why they rebelled, who the rebels were, the marriage plan, progress of the revolt, the results and significance of the revolt.
   b. The Ridolfi Plot: background, progress of the plot, outcomes and significance of the plot.
   c. The Throckmorton plot, 1583: who was involved, aims, events, failure, significance of the plot.
   d. The Babington Plot (1586) and the execution of Mary Q of S: who was involved, aims, events, failure, significance of the plot.
   e. Walsingham's spies: why Walsingham was important, his spy network, his use of ciphers, torture and execution; Agents provocateurs.

7. Evaluate the long-term tensions in relations with Spain:
   a. Political and Religious rivalry: religious rivalry, Spanish policy in the Netherlands, English response to Spain, Spanish fury and the Pacification of Ghent, Restoring Spanish influence, England and Spain closer to war.

Revision Tick List -- Paper 2 Section B: Superpowers and The Cold War

1. Explain reasons for the early tension between East and West: The Grand Alliance. The outcomes of the Tehran, Yalta and Potsdam conferences. The ideological differences between the superpowers and the attitudes of Stalin, Truman and Churchill. The impact on US-Soviet relations of the development of the atomic bomb, the Long and Novikov telegrams and the creation of Soviet satellite states in Eastern Europe.

2. Assess the reasons why The Cold War developed after 1946:
   The impact on US-Soviet relations of the Truman Doctrine and the Marshall Plan, 1947. The significance of Cominform (1947), Comecon (1949) and the formation of NATO (1949).
   Berlin: its division into zones. The Berlin Crisis (blockade and airlift) and its impact.
   The formation of the Federal Republic of Germany and German Democratic Republic.

3. Explain reason why The Cold War Intensified:
   The significance of the arms race and the formation of the Warsaw Pact.
   Events in 1956 leading to the Hungarian Uprising, and Khrushchev's response.
   The international reaction to the Soviet invasion of Hungary

4. Explain why there was increased tension between East and West:
   The refugee problem in Berlin, Khrushchev's Berlin ultimatum (1958), and the summit meetings of 1959–61.
   Soviet relations with Cuba, the Cuban Revolution and the refusal of the USA to recognise Castro's government. The significance of the Bay of Pigs Incident.
   Opposition in Czechoslovakia to Soviet control: the Prague Spring

5. Assess the causes, event and consequences of the Cold War crises:
   The construction of the Berlin Wall, 1961
   The events of the Cuban Missile Crisis.
   The Brezhnev Doctrine and the re-establishment of Soviet control in Czechoslovakia

Revision Tick List -- Paper 3 the USA, at home and abroad: Civil Rights and Vietnam

1. Explain how and why The Civil Rights Movement developed between 1954-60:
   a. How were black people treated in 1950s in 1960s America? Why?
   b. What did the principle of 'separate but equal' mean?
   c. Give two reasons why the civil rights movement grew in the 1950s.
   d. Explain who supported the Civil Rights Movement? Who opposed the Civil Rights Movement?
   e. What was the Ku Klux Klan?
   f. How did the NAACP fight for civil rights?
   g. What protest methods did CORE use?
   h. What happened to Emmett Till in 1955?
   i. Describe the actions of the Southern Democrat politicians who supported segregation?

2. Explain the causes, events and impact of the legislative successes in the late 1950s:
   a. What was the Brown vs Topeka case? What did it achieve? Why was it an important step in the Civil Rights Movement?
   b. What decision did the Supreme Court make in the Brown case (1954)?
   c. The limitations were there to the Brown ruling?
   d. What did President Eisenhower do in response to events at Little Rock High School in 1957? at happened in Little Rock? Why were these events significant?
   e. Why did the Montgomery Bus Boycott begin?
   f. Give two reasons why the Montgomery bus boycott was successful.
   g. the impact of Martin Luther King and the SCLC.

3. What methods of peaceful protest were used after 1960? Why were they significant?
   a. Greensboro sit-ins in 1960and the setting up of the SNCC.
   b. What was the aim and achievements of the Freedom Rides?
   c. What did President Kennedy do in the James Meredith case?
   d. Why did campaigners choose to campaign in Birmingham, Alabama, in 1963?
   e. Explain why the 1963 March on Washington was successful.
   f. Describe the issue that the Freedom Summer focused on?
   g. Describe the events at Selma in 1965?
   h. Give one limitation/weakness of the 1964 Civil Rights Act.
   i. What did the 1965 Voting Rights Act do?

4. Explain why protest grew more radical after 1965
   a. Explain why the Black Power movement grew in the 1960s, including their actions and impact, and the role if Malcom X.
   b. Describe the actions and impact of Smith and Carlos at the Mexico Olympics 1968
   c. Describe the aims, actions and impact of the Black Panthers from 1966
   d. Give one reason why Martin Luther King's 1966 campaign in Chicago was unsuccessful.
   e. Explain why there were 329 major riots across northern cities in the USA between 1964-1968.
   f. Details of the Kerner report and its impact.
   g. The impact of Martin Luther King's assassination.
   h. Name one positive reform that President Nixon introduced for black Americans.
   I . Give one way in which equality had still not been achieved by 1975.

US involvement in Vietnam

5. Explain the Cold War was and the differences in ideologies

6. Describe the colonial history of Vietnam before the war and the causes of conflict.
   a. Before WW2, Vietnam had been a colony belonging to which country?
   b. The Battle of Dien Bien Phu (1954), the end of French rule.
   c. Details of the leaders, Ho Chi Minh and Diem, and the division of Vietnam.
   d. Describe the aims and outcomes of The Geneva Accords (1954)

7. Explain why there was greater US involvement under Eisenhower (1953-61)
   a. Reason 1: The 'domino theory'
   b. Reason 2: Diem's government was weak

11. Explain the changes in the role of the authorities and local communities in law enforcement, including town watchmen.
The continued use of corporal and capital punishment; the introduction of transportation, the start of the Bloody Code.

12. Early Modern case studies:
- The Gunpowder Plotters, 1605: their crimes and punishment.
- Key individual: Matthew Hopkins and the witch-hunts of 1645–47. The reasons for their intensity; the punishment of those convicted

13. Industrial era: c.1700-1900.
Describe continuity and change in the nature of crimes against the person, property and authority, including:
● highway robbery, ● poaching ● smuggling. ● Changing definitions of crime exemplified in the ending of witchcraft prosecutions and treatment of the Tolpuddle Martyrs.

14. Explain the role of the authorities and local communities in law enforcement, including the work of the Fielding brothers.
● The development of police forces and the beginning of CID.
●Changing views on the purpose of punishment. The use and ending of transportation, public execution and the Bloody Code.
● Prison reform, including the influence of John Howard and Elizabeth Fry

15. Industrial case studies.
Pentonville prison in the mid nineteenth century: reasons for its construction;
● The strengths and weaknesses of the separate system in operation.
● Key individual: Robert Peel – his contribution to penal reform and to the development of the Metropolitan Police Force.

16. Modern era c.1900-present day.
Describe continuity and change in the nature of crimes against the person, property and authority, including new forms of theft and smuggling.
● Changing definitions of crime, including driving offences, race crimes and drug crimes.

17. Assess The role of the authorities and local communities in law enforcement, including:
- the development of Neighbourhood Watch.
- Changes within the police force: increasing specialisation, use of science and technology and the move towards prevention. The abolition of the death penalty; Changes to prisons, including the development of open Prisons; specialised treatment of young offenders; the development of non-custodial alternatives to prison.

18. Modern case studies:
- The treatment of conscientious objectors in the First and Second World Wars.
- The Derek Bentley case: its significance for the abolition of the death penalty.

b. Commercial rivalry with Spain: commercial rivalry, English hostility towards Spain, Privateering, deteriorating relations.

8. Evaluate the short-term cause of conflict with Spain
a. The Netherlands and Cadiz: background to war, the campaign in the Netherlands (1585-88), results, Drake's attack n Cadiz, significance of these attacks.
b. Spanish invasion plans: Why did Philip launch the Armada, strategy and tactics, why such a threat?

9. Analyse and evaluate the importance of the Armada
a. Reasons for the English victory: What happened to the Armada of 1588? Reasons for the English victory- communication problems, Spanish lack of supplies, English tactics superior, better armed and equipped, The Spanish panicked, the role of the weather.
b. Consequences of the English victory: For England- navy strengthened, Protestant cause stronger, improved foreign policy, Elizabeth's authority enhanced. Consequences for Spain- negative impacts.

10. Assess the key features of Elizabethan education and leisure:
a. Elizabethan education: attitudes to education, changing influences on education, types of education, changes in education 1558-88
b. Sport, pastimes and the theatre: Leisure in Elizabethan England- for different social classes. Spectator sports in Elizabethan England, literature and the theatre, Music and dancing.

11. Describe key features of poverty in Elizabethan England?
a. The problem of the poor: what was poverty? Types of people who were poor, reasons for poverty in Elizabethan England- population and town growth, bad harvests, economic recession, enclosure, sheep farming and increasing demand for land.
b. Changing attitudes: changing attitudes towards the poor, Elizabethans and poverty, Policies towards the poor in Elizabethan times- poor rate, charity, statute of artificers, poor relief act, and vagabonds act.

12. Evaluate factors promoting exploration: expanding trade, adventure, new technology, private investment, improvements in ship design, development of standardised maps, and the triangular trade. Drake's circumnavigation of the globe: Reasons for doing it- attacking Spain, revenge, profit. Significance of his circumnavigation.

13. Explain the circumstances leading up to and during Raleigh's attempts to colonise Virginia:
a. Raleigh and the attempted colonisation of Virginia: who Raleigh was, why Virginia was colonised, who went, what did they take?
b. The failure of Virginia: lack of food, poor leadership, lack of skills and experience, Native American attack, war with Spain. Significance if attempted colonisation.

6. Asses the Reaction to the crises:
Impact of the construction of the Berlin Wall on US-Soviet relations. Kennedy's visit to Berlin in 1963.
The consequences of the Cuban Missile Crisis: the 'hotline', the Limited Test Ban Treaty 1963; the Outer Space Treaty 1967; and the Nuclear Non-Proliferation Treaty 1968.
International reaction to Soviet measures in Czechoslovakia.

7. Explain why there were attempts to reduce tension between East and West:
Détente in the 1970s, SALT 1, Helsinki, and SALT 2.
The significance of Reagan and Gorbachev's changing
Attitudes.
Gorbachev's 'new thinking' and the Intermediate-Range Nuclear Force (INF) Treaty 1987.

8. Explain where and why flashpoints in the Cold War impacted relations:
The significance of the Soviet invasion of Afghanistan, the Carter Doctrine and the Olympic boycotts
Reagan and the 'Second Cold War', the Strategic Defence Initiative.

9. Evaluate the reasons for the collapse of Soviet control of Eastern Europe:
The impact of Gorbachev's 'new thinking' on Eastern Europe: the loosening Soviet grip on Eastern Europe.
The significance of the fall of the Berlin Wall.
The collapse of the Soviet Union and its significance in bringing about the end of the Warsaw Pact.

8. Explain why there was Greater Involvement Under Kennedy (1961-63)
a. The continuation of limited war, pacification, sensing in green berets, using chemicals to kill crops.
b. The Strategic Hamlet Program (1962): The US helped Diem set up strategic hamlets: large villages guarded by the ARVN, where people could feel safe and protected. The strengths and limitations of this.
c. Impact of the overthrow of Diem (1963), and Kennedy's assassination in 1963.

9. Explain why there was greater Involvement Under Johnson (1963-69)
a. aims- to set up a stable government in South Vietnam, and to avoid full-blown war.
b. Reasons why the Vietcong more of a threat by 1964.
c. The Gulf of Tonkin incident (1964)
d. Congress passed the Gulf of Tonkin Resolution. This allowed Johnson to send in US troops if necessary.
e. By 1965 the US was spending $2m a day on the war, there were 184,300 US troops in Vietnam (up from 23,300 in 1964)

10. Describe the US tactics:
a. Operation Rolling Thunder (1965-68)
b. Search and Destroy missions (operation cedar falls 1967)
c. Chemical warfare – Operation Ranch Hand 1961 (Agent Blue was used to kill crops. Agent Orange was used to kill jungle forests

11. Describe the strength of the Vietcong tactics
a. The Vietcong had the home advantage –they were familiar with Vietnam's jungle terrain and used it to their advantage. They fought a guerrilla war:
- They attacked with simple traps and sabotage (blowing up roads and bridges)
- They used 'hit and run' tactics, attacking then disappearing back into the jungle
- They only fought big battles occasionally, so that when they did it was a surprise tactic
- They dressed like normal people – they were a 'shadowy enemy'
- They used a complex system of tunnels to move around and surprise US troops

12. The key features of the Tet offensive, the aims, events, successes and failures for both sides.

13. Explain the key features of Vietnamisation Under Nixon (1969-73)
a. Nixon's ideas – known as the Nixon Doctrine - said that the US would no longer provide troops to its allies, only aid and training.
b. Vietnamisation meant shifting responsibility for fighting to the South Vietnamese Army (ARVN)
c. Reasons why it failed: The ARVN, US troops, training and equipment, Problems in South Vietnam.

14. Describe the Expansion of the War Under Nixon (1969-73)
a. In 1969 Nixon secretly ordered the bombing of the Ho Chi Minh Trail in neighbouring Cambodia, and in 1970 he sent in 30,000 US troops. Laos 1971.
b. Bombing of North Vietnam (1972)
c. attitudes to the war- support-patriotism, hard hats, Red Scare, Silent majority etc
d. Reasons that explain growing opposition to the war- US casualties, My Lai massacre 1968, The Draft, Kent State university, worldwide opposition, Civil Rights groups, role of the media etc.

13. Explain the reasons and actions that led to the end of the war in Vietnam between 1968-1975.
a. Ceasefire (1973) By 1972 both sides felt pressured to make peace, and a ceasefire was agreed in the Paris Agreement in 1973. However, America never got what it had been fighting for all along - in March 1975 North Vietnam invaded the South, and Vietnam became united as a communist country.

Question Stem Paper 1 (1 hour 20 minutes)	Questions Stem Paper 2 Part A (55 minutes)	Question Stem Paper 2 Part B (55 minutes)	Question Stem Paper 3 (1 hour 30 minutes)
Section A: Historic Environment (10%) Whitechapel Q1 a. Describe one features of…… (2) Q1 b. Describe one features of…… (2) Q2a How useful are Sources A and B for an enquiry into… (8) Q2b How could you follow up Source A to find out more about…. (4) Section B: Thematic Study (20%) Crime, policing and punishment, c1250 to present Q3 Explain one way in which X was different / similar to Y (4) Q4 Explain why….. (12) Q5 or Q6 'XXX was the turning point / most important reason why….' How far do you agree? (16 + 4 SPaG)	Booklet P: Period Study (20%) Superpower Relations and the Cold War, 1941–91 Q1 a. Explain one consequences of…. (4) Q1 b. Explain one consequences of…. (4) Q2 Write a narrative account analysing ….. (8) Q3 Explain two of the following: The importance of X for Y (8 + 8 = 16)	Booklet B: British Depth Study (20%) Early Elizabethan England, 1558–88 Q1a Describe one feature of…. (2) Q1b Describe one feature of…. (2) Q2 Explain why….. (12) Q3 or Q4 'The main reason why…. / XXX was the most important reason why…. / XXX was the most serious threat…..' How far do you agree? (16)	Modern Depth Study (30%): The USA: Conflict at home and abroad: civil Rights and Vietnam Q1 Give two things you can infer from Source A about…. (4) Q2a OR Q2b Explain why…. (12) Q3a How useful are Sources B and C for an enquiry into… (8) Q3b Interpretations 1 and 2 give different views on….. What is the main difference between the views? (4) Q3c Suggest one reason why Interpretations 1 and 2 give different views about ….. (4) Q3d How far do you agree with Interpretations 1 / 2 about ….. (16 + 4 SPaG)

Revision Tick List – Themes

Theme 1: My personal world

- Talk about family and friends – Explain why you get along or argue. ✔
- Give opinions on sports, music, TV, films, and talk about food, eating out, festivals, traditions, and family celebrations

Theme 2: Lifestyle and wellbeing

- Mental health - Daily habits (sleep, routine)
- Healthy unhealthy food - Exercise and sport
- Healthy lifestyle opinions - Dangers to health (screens, etc.)
- Changes to your lifestyle over time

Theme 3: My neighbourhood

- Talk about where you live, describe places, and give opinions.
- Talk about your town – Say what there is to do and explain what could be improved.
- Talk about your ideal town.
- Talk about the problems that face our planet.
- Write what you do at home and school to protect the environment.

Theme 4: Media and technology

- Discuss what you do online.
- Phones and apps.
- Advantages and disadvantages of technology.
- How you used technology before vs now.

Theme 5: Studying and my future

- Describe your school. Give your opinion about it.
- Say which are your favourite subjects, and why.
- Talk about the rules at your school.
- Describe a future or dream school trip.
- Talk about your plans after GCSEs, jobs, and careers.
- Talk about what qualities are needed for certain jobs

Theme 6: Travel and tourism

- Describe past holidays - Say where you want to go in the future and why.
- Talk about different ways to travel and say which you prefer.
- Describe a dream holiday – Describe where you would go and why

Revision Tick List - Paper 2 Listening (50 Marks) – Paper 3 Reading (50 Marks)

I have learnt my vocabulary, and I can use the listening Reading strategies:
Think of **similar words** - Beware of **tricky words** - Watch **negatives.**
Spot **opinions** - Check **tenses** and **time words**- Look at **verb endings**.
Beware of **False friends** – Avoid giving **vague answers** – Pay attention **to details.**

I can use comparatives to compare two things

- **C'est plus amusant que…** – It's more fun than…
- **C'est moins intéressant que…** – It's less interesting than…
- **C'est aussi facile que…** – It's as easy as…

Use superlatives **to** express "the most / the least / the best":
C'est le plus amusant. – It's the most fun. **C'est la meilleure activité.** – It's the best activity.
Le pire - the worst **Le meilleur – the best** **Le plus - the most** **Le moins – the least**
Use negatives: Je ne pense pas que… – I don't think that…
Use complex opinion structures: Il me semble que… – It seems to me that…

Revision Tick List - Paper 1 Speaking (50 marks)

Task 1: Read aloud (12 marks)

Read the short passage and pay attention to tricky sounds.
Pay attention to silent letters at the end of the words, **s liaisons (z sounds), tion, ch, e, é, oi, ille, gne, eu, au, en, ui, y….**

Answer two follow-on questions:
Question 1: J'aime le/la/les.....parce que c'est.....
Question 2: Á mon avis/Je pense que .....

Task 2: Role Play (10 marks)

Q1. Respond to questions about a specific time frame.
- **Je voudrais + infinitive/Je veux + infinitive**

Q2. Give opinions with reasons; **parce que c'est cher/amusant/moche/utile.**
Q3. Give a brief answer about a past event; **Récemment, j'ai fait de la natation.**
- **Le week-end dernier, j'ai + Past Participle.**

Q 4 &5. Ask two questions. **avez-vous… ? quel est…. ?est-ce que……. ? as-tu… ?**

Task 3: Picture Task (12 marks)

Describe the picture **in detail** using PALs. People, Location, Activity, Mood, sunshine)
Sur la photo je peux voir/il porte/ils sont dans/ils font/ils ont l'air + adjectif
People: *Sur la photo,* Il y a [number] personnes; elles portent [clothes] et ils ont l'air [happy/busy/etc.].Il sourit (he is smiling), il est sportif (he is sporty)
Location: La photo se passe [place], à l'intérieur/à l'extérieur; on voit [background/foreground]. *A gauche/á droite*
Activities: Ils/Elles sont en train de [activity] et l'ambiance est [happy/relaxed/etc.]
Answer two Follow-on questions:
Question 1: J'aime/ je n'aime pas .....parce que c'est .....
Question 2: Récemment, j'ai fait du vélo.....c'était.....

Task 4: Conversation (16 marks)

Expand your answers – Give more than one sentence, using connectives to extend answers and to connect ideas.
- Express your opinions and justify – If you do not have one, invent one.
- Talk about the past, present, and future in your answers.
- Use negative structures to contrast and develop your ideas further
- Use a wider vocabulary – Include words from different topics.
- Use infinitive structures –Modals with infinitives.
- Use complex grammar structures
- Give longer answers and speak independently without hesitation.

Express opinions in different tenses

Present – C'est (it is) **C'est très amusant** – It is very fun.
- **C'est assez facile** – It is quite easy Past – C'était (it was)
- **Avant, j'ai aimé les bonbons.** – Before, I liked sweets.
- **C'était fantastique.** – It was fantastic.

Future – Ce sera / ça va être (it will be / it's going to be)
- **Ce sera difficile.** – It will be difficult.
- **Ça va être passionnant.** – It's going to be exciting.

Make your sentences richer: **très** – very **beaucoup** – a lot **un peu** – a bit **assez** – quite **trop** – too **vraiment** – really **tellement** – so **plutôt** – rather

Revision Tick List - Paper 4 Writing (50 Marks) Q1 (90 words) Q2 (130-150 words)

I must cover and develop all the bullets points in each question

- **Use wide range of vocabulary related to the five themes.**
- **Use connectives to extend your sentences** (mais, et, donc, parce que, mais, aussi, et, parce que, car, en revanche, cependant, pourtant, ceci dit, étant donné que, vu que,donc,pour
- **Start with sequencers:** D'abord, ensuite, puis, finalement, en fin.
- **Use adjectives** (nul, marrant, passionnant ,amusant , fatiguant, facile, mauvais, démodé…)
- **Include qualifiers** : (très, un peu, assez, presque, trop, extrêmement, tellement,
- **Use negatives** (je ne pense pas que, il n'aime pas,il n'y a plus/jamais)

Express your opinions and give reasons

- **Likes and dislikes** : J'adore, J'aime , Je n'aime pas du tout, Je me passionne pour..., personnellement, Je pense que, à mon avis, pour moi, je trouve que, je crois que, je dirais que, j'estime que, ce que je j'aime c'est…
- **Express opinions in the past tense**. Avant, j'ai aimé les bonbons
- **Use complex opinions structures**: Il me semble que / Il me paraît que – J'ai horreur de
- **Use Comparatives** (c'est plus amusant que,…) - **Use Superlatives** (c'est le plus amusant)
- Use contrast between the past and now. Dans le passé.....mais maintenant.....

Narrate past events: Referring to the past

- **Le weekend dernier** – last weekend, **L'été dernier – last summer**
- **La semaine dernière** – last week, Le **mois dernier** – last month
- **L'année dernière** – last year, Dans le passé – in the past, Récement – recently
- **Il y a deux / trois jours / semaines / mois** – Two / three days / weeks / months ago

Use the perfect tense with avoir and être + past participle.
- Je suis allé, nous sommes allés, je suis resté.
- J'ai fait, j'ai regardé, nous avons vu, nous avons mangé

Use the imperfect tense: Quand j'étais petit, j'aimais/je faisais/je voulais
- **Use contrast** between past and now.

Avant j'ai voulu devenir infermier **mais maintenant** je veux travailler comme journalist.
amusant – fun **facile** – easy **fantastique** – fantastic **rapide** – fast **important** – important **utile** – useful **intéressant** – interesting **pratique** – practical **fascinant(e)** – fascinating **fier / fière** – proud **passionnant(e)** – exciting **animé(e)** – lively **tranquille** – calm/quiet **fatiguant** – tiring **difficile** – difficult **dangereux / dangereuse** – dangerous **inquiétant(e)** – worrying **ennuyeux / ennuyeuse** – boring **injuste** – unfair **grave** – serious **étroit(e)** – narrow **sale** – dirty **vieux / vieille** – old **démodé(e)** – old-fashioned

Narrate future events: Write about your plans

Use time phrases: La semaine prochaine – next week/ **L'année prochaine** – next year.
- **Á l'avenir/ dans le future/ dans cinq ans/plus tard**

Use Include time phrase and near future (je vais télécharger, je vais regarder)
- **Include the simple future tense.** J'irai, je ferai, je serai, j'habiterai
- **Express opinions in the future tense** Using ce sera....
- Use infinitive structures: Je dois + infinitive/ Je veux+ infinitive
- **Write about your hopes, dreams and wishes:**
- Use the conditional (je voudrais + inf, j'aimerais + inf,…, il y aurait, On pourrait + inf)

Include complex sentences such as:
- Si je pouvais, je voudrais - En+ present participle - Avant de + infinitive
- **Après avoir + past participle**/Après être + past participle
- Showcase what you know and avoid repetition.

You will always be asked for your opinions- if you do not have one, invent one.
J'adore – I love **J'aime** – I like. **Je n'aime pas du tout** – I don't like at all
J'ai horreur de… I am terrified of **Je déteste** – I hate.
Personnellement – Personally, **Je pense que –** I think that À **mon avis –** In my opinion.
Je trouve que – I find that **Je crois que –** I believe that. **Je dirais que –** I would say that.
J'estime que – I consider that. **Ce que j'aime, c'est–** What I like is…

I can use the present tense

I can use time phrases:
en géneral in general **maintenant** now
d'habitude usually **aujourd'hui** today
en ce moment right now **actuellement** currently
le jeudi on Thursdays

I can conjugate the regular verbs

The **present tense** is used to talk about things that are **happening now** or things you **do regularly**.
How to form it:
For regular verbs, take the **infinitive**, remove the ending, and add the correct present-tense endings.
Regular -ER verbs (e.g. *parler*)
Remove **-er**, add:
je … **e** tu … **es** il/elle/on … **e**
nous … **ons** vous … **ez** ils/elles … **ent**
Example: J*e parle* (I speak) Nous parl**ons** Ils parl**ent**
Regular -IR verbs (e.g. *finir*)
Remove **-ir**, add: **-IR** → is, is, it, issons, issez, issent
Regular -RE verbs (e.g. *vendre*)
Remove **-re**, add: **-RE** → s, s, -, ons, ez, ent
Je vends Ils vendent

Irregular verbs

Present tense of avoir (to have):
j'ai I have **tu as** you have **il/elle/on a** he/she/ one has
nous avons we have **vous avez** you have **ils/elles ont** they have
Present tense of être (to be)
je suis I am **tu es** you are **il/elle/on est** he/she/one is
nous sommes we are **vous êtes** you **are** **ils/elles sont** they are
Faire (to do / to make) Present tense:
je fais I do / I make **tu fais** you do / you make
il**/elle/on fait** he/she/one does / makes
nous faisons we do / we make **vous faites** you do / you make
ils/elles font they do / they make
Aller (to go) Present tense:
je vais I go / I am going
tu vas you go / you are going
il/elle/on va he/she/one goes.
nous allons we go / we are going
vous allez you go / you are going
il**s/elles vont** they go / they are going

I can narrate future events

la semaine prochaine next week **l'année prochaine** next year
le week-end prochain next weekend
dans le futur/à l'avenir in the future **dans cinq ans** in five years
d'ici une semaine in a week **un jour** someday

Near future tense and simple future

Near future tense expresses something that will happen **soon** or **for sure.**
Structure: Subject + aller (conjugated in the present) + infinitive verb
Example: **Je vais + manger (**I am going to eat)
•Je vais manger → I am going to eat
•Nous allons regarder un film → We are going to watch a film
Ils vont voyager → They are going to travel.
The simple future tense is used to talk about things that will happen in the future.
How to form it: For most verbs: infinitive + future endings
Future endings:
je … **ai** tu … **as** il/elle/on … **a**
nous … **ons** vous … **ez** ils/elles … **ont**
Examples: Je parlerai → I will speak
Tu finiras → You will finish Nous voyagerons → We will travel.
Irregular verbs (just the stems change, endings stay the same):
aller → ir- → **j'irai** (I will go) avoir → aur- → **j'aurai** (I will have)
faire → fer→ **je ferai** (i will do) être → ser- → **je serai** (I will be)

I can use the condional

Used to say what would happen.
- What you would do → **Je voyagerais.**
- Polite phrases → **Je voudrais…**
- Possibilities → **On pourrait…**

How to form it
1. Take the infinitive (parler / finir / vendre)
2. Add imperfect endings:

Ending Example (parler → parler-) je parlerais
je -**ais** tu -**ais** il/elle/on -**ait**
nous -**ions** vous -**iez** ils/elles -**aient**
Most important irregular stems
être to be ser- **je serais** avoir to have aur- **j'aurais**
aller to go ir- **j'irais** faire to do/make fer- **je ferais**
pouvoir to be able to pourr- **je pourrais**
vouloir to want voudr- **je voudrais**
Useful phrases
- **Je voudrais** = I would like **Ce serait** = It would be
- **Je pourrais** = I could **Je serais** content.
- **Il y aurait** = there would be **les jeunes devraient**

I can express opinions in different tenses:

Present – C'est (it is) C'est très amusant – It is very fun.
• C'est assez facile – It is quite easy Past – C'était (it was)
Past - Avant, j'ai aimé les bonbons. – Before, I liked sweets.
• C'était fantastique. – It was fantastic.
Future – Ce sera / ça va être (it will be / it's going to be)
• Ce sera difficile. – It will be difficult.
•Ça va être passionnant. – It's going to be exciting.
Conditional: Ce serait innoubliable – It would be unforgettable!

I can narrate past events: Referring to the past

Le weekend dernier – last weekend **L'été dernier** – last summer
La semaine dernière – last week **Le mois dernier** – last month
L'année dernière – last year **Dans le passé** – in the past,
Récemment – recently **Hier** — yesterday
Il y a deux jours — two days ago **Quand j'étais petit/plus jeune** – When I was younger

I can use the perfect tense with avoir

The perfect tense is used to talk about completed actions in the past (what you did, saw, ate, etc.). It has two parts: **Present tense of avoir + Past participle of the main verb.**
1 Present tense of avoir (to have)
j'ai I have **tu as** you have **il/elle/on a** he/she/one has.
nous avons we have **vous avez** you have **ils/elles ont** they have.
2 Forming the past participle Regular verbs.
-er parler → **-é** parlé **-ir** finir → -i fini **-re** vendre → **-u** vendu
3 Putting it together:
Subject + avoir (present) + past participle.
J'ai joué = I played Nous avons fini = We finished Ils ont vendu = They sold
4 Common irregular past participles (must learn them)
Avoir (to have) **eu** être (to be) **été** Faire (to do/make) fai**t** voir(to see) **vu** lire (to read) **lu** boire (to drink) **bu** prendre (to take) **pris**
Mettre (to put) **mis** vouloir (to want) voulu pouvoir (to be able to) **pu** dire (to say/tell) dit
5 **Negatives in the perfect tense.**
ne … pas goes **around the auxiliary** verb (avoir), not the past participle.
Je n'ai pas vu = I didn't see Nous n'avons pas mangé = We didn't eat

I can use the perfect tense with être

Some verbs form the perfect tense using être instead of avoir.
The structure is: **Subject + être (present) + past participle.**
BUT the past participle must agree with the subject.
1 Present tense of être (to be)
Je suis I am **nous sommes** we are
tu es you are **vous êtes** you (pl/formal) are
il/elle/on est he/she/one is **ils/elles sont** they are
2 **When do we use être?**
The Dr & Mrs Vandertramp verbs (movement/change of state)
Verb Meaning **Past participle**.
Rester to stay r**esté** Sortir to go out **sorti** Venir to come **venu**
Arriver to arrive **arrivé** Retourner to return reto**urné** Aller to go **allé** Partir to leave **parti**
Reflexive verbs: Always use être: Je me suis levé(e). (I got up.)
Past participle agreement
With être, the past participle must agree with the subject in gender and number:

Subject	Ending added	Example			
masculine singular		Il est allé	feminine singular	**+ e**	Elle est all**ée**
masculine plural	**+ s**	Ils sont allé**s**	feminine plural	**+ es**	Elles sont allé**es**

Negatives with être: ne … pas goes around the auxiliary (être). Je ne suis pas parti(e). Ils **ne** sont **pas** arrivés.

The imperfect tense:

The imperfect tense is used to talk about ongoing or repeated actions in the past, or to describe what things were like.
weather → **Il faisait** froid. feelings → **J'étais** triste.
Il y avait → there was J**e faisais** → I used to do
Je jouais au foot tous les samedis.
Nous regardions toujours la télé.
Quand j'étais petit, je voulais être avovat.

I will include complex grammatical structures such as

Si + imperfect tense + conditional
Si j'avais plus de temps**, je ferais** plus de sport.
Si je pouvais, je voyagerais en Australie**.**
•Pour + infinitive : Je fais du sport pour rester en forme.
•Après avoir / après être : Après avoir mangé, j'ai regardé un film.
• Use avant de + infinitive (Avant de partir, je vais ranger mes affaires).
• En faisant/en allant/ en mangeant/ en voyageant/ en buvant/en travaillant
Use complex opinion structures:
• **Il me semble que…** – It seems to me that…• **Il me paraît que…** – It appears to me that…

GCSE Business Studies Revision Master Sheet

PAPER 1	
Section A - BUSINESS ACTIVITY	**Explain the difference between training and development in a business context. How can both benefit a business?** (6 marks)
What is meant by "business activity," and how do businesses contribute to the economy? (5 marks)	**What is recruitment? Explain the difference between internal and external recruitment.** (6 marks)
Explain the differences between the primary, secondary, and tertiary sectors of business activity, with relevant examples for each. (6 marks)	**Describe the types of training offered by employers and how it benefits the business**
A business is deciding whether to expand into a new market. Discuss the factors that might influence their decision. (8 marks)	**Describe ways of motivating employees. Offering financial and non-financial rewards.**
What are the advantages and disadvantages for a business of being a sole trader compared to a limited company? (6 marks)	**A business is experiencing high employee turnover. Discuss two possible reasons for this and suggest two strategies the business could implement to reduce turnover.** (8 marks)
Explain the difference between a business' aims and objectives. (4 marks)	
Purpose of a business plan? (2 marks)	
Explain the difference between unlimited liability and limited liability with examples (6 marks)	
A small bakery has just opened. Discuss the advantages and disadvantages of the business being a sole trader. (6 marks)	
Section B: Marketing	
Explain what is meant by "market segmentation" and why it is important for businesses. (5 marks)	
Describe the role of the 4Ps (Product, Price, Place, Promotion) in developing a marketing strategy. (8 marks)	
A business is launching a new product. Discuss how market research can help the business make informed decisions. (8 marks)	**Command words (PAPER 1 AND 2)**
Evaluate the impact of digital marketing on businesses in the modern world. (9 marks)	**State/Define** questions (1 mark) can be either related to a case study or independent of a case study.
What is market research? Explain the difference between primary and secondary market research. (6 marks)	**Explain** questions (2 marks) require you to make a point that is then developed. If there is a given business in the question, then the answer also needs to be applied to the given case study. This means that you must use something specifically from the case study text.
Explain the concept of the marketing mix and describe how a company could use the 4Ps (Product, Price, Place, Promotion) to market a new smartphone. (8 marks)	**Analyse** questions (3 marks) require you to present a logical chain of reasoning. The chain of reasoning should begin with an appropriate point relating to the question and end with at least one impact of this particular point on the business. This should be applied specifically to the given case study.
What is a unique selling point (USP)? Why is it important for a business to have a USP in a competitive market? (6 marks)	**Discuss** questions (7 or 9 marks) require analysis of factors specifically applied to the given case study. Answers need to weigh up the factors and then conclude. These are always applied to a given case study.
Evaluate the benefits and challenges of using celebrity endorsements in marketing. (8 marks)	**Evaluate** questions (7 or 9 marks) require a supported judgement to be made. The question wording may use 'discuss', 'evaluate' or 'recommend' – all of these require a justified, reasoned, argument to be put forward.
Evaluate the advantages and disadvantages of using social media as a promotional tool for a new product. (8 marks)	**Justify** questions (9 marks) require focussing on one of the options given and considering the pros and cons of that option and then concluding that adds extra evaluation that hasn't repeated the same points as before. This essentially means stating which option is best and why. These questions always require application throughout the answer to the case study given. For a top-level answer, finish the conclusion with an 'it depends on' factor. It is important not to consider both options.
Section C – People	Case study – Unit one: Small business (answering using PINCC) product, industry, customers and competitors.
Explain the importance of good communication in a business. Give two examples of how poor communication might impact a business. (6 marks)	Case study – Unit two: Large business (answering using PINCC) product, industry, customers and competitors.
Describe the role of human resources (HR) in managing employees and ensuring their well-being.	

GCSE Business Studies Revision Master Sheet

PAPER 2	
Topic - Operations	**Topic - Influences on business**
What is meant by the term "production?" Explain the difference between capital and labour-intensive production. (6 marks)	**Explain how** economic conditions **such as inflation or recession can influence a business's decisions and performance.**
Explain the advantages and disadvantages of using mass production, batch, flow and job in a business. Add example to each production	**How can changes in consumer behaviour affect a business's marketing and product strategy?**
A company is considering using batch production for a new product. Explain what batch production is and describe two benefits of using this method. (6 marks)	**Describe two ways technological advancements might impact a business's operations or product development.**
Describe what is meant by "quality control" and explain two methods a business can use to ensure the quality of its products. (6 marks)	**What is meant by globalization, and how can it create opportunities or challenges for businesses?**
A company is facing challenges with its supply chain management. Discuss two factors that can affect supply chain efficiency. (6 marks)	**Identify and explain one legal factor (such as new regulations or employment laws) that could affect a business's operations.**
Describe the role of technology in improving operations. How can automation benefit a business's production process? (8 marks)	**Discuss the importance of economic influences, such as interest rates and unemployment, in shaping business strategies. Use examples from real businesses to support your answer.**
A business has been receiving a lot of complaints about the poor quality of its products. Discuss two strategies the business could use to improve its product quality. (8 marks)	**How do social factors like changing consumer attitudes towards sustainability and ethical sourcing affect the way businesses operate? Provide examples to illustrate your points.**
Explain what is meant by "economies of scale" and discuss two ways in which a business can benefit from economies of scale in production. (8 marks)	
Discuss the advantages and disadvantages of using just-in-time (JIT) inventory management for a business. (8 marks)	
Topic - Finance	
What is meant by the term "revenue"? (3 Marks) Explain how a business can increase its revenue. (3 marks)	
Explain the difference between gross profit and net profit. How can a business improve its net profit margin? (6 marks)	
What is a cash flow forecast? Describe two benefits of having a cash flow forecast for a business. (6 marks)	
A business is considering taking out a loan. Explain two advantages and two disadvantages of using loans as a source of finance. (8 marks)	
What is meant by "break-even analysis"? How can a business use break-even analysis to make decisions? (8 marks)	
Discuss the importance of profit for a business. What are two ways a business can increase its profitability? (6 marks)	
What is meant by "liquidity"? Discuss two ways a business can improve its liquidity position. (6 marks)	
Describing the role of budgeting (e.g., creating a financial plan that allocates resources, monitors expenses, and helps predict future financial performance).	
Explain the term "capital expenditure" and provide two examples of capital expenditure for a business. (6 marks)	
A business is considering taking out a bank overdraft. Explain what a bank overdraft is and discuss the advantages and disadvantages of using an overdraft as a source of finance. (8 marks	
Understand each type of course of finance	
Calculations – Break- even, ARR, Net profit, interpreting cash flow forecast.	

GCSE Computer Science Revision Master Sheet

Computer Science	80 Marks	2 Written Exams	90 Minutes
J277/01: Computer Systems		Component J277/02: Computational Thinking, Algorithms and Programming	
1.1 Systems Architecture	1.2 Memory and Storage	2.1 Algorithms	2.2 Programming Fundamentals
1. Describe the organisation and functions of computer systems. 2. Explain the role of the CPU, buses, registers, and other key components. 3. Diagram and label the internal structure of a computer system.	1. Explain the differences between primary (RAM, ROM) and secondary storage (HDD, SSD, optical, magnetic). 2. Describe the purpose and function of volatile and non-volatile memory. 3. Compare different storage media in terms of speed, capacity, and reliability.	1. Develop algorithms to solve defined problems using pseudocode and flowcharts. 2. Analyse and evaluate the efficiency of different algorithms. 3. Identify and correct errors in algorithm design.	1. Explain basic programming concepts including variables, data types, control structures, and functions. 2. Write, test, and debug simple programs. 3. Use pseudocode effectively to plan solutions before coding.
1.3 Computer Networks, Connections and Protocols	1.4 Network Security	2.3 Producing Robust Programs	2.4 Boolean Logic
1. Identify various network types (LAN, WAN, PAN, etc.) and their typical uses. 2. Explain the principles of data transmission, including network protocols (e.g. TCP/IP). 3. Describe the function of networking hardware such as routers, switches, and NICs. 4. Interpret network diagrams and understand how connections are established.	1. Explain common network security threats (malware, phishing, DoS attacks, etc.). 2. Describe the measures used to secure networks (encryption, firewalls, secure protocols). 3. Evaluate the effectiveness of different security strategies.	1. Design programs that handle errors and exceptions gracefully. 2. Ensure code is readable, maintainable, and well-documented. 3. Test programs thoroughly to verify that they meet the requirements and perform reliably under various conditions.	1. Construct and simplify Boolean expressions using AND, OR, NOT operators. 2. Apply Boolean logic in decision-making structures within programs. 3. Interpret truth tables and use them to validate logical expressions.
1.5 Systems Software	1.6 Ethical, Legal, Cultural and Environmental Impacts of Digital Technology	2.5 Programming Languages and Integrated Development Environments (IDEs)	Key Words
1. Explain the role and functions of system software, including operating systems and utility programmes. 2. Describe how the operating system manages hardware and software resources. 3. Compare system software with application software.	1. Discuss the ethical considerations surrounding digital technology and data usage. 2. Summarise key legal frameworks, including data protection and intellectual property laws. 3. Evaluate the cultural impact of digital technology on society. 4. Assess the environmental implications of computing and propose sustainable practices.	1. Understand the characteristics and applications of different programming languages. 2. Use an IDE to write, debug, and execute code efficiently. 3. Compare the advantages and limitations of various languages and environments for specific tasks.	CPU, Motherboard, RAM, SSD, LAN, TCP/IP, Encryption, Firewalls, Operating systems, Utility programmes Data protection, Sustainability, Pseudocode, Efficiency Variables, Functions, Debugging, Testing, Boolean expressions, Truth tables, Syntax, IDEs

Question Stems Computing

Knowledge & Recall	Understanding & Explanation	Application & Analysis	Evaluation & Justification
• Define the term [key computing concept]. • List the features of [technology/software/process]. • Identify three advantages of [computing system or concept].	• Explain how [a specific computing concept] works. • Describe the purpose of [computing tool or process]. • Compare [two computing concepts] and explain their differences.	• How would you use [a specific computing skill/concept] in a real-world scenario? • Given this scenario [describe a case study], what would be the best computing solution and why? • Analyse the impact of [a technology] on [a business/society].	• Evaluate the benefits and drawbacks of [a computing technology/system]. • Justify why [a certain computing solution] is more effective than another. • Assess the risks involved in [a computing-related decision].

ICT Revision Master Sheet

WJEC IT - Unit 1: ICT in Society	80 Marks	On Screen Exam	80 Minutes
Hardware and Software	Networks and Communication	Data and Storage	Cybersecurity and System Threats
1. Understand the purpose and functions of key hardware components (CPU, RAM, Storage, Input/Output devices). 2. Learn the different types of software (Operating Systems, Utility Software, Application Software). 3. Identify the differences between system and application software. 4. Explain the role of an operating system in managing hardware and software.	1. Understand the key network types: LAN, WAN, PAN, WLAN. 2. Learn about different network topologies (Star, Mesh, Bus, Ring, Hybrid). 3. Explain the role of networking hardware (Routers, Switches, Network Interface Cards, Wireless Access Points). 4. Know the advantages and disadvantages of wired vs wireless networks. 5. Understand IP addressing, MAC addresses, and their importance in networking.	1. Learn different types of storage (Primary, Secondary, Cloud, Optical, Magnetic, Solid State). 2. Explain the characteristics and benefits of each storage type. 3. Understand the need for data compression and encryption. 4. Know the importance of data redundancy and backup strategies.	1. Identify common cybersecurity threats: malware, phishing, social engineering, denial-of-service attacks. 2. Learn methods to prevent security threats (firewalls, anti-virus, authentication, encryption). 3. Explain the importance of strong passwords and multi-factor authentication. 4. Understand data protection legislation and its impact on businesses.
Software Development and Programming Concepts	Database Management	Cloud Computing and Emerging Technologies	IT and Business Applications
1. Learn the basic principles of programming: algorithms, pseudocode, flowcharts. 2. Understand different programming paradigms (Procedural, Object-Oriented, Event-Driven). 3. Identify common programming languages and their applications. 4. Know the software development lifecycle (Planning, Development, Testing, Deployment, Maintenance).	1. Understand the purpose of databases in IT systems. 2. Learn about relational databases, tables, primary keys, and foreign keys. 3. Explain the basics of SQL (SELECT, INSERT, UPDATE, DELETE commands). 4. Know the advantages of databases over spreadsheets.	1. Define cloud computing and explain its benefits and risks. 2. Understand different cloud service models (IaaS, PaaS, SaaS). 3. Learn about emerging technologies such as Artificial Intelligence, Blockchain, and Internet of Things (IoT). 4. Discuss the ethical and environmental impact of new technologies.	1. Explain how IT is used in different industries (Health, Finance, Education, Retail). 2. Understand the role of IT in decision-making and automation. 3. Learn about enterprise systems such as CRM and ERP. 4. Know the importance of IT policies and compliance in business settings.
Exam Strategy and Revision Techniques	Key Terms to Memorise	Example exam questions: (8 Marks)	Final Tips
1. Familiarise yourself with different question types (Short Answer, Extended Response). 2. Practice past paper questions and mark schemes. 3. Revise key terms and definitions using flashcards. 4. Create mind maps to summarise key concepts. 5. Use online resources for additional practice and interactive learning.	CPU, RAM, ROM, HDD, SSD, LAN, WAN, Cloud Computing, Encryption, Firewall, SQL, Algorithm, Cybersecurity, Operating System, Database, SaaS, IoT, Artificial Intelligence.	Evaluate the advantages and disadvantages of cloud computing for organisations. Provide examples to support your argument. A company is planning to upgrade its IT infrastructure. Discuss the key factors they should consider, including hardware, software, and network security. Assess the impact of emerging technologies such as Artificial Intelligence (AI) and Machine Learning (ML) on IT systems.	1. Allocate revision time effectively and focus on weaker areas. 2. Ensure understanding of practical applications, not just theory. 3. Take breaks and revise in manageable chunks. 4. Stay updated with current IT trends and developments. 5. Practice explaining concepts in simple terms to reinforce learning.

Question Stems for Unit 1

Knowledge & Recall	Understanding & Explanation	Application & Analysis	Evaluation & Justification
• Define the term [key IT concept]. • List the features of [technology/software/process]. • Identify three advantages of [IT system or concept].	• Explain how [a specific IT concept] works. • Describe the purpose of [IT tool or process]. • Compare [two IT concepts] and explain their differences.	• How would you use [a specific IT skill/concept] in a real-world scenario? • Given this scenario [describe a case study], what would be the best IT solution and why? • Analyse the impact of [a technology] on [a business/society].	• Evaluate the benefits and drawbacks of [a technology/system]. • Justify why [a certain IT solution] is more effective than another. • Assess the risks involved in [an IT-related decision].

GCSE Design and Technology Revision Master Sheet

Design and Technology Revision Tick List – Component 1-Core	– Component 1-Timbers
1. The impact of new and emerging technologies	1. Design contexts
2. How the critical evaluation of new and emerging technologies informs design decisions, considering contemporary and potential future scenarios from different perspectives, such as ethics and the environment	2. The sources, origins, physical and working properties of each natural and manufactured timber and their social and ecological footprint
3. How energy is generated and stored to choose and use appropriate sources to make products and power systems	3. The way in which the selection of each natural and manufactured timber is influenced
4. Developments in modern and smart materials, composite materials and technical textiles	4. The impact of forces and stresses on each natural and manufactured timber and how they can be reinforced and stiffened
5. The functions of mechanical devices used to produce different sorts of movements, including the changing of magnitude and the direction of forces	5. Typical stock forms, types and sizes used in order to calculate and determine the required quantity of each natural and manufactured timber
6. How electronic systems provide functionality to products and processes, including sensors and control devices to respond to a variety of inputs, and devices to produce a range of outputs	6. Alternative processes that can be used to manufacture typical products of each natural and manufactured timber to different scales of production
7. The use of programmable components to embed functionality into products to enhance and customise their operation	7. Specialist techniques, tools, equipment and processes that can be used on each natural and manufactured timber to shape, fabricate, construct and assemble a high-quality prototype
8. The categorisation of the types, properties and structure of ferrous and non-ferrous metals	8. Appropriate surface treatments and finishes that can be applied to each natural and manufactured timber for functional and aesthetic purposes
9. The categorisation of the types, properties and structure of papers and boards	
10. The categorisation of the types, properties and structure of thermoforming and thermosetting polymers	
11. The categorisation of the types, properties and structure of natural, synthetic, blended and mixed fibres, and woven, non-woven and knitted textiles	
12. The categorisation of the types, properties and structure of natural and manufactured timbers	
13. Performance characteristics of a wide range of materials, components and manufacturing processes, to be able to discriminate between them and select appropriately.	
14. Environmental, social and economic challenges when identifying opportunities and constraints that influence the processes of designing and making	
15. Investigate and analyse the work of past and present professionals and companies in order to inform design	
16. Use different design strategies to generate initial ideas and avoid design fixation	
17. Techniques employed when communicating and recording design ideas.	
Question Stem Component 1 Part A	Questions Stem Component 1 Part B
Give a property of the material…	Use notes and sketches to show…(6)
Explain advantages/disadvantages/reasons/working properties…	Explain advantages/disadvantages/reasons/working properties…
Discus features…	Show how…
Calculate volume/area/weight/quantity/cost/percentage…	Calculate volume/area/weight/quantity/cost/percentage…
Discuss…(6)	Evaluate with reference to…(9-12)

Health and Social Care Revision Master Sheet

R032 Principles of care in HSC	Command verbs	Useful Information
What are three rights that service users have when accessing care? Give an example of a care setting. Name one right a service user has when using that setting. What does “equal and fair treatment” mean in relation to service users’ rights? Describe two benefits for a service user’s health and well-being when their rights are maintained. What is meant by “confidentiality” in a health/social care context — and why is it important? Explain what could happen if a care setting fails to uphold a service user’s right to dignity or respect? List 5 person-centred values used in care What are the “6 Cs” that describe the qualities of a good service practitioner?	**State/Define** questions can be either related to a case study or independent of a case study. **Explain** questions require you to make a point that is then developed. If there is a given business in the question, then the answer also needs to be applied to the given case study. This means that you must use something specifically from the case study text. **Analyse** questions require you to present a logical chain of reasoning. The chain of reasoning should begin with an appropriate point relating to the question and end with at least one impact of this particular point on the business. This should be applied specifically to the given case study.	**Each Paper is 1 hour 15min** **1 minute per mark + 5 minutes reading time** **Worth 70 Marks** (Worth 40% of overall grade) **Structures to answer questions…** 1 Mark – Point 2 Marks – Point + Evidence 4 Marks – Point + Evidence x2 5 Marks – Statement & Point + Evidence x2 **Useful Websites:** OCR Cambridge Nationals - Cambridge Nationals - Health and Social Care Level 1/Level 2 – J835 Textbook - Health & Social Care textbooks, revision guides and workbooks | Hachette Learning

Health and Social Care Revision Master Sheet

Give an example of how a care practitioner might show “choice” and “respect” when working with a patient. Why is “independence” important as a person-centred value in care settings? Define “active listening” and explain why it is important when communicating with service users. What is “positioning” in communication (e.g. regarding space, height, personal space) and how can it support effective communication with residents in a care home? Give an example of a “special method of communication” and describe a care situation where it would be useful.	**Discuss** questions require analysis of factors specifically applied to the given case study. Answers need to weigh up the factors and then conclude. These are always applied to a given case study. **Evaluate** questions require a supported judgement to be made. The question wording may use ‘discuss’, ‘evaluate’ or ‘recommend’ – all of these require a justified, reasoned, argument to be put forward. **Justify** questions require focussing on one of the options given and considering the pros and cons of that option and then concluding that adds extra evaluation that hasn’t repeated the same points as before. This essentially means stating which option is best and why. These questions always require application throughout the answer to the case study given. For a top-level answer, finish the conclusion with an ‘it depends on’ factor. It is important not to consider both options.	

PE Revision Master Sheet

Paper 1

Anatomy and Physiology

Cardiovascular System

Cardiovascular system – transportation of oxygen, water and nutrients through the blood. Provide protection from disease with antibodies. Regulates body temperature by absorbing heat and taking it to the lungs or skin for release.

Arteries – oxygenated blood from heart to the body.

Veins – carry deoxygenated blood back to the heart.

Veins – link arteries and veins. Allow O2 and CO2 to pass through their walls.

Structure- consists of the heart, blood and blood vessels.

Effects of exercise

Long term effects

Increase in cardiovascular endurance, heart size and cardiac output. Lower resting heart rate and quicker recovery rate.

Short term effects

Increase in heart rate, blood flow to muscles, blood temperature.

Functions

Protection e.g. Skull protecting the brain.

Movement at joints.

Mineral Storage – Storage of calcium and Phosphorus.

Shape/Support for muscles and organs.

Blood cell production in the bone marrow.

Skeletal System

Effects of exercise

Short term effects

Increase release of synovial fluid, articular cartilage thickness, and range of movement at a joint.

Long term effects

Bone elongation (growth) and bone density.

Types of bones

Short bones e.g. carpals

Flat e.g. Cranium

Long bones e.g. femur

Irregular e.g. vertebrae

Joints

Hinge e.g. elbow

Ball and socket e.g. shoulder

Connective tissue

Tendons- join muscle to bone.

Ligaments – join bone to bone.

Cartilage is on the end of bones to stop bones rubbing.

Respiratory System

Effects of exercise

Long term effects

Increase in VO2 max, vital capacity and strength of respiratory muscles.

Short term effects

Increase in chest cavity size, breathing rate and tidal volume.

Recovery Period – take in extra oxygen to remove lactic acid. Expiration of breath – remove CO2 Perspiration – temperature control Excretion – remove excess water

Oxygen debt occurs in anaerobic respiration where we use the oxygen that is stored in the body which we then have to pay back after exercise.

Gaseous Exchange – the process where oxygen is exchanged for carbon dioxide. Takes place in the alveoli air sacs in the lungs.

Fatigue refers to the inability to continue exercise at a given intensity.

Energy Systems

Lactic acid is a poisonous waste product and cause fatigue

Anaerobic system- occurs in the absence of oxygen. Glucose = energy= lactic acid. Used for short bursts of activity.

Aerobic system- occurs in the presence of oxygen. Glucose + oxygen = energy+ carbon dioxide + water. Used during continuous activity.

Mechanics of Breathing

Breathing in – Intercostal muscles contract raise ribs and push out the sternum increasing chest cavity.

Breathing out – Intercostal muscles relax and ribs and sternum return to normal.

Muscular System

Cardiac

Make up the heart. They work automatically and contract continuously.

They work automatically and are controlled by the nervous system. Eg. Stomach.

Types of muscle

Voluntary/skeletal

Involuntary/smooth

They are controlled by us and are attached to the skeleton to provide movement and shape.

Movements

Flexion- Movement where angle between bones reduces.

Extension- Movement where angle between bones increases

Abduction- Movement where limbs are moved away from the body.

Adduction- Movement where limbs are moved back towards the body

Plantar Flexion- Movement at ankle where toes point towards the ground

Dorsiflexion- Movement at ankle where toes point upwards.

Rotation- Turning a limb along its long axis.

Circumduction- Circular movement of a limb

Contractions

Isotonic contraction is where the muscle contracts and changes in length. Shortening is called concentric contraction and lengthening is eccentric contraction.

Isometric contraction is where the muscle contracts but there is no visible movement. E.g. Handstand

Effects of exercise

Short Term

Increased blood flow to muscles

Muscular contractions

Lactic acid production.

Long Term

Muscular endurance improves

Number of mitochondria increases.

PE Revision Master Sheet

Paper 1

Movement Analysis and Physical Training

Components of fitness

Strength Is the ability to bear weight.
Dynamic – support own body weight over time or apply force to an object. (Cycling)
Explosive – short sharp bursts or movement (Shot putt)
Static – amount of strength that can be applied to immovable object. (pushing in rugby scrum)
Tested by hand grip dynamometer.
Improve by weight/strength and circuit training.

Speed - The ability to move all or parts of the body as quickly as possible. It is a combination of reaction time and movement time.
e.g. 100m sprint
Tested by 30M sprint test
Can be improved by strength training, sprints, plyometrics and shuttle runs.

Power This is the combination of maximum amount of speed and strength (Strength X Speed)
e.g. Throwing a javelin
Tested by standing broad jump or vertical jump.
Improved through weight training and plyometrics.

Flexibility - Refers to the range of movement around a joint. Can also be called suppleness
e.g. gymnastic movements.
Tested by the sit and reach test.
Improved by stretching.

Cardiovascular endurance Is the ability of the heart and lungs to work together efficiently during an endurance event. (Often known as 'stamina').
e.g. marathon runner.
Can be tested by the Cooper run and bleep test.
Improved through continuous training, circuit training and fartlek training.

Agility Ability to move quickly, changing direction and speed. It is a combination of flexibility and speed.
E.g. changing direction during a rugby game to avoid being tackled
Tested through Illinois agility run
One way to improve is different movements through an agility ladder.

Balance - The ability to maintain a given position in static and dynamic situation.
E.g. Gymnastic holding a balance
Tested by stork stand
Improved by strengthening core, or using balance ball.

Coordination - The ability to link all parts of a movement together and control the body during physical activity.
E.g. Catching a ball in rounders
Tested by alternate hand throw
Can be improved by skipping.

Reaction Time - Time taken for the body to react to a stimulus.
Simple – react to something that happens
Choice- size up a situation and decide how to act
E.g. A goal keeper catching a ball to make a save.
Tested by ruler drop
Improved by an increase in speed.

Muscular Endurance- Ability of a muscle or muscle group to undergo repeated contractions avoiding fatigue.
E.g. A long distance rower carrying out the same action repeatedly.
Tested by the sit up
Bleep test.

Principles of Training-
Specificity- Training needs to be specific to the needs of an individual and the demands of the sport.
Progressive Overload- working harder than normal whilst gradually and sensibly increasing the intensity of training. FITT principles are required for PO to occur.
Reversibility- Decrease in training or injury will lead to a drop in performance.
Tedium- Training should be altered to prevent

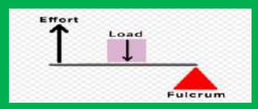
FITT Principles:
Frequency- How often someone trains
Intensity- How Hard you Train
Time- How long you train
Type- The type of training used.

Fitness testing- Reasons for: Identify strengths and weaknesses/ Inform training requirements/ To monitor improvement. **Limitations:** Tests are not sport specific/ Do not replicate movements of activities/ Tests have questionable reliability.

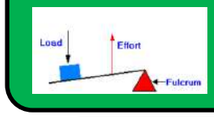
Levers (FRE = 123)

1st Class Lever-

2nd Class Lever-



3rd Class Lever-



Mechanical Advantage- The benefit to a lever system of having a short effort arm- giving rapid movements over a large range of movement- or a short resistance arm- giving the advantage of being able to move a heavy weight.

Planes and Axes

Sagittal Plane/ Transverse Axis- Flexion/ Extension E.G. Walking/ running/ front somersault

Frontal Plane/ Sagittal Axis- Abduction/ Adduction. E.G- Star Jumo/ Cartwheel

Transverse Plane/ Longitudinal Axis- Rotations. E.G.- Discus, 360 degree twist.

Methods of Training

Circuit Training- A series of exercises performed one after the other with a rest in between. **Advantage**- Exercises chosen can be simple to complex. **Disadvantage**- It may require specialist equipment

Plyometric- Takes form of bounding, hopping or jumping. Type of training that is used to increase power. **Advantage-** Ideal sport for performers trying to gai leg power. **Disadvantage-** Places lots of stress on muscles and joints.

Fartlek Training- Known as 'speed play'. Running at different intensities across different terrains. **Advantage-** Improves cardiovascular fitness. **Disadvantage-** Can be deemed as tedium.

Static Stretching- Stretching to the limit and holding the stretch isometrically. **Advantages-** can increase flexibility and can be done by everyone. **Disadvantages-** Can be time consuming and over stretching can cause injury.

Weight Training- use of free weights, resistance machines or any object which can safely be lifted. **Advantages-** It can easily be adapted for different fitness aims (Muscular strength/ muscular endurance). **Disadvantages-** Heavy weights can increase blood pressure.

Interval Training- Training method that incorporates periods of work followed by periods of rest. E.G.- Work, Rest, Work, Rest. **Advantage-** It burns body fat and calories quickly. **Disadvantage-** Requires high levels of motivation.

Training Seasons

Pre-Season- (Preparation) Aim to improve general and aerobic fitness so the performer is ready for the competitive season.

Competition/Peak Season- Aim is to maintain fitness levels while working on specific skills and tactics in their sport.

Post-Season- Aim is to rest and recover from the season. Many performers will continue to do light aerobic training.

Effective use of Warm Up and Cool Down

Altitude Training- Athletes train above 2000m/ There is less oxygen so the body overcompensates by producing more red blood cells/ when returning to sea level there is more RBC's therefore can now carry more oxygen as more oxygen in the air/ This helps to perform in aerobic/ endurance events.

Safety Principles when training- Warm up and cool down should be completed/ over training should be avoided/ Appropriate clothing and footwear should be worn/ keep hydrated/ Technique used should be correct/ Allow for rest and recovery/ Spotters when weight training should be used.

Warming Up- (4 Stages)
1. Gradual Pulse Raising activity.
2. Stretching- All relevant muscles
3. Skill based Practices
4. Mental Preparation- Starting to get focused.

Benefits of warming up- Body temperature will increase/ stretching increases range of movement/ gradual increase towards competitive pace/ focused and psychologically prepared.

Cooling Down- (3 stages)
1.Activity to maintain an elevated breathing and heart rate
2. Gradual reduction in intensity
3. stretching all main muscles used in the activity
Benefits of cooling down- Allows the body to recover/ removes lactic acid/ carbon dioxide and waste products/ helps prevents DOMS.

PE Revision Master Sheet

Paper 2

Sports Psychology

Basic Skills- Few decisions to make/ few decisions affect the success/; taught as a beginner/ learnt quickly/ walking is an example.
Complex- Complex decision making/ Lots of decisions to be made to be successful/ Taught after success in basic skills/ takes time to master/ E.G. High Jump.

Open Skills- Unstable Environment/ skill is affected by people around you/ may change the skill depending on the environment. E.G. Pass in football may change due to opposition positioning.

Closed Skills- Stable Environment/ nothing affects the outcome/ Carried out the same way each time/ The skill is typically self paced. E.G- Trampoline Routine

Gross- Involves big movements of the body/ Involves the use of large muscle groups/ Movements tend not to rely on accuracy and precision. E.G.- Kicking a Ball

Fine- Involves small, precise movements/ Involves the use of small muscles/ movements tend to involve precision and accuracy. E.G.- Archery Shot

Self-Paced- The start of the movement is controlled by the performer/ speed, pace or rate of the skill is controlled by performer. E.G- Serve in Tennis

Externally Paced- Start of movement is controlled by external factors/ speed, rate and pace of movement is controlled by external factors. E.G.- Marking in team sport

Skill Classification- skills are classified into categories or groups.

Basic to Complex

Open to Closed

Self-paced to externally Paced

Gross to fine

Skills- A Learned action/ behaviour with the intention of bringing about predetermined results.

Ability- Inherited from your parents, abilities are stable traits

When setting goals **SMART targets** must be applied:

Specific- specific to the demands of the sport/muscles/movements involved.
Measurable- must be possible to measure to see if has been achieved.
Accepted- Must be accepted and agreed by the performer and coach.
Realistic- It must be possible to complete the goal, physically capable.
Time-bound- Must be set over a fixed period of time.

Goal Setting- to improve motivation sports performance set themselves goals. There are two types of goals:

Performance Goals- Goals that an athlete compare to themselves. E.G.- Better start than last race.

Outcome Goals- Goals that are set to judge against the end result. E.G.- Winning

Stage 1- Input- Information from the environment using their senses. E.G.- Sight. Use selective attention to focus on relevant information.

Stage 2- Decision Making- Performer selects an appropriate response from memory. One that they may have used before. This would be recalled from long term memory where the performer can recall from a similar situation.

Stage 3- Output- The decision chosen is sent to the appropriate muscles to carry out the response. (Example- arms moving to catch a ball)

Basic Information Model- the simple process that a performer carries out in order to decide what skill to use

Stage 4- Feedback- Information is received intrinsically or extrinsically regarding the success of the action. This will affect how you carry out the action next time.

Aggression- An element of aggression may be required in order to succeed or win.

Direct Aggression- When there is actual physical contact between performers. The 'aggressor' uses physical contact to directly and deliberately inflict harm upon their opponent. E.G. Tackle in Rugby.

Indirect Aggression- Does not involve physical contact with an opponent but aggression towards an object. E.G.- Smashing a shuttle cock in badminton very hard to win the point.

Introvert and Extrovert Personality Types-

Introvert- Do not require high level of arousal, tend to be shy, quiet, thoughtful and solitary. Introverts tend to play individual sports where concentration/ precision is required.

Extrovert- Requires high levels of arousal characterised by being sociable, active, talkative and out-going-usually associated with team sports players.

Arousal- Arousal is a physical and mental state of alertness/ excitement varying from deep sleep to intense excitement.

Motivation- 'the drive to succeed or the desire to achieve something.

There are two types of motivation: **Intrinsic**- The drive that comes from within the performer.

Extrinsic- The drive experienced by a performer when striving to achieve a reward.

Deep Breathing- A physical technique which involves the performer exaggerating their breaths in and out. Controls nerves

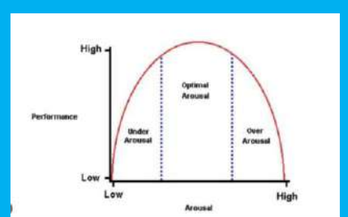
Mental Rehearsal- A mental technique involving the performer picturing themselves performing the skill perfectly before attempting it. Relaxes a performer imagining positive outcomes.

Controlling Arousal Levels
(Stress Release Techniques)

- Deep Breathing
- Mental Rehearsal
- Positive self-talk

Self-Talk- A mental/ cognitive technique whereby the performer talks to him/herself in their head to reassure themselves.

Inverted U theory of Arousal-



As arousal increases so does performance up to optimal performance. If arousal continues performance will decrease.

Guidance- To improve a performer will gain help through guidance from a teacher or coach. There are 4 types of guidance:

Visual- Being shown something.

Verbal- Hearing something/ Instructions

Manual- assistance with the movement

Mechanical- Use of objects and aids.

Visual- Very important for a beginner so that they can see and start to understand what they are expected to do. Demonstrations must be quick, clear and easy to understand.

Verbal- Often used with visual guidance. Involves one person telling another what they have done well or what they need to improve on. Useful for both beginners and elite performers.

Mechanical- Using mechanical aids to assist a performer, for example using a float in swimming or a harness in trampolining. Used more for beginners but will be used in dangerous situations.

Manual Guidance- Physically moving the performer, for example the coach supporting the movement through physical touch. Often used for beginners.

Feedback- Feedback is simply information that a performer receives. It can be received before, during or after performance. Can come from:

Within- Intrinsic

From Others- Extrinsic

Results/ Scores- Extrinsic

Positive Feedback- Is used to inform the athlete what was correct about the movement. This is vital for motivating performers.

Negative Feedback- Is used to inform the athlete what was incorrect about the movement. It provides information on the action to be successful.

Extrinsic/ Intrinsic Feedback-

Extrinsic- Feedback from an external sources. This can be from a coach or from a coach. Beginners heavily rely on feedback from others.

Intrinsic- Feedback from within, for example kinaesthetic feel.

Knowledge of results/ performance-

Knowledge of results- Feedback about the outcome. E.G.- Whether you score or not with a free throw in basketball.

Knowledge of Performance- Feedback about the quality of the performance. Relates to technique or specificaspects of movement.

PE Revision Master Sheet

Paper 2

Socio-Cultural Influences/ Health and Fitness

Players Conduct- The way people play sports is fixed by the rules but there are also unwritten rules
Etiquette- The unwritten rules concerning player behaviour.
Sportsmanship- Appropriate, polite and fair behaviour while participating in a sporting event.
Gamesmanship- The use of dubious methods, that are not strictly illegal, to gain an advantage.
Contract to Compete- Agreeing to play by the rules, trying to win but also allowing your opponent to play

Prohibited Substances- These are known as PEDs (Performance enhancing drugs) These drugs are banned from the National Governing

Stimulants- Make athletes more alert and mask the effects of fatigue.
Examples are amphetamines and caffeine.
Side-effects- Highly addictive and can cause high blood pressure, strokes and heart/ liver problems.

Narcotic Analgesics- Painkillers that mask pain caused by injury or fatigue, which can make the injury worse.
Side effects- Highly addictive and can cause withdrawal symptoms once you stop using them.

Anabolic Agents- Drugs that help athletes to train harder and build muscle. The most common example is steroids. They also make the user more aggressive and competitive.
Side effects- Can cause high blood pressure and damage to the liver, kidneys and heart. Women may develop manly features.

Peptide Hormones (EPO)- Increases the numbers of red blood cells and therefor improves oxygen delivery to the muscles. Ideal for long distance athletes.
Side effects- Thickens the blood making it harder for the heart to pump and increases risk of a stroke/ heart attack.

Diuretics- Drugs that remove fluid from the body. These are not used to improve performance but are used to lose weight. For example in boxing a boxer trying to make their weight category.
Side effects- Cause sever dehydration, low pressure and muscle cramps.

Beta Blockers- Drug taken to calm performer down by reducing the effects of adrenaline. It improves a students fine motor control and will improve precision. Ideal for target sports.
Side Effects- Include nausea, poor circulation leading to heart problems, tiredness and weakness.

Blood Doping- is a method to increase the number of a performers red blood cell count.
Method- Removal of about two pints of blood several weeks before competition and freeze. The body will naturally replenish the RBC's taken out. 1-2 days before the event defrost the blood and inject back into the body. This will increase the bodies RBC count.
For endurance athletes this allows for more red blood cells to carry oxygen to the muscles to create energy.
Side Effects- Increases thickening of blood. (Viscosity)
Potential for heart attacks.
Risk of HIV and hepatitis.
Embolism (A blockage of a vessel).

Advantages of Taking Performance Enhancing Drugs-
Better performance
Greater Income due to success
More fame and recognition
To keep a level playing field
Disadvantages of Taking Performance Enhancing Drugs-
It is cheating and immoral and goes against the concepts of sportsmanship and etiquette.
Banned from their sport if caught
Fined
Damages the performers reputation
Faces Long term negative publicity

Technology In Sport- Ensure you keep up to date with the latest technology used in various sports. Understand the positive and negative impacts of technology on the: Performer/ Sport/ Officials/ Spectators/ Sponsors.

Ethical Issues

Spectator Behaviour (Creates an atmosphere and home field)

Reasons for Hooliganism-

Rivalries between Local teams

Hyped up by media

Alcohol and drug consumption

Tribal behaviour (Sense of belonging- gang culture)

Frustration due to decisions are own teams performances.

Strategies to combat hooliganism-

Restrictions to travel for known hooligans.

Early kicks offs to prevent alcohol consumption

All seater stadiums

Segregation of fans

Increased policing and stewarding.

Introduction of CCTV

Banning spectators.

Introduction of campaigns by role models.

Consequences of a Sedentary Lifestyle-

Sedentary lifestyle- A person's choice to engage in little or irregular, physical activity.

Choosing a sedentary lifestyle will lead to:

Gaining weight/ suffer from heart disease/ Hypertension/ Diabetes/ Insomnia/ Poor confidence.

Obesity- A term to describe people with large fat content. On the Body Mass Index this would be over 30.
Being Obese can limit fitness components and create harmful effects on physical/mental and Social Health.

Physical, Mental and Social health and well-being.

Barriers to Participation- There are 12 barriers that prevents groups from participating in sport-

Attitudes/ Role models/ accessibility/ Media Coverage/ Stereotyping/ Culture and religion/ family commitments/ available leisure time/ Familiarity/ education/ socio-economic/ adaptability.

Post School Drop Out- The reduction in participation levels in young adults after they leave full time education.

Social Health- This refers to having the basic human needs (food shelter and clothing). Have friendship and support. Suffers little stress in social circumstances. Through taking part in sport this will-

Provide opportunities to socialise and make friends/ encourage co-operation/ encourage team work/ Ensure essential needs are met.

Mental Health- a state of well being in which every individual realises his or her own potential. Good mental health means a person can cope with the stresses of everyday life. Taking part in exercise can-

Reduce stress and tension levels/ release feel-good hormones/ enable a person to control their hormones.

Health- A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

Fitness- The ability to meet/ cope with the demands of the environment.

Physical Health- Refers to the idea that all the bosies systems are working well carrying out everyday tasks. Taking part in exercise can:

Improve your heart/ Improve efficiency of the body systems/ reduce the risk of some illnesses/ Help to prevent the onset of obesity

GCSE Sociology Revision Master Sheet

Component (Paper) 1 Understanding Social Processes	Component (Paper) 2 Understanding Social Structures	Useful Information
Key Concepts: What is culture? What examples are there of cultural diversity? (Over time, between groups, across countries.) What is a social structure? What is social stratification? What is meant by the process of socialisation? What is meant by identity? What is meant by a feral child? What are the key theoretical views of society, Functionalist, Marxist, Feminist, The New Right, Postmodernist & Interactionists? **Family:** How do the key theories; Functionalists, Marxists, Feminists, The New Right and Postmodernists view the purpose of the family? What's the difference between a family and a household? What are the traditional family types? What are the alternative forms of the family emerging more in today's contemporary society? How do families differ in other cultures? What are the key patterns/trends for family types including, marriage and divorce rates? What reasons are given to explain the changes in these patterns overtime? How are gender roles within the family changing? What is meant by a child-centric society?	**Stratification:** What is inequality? What is social stratification? What types of authority are there in society? What are the key theoretical views, Functionalists, Marxists, Feminists, The New Right and Postmodernists hold of inequality? What inequalities still exist in UK society? What is a life chance? What are the various factors affecting life chances? Which social groups are adversely affected by this? (Age, Disability Ethnicity, Gender, Social Class, Sexuality) What has been put in place to try to overcome inequalities in UK society? What is globalisation? What is absolute poverty? What is relative poverty? What is the cycle of deprivation? **Crime & Deviance:** What is a crime? What is deviance? What is informal social control? What is formal social control? Who are the agents of social control? How do the key theories; Functionalists, Marxists, Subculturalist and interactionalists view crime? How is crime recorded? What is the dark/hidden figure of crime? What are the key patterns/trends of crime in UK society?	**Each Paper is 1 hour 45 minutes -** **1 minute per mark + 5 minutes reading time** **Worth 100 Marks** **Structures to answer questions…** 1 Mark – Point 2 Marks – Point + Evidence 4 Marks – Point + Evidence x2 5 Marks – Statement & Point + Evidence x2 8/9 Marks – PEELA x2 12/15 Marks – Intro, D1, E1, D2, E2 + Conclusion **Useful Websites:** Eduqas (the exam board) - https://www.eduqas.co.uk/qualifications/sociology-gcse/#tab_keydocuments Seneca – https://senecalearning.com/en-GB/revision-notes/gcse/sociology/aqa Tutor2u – https://www.tutor2u.net/sociology/collections/quick-revise-aqa-gcse-sociology-revision-blast-videos?srsltid=AfmBOorP59d4pbbye8U_48DXq1N9jPGy-17h7c13xbLdOUq5sy2ioSz_

Education: What are the legal age requirements for education in the UK? What school types operate in the UK? What are the educational alternatives to schools? How do each of the key theories, Functionalists, Marxists, Feminists, The New Right and Postmodernists view the purpose of education? What differences are found in the achievements of different social groups? (Social Class, Ethnicity, Gender) What are the external reasons put forward for these statistical differences? What are the internal reasons put forward for these statistical differences? What is meant by cultural deprivation? What is meant by material deprivation? Which educational policies have been implemented to try to close the gap in differences observed in achievements between different social groups? **Research Methods:** **Will be tested on both papers.** 	What reasons are given to explain the rates of offending for different social groups? (Age, Ethnicity, Gender, Social Class) How accurate is the reporting of crime by the media? What is the Hypodermic Syringe Model? How does the media create a moral panic? What is a folk devil? How does the CJS operate? How do people protect themselves from becoming victims of crime? **Research Methods:** What is the scientific method? What's the difference between quantitative and qualitative research? What's the difference between primary and secondary sources? What's the difference between an aim and a hypothesis? What's the difference between the IV and DV in any study? What is the importance of a pilot study? What sampling technique may a sociologist employ? What data collection methods do sociologist employ? What are the strengths and limitations of these methods? (Practical, ethical and theoretical) How can these methods be employed by a sociologist to study society?	

GCSE Visual Arts Revision Master Sheet

Assessment Objectives and Descriptions	Core Knowledge
Assessment Objective 1: RESEARCH & INVESTIGATION DEVELOP IDEAS through INVESTIGATIONS, demonstrating CRITICAL UNDERSTANDING of SOURCES. ANALYSE the work of artists, designers and photographers to DISCOVER IDEAS, TECHNIQUES, emotions, multiple perspectives, and MEANING.	Artist, designer, photographer INVESTIGATIONS should be PURPOSEFUL and INFORM your own IDEAS and PROJECT. Refer to the WHAT, HOW, WHY framework in your Knowledge Organiser to see the questions you should be answering when analysing artists and designers. Use a RANGE of SOURCES to INFORM your work, such as different artist or photographers, looking at different MEDIA i.e. books, magazines, blogs, websites etc. and even SOURCES that conflict or contradict with one another.
Assessment Objective 2: EXPERIMENTATION REFINE work by EXPLORING IDEAS, SELECTING and EXPERIMENTING with appropriate MEDIA, MATERIALS, TECHNIQUES and PROCESSES. REFINEMENT is the IMPROVEMENT of the IDEA or PROCESS. It does not involve radical changes but is about making small changes which IMPROVE the IDEA in some way. How this might be done →	○ SELECTING your most successful choice of SUBJECT MATTER or EXPERIMENTATIONS to develop further. ○ AMENDING a TECHNIQUE or an aspect of the COMPOSITION. ○ CHANGING the positioning of a subject to make the COMPOSITION more balanced, or to create more tension, as appropriate. ○ VARIATION of a technique - e.g. trying oil pastel rather than painting to achieve an expressive style; trying a range of editing techniques. ○ ADAPTATION of the idea - e.g. including some detail in the foreground of a landscape to add more depth and distance; using a range of backgrounds for a photoshoot.
Assessment Objective 3: RECORDING & ANNOTATING RECORD IDEAS, OBSERVATIONS and INSIGHTS, relevant to intentions AS WORK PROGRESSES. An ANNOTATION is a NOTE, DIAGRAM or COMMENT added to a text, drawing or photograph to provide EXPLANATION or CRITICISM about a particular part of it.	Ensure you ANNOTATE everything in your SKETCHBOOK or PRESENTATION clearly. This is similar to AO1, in that you are analysing your own work, so you can use the WHAT, HOW, WHY framework with ANNOTATIONS as well. Note WHAT you have done, HOW you have done it and WHY you have done it. For example, when you TEST one of your IDEAS and EXPERIMENT with different TECHNIQUES, ANNOTATE WHAT you did and WHAT went well, HOW you did it using different MATERIALS or PROCESSES and WHY you did this to achieve a certain EFFECT. You can also note what you would improve and your next steps.
Assessment Objective 4: PERSONAL RESPONSE OUTCOMES Present a PERSONAL and MEANINGFUL RESPONSE that REALISES INTENTIONS and demonstrates understanding of VISUAL LANGUAGE. For each IDEA you have FULLY EXPLORED, produce HIGH-QUALITY FINAL and PERSONAL pieces of ART or PHOTOGRAPHY, that makes CONNECTIONS between all your RESEARCH and your PREPARATORY WORK.	Create a PLAN of ACTION as to how to achieve the OUTCOME, by planning what you are going to do, how and when you are going to do it and what EQUIPMENT and MATERIALS you need. Work in progress can also become OUTCOMES, if they are successful. LABEL all your OUTCOMES so that it is clear which pieces of work are to be marked in AO4. You are not restricted to just one OUTCOME. You can PRODUCE a SERIES of ARTWORKS or a set of PHOTOGRAPHY IMAGES, within the set THEME.

'EXCEPTIONAL' students utilise school resources through intervention time. 'EXCEPTIONAL' students visit galleries and museums to inform their ideas and projects. 'EXCEPTIONAL' students are self-aware and independent. 'EXCEPTIONAL' students regularly reflect on what needs to be undertaken in their portfolio and spend at least 1 hour a week on their work, outside of lesson time.

Level 1: MINIMAL	Level 2-3: SOME	Level 3-4: MODERATE	Level 4-6: CONSISTENT	Level 7-8: HIGHLY DEVELOPED	Level 9: EXCEPTIONAL
• Random, disconnected, lacks relevance. • Limited analysis. • Brief or lacking investigation. • Lacks experimentation. • Rudimentary skills. • Lacks coherence. • Arbitrary. • Lacking any sense of purpose. • Insignificant and minimal choices. • Dependent on copying. • Haphazard and disorganised. • Fragmented, disconnected.	• Simple, brief references. • Beginnings of purpose. • Cursory analysis. • A sense of intention. • Attempts at selection. • Uncomplicated insights and ideas. • Fundamental skills. • Brief journeys. • Lacking in analysis, awareness and insight. • The beginnings of a personal response. • Moving towards understanding.	• Variable depth of understanding. • Derivative, imitative responses. • Sources provide basic inspiration. • Sometimes superficial. • Emerging, growing capacity. • Variable standard of creativity and independence. • Perhaps repetition of ideas and process. • Safe, uncomplicated. • Developing sense of purpose.	• Appropriate, relevant and informed. • Purposeful investigation of sources and process. • Little or no variation in standard. • Recognition of value and increasing understanding. • Informed refinement. • Increasing confidence. • Well defined intentions. • Increasingly personal responses.	• Consistently inquisitive. • Independent exploration. • In depth investigation. • Insightful, informed analysis. • Increasing confidence. • Willingness to take risks. • Sustained reflection. • Increasing clarity of purpose. • Overall depth of understanding and application. • A synthesis of ideas and production qualities. • Strong realisation.	• Highly discriminating, rich and rigorous ideas and process. • Thorough enquiry. • Confident and self-assertive. • Mature. • Self-aware. • Well informed analysis leading to well informed realisation. • Sophisticated abilities and reflection. • Perceptive. • Discerning. • Astute. • Clear and coherent intentions. • Genuine creativity and discovery.