YEAR 11 KNOWLEDGE ORGANISER

LENT TERM 2020/21

Name:

Family Group:

LEARNING - LOVING - LIVING

CONTENTS PAGE

LEARNING – LOVING – LIVING

GENERAL INFORMATION

The knowledge organiser is a book that sets out the **important**, **useful** and **powerful knowledge** of a single topic on one page.

When used effectively, Knowledge Organisers are useful in:

- Helping build a foundation of **factual knowledge.**
- Embedding **revision techniques** for now and future studies (A-Level, College, University)
- Allowing knowledge to become stored in **long term memory** which frees up working memory for more complex ideas. It also allows you to connect concepts together, even across subjects

Other revision tools include:

-FREE **online** revision tools such as www.senecalearning.com, the recently updated BBC BITESIZE and YouTube.

-Other **online** platforms and **apps** like https://mathswatch.co.uk and Duolingo.

-Subject **revision guides** (some available at school and book shops)

-Practice **exam questions** (see your teacher)

-**Past Papers** from your teacher or exam board websites.

MICROSOFT TEAMS

Remember to check TEAMS regularly for updates and additional home learning files including copies of your mastery booklets.

You can also ask your teachers questions on teams and view videos of 'how to use your knowledge organiser'.

HOMEWORK TIMETABLE

Year 11	Subject 1	Subject 2	Subject 3
Monday	Maths	Option A	Option C
Tuesday	English	Option B	Option C
Wednesday	Maths	RE	Option D
Thursday	English	Science	Option A
Friday	Maths	Science	Option B

WELLBEING DURING REVISION AND EXAMS- YOUNG MINDS

1. Always take a moment just to breathe, whether in the exam, before or after.
2. Remember that school does offer support, just reach out and ask!
3. Keep your work balanced. Spend time revising, but socialise and relax too.
4. Keep a self-care routine so that your revision is the most productive it can be whilst you feel as good as possible.
5. Break up revision with food and exercise to make sure you stay energised.
6. Remember that results do not define you.
7. Find a revision space and style that works for you: silence, background chatter, music with or without lyrics.
8. Work to your own pace – everyone is different in how they work.
9. If you feel nervous about the time pressure of an exam, practice timing yourself when you revise, or try some test papers.
10. Plan in some treats to reward yourself, and celebrate when it's all over!

Here are some activities that you can try at home with your knowledge organiser to help revise. There are even more strategies on page 3.

4 Methods of Retrieval Practice

@ImpactWales

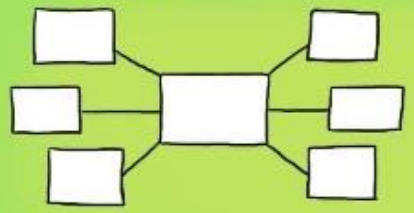
Before you start put away all your books & classroom materials.

Retrieval Practice Examples

- Exit Tickets
- Starter quizzes
- Multiple choice quizzes
- Short answer tests
- Free write
- Think, pair, share
- Ranking & sorting
- Challenge grids

BRAIN DUMP

Write, draw a picture, create a mind-map on everything you know about a topic.



Give yourself a time limit, say 3 minutes, then have a look at your books & add a few things you forgot.

QUIZZING

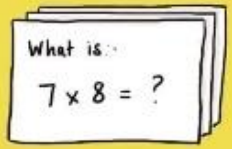
Create practice questions on a topic. Swap your questions with a partner & answer.

Question - What is a metaphor?

- ☐ A comparison using 'like, as, than'.
- ☐ A comparison where one thing is another.
- ☐ A comparison with a human attribute.

FLASHCARDS

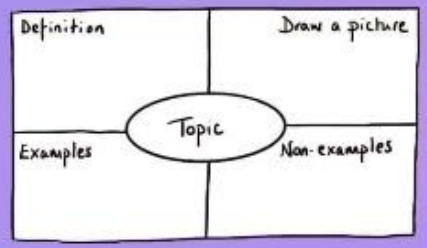
Create your own flashcards, question on one side answer on the other. Can you make links between the cards?



You need to repeat the Q & A process for flashcards you fail on more frequently & less frequently for those you answer correctly

KNOWLEDGE ORGANISERS

Complete a knowledge organiser template for key information about a topic.



You can use knowledge organisers to learn new vocab & make links in between subjects or ideas.

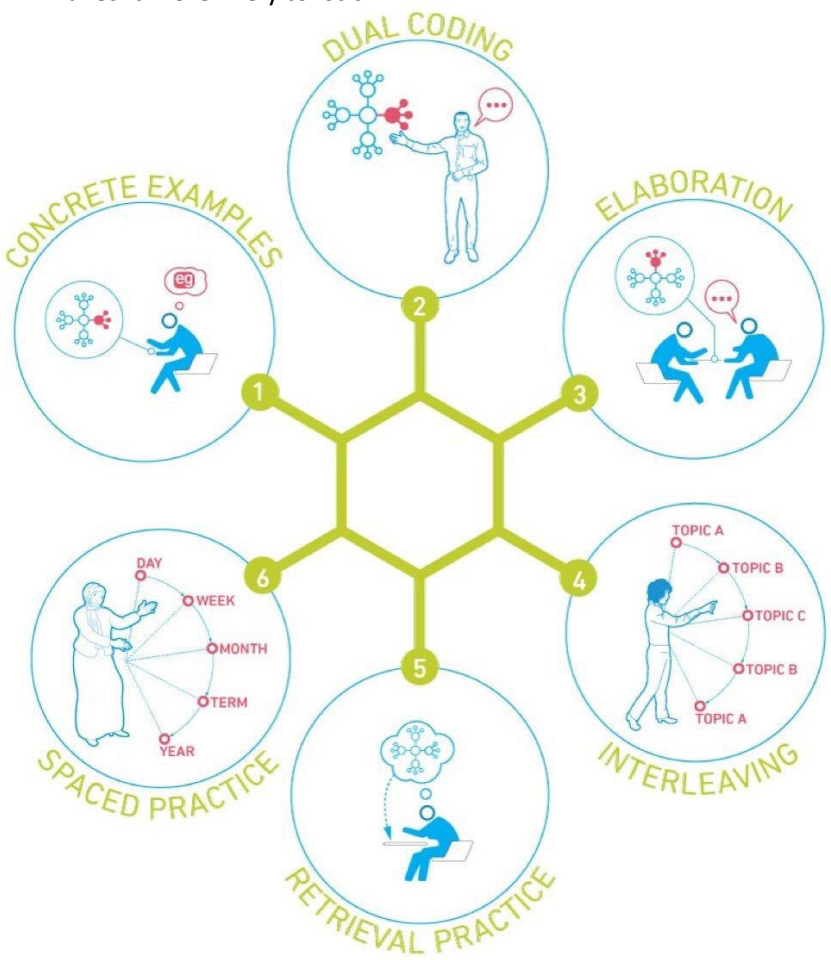
After you have retrieved as much as you can go back to your books & check what you've missed. Next time focus on that missing information

DUAL CODING

Dual coding is the process of combining visual and written materials. You can visually represent materials using methods such as info graphics, timelines, cartoon/comic strips, diagrams and graphic organisers. Combing images with words or explaining an image makes it more likely to 'stick'.

CONCRETE EXAMPLES

When you're studying, try to think about how you can turn ideas you're learning into concrete examples. Making a link between the idea you're studying and a real life example, concrete example, can help students understand abstract ideas and make it 'stick'.



ELABORATION

When talking about studying, elaboration involves explaining and describing ideas with many details. Elaboration also involves making connections among ideas you are trying to learn. Ask yourself questions about a topic to delve deeper. The more information you have about a specific topic the stronger your grasp and ability to recall.

SPACED PRACTISE

Divide up your revision into short manageable chunks of time . When revising aim for 20 - 30 minutes per session. Five hours spread out over two weeks is better than the same five hours all at once. This is **spaced practice** and it is regarded as one of the most effective revision strategies.

INTERLEAVING

Interleaving is a process where you combine multiple subjects and topics while you study in order to improve learning. Switch between ideas and make links between them during a study session. Interleaving has been shown to lead to better long-term retention

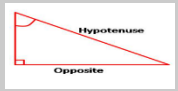
RETRIEVAL PRACTICE

Through the act of retrieval, or calling information to mind, our memory for that information is strengthened and forgetting is less likely to occur. Retrieval practice ideas include: Read, cover, write, check, flashcards and brain dumps.

Grammar Term	Definition	Example (the word that is underlined)
Noun	Places, people, things, ideas	Macbeth's sword 'smoked with bloody execution'.
Proper Noun	The name of something-it will have a capital letter	Eric said that he was 'in a state when a chap turns nasty.'
Abstract Noun	Something that cannot be experienced by the 5 senses	Blake is indignant at the oppression and poverty that he sees in London.
Pronoun	A word used to replace a noun (I/you/he/she/it/we/they/me/him/her/us/them	Enfield states 'The more it looks like Queer Street, the less I ask'
Verb	They are often actions or processes. Has/have and is/are/was/were are also verbs.	Macbeth 'unseamed him from the knave to th'chaps.'
Passive verb	a form or set of forms of a verb in which the subject undergoes the action of the verb	He was kicked.
Modal Verb	A verb that expresses necessity or possibility (should/could/might/can/will/must/may/ought)	Enfield explains that Hyde 'gives a strong feeling of deformity, although I couldn't specify the point."
Adjectives	Adjectives describe nouns by answering one of these three questions: What kind is it? How many are there? Which one is it?	Deformed and repulsive, Hyde is the opposite to Jekyll.
Superlative	the biggest/best/most expensive etc.	The earliest to feel remorse, Sheila quickly realise that 'these girls aren't cheap labour'.
Comparative	bigger than/ less interesting than etc.	Jekyll's transformation into Hyde causes Lanyon to become 'visibly balder and older.'
Adverb	Adverbs tweak the meaning of verbs, adjectives, other adverbs. They often end in 'ly' although not always!	Jekyll explains that 'this brief condescension to evil finally destroyed the balance of my soul'
Preposition	Prepositions are the words that indicate location. Usually, prepositions show this location in the physical world	Jekyll recognises that 'Men have before hired bravos to transact their crimes, while their own person and reputation sat under shelter.'
The Subject	In a sentence, every verb must have a subject. If the verb expresses action—like sneeze, jump, bark, or study—the subject is who or what does the verb	Contradicting himself, Jekyll refers to 'this extraneous evil.' (Jekyll: Subject; Refers: Verb)
Independent Clause	Every main clause will follow this pattern: Subject + Verb = complete thought.	Hyde 'snarled aloud into a savage laugh.' (Hyde: Subject; Snarled: Verb
Past Participial Phrase	Past participle phrases always function as adjectives, adding description to the sentence. They often use an 'ed' form of the verb, although no always!	Described as a 'fiend', Hyde is seen as a deviant, demonic and degenerate character.
Present Participial Phrase	Present participle phrases always function as adjectives, adding description to the sentence. It will always use the 'ing' form of the verb.	Complaining that Jekyll 'became too fanciful', Lanyon is criticising Jekyll's obsession with transcendental medicine.
Absolute Phrase	It either zooms in on a part of the noun OR describes the whole scene	His words filled with biblical imagery, the Inspector admonishes the Birlings, exclaiming that they will suffer 'in fire and blood and anguish.'
Noun Appositive	An appositive is a noun or noun phrase that renames another noun right beside it	Hyde, a man who 'gives a strong feeling of deformity', could represent upper class fears of deviancy and lower class criminality.
Declarative Sentence	A sentence in the form of a statement	Jekyll spends the entire last chapter giving reasons and excuses for the creation of Hyde
Imperative sentence	A command or order	'Look on My works ye mighty and despair!'
Interrogative sentence	A type of sentence that asks a question	'When shall we three meet again, In thunder, lightning, or in rain?'

	Sentences to Practice
1	Despite the fact that sports stars are constantly in the public eye, many of them behave terribly.
2	Formula One drivers earn millions every year, whereas Rugby players earn very little in comparison; perhaps there is a correlation between earnings and behaviour?
3	While sports stars are expected to set an example for young people, few of them can be said to be respectable role models.
4	Wayne Rooney, one of Manchester United's biggest stars, is globally recognised, however, he is also known for behaving badly off the pitch.
5	Not only do footballers court controversy on the pitch, but their antics outside of the game, particularly when alcohol is involved, are notorious.
6	Yes footballers earn phenomenal sums of money, but they have trained and practised hard to deserve it, and more importantly they bring millions of people immense pleasure.
7	While you could argue that being famous doesn't mean you have to act responsibly, surely the stars know that young people look up to them?
8	Unless footballers are held to account for their antics, they will continue to behave in the way that they currently do.
9	Since the 1960s, Footballers have been lauded in the press and their drunken exploits have filled the pages of our tabloids.
10	Whether you think public figures should behave better or whether you think that they have no obligation to monitor their behaviour, the reality is that teenagers look up to famous people and are influenced by them
11	In order to clean up the image of football, players should be fined if they swear during a game.
12	Even if referees were to punish footballers for swearing, it would still happen.
13	Due to the intense pressure of being a sports star, some athletes go off the rails.
14	The more footballers get paid, the more absurd their lifestyles become.
15	The less players swear during games, the less teenagers will want to emulate their foul language.

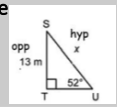
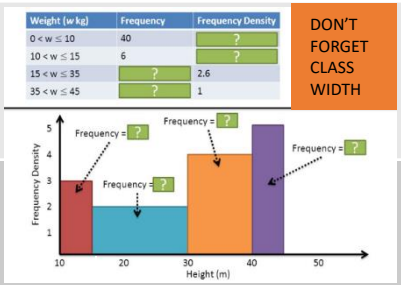
Important Ideas

Use SOH CAH TOA… 	**FOR RIGHT ANGLE - TRIANGLES** Sine Ratio: $\sin\theta = \frac{\text{Opposite}}{\text{Hypotenuse}}$ Cosine Ratio: $\cos\theta = \frac{\text{Adjacent}}{\text{Hypotenuse}}$ Tangent Ratio: $\tan\theta = \frac{\text{Opposite}}{\text{Adjacent}}$
HISTOGRAMS	**FREQUENCY = Area of each bar** **Frequency Density = $\frac{frequency}{class\ width}$**
FRACTIONAL INDICES	**…Tell us to take the 'roots'** $a^{-1} = \frac{1}{a}$ and $a^{-m} = \frac{1}{a^m}$ $a^{\frac{1}{2}} = \sqrt{a}$ and $a^{\frac{1}{m}} = \sqrt[m]{a}$ $a^{\frac{n}{m}} = (a^{\frac{1}{m}})^n = (\sqrt[m]{a})^n$
NEGATIVE INDICES	**…Tell us to take the reciprocal**
SIMILAR SHAPES	**If s.f. for length = k** **s.f for area or surface area = k^2** **s.f. for volume = k^3**

Vocabulary

Class Width	is the difference between the two boundaries of a **class interval**
Reciprocal	1 divided by the number (numerator and denominator are swapped)
Similar Shapes	Two shapes whose angles are all equal, and corresponding sides are in proportion
Congruent Shapes	Two shapes whose angles and corresponding sides are equal
Scale Factor (s.f.)	is a number which scales, or multiplies, some quantity

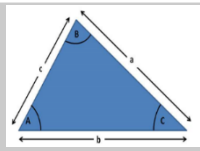
Q& A

Calculate the value of x. 	$\sin 52° = \frac{13}{x}$ $x = \frac{13}{\sin 52°}$ $\therefore x = 16.5\ m$
Calculate the Frequencies from the frequency density table	DON'T FORGET CLASS WIDTH
And complete the frequency Density Table	
Evaluate: $(81x^2y^8)^{\frac{1}{2}}$ $(3x^3y^2)^3$	$(81x^2y^8)^{\frac{1}{2}} = \sqrt{(81x^2y^8)} = 9xy\text{^}4$ $(3x^3y^2)^3 = (3x^3y^2)(3x^3y^2)(3x^3y^2)$ $= 3 * 3 * 3 * x^3x^3x^3 * y^2y^2y^2$ $= 27x^9y^6$

MathsWatch References

168, 218, 201-203	trigonometry
205, 186	Histograms, Cumulative Frequency Charts
29, 82, 154, 188	Indices
144, 200	Similar Shapes

Key Facts & Formula



Sine & Cosine rules for ALL triangles

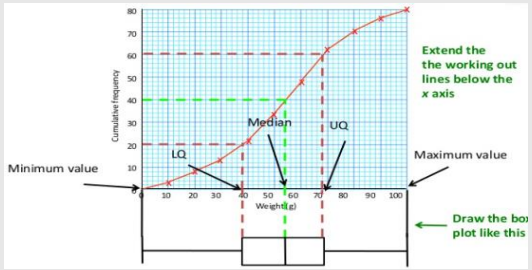
$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

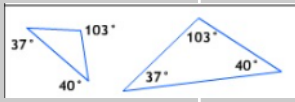
$b^2 = a^2 + c^2 - 2ac(\cos B)$

$c^2 = a^2 + b^2 - 2ab(\cos C)$

CUMULATIVE FREQUENCY CURVES AND BOX PLOTS



Each QUARTILE is 25% of the dataset

Similar These pairs of shapes are ***similar***.	Not Similar These pairs of shapes are ***not similar***.
	

Converting Units of Measurement

1m = 100cm

Area = 1m x 1m = $1m^2$

= 100 cm x 100 cm

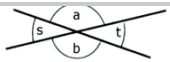
= $(100)^2\ cm^2 = 10\ 000cm^2$

Therefore $1m^2 = 10\ 000cm^2$

Important Ideas

Angle Facts

Vertically opposite angles are equal.



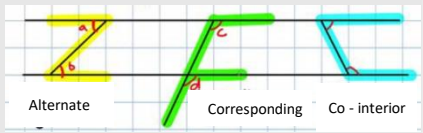
a = b

s = t

Angles at a point add up to 360°.

s + a+ b + t = 360°

Angles between Parallel Lines

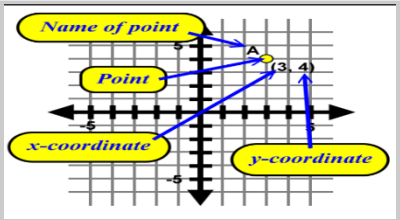


Alternate angles are equal

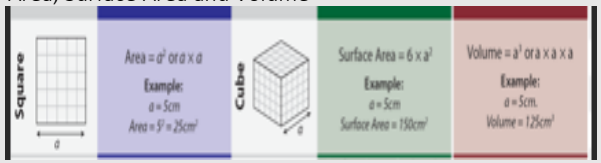
Corresponding angles are equal

Co-interior angles sum to 180°

Coordinates



Area, Surface Area and Volume

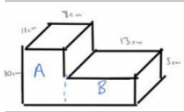


Vocabulary

Surface Area	The area of all the faces of a 3D object
Proportion	As one variable increases, another increases by the same rate

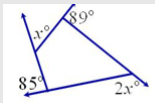
Q& A

Calculate Volume



Cuboid A
8cm x 10cm x 11cm = 880cm³
Cuboid B
13cm x 5xm x 11cm = 715cm³
Total = 880cm³ + 715cm³ = 1595cm³

Calculate x



Use the Polygon Exterior Angles Theorem to write and solve an equation.

$x° + 2x° + 89° + 85° = 360°$

$3x + 174 = 360$

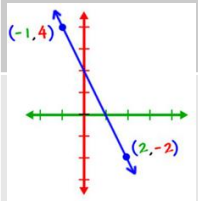
$3x = 186$

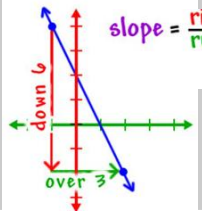
$x = 62$

Polygon Exterior Angle Theorem. Combine like terms.

Solve for x.

Calculate the slope of the line.





slope = $\frac{\text{rise}}{\text{run}} = \frac{-6}{3} = -2$

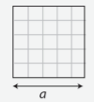
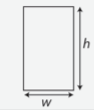
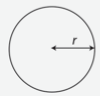
Negative -- and the line is going downhill

MathsWatch References

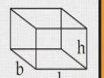
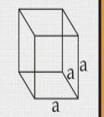
45, 120-122	Angle Facts
8, 113, 149	Coordinates and Equations of Straight Lines
53-56, 114a&b, 117	Areas and surface Area
115, 119	Volumes
42, 142	Proportion & Compound Units

Key Facts & Formula

Area

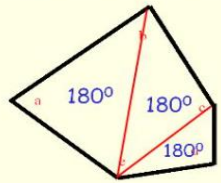
Square		Area = a^2 or $a \times a$ **Example:** $a = 5cm$ $Area = 5^2 = 25cm^2$
Rectangle		Area = $w \times h$ **Example:** w = width=10cm height=20cm $Area = 10 \times 20 = 200cm^2$
Triangle		Area = $b \times h \times 0.5$ **Example:** b = base = 20cm h = vertical height = 15cm $Area = 20 \times 15 \times 0.5 = 150cm^2$
Reg Polygon		Area = $n \times s \times a \times 0.5$ **Example:** n = number of sides = 6 length of side=5cm a = apothem=15cm $Area = 6 \times 5 \times 15 \times 0.5 = 225cm^2$
Circle		Area = $\pi \times r^2$ **Example:** $\pi = pi = 3.14$ r = radius = 5cm $Area = 3.14 \times 5^2 = 3.14 \times 5 \times 5 = 78.5cm^2$

Volume

Cuboid		lbh
Cube		a^3
Right circular cylinder		$\pi r^2 h$
Right circular cone		$\frac{1}{3}\pi r^2 h$

Interior Angles of a Polygon

How to find the sum of the interior angles



Split the shape up into triangles

Each triangle contains 180°

3 x 180° = 540°

BIDMAS N3

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

- Brackets
- Indices (or pOwers)
- Division and Multiplication
- Addition and Subtraction

Types of number N4

Integer: a "whole" number

Factors; the divisors of an integer

➔ Factors of 12 are 1, 2, 3 ,4, 6, 12

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

➔ Multiples of 12 are 12, 24, 36 ...

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

HCF, LCM N4

Highest Common Factor (HCF)

➔ Factors of 6 are 1, 2, 3, 6

Factors of 9 are 1, 3, 9

HCF of 6 and 9 is 3

Lowest Common Multiple (LCM)

➔ Multiples of 6 are 6, 12, 18, 24, ...

Multiples of 9 are 9, 18, 27, 36, ...

LCM of 6 and 9 is 18

Prime factors N4

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

➔ $720 = 5 \times 3^2 \times 2^4$

Powers and roots N6, N7

Special indices: for any value a:

$$a^0 = 1$$

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

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

Calculating with fractions N8

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

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

Multiplying fractions; multiply numerators and denominators...

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

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

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

Fractions, decimals N10

Fraction is numerator ÷ denominator

➔ $\frac{5}{8} = 5 \div 8 = 0.625$

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

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

Learn the most frequently used ones:

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

Surds N8

Look for the biggest square number factor of the number:

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

Standard form N9

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

Standard units N13

1 tonne = 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)

$5.825 \leq x < 5.835$

➔ $y = 46$ (2 significant figures)

$45.5 \leq y < 46.5$

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

Algebraic notation A1

$$ab = a \times b$$

$$3y = y + y + y$$

$$a^2 = a \times a$$

$$a^2b = a \times a \times b$$

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

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:

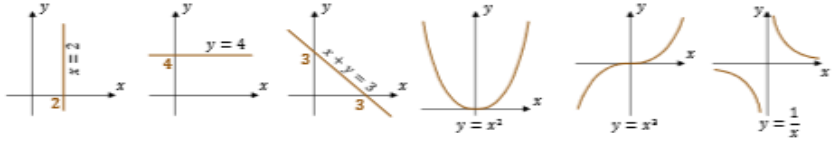
$$a^x \times a^y = a^{x+y}$$

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

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

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

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

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

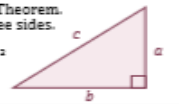
Right angled triangles G20, G22

Pythagoras Theorem.

Links all three sides.

No angles.

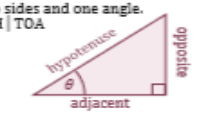
$a^2 + b^2 = c^2$



Trigonometry.

Links two sides and one angle.

SOH | CAH | TOA



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

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.

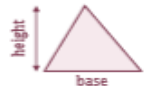
Special values of sin, cos, tan

Learn (or be able to find without a calculator)...

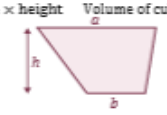
$\theta°$	$\sin\theta°$	$\cos\theta°$	$\tan\theta°$
0	0	1	1
30	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$
45	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	1
60	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
90	1	0	

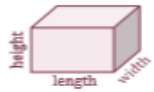
Areas and volumes G16, G17, G18, G23

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



Volume of cuboid = length × width × height

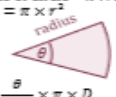




Area of trapezium = $\frac{1}{2}(a + b) \times h$

Circumference of circle = $\pi \times D$

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



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

Volume of cylinder = $\pi r^2 \times$ height

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

Volume of prism = area of cross section × length

Transformations G7, G8

Reflection
- Line of reflection

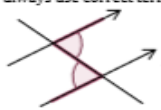
Translation
- Vector

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...



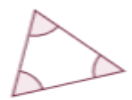
Alternate angles

Corresponding angles

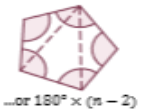
Angles on a straight line total 180°

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

$p = \frac{\text{n[equally likely favourable outcomes]}}{\text{n[equally likely possible outcomes]}}$

$p = 0$	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)

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

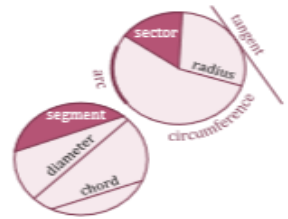
Add for mutually exclusive events

➔ 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

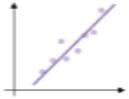
Mode: most frequently occurring

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

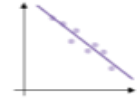
Mean = $\frac{\text{total of items of data}}{\text{number of items of data}}$

Correlation S6

Positive correlation



Negative correlation



Listing strategies N5

Product rule for counting:

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

Powers and roots N6, N7

Special indices: for any value a:

$$a^0 = 1$$

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

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

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

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

Surds N8

Look for the biggest square number factor of the number:

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

Rationalise the denominator N8

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

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

➔ $\frac{2}{4+\sqrt{5}}$

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

Standard form N9

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

Recurring decimals N10

Make a recurring decimal a fraction:

➔ $n = 0.236$

(two digits are in the recurring pattern, so multiply by 100)

$100n = 23.6$

(this is the same as 23.636)

$99n = 23.636 - 0.236 = 23.4$

$n = \frac{23.4}{99} = \frac{234}{990} = \frac{13}{55}$

Error intervals N15

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

➔ $x = 5.83$ (2 decimal places)

$5.825 \leq x < 5.835$

➔ $y = 46$ (2 significant figures)

$45.5 \leq y < 46.5$

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

Equations and identities A3

An equation is true for some particular value of x

➔ $2x + 1 = 7$ is true if $x = 3$

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

➔ $(x + a)^2 \equiv x^2 + 2ax + a^2$

(note the use of the symbol ≡)

Laws of indices A4

For any value a:

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

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

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

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

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:

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

➔ If $f(x) = x + 3$ and $g(x) = x^2$

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

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

The inverse of f is f^{-1}

➔ If $f(x) = 2x + 5$ then

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

$y = mx + c$ A9

Equation of straight line $y = mx + c$

m is the gradient; c is the y intercept:

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

Find its gradient...

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

...and its y intercept...

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

Equation is $y = 4x + 3$

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 $y = f(x)$:

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

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

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

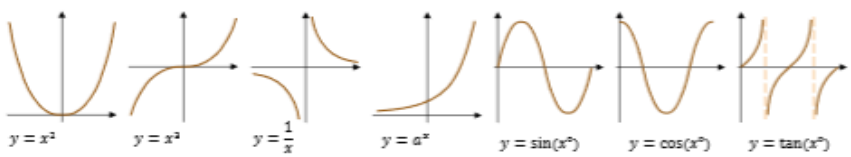
Reflect y axis for $y = f(-x)$

Velocity - time graph A15

Gradient = acceleration (you may need to draw a tangent to the curve at a point to find the gradient);

Area under curve = distance travelled.

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 at (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

$x = 10 - 3y$

so $(10 - 3y)^2 + y^2 = 20$

Expand and solve the quadratic

$100 - 60y + 9y^2 + y^2 = 20$

$10y^2 - 60y + 80 = 0$

$y = 2$ or $y = 4$

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

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

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

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 $x_1 = -2.8$

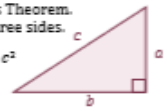
$x_2 = \sqrt[3]{6 \times (-2.8) - 4} = -2.750\ldots$

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

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

Right angled triangles G20

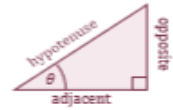
Pythagoras Theorem.
Links all three sides.
No angles.
$a^2 + b^2 = c^2$



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

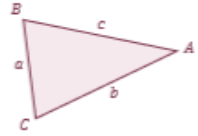
$\sin\theta = \frac{opp}{hyp}$ $\cos\theta = \frac{adj}{hyp}$ $\tan\theta = \frac{opp}{adj}$

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

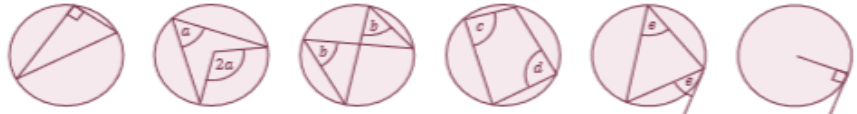
Missing side: $a^2 = b^2 + c^2 - 2bc\cos A$

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°

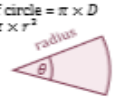
Alternate segment theorem

Tangent and radius are perpendicular

Areas and volumes G16, G17, G18, G23

Circumference of circle = $\pi \times D$

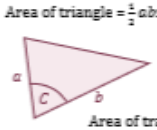
Area of circle = $\pi \times r^2$

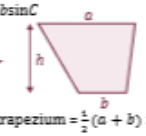


Arc length = $\frac{\theta}{360°} \times \pi \times D$

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.

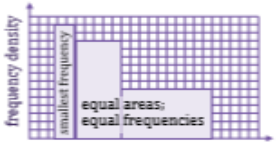
In general...

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

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

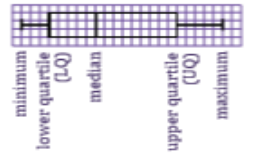
Histograms S3

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



Box plots S4

Interquartile range (IQR) = UQ – LQ



Ecology and Interdependence

Ecology is the study of everything from individual organisms to the whole biosphere (everywhere that life is found on Earth). An ecosystem is an interconnected network of living organisms and their environment.

The feeding relationships are one way in which organisms depend on each other. To begin with, almost all organisms rely on the Sun as the original source of energy for their ecosystem. **Plants** and **algae** can make use of the Sun's energy to produce food molecules, in the process of photosynthesis. This is why they are called **producers**. Other types of organism can't do this, so they rely on the plants and algae. **Consumers** eat the producers, so the energy from the sun flows through the ecosystem. Molecules (which are stores of energy) also flow through, and get recycled when organisms produce waste (poo and wee!) and after they die and decay. The diagram helps to show this.

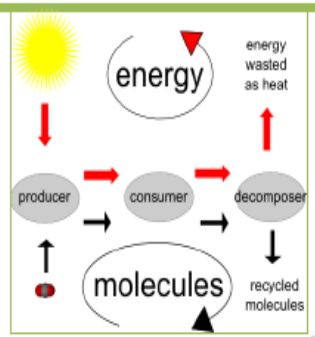
You can see that all the organisms in the ecosystem depend on each other. This is called **interdependence**. The consumers wouldn't survive without the producers capturing energy from the sun, the producers wouldn't survive without the decomposers recycling molecules for them to use (e.g. nutrients from the soil), and the decomposers need the waste from other organisms, and their bodies once they die. A stable community is one where all the species' populations and the abiotic factors are in balance; as a result, population sizes don't change much in stable communities.

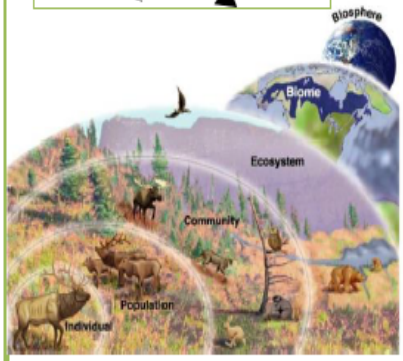
Biotic and abiotic factors affecting organisms

Communities of organisms are obviously affected by the environmental factors of their habitat. Factors that are non-living are called **abiotic** factors; those that are living are called **biotic** factors. These may affect the distribution of organisms (i.e. how they are spread out in the environment), their population size, their growth, behaviour or anything else really.

Examples of abiotic factors: light intensity; temperature; moisture levels; soil pH and mineral content; wind intensity and direction; carbon dioxide level for plants; oxygen levels dissolved in water for **aquatic** animals.

Examples of biotic factors: food availability; new predators arriving; new pathogens; competition between species. Competition can actually lead to extinction of a species – if another species outcompetes it, the first one may end up without sufficient numbers to breed.





Key Terms	Definitions
biosphere	Wherever life is found on Earth (and in the atmosphere).
biome	A large zone of life with particular characteristics – e.g. tropical rainforest, arctic tundra.
ecosystem	A complex network of **communities** of organisms, which all depend on each other and which are adapted to the biotic and abiotic conditions they live in.
community	A group of **interdependent** organisms. Communities interact with each other and with the physical environment – **ecosystem** refers to the interaction of living communities with the non-living environment.
habitat	A specific set of conditions, usually a specific location, where an organism (or organisms) is adapted to live.
population	A whole group of organisms – for instance, all the buffalo on the savannah, or all the greenfly on one rose bush.
interdependence	All organisms in a community rely on one another – for food, shelter, pollination, seed dispersal, nutrient recycling and so on.
biotic	Living factors affecting a community.
abiotic	Non-living factors affecting a community (e.g. light intensity, temperature, soil pH).

Adaptations

ALL organisms, now matter how simple they might seem, are adapted to their natural environment. Their features, or adaptations, enable survival in the particular conditions where they live. Adaptations can be:

- **Structural**: adaptations in terms of body form and shape. This would include examples like: streamlined shape for speed; long stem to maximise light exposure
- **Behavioural**: adaptations of behaviour – for instance, hunting behaviours, using tools, plants growing in the direction of a source of light.
- **Functional**: adaptations in terms of how the body works. For instance: being able to digest a certain food, maintaining a constant body temperature and so on.

Some organisms are adapted to live in what we would consider to be extreme environments – for instance, very high temperatures, high pressures, high salt concentration. The organisms that can survive in these kinds of conditions are called **extremophiles**. A great place to find extreme conditions and extremophiles is around and inside deep sea hydrothermal vents.

Organisation of ecosystems

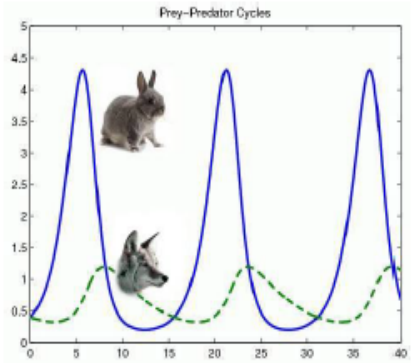
Apart from some ecosystems in deep sea vents, ALL biomass on Earth is produced by **photosynthetic** organisms. So, these organisms are called **producers**. This is vital for other organisms, since these producers start off food chains. **Food chains** represent the feeding relationships in a community. The producer is usually a green plant or algae, and they make **glucose** by photosynthesis.

The producers are eaten by **primary consumers**, which might be eaten by the next trophic level – **secondary consumers**. The secondary consumers may be eaten by **tertiary consumers**. Of the consumers, if they kill and eat other animals, they are called **predators**. The animals eaten by predators are their **prey**. In a *stable* community (one that stays pretty steady in terms of population sizes), the population size of predators and their prey rise and fall in cycles, as the graph shows. When there aren't many predators, the prey population grows rapidly. When it rises, there is more food for predators so their population increases. This puts pressure on the prey so their population drops – cycles, see.

The carbon cycle

In all ecosystems, many materials have to be cycled through the biotic and abiotic components of the ecosystem – e.g. water, carbon, minerals, nitrogen. Microorganisms play a key role in cycling such materials. Carbon can appear in abiotic locations (the air as CO_2, in soil minerals) and biotic locations (in the carbohydrates, lipids and proteins that living organisms are built from). When we say it is cycled through these components, we mean that carbon atoms don't stay in any material for ever. They are cycled by various processes:

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



Key Terms	Definitions
photosynthetic	Describes any organism that can carry out photosynthesis, producing biomass from simple chemicals (CO_2 and H_2O)
biomass	The materials that living things are made from: proteins, carbohydrates and lipids.
food chain	Used to represent the feeding relationships in a community. Starts with a producer and shows what organism eats what, as well as how energy and biomass are transferred in the community.
distribution	Describes how organisms are spread in an ecosystem.
abundance	How many individuals of a particular species there are.
quadrat	A square frame used for sampling plants in an ecosystem. Can be used for counting plants for measuring the coverage of the ground by a particular species.
transect	Sampling method where a quadrat is laid down at regular intervals along a line. This is used to measure the change in distribution of organisms when a particular factor changes, such as light intensity.
interval	The spaces between measurements – e.g. on a transect, the interval might be 1 m.

Measurements of ecosystems

Biologists measure both the **distribution** and **abundance** of organisms in ecosystems to help us understand them (see definitions). It would be impractical to attempt to count e.g. all the seaweed on a beach, so biologists use **sampling** techniques. If you just want to measure the abundance in an area, or to compare two locations for abundance of e.g. seaweed, ***random sampling*** would probably be used of the area. To count plants, quadrats are used. If, however, you are interested in how the distribution (spread) of organisms changes as a factor changes, you measure along a **transect**. For instance, with the seaweed example, you could set up your transect line down the beach towards the water (just using a long tape measure) and measure the coverage by seaweed at 2 metre **intervals**, or some other suitable interval. Data may be summarised using means, modes or medians, and graphs can be produced to represent differences between locations, or the change in distribution along a transect.

The water cycle

Like carbon, **water is constantly cycled** in ecosystems between abiotic and biotic components of the ecosystem. Water is released in aerobic respiration by all organisms. In terms of the abiotic components, water is constantly evaporated and precipitated (so, goes from land/waterways to the atmosphere and back again). The water precipitated provides fresh water for organisms on land before draining into the sea.

Biodiversity

Biodiversity, the *variety of all the species of organisms*, can be measured at the level of a community, ecosystem or the whole earth (biosphere). A large biodiversity increases the stability of ecosystems, because it reduces the dependence of one species on another, for instance for food. So, for example, if a species has only one food source (think: pandas and bamboo shoots), it may be easily threatened by environmental changes.

In spite of our future as a species on Earth depends totally on maintenance of biodiversity, many human activities threaten biodiversity. Indeed, in many ecosystems, we have already significantly reduced biodiversity. For instance, **deforestation** had damaged biodiversity in all kinds of forest. Our **waste**, **polluting** land, air and sea, has negatively affected biodiversity in many areas. And the big one: **global warming** is already having measurable effects on global biodiversity. It is only recently that humans have taken any measures to try to prevent our damage to biodiversity going too much further – obviously, we don't yet know if these measures will be enough.

Land use

Humans reduce the amount of land available for other organisms by: building, quarrying, farming and dumping waste (landfill). This in turn can reduce biodiversity.

Peat bogs are made of peat, a type of fossil fuel formed from dead plants. Peat bogs are destroyed as peat can be used as a fuel and is a very good fertiliser if you're growing plants. This has seriously reduced the area of this habitat and reduced biodiversity as a result. Furthermore, using peat as a fuel produces CO_2 (contributing to global warming) and using it as a fertiliser (in compost) allows it to decay, which also produces CO_2.

Key Terms	Definitions
evaporated	Water changing state from liquid to vapour.
precipitated	Water changing from vapour to liquid/solid form – i.e. rain, hail, snow.
biodiversity	The variety of all the different species of organisms.

Waste management

Since the human population is growing at an incredible rate, and in general people's living standard is going up globally, we (the human population) is using more and more resources and producing more and more waste. Our waste causes pollution, which can occur:

- In **water**, thanks to sewage, fertilisers running off farmland, or toxic chemicals used in industry;
- In the **air**, from smoke, waste gases and acidic gases (e.g. sulphur dioxide)
- On **land**, from landfill (rubbish dumps) and from toxic chemicals.

Pollution kills organisms; therefore it can reduce biodiversity.

Deforestation

Deforestation on a large scale happens to provide land, with the largest areas cleared for raising cattle, to plant rice fields and to grow crops that can be made into biofuels. Our food and fuel needs conflict with the need to preserve forests and rainforests so biodiversity is maintained.

Global warming

As you'll know, since the industrial revolution, human activities have dramatically increased the levels of **greenhouse gases** in the atmosphere. The main gases involved are **carbon dioxide** and **methane**. The molecules of these gases absorb infrared (heat) radiation and re-radiate it, causing gradual but measurable increases the atmosphere's, and therefore Earth's, temperature. Global warming as caused by humans used to be controversial; now, thousands of peer-reviewed publications later, the global scientific consensus is that humans are definitely causing climate change through global warming.

Maintaining biodiversity

As you've seen, many human activities have negative effects on biodiversity. However, as the scale of our negative influence has become more and more apparent, scientists and concerned citizens have brought in programmes to try to reduce our negative influences. Here are the key examples you should know:

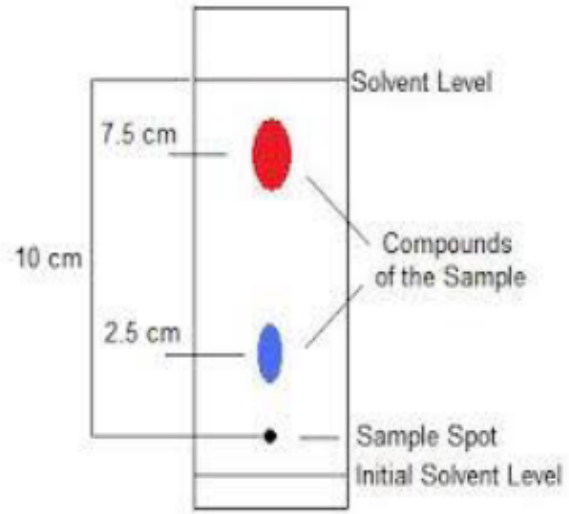
- **Breeding programmes** for endangered species. For instance, tigers and pandas are bred in captivity to ensure they do not become extinct.
- **Protection** and **regeneration** of rare habitats. This includes passing laws to ensure people leave certain areas alone (e.g. parts of the Great Barrier Reef). Regeneration means activity trying to bring a habitat back to its former glory.
- Reintroduction of **field margins** and **hedgerows** in agricultural areas where farmers only grow one kind of crop. Growing one sort of crop (called monoculture) is bad for biodiversity because it only provides a habitat for a few species. So, farmers are encouraged to used hedges (not fences) and leave a margin around the edge of their crop fields, so wild plants can grow there, which in turn allows other organisms (e.g. insects) to survive there too. This improves biodiversity on agricultural land.
- Reduction of **deforestation** and carbon dioxide by some governments. There have been numerous attempts, not always totally successful, to get governments of countries around the world to agree to specific targets for how much carbon dioxide they emit, since global warming is, of course, a worldwide problem. As with many things in politics, agreement is very difficult to obtain... but progress has been made in these international agreements.
- **Recycling** resources rather than dumping in landfill. You are used to recycling as much of your household waste as you can. Work continues to increase the range of materials that can be recycled so we can continue to reduce the amount of waste dumped in landfill.

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

A lovely big field margin, and hedgerow on the left

Chromatography and R_f values

- When carrying out chromatography we can calculate an R_f (retention factor) value.
- The retention factor is a ratio between the distance travelled by the solvent and the distance travelled by a compound, which is written down as a decimal less than 1.
- Chromatography has two phases- a **stationary phase** where particles can't move (the filter paper in most cases), a **mobile phase** where particles can move (a solvent for example water).
- Different compounds will have different R_f values in different solvents. This allow us to see whether a substance is pure or impure.
- To calculate R_f value you need to divide the distance moved by the solvent by the distance moved by the spot.
- For example to work out the Rf for the spot further up the paper:
- $R_f = \frac{B}{A}$ $R_f = \frac{7.5}{10} = 0.75$
- There are no units as the answer is a ratio.
- The higher the R_f value, the further the spot has moved up the paper, compared to the solvent.



Key Terms	Definitions
Retention Factor	The ratio between the distance travelled by the substance and the distance travelled by the solvent.

Equation	Meanings of terms in equation and units
$R_f = \frac{B}{A}$ *	R_f = Retention Factor (no units) B = Distance travelled by solute substance (cm) A= Distance travelled by solvent (cm)

Melting Point and Boiling point

- A chemically pure substance will melt or boil at a very specific temperature.
- If a substance is chemically impure it will melt or boil at a lower temperature and across a broader range.
- The closer the substance is to the melting point the purer the substance.

Formulations

- Formulations are mixtures made using a precise proportion of each substance, so they can serve a particular purpose.
- For example, paints, medicines and Coca Cola are formulations.

Pure and Impure Substances

- A pure substance contains only one type of **element** or **compound.**
- **An impure substance** contains more than one type of element or compound in a mixture, for example salt water contains NaCl and H_2O. All mixtures are impure substances.
- Mixtures are much easier to separate than elements or compounds as they are not chemically bonded
- There are a variety of ways that mixtures can be separated and they are outlined below. Remember that these are all physical changes and chemical bonds are not broken during any of these processes.

Gas Tests

During electrolysis the products made are often gases. Below are the tests for three common gases you need to know:

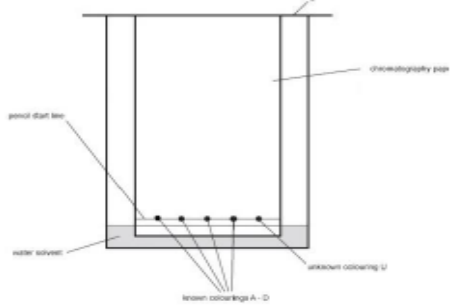
Gas	Test	Result
Hydrogen	Place a lit splint into the gas	If a squeaky pop is heard hydrogen is present
Oxygen	Place glowing splint into gas	If splint is relighted then oxygen is present
Chlorine	Damp litmus paper placed in gas	If the litmus paper bleaches, chlorine is present
Carbon Dioxide	Bubble the gas through limewater	If the limewater goes cloudy, carbon dioxide is present

Key Terms	Definitions
Rf	Retention factor- a ratio that shows how far a substance has moved up the paper
Chromatogram	The results from a chromatography experiment, the paper which shows the Rf values of the substances
Pure	A substance which contains only one type of element or compound
Impure	A substance which contains more than one kind of element or compound
Stationary Phase	The part of a chromatography experiment where the molecules can not move. In most cases this is a solid but it can be a very thick liquid
Mobile phase	The part of the chromatography experiment where the molecules can move, this is a liquid or a gas

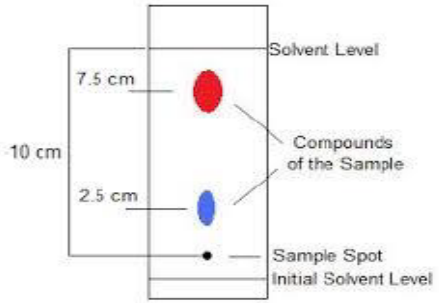
Risk Assessment
Care should be taken with sharp broken melting point tubes.

Diagram

This diagram shows how the experiment should be set up



How to calculate Rf



Rf for top spot= 7.5/10= 0.75

Common Errors
The baseline should be drawn in pencil as ink will be separated
The solvent front should not go all the way to the top of the paper
The solvent should not be higher than the baseline

The Atmosphere

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

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

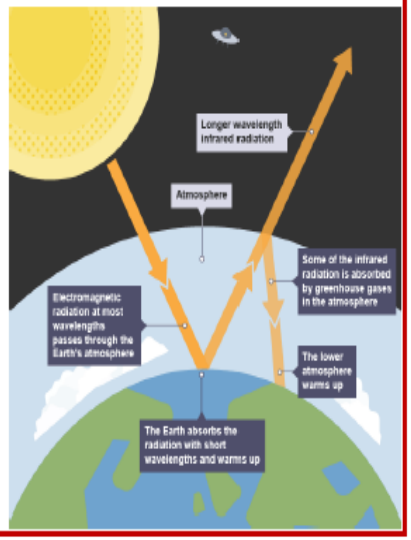
The Greenhouse Effect

The Earth has a layer of gases called the **Greenhouse layer.** These gases, which include carbon dioxide, methane and water vapour, maintain the temperature on Earth high enough to support life.

The greenhouse layer allows the short wave infrared radiation emitted by the Sun to pass through it but absorbs the long wave infra red radiation which is emitted by the Earth, preventing rapid heat energy transfer to space. This is how it insulates the Earth.

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

- combustion of fossil fuels
- deforestation
- methane release from farming
- more animal farming (digestion, waste decomposition)



Key Terms	Definitions
greenhouse layer	The layer of gases which absorb infra red radiation emitted from the Earth

The Evolution of the Atmosphere

Scientists are not sure about the gases in the early atmosphere, as it was so long ago (4.6 billion years) and there's a lack of evidence. Many scientists believe the early atmosphere was made up of mainly carbon dioxide, water vapour and small amounts of methane, ammonia and nitrogen, released by **volcanoes. There was little or no oxygen around at this time.** The early Earth was very hot, but as it cooled the water vapour in the atmosphere condensed and **formed the oceans.**

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

Approximately 2.7 billion years ago, plants and algae evolved. This decreased the amount of carbon dioxide in the atmosphere and increased the amount of oxygen in the atmosphere.

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

Once enough oxygen was in the atmosphere, it could support animals, which carry out respiration. These processes have caused the levels of gases in the atmosphere to be where they are today.

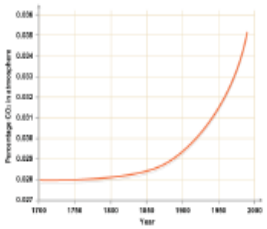
Changes in the atmosphere

Recent activity by humans has changed the composition of the atmosphere.

- Combustion of fossil fuels has increased the amount of carbon dioxide in the atmosphere
- It has increased the amount of harmful gases such as **nitrous oxides**, which are made by nitrogen reacting with oxygen from the air in engines.
- Sulphur is also present in many fuels; this has increased the amount of **sulphur dioxide**, which causes acid rain.
- **Carbon particles (aka particulates)** can also released, which cause smog
- The toxic gas **carbon monoxide** is produced during incomplete combustion.

The Enhanced Greenhouse Effect

In the last 100 years humans have added to the greenhouse effect through combustion of fossil fuels, increased farming and deforestation. Many scientists believe this has lead to a **rise in global temperature.**



However, this is such a complex system that misunderstandings of it can lead to **inaccurate or biased** opinions being reported in the media.

Consequences of Climate Change

An increase in average global temperature is a major cause of **climate change.**

The potential effects of global climate change include:

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

Students should be able to discuss the scale, risk and environmental implications of global climate change.

Waste water and Sewage

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

Key Terms	Definitions
carbon footprint	The **carbon footprint** is the total amount of carbon dioxide and other greenhouse gases released over the life of a product
carbon neutral	There is no net increase in **carbon dioxide in the atmosphere**

Carbon Footprint

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

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

People also try to **offset** their carbon by planting trees.

If something is carbon neutral, this means that there is no net increase in **carbon dioxide in the atmosphere** when it is used.

Water

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

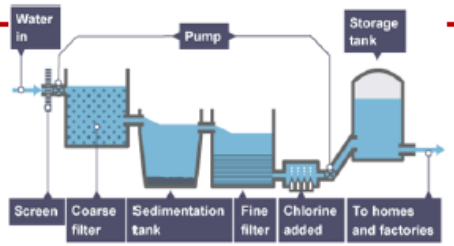
The methods used to produce potable water depend on available supplies of water and local conditions.

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

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

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

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



LCAs

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

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

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

Example of two Life Cycle Assessments:

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

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

Recycling

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

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

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

Magnets

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

Magnets exert forces on one another when they are brought together: a **non-contact** force. If like poles (N-N or S-S) are brought together, the force is of repulsion. If unlike poles are brought together (N-S), the force is of attraction.

Magnets can be classified as **permanent** or **induced** (temporary). Permanent magnets have their own magnetic field, and it doesn't go away. Induced magnets are made when a material is placed in a magnetic field. (In most cases, this needs to be a magnetic material. The only magnetic materials are iron, steel, cobalt and nickel.) Induced magnets are always **attracted** to the magnet that turned them into a magnet – this is why you can pick up paper clips or nails with a bar magnet: the paper clip becomes an induced magnet with poles that are aligned so there is a force of attraction. See the poles labelled on the diagram. Induced magnetism is quickly lost when the material is removed from the magnetic field that induced it.

Magnetic fields

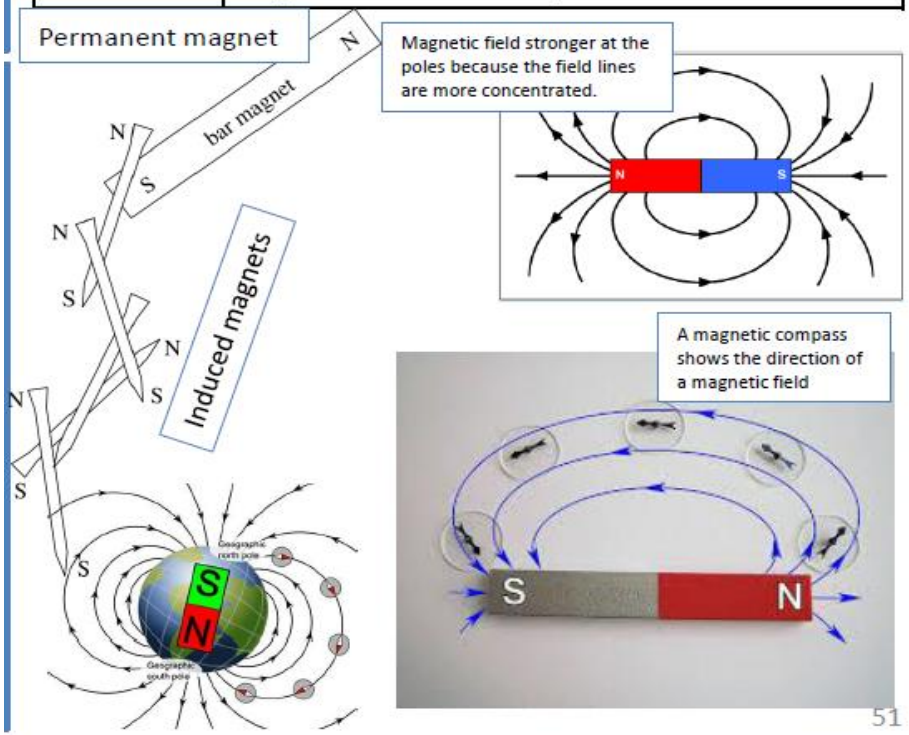
Magnetic fields are around all magnets (permanent or induced). The **direction** of the magnetic, as the diagram shows, is from **north** to **south**. The north pole of a magnet is properly defined as: *the pole that causes a force away from it, if a north pole is placed at that end.* This makes sense when you remember that like poles repel. So you can decide which end in north on an 'unknown magnet' by looking at the direction of the force that acts if a north pole (on another magnet) is brought to one end of your magnet. Repulsion (force away) means that end must be a north pole. Sometimes the north pole is called the **north seeking pole**, because it will point north on Earth if left freely suspended.

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

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

Furthermore, we know it is the **core** of the Earth that is magnetic (not the whole thing) because a compass at the north pole (in the Arctic circle) points down below your feet. It is worth realising, too, that the geographic north pole (the top of Earth's axis) is in a different location to 'magnetic north' – the latter is actually in northern Canada. So a magnetic compass actually wouldn't be much use if you were trying to get to Father Christmas's house.

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



51

Electromagnetism – current and magnetic fields

A wire that is carrying a current has a magnetic field around it. No current means no magnetic field, but switch it on and you get a magnetic field. As the diagram shows, switching the direction of the current switches the direction of the magnetic field. Also notice that the magnetic field gets stronger as you get closer to the wire carrying the current – this is shown by the field lines getting closer together (more concentrated).

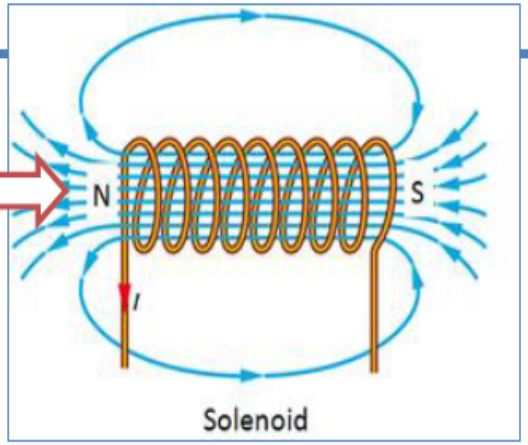
Not surprisingly, increasing the current increases the strength of the magnetic field. You can easily check the *direction* of the magnetic field with a magnetic compass, just like with bar magnets. We can dramatically increase the strength of the magnetic field by winding the current-carrying wire into a coil called a **solenoid**. Even with the same size current, the magnetic field is stronger in a solenoid. Once you've made a solenoid, notice that the magnetic field is very similar in shape to the magnetic field of a bar magnet – it has a north and south pole, and it strongest at the poles. The magnetic field is also strong *inside* the coil – as the concentrated field lines show.

We can increase the strength of the magnetic field even further by putting a magnetic (e.g. iron) **core** in the solenoid – literally a cylinder of iron. We call this an **electromagnet**. (see diagram)

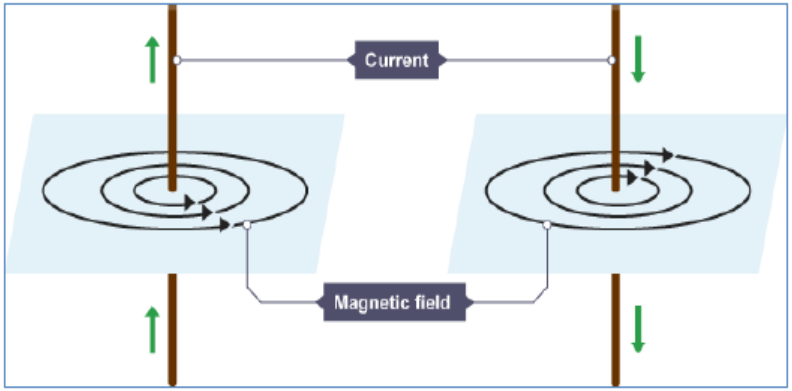
You can make an electromagnet **stronger** by:

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

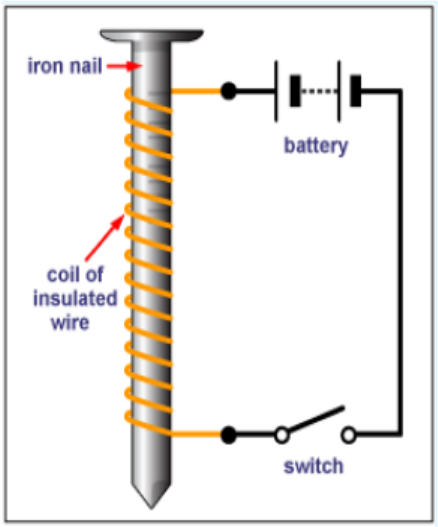
A north pole, since another north pole brought to this end would be repelled.



Key Terms	Definitions
current	The rate of flow of charges in a circuit. If a current is flowing in a component, charges (e.g. electrons) are flowing through it.
solenoid	A coil of wire.
iron core	A piece of iron placed in the middle of a solenoid.
electromagnet	A coil of wire with an iron core



In school, an iron nail is an easy choice for the iron core of an electromagnet.



Fleming's left hand rule and the motor effect

If you have a current-carrying wire and a permanent magnet, each have their own magnetic fields. This means that if you put them near each other, there'll be a force acting on each of them – just thanks to magnetic attraction or repulsion. This is called the **motor effect**.

You can work out the direction that the force acts if you know the direction of the magnetic field and the direction of the current – we use **Fleming's left hand rule**. It has to be your left hand to work. Hold it as shown, and you can work out the direction of whichever quantity you don't know. You have to think in three dimensions here. You can twist your hand at the wrist to get it right – confirm using the example of the wire cutting through the magnetic field in the diagram – field from N to S with first finger, current with middle finger pointing downwards, meaning force must be out of the page towards you, like the diagram shows.

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

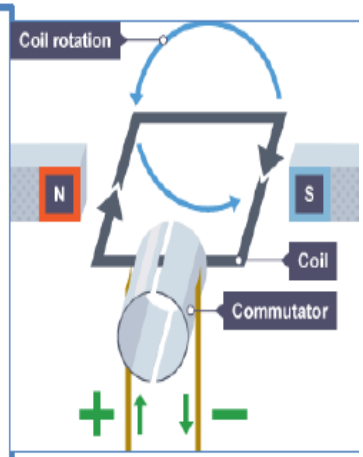
1. The **length** of the wire in the magnetic field, measured in metres
2. The **strength** of the magnetic field (formally, the **magnetic flux density**, in teslas, T)
3. The **size** of the **current** (A, as usual).

As the equation shows, increasing any or all of these factors will increase the size of the force on the conductor. [NB this equation only applies when the current and magnetic field are at right angles to each other]

Electric motors

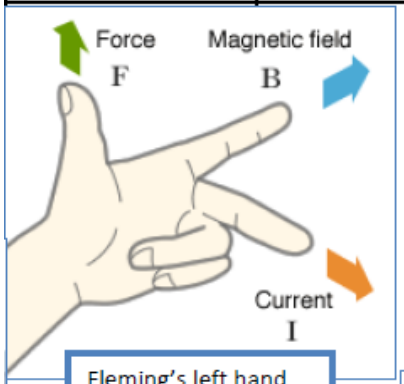
Electric motors make use of the motor effect. A coil of wire carrying a current is placed in a magnetic field; as you know, the magnetic fields interact to cause a force on each part of the motor. If the coil is set up so it can spin, it most certainly will. In fact, it will spin round and round (**rotate**).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

The magnetic field goes from N to S of course, and the arrows on the coil show the direction of the current. So, the left side of the coil has a force **downwards** exerted on it (use the left hand rule). The right side of the coil has a force **upwards** exerted on it, so it rotates as shown. (NB the commutator just allows the coil to spin without the wires getting tangled up or the current flipping direction!)

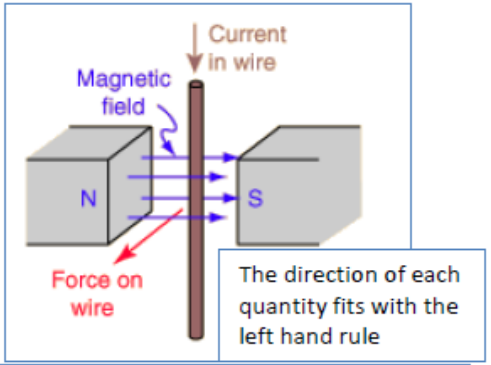


Key Terms	Definitions
motor effect	The forces exerted on each other by a wire carrying a current and a magnetic field, thanks to the two magnetic fields interacting.
magnetic flux density	A measure of the strength of a magnetic field – think of it as the number of magnetic field lines going through a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

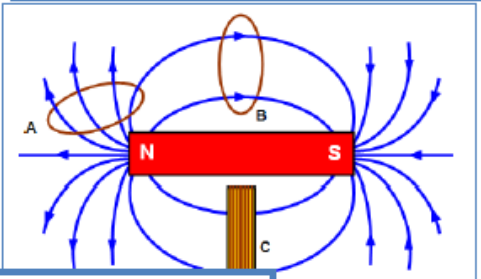
Equation	Meanings of terms in equation
$F = B\,I\,l$	*F = force (newtons, N)* *B = magnetic flux density (tesla, T)* *I = current (amps, A)* *l = length (m)*



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



The direction of each quantity fits with the left hand rule

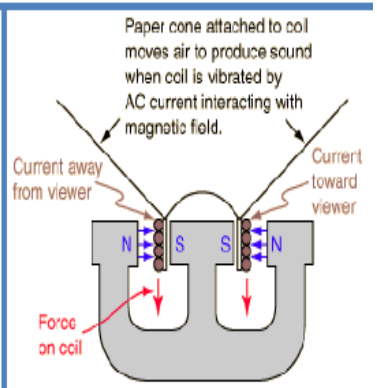


Magnetic flux density is larger at A than B since more magnetic field lines cut through a given area (area shown by the oval).

Loudspeakers and microphones

The motor effect is also put to good use in loudspeakers and headphones. They have a 'moving coil' which moves in a magnetic field according to the current running through the coil. This moving coil is connected to a cone that moves with it. The cone causes vibrations in the air around it – in other words, it causes sound waves. Microphones do the exact opposite: sound waves (pressure variations) cause the cone the move, which causes a changing current in the coil.

Study the diagram. Just like in a motor, a force is produced on the coil of wire by placing it in a magnetic field (that's a permanent magnet at the bottom) and turning on the current. As the current alternates in direction (i.e. AC is used), and the size of the current is varied, the coil moves back and forth. As you can see, the coil is joined to a cone, which moves with it. The cone vibrates the air according to the current, then. The current transfers the information about the sound being played.



Key Terms	Definitions
moving coil	Describes a loudspeaker that involves a coil of wire moving in a magnetic field, to vibrate a cone and produce sound waves.
induce	To cause something to happen.
AC	Alternating potential difference – the direction of the current switches back and forth.
cone	Literally a cone-shaped piece of material found in loudspeakers. They vibrate, causing pressure changes in the air – i.e. sound waves.
induced potential	A potential difference caused by either: a) moving a coil in a magnetic field, or b) changing the magnetic field around a coil.
generator effect	Using the interaction between a magnetic field and a conductor to generate electric current.

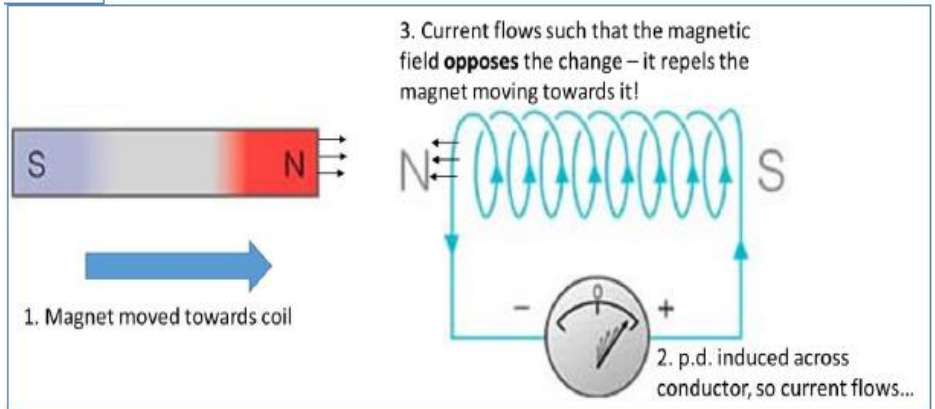
Induced potential and the generator effect

You can switch the motor effect around – instead of using interacting magnetic fields to produce movements, you can use movements to produce a current in a wire. Here's how it works:

1. Place a conductor (e.g. coil of wire/solenoid) in a magnetic field and move it around (e.g. rotate the coil)
2. OR keep the coil still but change the magnetic field (e.g. flip N and S back and forth)
3. Either of these **induces** a potential difference across the ends of the conductor
4. Assuming your conductor is part of a complete circuit, a current starts to flow in the conductor thanks to this potential difference.

This is called the GENERATOR EFFECT, because the method is used to generate electricity. It is also known as electromagnetic induction.

Now, importantly, the current in the conductor produces a magnetic field, as always. But the direction of the magnetic field acts to oppose the change, the 'change' being the original 1 or 2 from the steps above. This is shown in the diagram right.



Factors affecting induced potentials

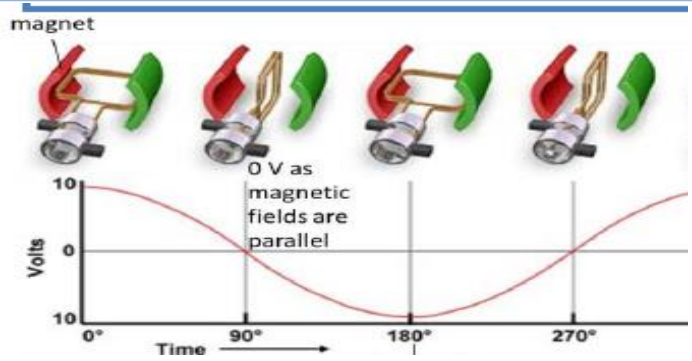
The size of the induced potential in the generator effect depends on:

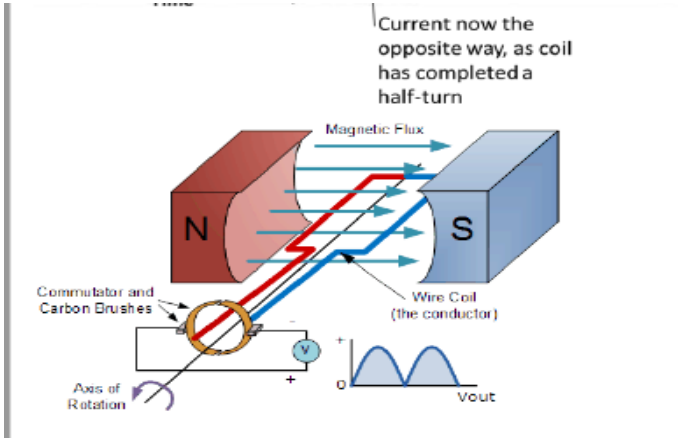
- The size/strength of the magnetic field (larger magnetic field → larger induced potential)
- The number of turns on the solenoid (more turns → larger induced potential)
- The speed of movements/changes to magnetic fields (faster → larger induced potential)

Using the generator effect

Depending on the set-up, you can use the generator effect to generate ac or dc.

- ac is generated in an alternator. In this set-up, each end of the coil of wire spin inside, and make contact with, a complete loop of conductor that's connected to the rest of the circuit. Since every 180° of turn of the coil the current flips direction (just like the left hand rule tells us), you get ac. This is shown on the diagram below, with a graph showing alternating potential difference.
- dc is generated in a dynamo. To prevent the current flipping direction every half-turn, a clever **commutator** is used. This ensures the current is restricted to one direction only in the coil – i.e. direct potential difference. See second diagram and graph.



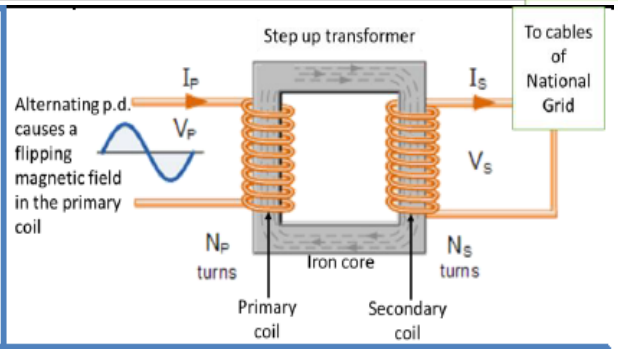


Key Terms	Definitions
national grid	A system of cables and transformers linking power stations to consumers of electricity. The National Grid is used to transfer electrical power from the power stations to users.
commutator	Device used in dynamo, made of two half-rings of conductor, not quite joined up to each other. Keeps the current flowing one way only.
step-up transformer	Device that increases potential difference in an electric supply, using more turns on the secondary coil than the primary coil. Step-down transformers do the opposite.

Equation	Meanings of terms in equation
$\frac{V_p}{V_s} = \frac{N_p}{N_s}$	V_p = *potential difference across primary coil* (V) V_s = *potential difference across secondary coil* (V) N_p = *number of turns on primary coil* N_s = *number of turns on secondary coil*
$V_p \times I_p = V_s \times I_s$	V_p = *potential difference across primary coil* (V) V_s = *potential difference across secondary coil* (V) I_p = *current in primary coil* (A) I_s = *current in secondary coil* (A)

Transformers

Transformers exist to firstly, massively increase the p.d. of electric power to transmit it efficiently through cables from power stations, then, secondly, to dramatically decrease it again for safe use by consumers. They work using the second sort of generator effect – a changing magnetic field inducing a p.d. in a conductor nearby. Transformers are made of two coils of wire, wrapped around each end of a square-shaped iron core. Iron is used because it is easily magnetised. An alternating current in the primary coil causes a magnetic field in this coil, that constantly changes direction. This in turn induces a changing magnetic field in the iron core, which then induces a changing magnetic field (and therefore current) in the secondary coil.



Transformer equations

In transformers, the ratio of the potential differences across the coils is equal to the ratio of the number of turns on each coil. This is shown in the first equation.

Assuming transformers are 100% efficient, the power input is equal to the power output. This leads to the second equation (since $P = IV$).

Number	Key term	Definition
1	**Biome**	A large scale ecosystem
2	**Latitude**	Measures how far north or south a location on the Earth's surface is from the equator.
3	**Biosphere**	A living layer of Earth between the lithosphere and atmosphere
4	**Precipitation**	Anything wet falling from the sky i.e. rain, sleet, snow.
5	**Ecosystems**	A localised biome made up of living things and non living environment.
6	**Altitudinal Zonation**	The change in ecosystem at different altitudes, caused by alterations in temperature, precipitation, sunlight and soil type.
7	**Biotic**	Living part of an ecosystem (flora and fauna)
8	**Abiotic**	Non living part of an ecosystem (atmosphere, water, rock and soil)
9	**Goods**	Physical materials of products that have value to us.
10	**Services**	Functions that satisfy our need.
11	**Indigenous people**	The original people of a region.

Number	Key term	Definition
12	**Ecosystem services**	Is a collective term for all the ways humans benefit from ecosystems.
13	**Provisioning Services**	Products obtained from ecosystems. Food, nuts, berries, fish, game, crops, fuel wood, firewood.
14	**Regulating Services**	Services link to other physical systems and keep areas and the whole planet healthy. = Storing carbon, emitting oxygen, purifying water, regulating the hydrological cycle.
15	**Supporting Services**	These keep the ecosystems healthy so it can provide the other services: nutrient cycling, photosynthesis and soil formation
16	**Cultural Services**	These are benefits people get from visiting or living in a healthy ecosystem: Recreation and tourism, education and science, spiritual well being and happiness.
17	**Carbon Sink**	Natural stores for carbon-containing chemical compounds, like carbon dioxide or methane.
18	**Nutrient Cycle**	Nutrients like nitrogen and phosphorous move between the biomass, litter and soil as part of the continuous cycle which keeps both plants and soil healthy.

Number	Key term	Definition
19	**Biodiversity**	Means the number of different plants and animal species in an area.
20	**Emergent layer**	Hardwood, evergreen trees that have broken through the dense canopy layer below to reach the sunlight. Monkeys and birds live up there/
21	**Canopy layer**	The dense canopy layer is home to tree snakes, birds, tree frogs and other animals because there is so much food available.
22	**Understory Layer**	This layer contains young trees and those with large leaves to capture sunlight; huge numbers of insects live in the understory layer.
23	**Forest floor**	The darkness of the forest floor means shade loving ferns with large leaves live here along with mammals like the jaguar.
24	**Biomass**	The total of living matter in the ecosystem.
25	**Leaching**	When nutrients are washed out of the soil by water moving through it.
26	**Taiga**	Biome located 50°C and 60°C latitude mostly in the northern hemisphere. Sometimes it is referred to as boreal forest.

Number	Key term	Definition
27	**Taiga Climate**	Short wet summers. Three months when temperatures can get up to 20°C. Long cold, dry winters with several months of below freezing, as low as -20°C. Low precipitation- below 20mm for 5 months of the year.
28	**Hibernate**	Animals go into a dormant state in the winter months to avoid the cold and food shortage.
29	**NPP**	Net primary productivity- is a measure of how much new plant and animal growth- biomass- is added each year. It is measured in grams per square meter.
30	**Deforestation**	The deliberate cutting down of forests to exploit forest resources.
31	**Direct threats**	This involve deliberate cutting down of trees for timber, to make roads or to convert forest into farm land.
32	**Indirect threats**	These come from pollution, global warming or disease.
33	**Wildfire**	Uncontrolled burning through forest, grassland or shrub. Such fires can “jump” roads and rivers and travel at high speed.
34	**Invasive species.**	Is a (sometimes called alien species) plant, animal or disease introduced from one area to another.

Number	Key term	Definition
35	**Non-renewable**	Finite resources such as the fossil fuels (coal, oil and gas)
36	**Renewable**	These will never run out and can be used over and over again e.g. wind power, solar power and HEP.
37	**Recyclable**	These provide energy from sources that can be recycled or reused i.e. biofuel energy.
38	**Energy poor**	Lack of access to energy sources either due to a lack of resource of a lack of money.
39	**Energy diversification**	Getting energy from a variety of different sources to increase energy security.
40	**Energy Security.**	Having access to reliable and affordable energy sources.
41	**Ecological debt**	When the Earth's resources are being used up faster than the Earth can replace them.
42	**Ecological footprint**	This is a calculation measured in global hectares (gha). It is the amount of land and water required to produce resources to deal with waste from each country.

Number	Key term	Definition
43	**Black gold**	A term used for oil as it is regarded as such a valuable commodity.
44	**Peak oil**	The theoretical point at which half of the known reserves of oil in the world have been used.
45	**OPEC**	Organisation of Petroleum Exporting Countries. This was established to regulate the global oil market, stabilise prices and ensure a fair return for its 12 member states who supply 45% of the world's oil.
46	**Demand**	High demand causes prices to rise, and falling demand causes lower prices.
47	**Supply**	Supply affects the price- too much oil and the price falls, too little and it rises.
48	**Fracking**	Water is blasted at very high pressure into rock fractures to extract shale gas.
49	**Liquefaction of natural gas.**	Converting gas into liquid.
50	**Tar Sands**	A mixture of sand, clay, water and a very dense sticky form of petroleum called bitumen.
51	**Biofuels**	Any kind of fuel made from living things, or from the waste they produce.

The Weimar Republic	
1	This was the name given to Germany after the Kaiser had abdicated in November 1918. This was a time of despair and hope for Germany. At first, the country faced lots of chaos but under Gustav Stresemann, there was some stability.
Key events	
2	**1918** World War One ended. The Kaiser abdicated and Germany became a country without a monarch (a Republic).
3	**1919** January Spartacist Uprising
4	**1919** June Signing of the Treaty of Versailles
5	**1919** August Weimar Constitution finalised
6	**1920** Kapp Putsch
7	**1923** French occupation of the Ruhr and hyperinflation
8	**1924** Dawes Plan
9	**1925** Locarno Pact
10	**1926** Germany joins League of Nations
11	**1928** Kellogg Briand Pact
12	**1929** Young Plan
Key Concepts	
13	**The Weimar Republic** faced much opposition, it was disliked by the left wing who wanted Germany to be like Communist Russia and it was disliked by the right wing who wanted the monarchy back.
14	**The Treaty of Versailles** caused many problems for Germany. The German people disliked the politicians for signing it and it caused political problems and economic problems.
15	**Gustav Stresemann** helped to bring about recovery in Germany after 1924. He solved economic problems by making friends with other countries. However, historians have very different views about the extent of this recovery**.**
16	**The Golden Age** was the period from 1924-29 and it saw significant changes in culture, the standard of living and the position of women.

Key Words		
17	**Abdication**	When a monarch leaves the throne
18	**Republic**	A country without a King or a Queen
19	**Ebert**	The first President of the Republic
20	**Stresemann**	The Chancellor of Germany from the Summer of 1923
21	**Article 48**	The President could use this to ignore the Reichstag and rule as he saw fit
22	**Kaiser**	King
23	**Armistice**	An agreement to end war
24	**Weimar**	The new government could not meet in Berlin as it was so dangerous, so they met here instead
25	**Constitution**	This is an agreement about how the country would be ruled
26	**Reichstag**	German parliament
27	**Gewaltfrieden**	An enforced peace
28	**Freikorps**	Ex military soldiers who wanted to overthrow the Republic
29	**Rentenmark**	The currency of Germany after November 1923
30	**Hyperinflation**	When money looses its value
31	**Dawes Plan**	An agreement where the USA would lend Germany money
32	**Young Plan**	This lowered the reparations payment and gave Germany longer to pay
33	**Treaty of Versailles**	This decided how Germany was going to be treated after WW1
34	**Locarno Pact**	An agreement on borders signed by Britain, France, Italy and Belgium
35	**Kellogg Briand Pact**	65 counties including Germany agreed to resolve conflict peacefully
36	**Coalition**	A government of two or more political parties

Hitler's Rise to Power	
1	Hitler sets up the Nazi Party in 1920 and becomes Chancellor in January 1933. This happens for a variety of reasons – Hitler's strengths, inbuilt problems of the Weimar Republic, and the weaknesses of others.
Key events	
2	**1919** Hitler joins the German Worker's Party
3	**1920** Hitler sets up the Nazi Party
4	**1921** Hitler introduces the SA
5	**1923** The Munich Putsch
6	**1925** Mein Kampf published
7	**1926** Bamberg Conference
8	**1928** Nazis win 12 seats in Reichstag
9	**1929** Death of Stresemann and Wall Street Crash
10	**1930** Nazis win 107 seats in Reichstag
11	**1932 July** Nazis win 230 seats in Reichstag
12	**1932 November** Nazis win 196 seats in Reichstag
13	**1933 January** Hitler becomes Chancellor
Key Concepts	
14	**The Munich Putsch** is a significant event. Although a failure, Hitler gained publicity, he wrote Mein Kampf and he realised that if he was to win power, he needed to do this by votes and not by force.
15	**Stresemann** caused problems for the popularity of the Nazi Party. When times were good, voters were not attracted to the Nazi policies.
16	**The Wall Street Crash** was a major turning point in the fortunes of the Nazi Party. The Nazi message did not change but people were now prepared to hear it.

Key Words		
18	**NSDAP**	The Nazis
19	**Iron Cross Award**	Given for bravery in war
20	**Volk**	The notion of pure German people
21	**25 Point Programme**	The political manifesto of the Nazi Party
22	**Volkischer Beobachter**	People's Observer, a Nazi newspaper
23	**Fuhrerprinzip**	Belief that one person should run a Party
24	**Swastika**	Emblem of the Nazi Party
25	**SA or Sturmabteilung**	Private army of the Nazi Party headed by Himmler
26	**Aryan**	Pure German people
27	**Anti-Semitism**	Hatred of the Jewish people
28	**Mein Kampf**	Hitler's autobiography
29	**Putsch**	An attempt to get power illegally
30	**Blood Martyrs**	16 Nazis who died at the Munich Putsch
31	**Gaue**	Local party branches
32	**SS or Schutzstaffel**	Hitler's bodyguards
33	**KPD**	German Communist Party
34	**Propaganda**	Goebbels attempted to make people think in a certain way
35	**Hindenburg**	The President of the Republic from 1925 to 1934

Nazi Control and Dictatorship	
1	This was a time when Hitler formed a legal dictatorship and put in place methods of propaganda and censorship to persuade and encourage all Germany people to support Nazi ideals.
Key events	
2	**1933 January** Hitler becomes Chancellor
3	**1933 February** Reichstag Fire
4	**1933 March** Nazis win 288 seats
5	**1933 March** Enabling Act passed
6	**1933 July** Nazis become the only legal party in Germany
7	**1934 June** Night of the Long Knives
8	**1934 August** President Hindenburg dies
9	**1934 August** Hitler combines the post of Chancellor and President and becomes Fuhrer
10	**1934** August German army swears allegiance to Hitler
11	**1938** Over the course of the year, Hitler removes 16 army generals from their positions
Key Concepts	
12	**Removal –** From 1933 to 1934, Hitler removed all opposition and established himself as Fuhrer.
13	**Control –** There was an attempt to control and influence attitudes. This was done by propaganda and terror.
14	**Opposition –** The youth and the churches opposed the regime**.**

Key Words		
15	**Marinus van der Lubbe**	The Reichstag Fire was blamed on this Communist
16	**Enabling Act**	Gave the Nazis full power for the next 4 years
17	**Gleichschaltung**	Hitler's attempt to bring German society into line with Nazi philosophy
18	**German Labour Front (DAF)**	Set up to replace Trade Unions
19	**Dachau**	First concentration camp
20	**Centralisation**	Germany had been divided into districts called Lander. Now Germany was run from Belin alone
21	**Purge**	To get rid of opposition
22	**Gestapo**	Secret police headed by Goering.
23	**Night of the Long Knives**	Removal on internal and external opposition
24	**Sicherheitsdienst (SD)**	The intelligence body of the Nazi Party
25	**Concordat**	In July 1933 the Pope agreed to stay out of political matters if the Nazis did not interfere with Catholic affairs
26	**Eidelweiss Pirates and Swing Youth**	Groups who apposed the Hitler Youth
27	**Confessional Church**	Followed traditional German Protestantism and refused to allow the Nazification of religion. Led by Pastor Martin Niemoller
28	**Mit Brennender Sorge (With Burning Concern)**	The Pope wrote to priests in Germany about his concerns over the Nazi attempts to control religion

Life in Nazi Germany	
1	The lives of German citizens were changed after Hitler's appointment as Chancellor. For some, life was better under the Nazis but for others, it was much worse.
Key events	
2	**1933** Boycott of Jewish shops and businesses. Law for the Encouragement of Marriage. Sterilisation Law passed.
3	**1935** The Nuremberg Laws were passed.
4	**1935** Conscription introduced.
5	**1936** Membership of the Hitler Youth made compulsory.
6	**1938** Jewish children were not allowed to attend German schools. Lebensborn programme introduced. Kristallnacht.
7	**1939** The euthanasia campaign began. Designated Jewish ghettos established.
Key Concepts	
9	**Anti-Semitism** – Persecution of the Jews grew continuously after 1933.
10	**Young**– The Nazis placed much emphasis on controlling the young as only then could they secure a 'thousand year Reich'. Youth organisations and education indoctrinated the German youth.
11	**Women –** The Nazis had traditional family values but even these were tested by the needs of war and the desire to ensure a growing Aryan population.
12	**Living Standards** – The Nazis did reduce unemployment but they did this by banning Jews and women from the workplace and by putting Germany on a war footing. Workers had limited rights.

Key Words		
13	**Kinder, Kuche, Kirche**	Children, Kitchen, Church. This summed up the Nazi ideal of womanhood
14	**The Motherhood Cross Award**	Given to women for large families
15	**Lebensborn**	Where unmarried women were impregnated by SS men.
16	**Napola**	Schools intended to train the future leaders of Germany
17	**Nazi Teachers League**	All teachers had to swear an oath of loyalty to the Nazis
18	**Reich Labour Service**	A scheme to provide young men with manual labour jobs
19	**Invisible unemployment**	The Nazi unemployment figures did not include women, Jews, opponent and unmarried men under 25
20	**Autobahn**	Motorway
21	**Rearmament**	Building up the armed forces I readiness for war
22	**Volksgemeinshaft**	The Nazi community
23	**Strength Through Joy**	An attempt to improve the leisure time of German workers
24	**Beauty of Labour**	Tried to improve working conditions of German workers.
25	**Volkswagen**	People's car
26	**Eintopf**	A one pot dish
27	**Herrenvolk**	The master race or the Aryans
28	**Nuremberg Laws**	Jews were stripped of their citizenship rights and marriage between Jews and non Jews was forbidden
29	**Kristallnacht (Night of the Broken Glass)**	A Nazi sponsored event against the Jewish community

<table>
<tr><th colspan="4">Key Ideas</th></tr>
<tr><td>Protests and Terrorism
  </td><td colspan="2"><u>Protests</u>
The right to gather together and protest is a fundamental democratic freedom.
UK law allows for peaceful public protest but sometimes protects can turn violent and become a riot.
Christians often protest unjust laws or for other forms of justice but would rarely advocate the use of violence in protest.</td><td><u>Terrorism</u>
Examples of terrorism include suicide bombing, mass shootings or using vehicles to injure pedestrians.
The aim of terrorism is to make society aware of a cause or issue and to make people frightened to go about their business.
Christians don't promote political violence + believe terrorism is wrong as it targets innocent people</td></tr>
<tr><td>Reasons for War
  </td><td><u>Greed</u>
To gain more land or to control important resources such as oil or gas.
e.g. The UK and US invading Iraq in order to control oil resources</td><td><u>Self-Defence</u>
To defend one's country against invasion or attack or to protect allies who are under attack
e.g. UK threatened by Nazi invasion in WWII</td><td><u>Retaliation</u>
To fight against a country that has done something very wrong or to fight against a country that has attacked you
e.g. US invading Afghanistan in retaliation for 9/11</td></tr>
<tr><td>Nuclear War and WMD
  </td><td colspan="3">Nuclear weapons work by a nuclear reaction and devastate huge areas and kill large numbers of people. They are a type of WMD (weapons of mass destruction) which also includes chemical and biological weapons. All these weapons are not allowed under the Christian Just War Theory and would therefore be rejected by most Christians.
Nuclear weapons were used at the end of WWII in Japan to force the Japanese to surrender. Some people say their use was justified as it prevented more suffering even though 140,000 people died.
Although some Christians justify war with 'an eye for an eye', this cannot be used to justify the use of weapons of mass destruction as they are not a proportionate response.</td></tr>
<tr><td>Holy War
  </td><td colspan="3">A Holy War is a war which is fought for religious reasons, often with the backing of religious leaders. An example of this was the Crusades fought from the 11th-14th Century by Christians, backed by the Pope.
Religion can still be a cause for war today such as in Northern Ireland where Protestant and Catholic Christians fought a civil war between 1968-98.</td></tr>
</table>

Just War Theory 	Just War Theory is a Christian moral theory for working out if a war meets internationally accepted criteria for fairness. These are some of the conditions that must be met in order for a war to be just: • Just Cause – fought in self-defence or to protect others • Just Intention – fought to promote good and defeat wrongdoing • Last Resort – only going to war if all other methods have been tried first • Proportional – excessive force should not be used and innocent civilians must not be killed	
Pacifism and Christian Responses to War 	**Pacifism** is the idea that **all forms of violence are wrong**. Pacifists such as Quakers refuse to take part in war and often choose to be a **conscientious objector** (someone who doesn't go to war for moral reasons) or to assist in medical tasks like ambulance driving. Christians try to follow Jesus' teaching that "blessed are the peacemakers"	Christians try to show **mercy** and **agape** to victims of war and provide them with assistance. This can be through charity or through welcoming them into their churches. It can be victims in their own country or **refugees** such as people fleeing from Syria or Yemen. This is an example of 'love your neighbour' in action.

RS Revision: Quotes for Peace and Conflict Unit

"Those who lives by the sword, die by the sword"

"Love your enemies and pray for those who persecute you"

"Blessed are the Peacemakers"

"A time to love, and a time to hate; a time for war, and a time for peace."

"Blessed are the merciful, for they shall receive mercy."

"Christ is all, Christ is in all"

"Repay no one evil for evil"

The Parable of the sheep and goats

"But I tell you, do not resist an evil person. If anyone slaps you on the right cheek, turn to them the other cheek also."

"Love your neighbour as you love yourself."

"An eye for an eye, a tooth for a tooth"

"They will beat their swords into plowshares and their spears into pruning hooks. Nation will not take up sword against nation, nor will they train for war anymore."

"Do not envy a man of violence and do not choose any of his ways"

The story of Sodom and Gomorrah

"You are all one in Christ Jesus"

"The Parable of the Good Samaritan"

"Strive for peace with everyone"

"God's love is too great to be confined to any one side of a conflict or to any one religion" **Desmond Tutu**

"Thou shall not murder"

"Whoever sheds the blood of man, by man shall his blood be shed"

"Nation will not take up sword against nation, nor will they train for war anymore."

"For the love of money is a root of all kinds of evil. Some people, eager for money, have wandered from the faith and pierced themselves with many griefs"

"Blessed are the merciful"

"The purpose of all wars is peace"
St Augustine

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

LO1: Know the personal qualities, styles, roles and responsibilities associated with effective sports leadership

1. What is leadership? It can be defined as the action of leading a group of people. However, being a leader has distinctive requirements. Leaders hold responsibility and respect and have followers who they can influence.

2. Different leadership roles:

- Captains: Help to make decisions for their team and influence and motivate those around them.
- Managers: Help to manage the processes and procedures, tactics and strategies that a team or sports performer uses.
- Teachers: Are in apposition of authority and subsequently have the opportunity to lead and guide those they are teaching.
- Coaches: Influence those who they coach. Their leadership role is to guide and help performers in order to eradicate weaknesses and maximize strengths.
- Expedition leaders: Influence those in the expedition and often need to help others to lead and to take on responsibilities.
- Role models: They can be positive or negative. However, there is a general belief that sportspeople should act as positive role models to the general public, leading and guiding other sports performers in how to conduct themselves.

3. Role-related responsibilities:

- Knowledge of activity - Any sporting leader must fully understand the activity and know the rules so that can enforce the rules during play.
- Enthusiasm for activity - A sports leader has to show an appropriate amount of motivation and enthusiasm for the activity they are leading.
- Knowledge of safety - The prime concern of anyone in a position of responsibility should be the safety of those involved
- Knowledge of child protection issues - Safeguarding, or protecting children from harm, is a major consideration for any sporting leader.
- Knowledge of basic first aid - Sports Leaders have often attended first aid awareness training to enable them to use basic first aid in the event someone getting injured.

4. Personal qualities that relate to leadership roles: Sports Leaders must be punctual for training and reliable in attendance. They must be able to communicate with the people they are leading and be fair to everyone. They must have the confidence to instruct and the charisma or charm to persuade and motivate. Sports leaders must be creative when designing sessions for their group and knowledgeable about the activity, its skills, techniques and specific requirements.

5. Leadership Styles:

Democratic - Leaders consult the group when they make decisions.

Autocratic - Leaders do not value opinions of others. They do not ask for opinions or welcome suggestions. They are the sole leader and therefore make all decisions.

Leissez-faire - It is a leadership style which the leader does not intervene and allows the activity to follow its own, natural course.

LO2: Be able to plan sports activity session

1. **Things to consider when planning your session:**

- Who are you going to teach? (year 4, year 5, year 6, year 7)
- What are you going to teach them? (Sport, skill, what game?)
- When are you planning to teach your session? (Date, time)
- Where are you going to teach? (i.e. sports hall, field, gym)
- Why are you planning? (To help you when put your leadership skills into practice and to make sure the session goes well)
- How are you going to break up the session? (Warm up, main activity x2, cool down)

2. Safety considerations when planning sports activities:

- Risk assessments (e.g. facilities, equipment/clothing checks, activity-specific risks)
- Corrective action (e.g. wiping up puddles, removing litter, reporting faulty equipment)
- Emergency procedures (e.g. procedures in the event of an accident, procedures in the event of other emergencies, summoning qualified help, completion of relevant documents).

Law controls use of data: - Data protection act (after Dec 31st 2020, UK will decide whether to follow General data protection regulation: GDPR)
Lawfulness, **fairness** and **transparency**. collected for specified,
Purpose limitation. explicit and legitimate purposes
Data minimization: not kept for longer than **required – only information needed – not about something not related to its purpose**
Accuracy: make sure systems are in place to gather correct data
Storage limitation: some places keep data for historical archiving which is ok – p60, P45 must be kept by you for 6 years
Integrity and confidentiality (security): data must be lawfully kept secure on systems and process data securely, both physical and digital data (anti-virus / policies / training to staff who use the data)
Accountability: prove that data protection complies with regulations – privacy policies in place and can be trusted.

Ethical: issues about what would be considered right or wrong by society
Legal issues are about what is actually right and wrong in the eyes of the law
Cultural issues – how groups of people with particular practices or languages maybe affected, e.g. ethnic group, religions, countries
Environmental issues – about how we impact the natural world

Privacy online: Social media encourage users to post personal information online.
Cloud computing: Encourage people to save personal files on their servers
Companies may sell your information: including personal details, buying habits/likes/dislikes who target adverts and spam to you – they can do this if they stay within privacy agreement
People do not always read privacy agreements – often users of sites have no choice but to agree, so they can use the site
Users expect companies to keep their information secure even when they don't

Copyright, design and patents act protects intellectual property (song, software, invention).
Copyright covers: written, recorded books, music, film, software and games (cannot copy and distribute without owners permission.

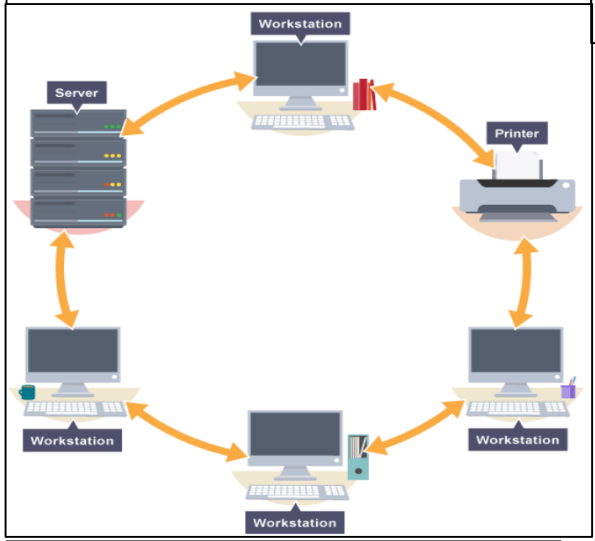


Social engineering: giving information away by influencing people – over telephone – person rining and pretending to be from organization, persuade person into giving company information
Phishing: criminals send email or text claiming to be from well known business – bank or retailer – email contains spoof versions of company site – tells user to update personal information – e.g. password – user filling in details on spoof site, hand over details – sent to thousands of people

Cyber crime refers to illegal activity involving computers or networks
Hacker is a cyber criminal that gains access to system that showing the weakness in its security. Hacker will steal and destroy data or infect it using malicious software.
Computer misuse act: -introduced to stop online crime. Introduced three offences, unauthorized access to device through hacking (breaking this law leads to fine or prison sentence)
Gaining unauthorized access to commit a crime, stealing and/or destroying a network.
Modifying computer material – deleting/changing files without permission – makes it illegal to make, supply or obtain malware.
Malware (malicious software installed on people computers without their permission: software that damages devices, steals data, and causes chaos – actions of malware: deleting, modifying files so that monitoring / gaining access of personal information such as password
Types of malware: virus – attach themselves to files – e.g. emails and spread between computers shared – when file is opened, it is activated – can replicate itself
Worms: can replicate without user having to open it etc. – exploits weakness in network security.
Trojans: malware in disguise as legitimate software (THESE DO NOT REPLICATE THEMSELVES) user installs them without realizing.

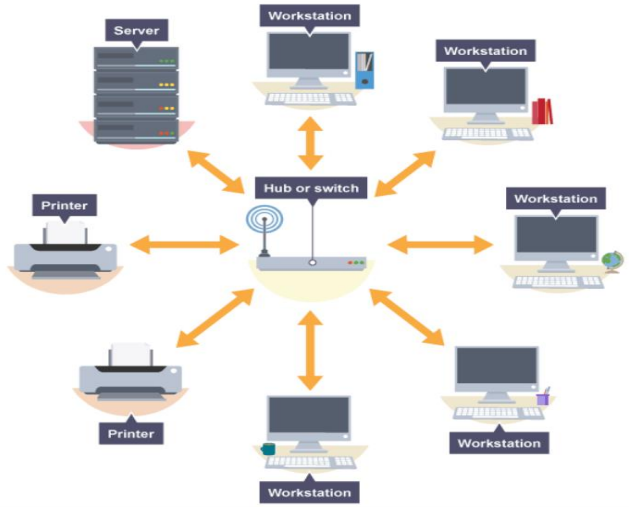
A **computer virus** is malware attached to another program (such as a document), which can replicate and spread after an initial execution on a target system where human interaction is required. Many **viruses** are harmful and can destroy data, slow down system resources, and log keystrokes.

In a **ring topology** network each **node** is connected to two other **devices**. A ring for the signals to travel around is formed. Each packet of data on the **network** travels in one direction and each node receives each packet in turn until the destination node receives it.



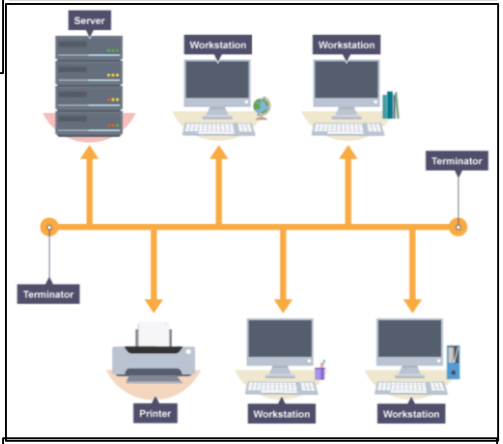
The advantages of a ring **topology** are:
it is easy to install extra network devices adding additional nodes doesn't have an impact on the performance of the network
The disadvantages of a ring topology are: if the main cable fails or gets damaged, the whole network will fail every node on the network receives all of the data sent on the network - this is a security risk it is more expensive than a **bus** network as more cable is needed to join the final and first nod

In a **star topology** all **nodes** indirectly connect to each other through one or more **switches** or **hubs**. A hub broadcasts a message across the whole **network**, whereas a switch sends the message to the intended recipient only. The switch or hub acts as a central point through which all communications are passed. Star topologies are used in many networks, large and small.



Each node is separately connected. Therefore, the failure of one node or its link, also known as **transmission media**, does not affect any other nodes.
New nodes can be added to the network simply by connecting them to the switch.
Star networks tend to have higher performance, since a message is passed on only to its intended recipient.
The disadvantages of a star topology are: the whole network fails if the switch fails, since no node can communicate a wired star topology requires a lot of cable - in a large network this can be expensivee

In a **bus network** all the **nodes** are joined to one cable - the bus. At each end of the cable, a terminator is fitted to stop signals reflecting back down the bus.



The advantages of a bus **topology** are:
it is easy to install extra network devices
it is cheap to install as it doesn't require much cable
The disadvantages of a bus topology are: if the main cable fails or gets damaged, the whole network will fail as more nodes are connected, the performance of the network will become slower because of **data collisions** every node on the network receives all of the **data** sent on the network - this is a security risk

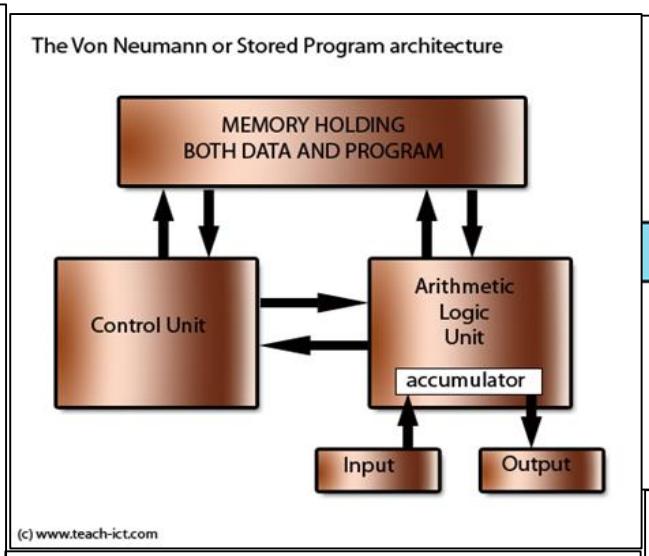
Memory
The computer will have memory that can hold both data and also the program processing that data. In modern computers this memory is RAM.

Control Unit
The control unit will manage the process of moving data and program into and out of memory and also deal with carrying out (executing) program instructions - one at a time. This includes the idea of a 'register' to hold intermediate values. In the illustration above, the 'accumulator' is one such register.
The 'one-at-a-time' phrase means that the Von Neumann architecture is a **sequential processing machine**.

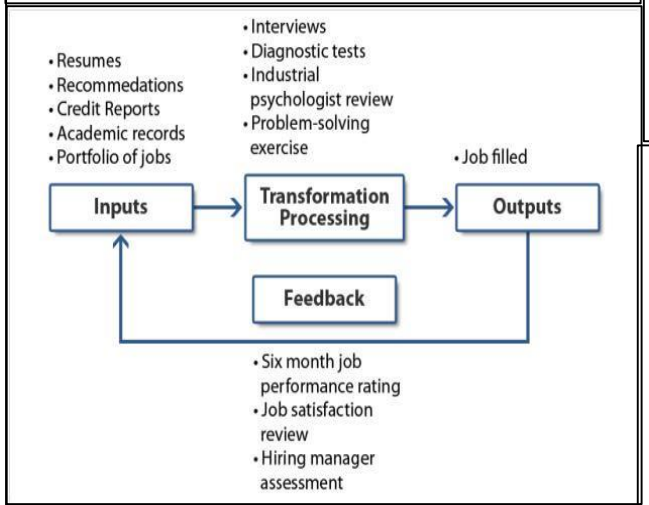
Input - Output
This architecture allows for the idea that a person needs to interact with the machine. Whatever values that are passed to and forth are stored once again in some internal registers.

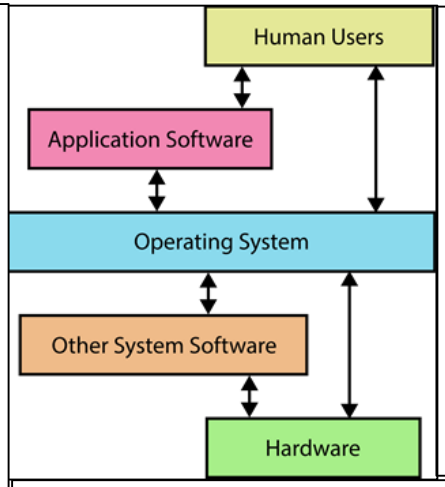
Arithmetic Logic Unit
This part of the architecture is solely involved with carrying out calculations upon the data. All the usual Add, Multiply, Divide and Subtract calculations will be available but also data comparisons such as 'Greater Than', 'Less Than', 'Equal To' will be available.

Bus
Notice the arrows between components? This implies that information should flow between various parts of the computer. In a modern computer built to the Von Neumann architecture, information passes back and forth along a 'bus'. There are buses to identify locations in memory - an 'address bus'



Computer Systems
The Input-Process-Output model
Different systems, pros & cons:
- Input-Process-Output model:





Types of Software
- **Applications**: Software for the End-User
  - Word processor
  - Spreadsheets
  - Image Editor
  - SIMS
  - Ticket booking system
- **Find out about Utilities, what do each of the following do?**
  - Antivirus
  - Firewall
  - System clean up
  - Defragmentation
  - Task Manager

System software
- Software that controls the hardware: What is an OS and a Driver

Secondary storage (list facts about them)
Magnetic hard disk
Optical disk - Flash memory - Cloud Storage
Non-volatile (disappears after shutting down)
Internal/Removable: *Considerations for selecting storage:* Capacity / Speed / Portability / Durability / Reliability

General-purpose systems: Personal computers, including desktops, notebooks, smartphones and tablets,
Embedded systems: **embedded systems** are MP3 players, mobile phones, video game consoles, digital cameras, DVD players, and GPS. Household appliances, such as microwave ovens, washing machines and dishwashers, include **embedded systems** to provide flexibility and efficiency
Expert systems: MYCIN: It was based on backward chaining and could identify various bacteria that could cause acute infections. ...
DENDRAL: **Expert system** used for chemical analysis to predict molecular structure.

Memory: Find out the purpose

Effect on Performance of

Random Access Memory (RAM) (Volatile)

Faster **RAM** can improve communication speed with the processor and decrease load times.

Read Only Memory (ROM)(Non-volatile)

Increasing the amount of **ROM** in a system could reduce the amount of a program that is installed on a slower disk or other external memory device. It could also be used to store lookup tables that might otherwise be created in RAM which can slow down a program's execution.

Virtual memory: The operating system makes part of the storage drive available to use as **RAM**. ... It copies the data back into **RAM** when the process is needed again. Using **virtual memory** slows the **computer** down because copying to a hard disk takes much longer than reading and writing **RAM**.

Flash memory: Flash memory, also known as flash storage, is a type of nonvolatile memory that erases data in units called *blocks* and rewrites data at the byte level. Flash memory is widely used for storage and data transfer in consumer devices, enterprise systems and industrial applications. Flash memory retains data for an extended period of time, regardless of whether a flash-equipped device is powered on or off.

Read/Write operations: **Write** caching lets your **computer** store data in a cache before it is written to the hard drive. Because a **computer** can **write** data to a cache much more quickly than to a hard drive, the overall **read/write performance** of the hard drive is improved. Remember, however, that data in a cache is only temporary.

Features affecting performance:: Clock speed (MHz, GHz)

A PC **clock speed** is normally in the gigahertz region. That is a billion cycles per second. Typical **speeds** are two to four gigahertz. The faster the **clock speed**, the faster the instructions can be processed by the **processor**.

Cache Memory

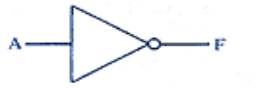
Cache plays the greatest part in improving the **performance** of the processors. The larger the **cache** size, the faster the data transfer and the better the CPU **performance**.

Multiple cores

This means that a **processor** can be up to **two** or four times faster than a normal **processor** . However the actual speed of the **processor** is dependent on the software that's being run. Not **all** software will take advantage of the quad and dual **cores**.

Binary logic

- Why binary? (transistors) Computers use **binary** - the digits 0 and 1 - to store data. ... The circuits in a computer's processor are made up of billions of **transistors** . A **transistor** is a tiny switch that is activated by the electronic signals it receives. The digits 1 and 0 used in **binary** reflect the on and off states of a **transistor**.

Name	Graphic Symbol	Algebraic Function	Truth Table
AND		F = A · B or F = AB	A B | F 0 0 | 0 0 1 | 0 1 0 | 0 1 1 | 1
OR		F = A + B	A B | F 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 1
NOT		$F = \overline{A}$ or F = A′	A | F 0 | 1 1 | 0

Central processing unit (CPU) – what are the following?

Arithmetic & logic unit: An arithmetic-logic unit (ALU) is the part of a computer processor (CPU) that carries out arithmetic and logic operations on the operands in computer instruction words. In some processors, the ALU is divided into two units, an arithmetic unit (AU) and a logic unit (LU).

Control Unit (CU): A control unit (CU) handles all processor control signals. It directs all input and output flow, fetches code for instructions from micro-programs and directs other units and models by providing control and timing signals. A CU component is considered the processor brain because it issues orders to just about everything and ensures correct instruction execution.

Registers (Memory Unit): A register may hold an instruction, a storage address, or any kind of data (such as a bit sequence or individual characters). Some instructions specify registers as part of the instruction. For example, an instruction may specify that the contents of two defined registers be added together and then placed in a specified register.

Fetch-Decode-Execute: The fetch execute cycle is the basic operation (instruction) cycle of a computer (also known as the fetch decode execute cycle).

During the fetch execute cycle, the computer retrieves a program instruction from its memory. It then establishes and carries out the actions that are required for that instruction. The cycle of fetching, decoding, and executing an instruction is continually repeated by the CPU whilst the computer is turned on.

Buses and their Purposes: The **CPU** sits on the motherboard (also called the logic board). **Buses** are circuits on the motherboard that connect the **CPU** to other components. There are many **buses** on the motherboard. A **bus** moves instructions and data around the system.

The Boot Sequence: **Boot sequence** is the **order** in which a computer searches for nonvolatile data storage devices containing program code to load the operating system (OS).

Main Characters – Consider what Russell intended through his characterisation of each of the below...	
Mickey – Mickey is the biological twin of Edward who Mrs Johnstone opts to keep. Mickey has a harsh working-class upbringing, but at his heart he is honest and sincere. He takes a number of knocks in life (that Edward is fortunate enough to avoid) for example impregnating his girlfriend (Linda) and getting laid off from his industrial job. He hardens as the play goes on, becoming cynical after time in prison, and becomes addicted to anti-depressants.	**Edward** – Edward is the biological twin of Mickey, who Mrs Johnstone gives to Mrs Lyons to raise as her own. Like Mickey, Edward is honest and sincere, remaining kind and down-to-earth despite his luxury upbringing with the snobbish Mrs Lyons. Unlike Mickey, however, Edward benefits from every advantage in life, such as attending private schools and university. He uses his position as a councilman to help Mickey, but also begins an affair with Linda.
Mickey Quote: "Do you wanna be my blood brother, Eddie?"	**Edward Quote:** "It's just a secret, everybody has secrets, don't you have secrets?"
The Narrator – All-knowing and slightly menacing, the Narrator takes on a number of roles throughout the play. Sometimes he plays parts (e.g. the Milkman) whilst at other times he stands back and comments upon the action as it unfolds. The Narrator reminds the audience of the terrible act that causes the tragedy to unfold, and warns the audience of the tragic events that are to come.	**Linda –** Linda begins the play as a tomboy who enjoys playing with Mickey and Edward, but she soon becomes an object for their desire. At the beginning of her adolescence, she seems solely attracted to Mickey, telling him that she loves him even before their first kiss. However, after years of poverty (and Mickey's imprisonment) she turns to Edward for comfort and the two begin an affair.
Narrator Quote: "So did y'hear the story of the Johnstone twins?"	**Linda Quote:** "You can get up off the ground again"
Mrs Johnstone – Mrs Johnstone is the biological mother of Mickey and Edward, as well as a number of other children. She is a deeply superstitious woman who has to struggle to get by, however she also has a good heart and a strong sense of right and wrong. She gives up one of her twins as she genuinely believes that she has no choice after being left by her husband. As the play progresses, she is overcome by regret, however she always remains kind and loving.	**Mrs Lyons** – Mrs Lyons is the opposite of Mrs Johnstone – arrogant, snobbish, and infertile. She adopts Edward and brings him up as a wealthy, middle-class boy. Like Mrs Johnstone, Mrs Lyons is racked with guilt from the deed of separating the twins, but this influences her to create a superstition to keep Mrs Johnstone away. She eventually becomes so unhinged and paranoid that she will lose her son that she attempts to kill Mrs Johnstone.
Mrs Johnstone Quote: "In the name of Jesus, the thing was done,"	**Mrs Lyons Quote:** "Oh...you mean you're superstitious?"

Russell's Dramatic Devices		**The Features of Tragedy**
Dramatic Irony	The audience is aware throughout the play that Mickey and Edward are twins, but they do not know this until the very last scene.	**Tragic Hero -** A main character cursed by fate and in possession of a tragic flaw (both Mickey and Edward display some features of tragic heroes). 
'The Fourth Wall'	The Narrator and Mrs Johnstone break the fourth wall when they speak to the audience directly at the beginning and end of the play.	**Hamartia** - The fatal character flaw of the tragic hero (their upbringings/differences, and also their bond between one another).
Stage Directions	The precise directions detailing how Mickey, '*uncontrollable with rage*', '*waves*' the gun around before it explodes at Edward.	**Catharsis** - The release of the audience's emotions through empathy with the characters. 
Dramatic Tension	The events leading up to the final scene, including Edward and Linda's affair, and Mickey finding out, help to build the dramatic tension.	**Internal Conflict** - The struggle characters engage with over incidents/flaws. (Mrs Johnstone's regret at giving one of her twins away).

Context – *Blood Brothers* was written by Willy Russell, and was first staged in 1983.

Willy Russell– William Russell (born 23rd August 1947) is an English dramatist, lyricist and composer. Amongst his most popular works are *Educating Rita, Shirley Valentine* and *Blood Brothers*. Russell is from Liverpool, and wrote his first play, *Keep Your Eyes Down*, in 1971 whilst he attended the city's St Katherine's College of Higher Education. Two of his plays, *Shirley Valentine* and *Educating Rita*, have become successful feature films.

Margaret Thatcher – Margaret Thatcher was a Conservative politician who was elected as Prime Minister of the United Kingdom in 1979, four years before *Blood Brothers* was first performed. Seeing British manufacturing as uncompetitive, she blamed trade unions as being too strong in calling strikes on weakened employers. So, she reduced unions' powers and sold off and closed uncompetitive companies.

Influences through Russell's Life –Much of Willy Russell's work is influenced by his own working class background. Russell was a child from a low-income family, with a father who struggled with drug addiction. His father worked in a factory and his mother worked as a nurse. Russell left school at age 15, without any academic qualifications, and became a hairdresser. He did not return to education until age 20. Russell has a love of popular music (one of his earlier plays is about The Beatles) which is evident in most of his plays.

Effect in the UK/ Liverpool – A short-term effect of companies being closed and sold off was that there was an economic downturn across the UK and unemployment soared. This particularly effected the more industrialised northern areas of the country, with Liverpool being a prime example. Liverpool's docks, a chief source of employment in the city, were allowed to fold, causing thousands of households to fall into poverty and unemployment. Crime levels increased, drug use sky-rocketed, and housing deteriorated in poorer areas.

Marilyn Monroe – Marilyn Monroe was an extremely famous Hollywood actress, whose fame transcended the boundaries of her Hollywood films. She was presented in the media as a 'fantasy' woman who lived a perfect life. Yet, the reality was very different – she became addicted to anti-depressants and eventually died from an overdose. From the 1950s onwards, Monroe was just one part star from a society in which everyday people became more influenced by pop/celebrity culture.

Thatcher's Values vs. Russell's Values – One of the pivotal beliefs in Thatcher's system was that success and wealth came to those who chose to work hard. In Blood Brothers, Russell demonstrates opposition towards that view, suggesting that opportunities are more limited for those that are raised in working class backgrounds, when compared to those from the middle classes. This is divided society is demonstrated through showing the effect of different upbringings on a set of twins.

Themes – A theme is an idea or message that runs throughout a text.

Class and Money – The themes of class and money are dominant as they both control the actions of characters and significantly impact upon their lives. For example, the catalytic deed – Mrs Johnstone giving one of the twins away – comes about because she simply cannot afford to keep them both. Class then heavily influences the paths that Mickey and Edward then follow.

Fate and Superstition – The voice of fate is provided over and over again throughout the play by the Narrator, who reveals even at the outset that the two will die. Mrs Lyons plays on Mrs Johnstone's belief in superstition in order to keep her away from Edward. However ridiculous and made-up it sounds, it eventually comes to pass, almost as if the false threat is in itself a sin.

Nature vs Nurture – As Mickey and Edward are twins, they are genetically (nature) as similar as can be. Therefore, Russell is suggesting that it is in fact nurture (their upbringing) that causes their contrasting behaviours, actions, and mannerisms. It is clear that Russell feels that unjust society is the heaviest influence in where people end up.

Coming of Age – Although much of the play focuses on dark and complex ideas, one of the lighter themes within the play is the theme of the boys 'coming of age.' Although the play ends tragically, much of it deals with the boys growing up, evolving from young boys, to teenagers, to men. As they mature, their experiences and preoccupations notably shift.

Vocal Skills

Volume- how loud the lines are being spoken.
Crescendo – Increasing volume
Pitch- highness or lowness of the voice.
Pace/Tempo- how fast or slow the lines are being spoken.
Rhythm – Fluctuation in pace
Phrasing – grouping words together to create interesting speech
Accent- A way of speaking that denotes where the character is from and/or their status
Tone- portraying different emotions through the voice.
Pause: Breaks in speech
Inflection: Emphasis on a word
Articulation: Emphasis on letters.
Silence: The absence of sound
Echo: Repeated layers of words

Lighting Design

Flood lights- large lights used to wash a large section of the stage with light.
Spotlight- projects a beam of light onto a section of the stage.
Lanterns- wide, soft edged beam of light, used for back light and top light.
Coloured gel- transparent coloured material placed over a light to change the colour
Gobo- template/stencil placed in front of a light to create a pattern or image on the light.
House lights (audience)- illuminate the audience section of the theatre.
Naturalistic – The lighting is realistic and believable as if produced from a natural resource.
Stylised – the lighting is not designed to give the impression of real life, but be more symbolic. Spotlights with hard edges and non-natural colours are usually used.

Set Design

Naturalistic- the set is realistic and believable.
Stylised- the set is not realistic or believable, but may be symbolic or represent an idea.
Minimalistic- the set is very basic, with little furniture and a basic background.
Hydraulics- the stage (or part of it) moves, rises, falls or tilts throughout a performance.
Flying gallery- rigging system where ropes are used to raise or lower scenery, lights, etc.
Pyrotechnics-, flashes, smoke, flames, fireworks etc. Used to create special effects.
Props- a portable/movable object on stage, used by actors.
Cyclorama- a large piece of fabric that lights or images can be projected on.
Levels- different heights of staging used to create an effect or perhaps, indicate status.
Truck – A platform on wheels upon which scenery can be mounted and moved
Fly – Raising and lowering scenery or other items onto the stage using ropes.
Set Dressing – Items on the set that are not actually used as props, but they create detail e.g. a vase or wall painting
Composite Set – A single set that represents several locations at once.

Physical Skills

Movement- moving around the stage.
Gestures- a movement, e.g. of the hand or head, to express an idea or meaning.
Posture- the position that someone holds their body when standing up or sitting down.
Facial expression- an actor using their face to reinforce their feelings, emotions and reactions.
Levels- different heights used to create visual interest or perhaps show status of characters.
Proxemics- how close or far apart actors are positioned on stage.
Characteristics- features or qualities belonging to a person, place or thing to identify them.
Gait- the way in which a performer walks on the stage.
Stance- the way in which someone stands
Ensemble- a group of people who perform together.

Costume, hair and makeup design

Prosthetics- makeup that uses moulds and wax to create special effects, e.g. scars or cuts.
Silhouette- the outline or shape of a figure created by a costume, e.g. baggy or fitted.
Hairstyle- the way the hair is styled to reinforce time period, character's personality or status.
Style- costume should reinforce time period, setting, or a character's personality or status.
Accessories- additional elements of costume, e.g. jewellery, handbags, hats etc.
Footwear- the shoes should reinforce time period, or a character's personality or status.
Makeup- products applied to the face to show a character's age, status, personality etc.
Colours- suggest meaning
Fabrics- the fabrics used for the costume could reflect the character's status or background etc.

Sound Design-

Timing- a particular point that a sound is produced in a performance.
Atmosphere- the sound is creating a certain mood for the audience at a certain point.
Volume- how loud or quiet the sound is.
Emotive- the sound reflects the emotions felt by a character/characters at a certain point.
Band- the sound is live and being played by a group of people playing different instruments.
Singing- performing songs and making musical sounds with the voice.
Soundscape- a combination of different sounds.
Music- sounds combined to produce harmony, expression and/or emotion.
Sound effects- a sound that isn't speech or music, created artificially in a play. (SFX)
Mark the Moment – Various ways including Sound Effects(SFX) or silence
Crescendo – Gradually getting louder
Pitch – Bass or Treble
Pace – Fast (staccato) Slow (Elongated notes)
Silence – The removal of all sound
Contrast – Opposing sounds used
Entrance – How the sound is first played e.g. Dynamic and loud or soft slow fade in
Foley Sound – Replace original sound (e.g. baby's crying or gun shot.
Sound Bridge – The sound from one scene carries over into the next scene

KEYWORDS
1- Programmed drum track: Information inputted to a DAW.
2- Synth Patch: A saved user or pre-set setting on a musical device - a patch that sets the functions of a synthesiser.
3- Sampler: A device for recording and/or playing back audio.
4- Internal Routing: Activities required or undertaken to conserve the original condition of an item.
5- sends: An auxiliary output from a physical or software mixer.
5- inserts: A direct break in a channel strip to insert a device or processor.
5- automation: The recording or programming data for the use in playback.
5- plug-in: A software processor that can affect the audio
5- mixer: A physical or software device for the combining of signals

Planning your EXAM project (1000 words)
Personal Aims You will need to think about your contribution to the recording. Your statement should describe your personal aims in relation to the recording. You may want to think about the following questions: What do I want to achieve with my contribution? What skills do I have that I can use? How will I know if I have achieved it?
Project Timeline You must produce a project timeline that will map out the DAW project you are undertaking. This can be presented as a flow chart, Gantt chart, or any other way that adequately displays the time taken on different aspects of the brief. The content of this chart should be led by the assessment criteria.
Audience Expectation You must address the briefs scenario. What do you think the audience will be looking for? How will you meet or exceed their expectations?
Resources You will need to consider the resources that will be used during this project. List and describe the resources that you will need to complete your work.

EXAM – Creating your Project (1200 words)
3-5 Minute composition with at least 8 TRACKS
A programmed DRUM TRACK Simple/effective & creative/more complex drum patterns
Create & Saved SYNTH PATCH Some creativity/creative/very creative in synth & sample patches
Create & save patch within a SAMPLER – min. 3 audio files
Internal Routing: two alternative signal paths Some basic/good/greater insight into architecture (incl. internal routing), using some/range/more complex operations
Use Sequencer to edit note data & velocity Simple quantisation/correct usage using basic/beyond basic snap parameters Some/clear/efficient use editing
AUTOMATION: mixer, plug-in, instrument Simple/creative & developed automation
Save all work in one folder & create mp3 mixdown
Evaluation (800 words)
Review the project in light of feedback: - Look back at your aims and review the success of your project as a whole - Make use of feedback from tutors and peers.
SCREENSHOTS: Annotated screenshots of the project… …that are basic but outline the essentials …that are relevant and clear …that are detailed, relevant and clear.
Highlight Strengths & areas of development: - How successful was your DAW project in regard to the brief? - What areas of the project were you happy with and why? - What areas of the project could be improved in the future, why? How?

KEYWORDS

1- Compose: an original musical creation.
2- Style: The style or genre of music (Blues, Hip-Hop, Rock are 3 different musical styles).
3- Rhythm Track: a regular repeated pattern, often heard on drums.
4- Bassline: the lowest frequency notes in the composition.
5- Harmonic Progression: the chord changes that move to form the harmonic characteristic of the composition.
6- Melody: short riffs and musical ideas combined to create a tune
7- Lyrics: written words that are sung, spoken or otherwise performed with the composition.
8- Chord: 2 or more notes played simultaneously.
9- Conjunct: moving by step.
10- Phrase: a musical sentence, usually in 2, 4 or 8 bars.
11- Structure: how a piece is organized (Verse-chorus, ABA, strophic are 3 different types of song structure).

KEY QUESTIONS
What musical style are you composing?
What are the key music features of your chosen style?
What makes a successful composition in this style?

When composing a piece, all the parts should match and fit together harmoniously.

In order to do this, all the parts should relate to set of chords arranged together in a strong progression.

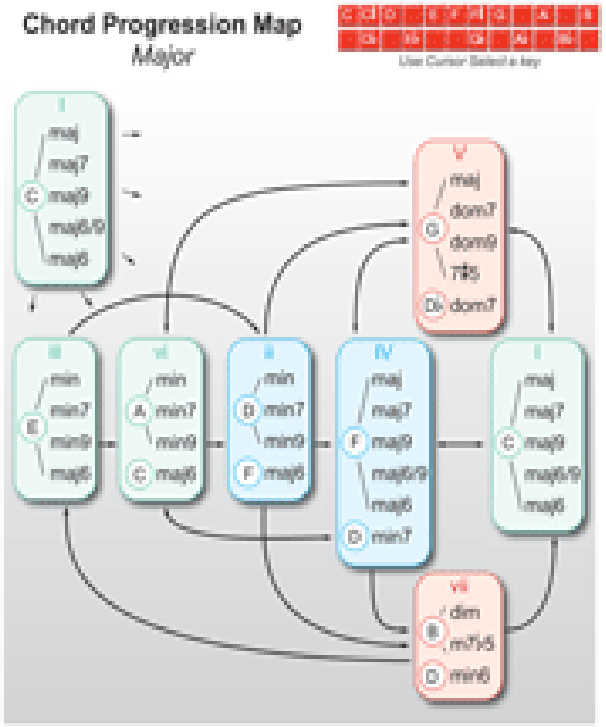
Different songs use different amounts of chords and chord progressions:

- Two-chord songs
- Three chords across 2-bars
- 4-bar patterns
- 8-bar patterns

The strongest chord progressions focus around the **tonic** (I), **subdominant** (IV) and **dominant** (V) chords.
You should avoid using the median (iii) and leading note (vii).

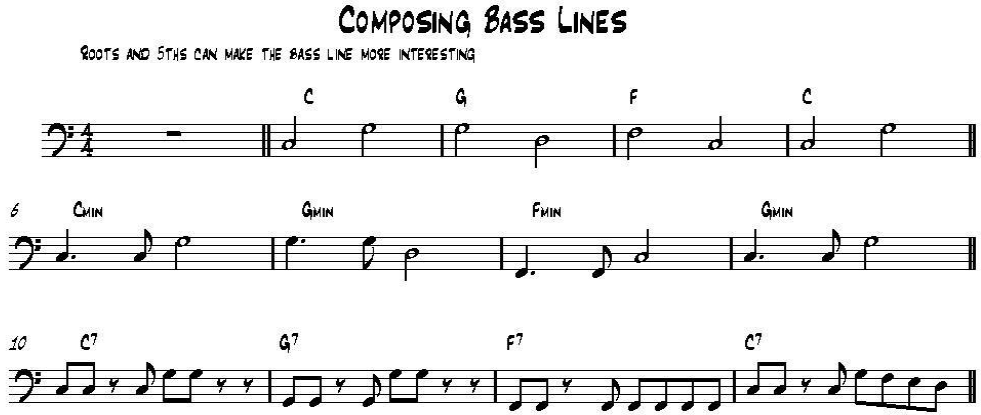
Listen to as many songs in your style and try to answer the analysis questions.

The more you listen to and identify the different features of all the parts, the better your composition will be!



CHECKLIST (3+)

1. Rhythm Track – drums or percussion?
2. Bassline – repetitive or melodic riff?
3. Harmonic Progression – how many chords? Will they change for different sections? Use the progression map for good progressions.
4. Melody – short motifs/riffs in phrases – structure.
5. Lyrics – sung or bars?



Scientific method for NEA 1

Analyse
Break down a task or question explaining the keywords and what is required

Hypothesis
An idea, prediction or explanation that you then test through experimentation

Research
Gathering data or information about the ingredient(s) that you are investigating.

Hypothesis
An idea, prediction or explanation that you then test through experimentation

Investigation
practical work that is undertaken by experimentation to prove or support the hypothesis.

Analysis
Explanation of the results linked to the data. Link back to research

Annotate
Add information to a photograph or chart

Fair test
An experiment that tests exactly the same thing during the investigation changing ONE part of the experiment..

Control
The part of the experiment that stays the same. This ensures that a 'Fair Test is carried out.

Independent variable
The part of the experiment that is changed

Dependent variable
The outcome of the experiment that can be measured

Sensory testing and tasting
Measuring the outcomes of experiment using the senses to describe outcomes.

Aeration
Incorporating air into a mixture.

Agitate
To stir, shake or disturb a liquid.

Al dente
'Firm to the bite', a description of the texture of correctly cooked pasta.

Ambient
Foods that can be stored, at room temperature (ordinary room temperature 19°C to 21°C), in a sealed container. All foods found on supermarket shelves are ambient foods.

Amino acids
The building blocks of proteins.

Antioxidant
A molecule that is able to stop the oxidisation process in other molecules and therefore can be useful in stopping foods from deteriorating. Antioxidants can prevent or slow down damage to the body which otherwise can lead to diseases such as heart disease. Antioxidants also improve our immune system.

Antioxidant vitamins
Vitamins A, D and E, found in fruits and vegetables.

Bacteria
Pathogenic microscopic living organisms, usually single-celled, that can be found everywhere. They can be dangerous, such as when they cause infection, or beneficial, as in the process of fermentation (for wine).

Baking
Convection-conduction, cooking foods in a hot oven.

Basted
When fats or juices are poured over something (usually meat) while cooking in order to keep it moist, eg roasting meats.

Batter
A mixture of flour, milk or water, and usually an egg.

Bind
To bring the ingredients in a mixture together using an ingredient, eg egg.

Biological catalysts
Substance which speeds up a chemical reaction.

Biological raising agent
Using yeast to produce CO2 gas.

Biological value
The number of amino acids that a protein food contains.

Blanching
A method of cooking where food is cooked very quickly in boiling water for a short period of time. It stops enzyme actions which can cause loss of flavour, colour and texture. Conduction-convection.

Blanching
A method of cooking where food is cooked very quickly in boiling water for a short period of time. It stops enzyme actions which can cause loss of flavour, colour and texture. Conduction-convection.

Braising
Conduction-convection, sealing meat/vegetables in hot fat, then cooking slowly in a covered dish with some cooking liquid.

Bridge hold
Use thumb and forefinger and grip either side of the ingredient, use knife under the bridge to cut.

Calcium
Main mineral in the body, teeth and bones. It needs vitamin D to help absorption.

Caramelisation
Breaking up of sucrose molecules (sugar) when they are heated. This changes the colour, flavour and texture of the sugar as it turns brown into caramel.

Carbohydrates
Macronutrients required by all animals; made in plants by the process of photosynthesis.

Chemical raising agent
Uses baking powder or bicarbonate of soda to produce CO^2 gas

Choux pastry
A light, crisp, hollow pastry used to make profiteroles, éclairs and gougères.

Claw grip
Tips of fingers and thumb tucked under to hold the ingredient before chopping.

Coagulation
The setting or joining together of lots of denatured protein molecules during heating or change in PH. An irreversible change to the appearance and texture of protein foods.

Coat
To add another ingredient to create an attractive finish, or to create a protective layer on food when cooking.

Conduction
Transfer of heat through a solid object into food.

Consistency
Thickness or viscosity.

Convection
Transfer of heat through a liquid or air circulation into food.

Cook's knife
A large general purpose knife with a deep blade, used for cutting, chopping, slicing and dicing.

Danger zone
Range of temperatures between 5°C to 63°C at which bacteria begin to multiply rapidly s.

Deglazing
To loosen the browned juices on the bottom of the pan by adding a liquid to the hot pan and stirring while the liquid is boiling.

Denaturation
Chemical bonds in the protein food have broken, causing the protein molecule to unfold and change shape.

.**De-seed**
To remove seeds before using.

De-skin
To remove the skin by either putting the fruit or vegetable into boiling water or, for peppers, placing on direct heat.

Dextrinisation
Breaking up of the starch molecules into smaller groups of glucose molecules when exposed to dry heat, eg toast.

Dietary fibre
Complex carbohydrate/non-starch polysaccharide, eg whole grain cereals and cereal products.

Disaccharide
A carbohydrate made from two sugar molecules.

Discrimination tests
Test used to find out whether or not people can tell the difference between similar samples of food.

Dry-frying
Heating food on a low heat without any fat or oil. Conduction.

Efficacy
Power or capacity to produce a desired effect; effectiveness.

Enzymic action
Causes fruit to ripen, change colour, texture, flavour and aroma; maturing of fruits and vegetables.

Enzymic browning
The discolouration of a fruit or vegetable due to the reaction/chemical process where oxygen and enzymes in the plant cells of the food to react and cause the surface to become brown. This process cannot be reversed.

Emulsification
Refers to the tiny drops of one liquid spread evenly through a second liquid. An emulsifier (such as egg yolk) is used to stabilise an insoluble mixture.

Enzymes
Biological/natural substances (catalysts) which speed up biochemical reactions without being used up themselves.

Fats
Macronutrient which supplies the body with energy.

Fat soluble vitamins
Vitamins (the A, D E, and K groups) that dissolve in fat.

Filleting knife
A thin, flexible, narrow blade knife used to fillet fish.

Fluoride
Strengthens the bones and teeth, helps prevent tooth decay.

Foam formation
Foams are formed when gases (mainly air) are trapped inside a liquid, for example meringue, whisked sponge.

Free range
A method of farming husbandry where the animals, for at least part of the day, can roam freely outdoors.

.

Free sugars
All monosaccharides and disaccharides added to foods by the manufacturer, cook, or consumer, plus sugars naturally present in honey, syrups, and fruit juices.

Fruit sugars
Carbohydrate, which is the natural sugar in fruit –mostly in the form of fructose, or glucose.

Gelatinisation
When starch granules swell when cooked with liquid, then burst open and release the starch, causing the liquid to thicken.

Gliadin and glutenin
The core proteins of the gluten part of wheat seeds.

Gluten formation
Formed from the two wheat proteins gliadin and glutenin, in presence of water. Gluten is developed by kneading.

Gluten free
Food which does not contain gluten (crucial for those with Coeliac disease).

Grading tests
Put in order particular characteristics of a food product.

Grilling
Radiation cooking foods under intense heat.

Hedonic rating test
People give their opinion of one or more food products by filling out a table that uses a preference scale.

High Biological Value (HBV)
Protein foods that contain all the essential amino acids.

Iron
Needed to make haemoglobin in the red blood cells, requires Vitamin C for absorption.

Julienne
Cutting vegetables into matchstick strips.

Knead
To manipulate dough by pushing it across a work surface and pulling it back. This is essential to develop the gluten.

Knock back
To knead out the carbon dioxide in risen dough to remove large air pockets to ensure an even texture.

Lactose
A natural sugar found in milk and dairy products.

Lactose intolerant
A condition which means you cannot digest disaccharide sugar lactose.
Layer
To make up a dish with differing ingredients one on top of another.
Marinade
To soak foods such as fish, meat, poultry and vegetables in a liquid to help develop the flavour, tenderise and in some instances colour the food before it is cooked. The liquid can be acidic or a salty solution. Protein is denatured by marinating.
Mash
To reduce to a soft mass by using a masher.
Mechanical raising agent
Whisking, beating, sieving, creaming, rubbing in or folding to trap air into the mixture.
Micro filtered
All bacteria in milk are removed, by forcing it through filtration membranes, then pasteurised and homogenised.
Micronutrients
Nutrients required in small quantities to facilitate a range of physiological functions.
Microorganisms
Tiny forms of life, usually single cell microscopic organisms such as bacteria, moulds and fungi.
Milk sugars (lactose)
A single molecule of glucose linked to a single molecule of galactose to form a carbohydrate, known as lactose.
Milling
Breaking cereal grains (seeds) down and separating the layers, turning grain into flour.
Minerals
Chemical substances found in a wide variety of foods.
Mix
To combine two or more ingredients together to become one.
Monosaccharide
A simple carbohydrate. Mono means one, saccharide means sugar.
Monounsaturated fats
Fats that contain one double bond in the molecule.
Nutrients
The properties found in food and drinks that give nourishment – vital for growth and the maintenance of life. The main nutrients needed by the human body are carbohydrates, proteins, fats, vitamins and minerals.

. **Nutritional analysis**
Nutritional information for different foods, creating a nutritional profile of the specific nutrients in the food.
Oil in water emulsion
Keeping drops of oil or fat suspended in a liquid to prevent them from joining together, for example butter.
Olfactory systems
The receptors found in the back of the nose that are responsible for our sense of smell/aromas.
Oxidation
Substances pick up oxygen from the air; they then oxidise to undergo a chemical reaction, resulting in food losing freshness and colour.
Palatability
Reward provided by foods or fluids that are agreeable with regard to the satisfaction of nutritional, water, or energy needs.
Paired preference
People given two similar samples of food and they have to say which one they prefer.
Paring knife/vegetable knife
A small multi-purpose knife mainly used for slicing and dicing.
Pasteurisation
The process of heating a food to a specific temperature for a specific period of time in order to kill microorganisms that could cause disease, spoilage or undesired fermentation.
Phosphorous
Helps calcium to mineralise the teeth and bones.
Poaching
A method of cooking where food is cooked in a liquid that is just below boiling point. Conduction-convection.
Polysaccharide
A complex carbohydrate: many sugar molecules joined together, they do not taste sweet.
Polyunsaturated fats
Fats that contain several double or even triple bonds in the molecule.
Plasticity
The ability of fat to soften over a range of temperatures to hold its shape, or be shaped and spread.
Preservatives
Used to prevent food from spoilage by microorganisms; increases the shelf life of commodities.
Profiling
People asked to rate the intensity of a food product from 1–5 against a set of sensory descriptors.
Protein
A macronutrient that is essential to building muscle mass.
Protein alternatives
Manufactured protein food products consumed in place of meat or fish.
Proving
The last rising of the bread dough in its final shape before it is baked.
Radiation
A heating process that does not require physical contact between the heat source and the food being cooked. Instead, energy is transferred by waves of heat or light striking the food. Two kinds of radiation heat are used in the kitchen: infra-red and microwave.

Ranking
People asked to rank order samples of food according to a criteria.
Rating
People asked to rate a food sample for a specific characteristic.
Raising agents
An ingredient or process that introduces a gas into a mixture so that it rises when cooked.
Reduction
The process of simmering a liquid over heat until it thickens. It is also the name of the concentrated liquid that forms during this process.
Roasting
Convection-conduction, cooking foods in oil or fat in a hot oven.
Saturated fats
This type of fat is mostly from animal sources; they are normally solid fats. All of the carbon atoms in the fatty acid molecules are linked by single bonds.
Scientific principles
Demonstrates how science of the ingredients are at work in producing, processing, preparing, preserving, and metabolising foods.
Segment
To peel and pull apart, for example an orange.
Sensory properties
Smell, appearance and texture, mouth feel influence what we select to eat.
Sensory testing methods
A way of measuring the sensory qualities of food and is used by chefs, food manufacturers and retailers to analyse a food product.
Shallow frying
A quick method of cooking where a small amount of fat is used to cook food in a frying pan.
Shortening
The ability for fat to shorten the length of the gluten molecules in pastry or shortbread, for example butter, lard or other fat that remains solid at room.
Shred
To slice into long, thin strips.
Simmering
Water that is heated to just below boiling point.
Skewer
A long metal or wooden pin used to secure food on during cooking; to skewer is to hold together pieces of food using a metal or a wooden pin.
Sodium (salt)
Controls the amount of water in the body.
Snip
To cut (usually with a pair of scissors) with a small, quick stroke.
Stabilisers
Help stop substances separating again after they have been mixed stabilise an emulsion.

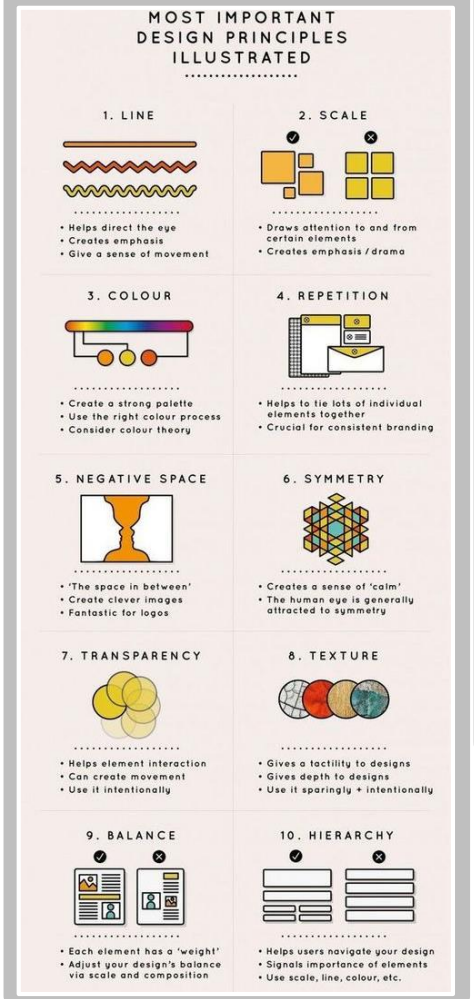
Starch
A polysaccharide, a complex carbohydrate.
Steaming
A method of cooking where food is cooked in the steam coming from boiling water. Conduction-convection.
Sterilised
Heated in sealed bottles to 110°C for 30 seconds
Stir-frying
A quick method of cooking where small pieces of food are fast-fried in a small amount of oil in a wok.
Taste receptors
Special cells on the tongue that pick up flavours.
Tasting panel
A process of testing foods. The process must be fair and realistic controlled conditions.
Temperature control
Range of temperature for the storage of food correctly.
Temperature probes
Give an accurate reading of the core temperature (centre) of the food. Food probes must be used correctly.
Triangle test
People given three samples of a food product to try. Two samples are identical, the third something is different; they need to discriminate between the samples.
Ultra Heat Treatment (UHT)
Heated very quickly in a heat exchanger to 72°C for 15 seconds cooked rapidly to below 10°c (normally 4°C).
Unsaturated fats
Fats that contain a high ratio of fatty acid molecules with at least one double bond. Unsaturated fats are normally liquid oil.
Vegan
People who do not eat flesh or any animal products. They can eat plant protein soya, TVP, tofu.
Vegetarian
A lacto-vegetarian diet includes dairy products and plants, and a lacto-ovo vegetarian diet includes eggs, dairy products and nuts.
Vitamin B2 (Riboflavin)
Enables energy to be released from carbohydrate, fat and protein in the body found in many foods, such as milk, eggs, rice. Deficiency is rare.
Vitamin B3 (Niacin)
Enables release of Vitamin C (ascorbic acid) needed for absorption of iron, to maintain body cells. Found in citrus fruits, green vegetables.
Vitamin B12
Works with folic acid, found in meat, fish fortified cereals.
Water based
Using liquid to transfer heat via convection.
Water in oil emulsion
Where liquid is suspended in oil or fat and prevents them from separating out, for example mayonnaise.
Water soluble vitamins
Soluble vitamins (the B group and vitamin C) in water of energy in the body. Found in wheat flour, eggs, milk some meats. Deficiency is called pellagra.
Yeasts
A microscopic fungus consisting of single oval cells that reproduce by budding, and capable of converting sugar into alcohol and CO_2 gas. Also ferments in the correct conditions to make bread rise.

A. Key Terms

Keyword	Description
1. Abstract	Abstract art is art that does not represent an accurate depiction of reality but instead uses shapes, forms and gestural marks to effect.
2. Distorted	A shape that has been changed looks proportioned or realistic.
4. Impasto	Impasto refers to an area of thick texture, in a painting.
5. Depth	The illusion of space within an
6. Geometric	Refers to the shapes such as circles, triangles, squares, etc.

Command Words
Demonstrate, Evidence, Organise, Research.

B. Key concepts



C. Key Artists

Anselm Kiefer – Lilith 1987
A large grey toned oil painting on canvas looking down over a city. The paint is extremely rough and thick in areas. Lilith was inspired by photographs taken in a helicopter above Sao Paulo and its favelas. German born artist.

Frank Bowling – Sacha Jason Guyana Dreams 1989
A large scale painting richly textured through the use of a spatula and acrylic gels. Aiming to depict a mood and emotion through the movement and colour choices. Bowling focuses on light and luminosity inspired by classic artists such as J.M.W. Turner and John Constable. Guyana born artist.

Nigel Henderson - Untitled No 8 (Shattered Glass) 1959
A large scale collage made from lots of different photos of urban textures and surfaces. Henderson has added black ink on top to create a splintered effect. His work in the 1950's had a strong Brutalist aesthetic.
Nigel Henderson was an English documentary artist, and photographer.

D. Key Techniques

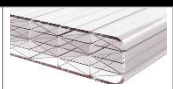
Materials – Ferrous metals - containing IRON

			
Cast iron	High carbon steel	Low carbon steel	Stainless steel
Good compressive strength, good for casting.	Strong and hard but difficult to form.	Tough and low cost.	Strong and hard, good corrosion resistance.

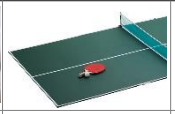
Materials – NON Ferrous metals / alloys – containing NO iron

					
Aluminium	Copper (pure metal)	Brass (alloy of 65% copper 35% zinc)	Bronze (alloy of 90% copper 10% tin)	Lead (pure metal)	Zinc (pure metal)
Light, strong, ductile, good conductor, corrosion resistant.	Malleable, ductile, tough, good conductor, easily joined, corrosion resistant.	corrosion resistant, good conductor, easily joined, casts well.	Tough and hardwearing, corrosion resistant.	Very soft and malleable, heaviest common metal, corrosion resistant.	Low melting point, extremely corrosion resistant, easily worked.

Materials – Polymers – Thermoplastics – shaped when hot – can be reheated

			
ABS	Acrylic	Polycarbonate	Polystyrene
Strong and ridged, hard and tough, expensive.	Good optical properties, transparent, good colour, hard wearing, shatter proof.	High strength and toughness, heat resistant, good colour stability.	Good toughness and impact strength, good for vacuum forming and injection moulding.

Materials – Polymers – Thermosetting plastic – can be moulded – non recycleable

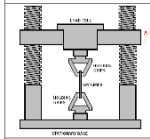
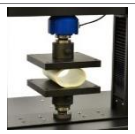
			
Polyester resin	Melamine resin	Polyurethane	Vulcanised rubber
Good strength but brittle	Stiff hard and strong	Hard with high strength, flexible and tough	Highest tensile strength, elastic, resistant to abrasion

Properties and characteristics of materials

	Absorbency	To be able to soak up liquid easily.
	Strength	The capacity of an object or substance to withstand great force or pressure.
	Elasticity	The ability of an object or material to resume its normal shape after being stretched or compressed; stretchiness.
	Plasticity	The quality of being easily shaped or moulded.
	Malleability	To be able to be hammered or pressed into shape without breaking or cracking.
	Density	The quantity of mass per unit volume of a substance
	Effectiveness	The degree to which something is successful in producing a desired result; success.
	Durability	The ability to withstand wear, pressure, or damage.

Testing materials

Materials testing is used to check the suitability of a material.	Testing can be non-destructive or destructive.	Most Non destructive testing will be visual.	Tensile testing, compressive strength tests and hardness testing are destructive.

Tensile test	Compressive test	Hardness test
		
- Used to find the strength under tension. - The maximum pulling or stretching force before failure. - Used by applying a load and observing the changes.	- The resistance of a material under a compressive force. - A material is placed under compression to see its resistance. - concrete is a good example of material with compressive strength.	- Used to find out how hard a material is. - In a work shop a hammer and dot punch is used to create an indentation in the material.

SI Base Units

unit	abb	physical quantity	Smallest - - - - - - - Largest
metre	m	length	Micrometer, millimeter, centimeter, meter
second	s	time	Microsecond, millisecond, seconds
kilogram	kg	mass	Milligram, gram, kilogram
ampere	A	electric current	Micro amp, milliamp, amp, kiloamp
kelvin	K	thermodynamic temperature	Kelvin, degrees Celsius
candela	cd	luminous intensity	Microcandela, millicandela, candela
mole	mol	amount of substance	Nanomole, micromole, millimole, mole

Engineering Disciplines

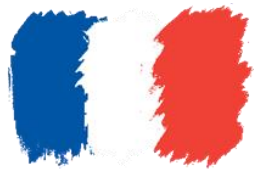
Mechanical	Hydraulics, gears, pulleys.
Electrical	Power station, household appliances, integrated circuits
Aerospace	Aircraft, space vehicles, missiles
Communications	Telephone, radio, fibre optic
Chemical	Pharmaceuticals, fossil fuels, food and drink
Civil	Bridges, roads, rail
Automotive	Cars, motorcycles, trains
Biomedical	Prosthetics, medical devices, radiotherapy
Software	Applications, systems, programming

Understand the making Process

1	Preparation	Drawing, CAD, sketches, plans.
2	Marking Out	Pencil, scribe, steel rule, tri square, marking gauge, calipers, centre punch.
3	Modification	Saw, jigsaw, scroll saw, laser cutter, pliers, hammer, drill, file, glass paper.
4	Joining	Riveting gun, spanner, screwdriver, hot glue, gun , soldering iron, nail gun.
5	Finishing	Hand sander, glass paper, disc sander, buffing wheel, polish, spray paint, varnish.

Health & Safety Legislation

Health and Safety at work Act – an agreement to keep us safe.	Personal Protective Equipment – to protect your body.	Manual Handling Operations – lifting and carrying.	Control of Substances Hazardous to Health – chemicals.	Reporting of Injuries RIDDOR – keeping a log of accidents.



Les métiers	***Jobs***		
Je suis/Il/Elle est …	*I am/He/She is a/an …*	facteur/factrice	*postman/woman*
Je veux être …	*I want to be a/an …*	instituteur/institutrice	*primary school teacher*
Je veux travailler comme …	*I want to work as a/an …*	boucher/bouchère	*butcher*
avocat/avocate	*lawyer*	boulanger/boulangère	*baker*
ingénieur/ingénieure	*engineer*	fermier/fermière	*farmer*
électricien/électricienne	*electrician*	infirmier/infirmière	*nurse*
mécanicien/mécanicienne	*mechanic*	pompier/pompière	*firefighter*
musicien/musicienne	*musician*	architecte	*architect*
maçon/maçonne	*builder*	chef de cuisine	*chef*
patron/patronne	*boss*	comptable	*accountant*
coiffeur/coiffeuse	*hairdresser*	dentiste	*dentist*
programmeur/programmeuse	*programmer*	journaliste	*journalist*
serveur/serveuse	*waiter/waitress*	pilote	*pilot*
vendeur/vendeuse	*salesperson*	secrétaire	*secretary*
acteur/actrice	*actor/actress*	vétérinaire	*vet*
agriculteur/agricultrice	*farmer*	agent de police	*policeman/woman*
créateur/créatrice de mode	*fashion designer*	médecin	*doctor*
créateur/créatrice de jeux vidéo	*video game designer*	professeur	*teacher*
directeur/directrice d'entreprise	*company director*	soldat	*soldier*

Lieux de travail	***Workplaces***		
Je travaille/Il/Elle travaille …	*I work/He/She works …*	dans un restaurant	*in a restaurant*
dans un bureau	*in an office*	dans un salon de coiffure	*in a hair salon*
dans un commissariat de police	*in a police station*	dans une boulangerie	*in a bakery*
dans un collège	*in a secondary school*	dans une école primaire	*in a primary school*
dans un garage	*in a garage*	dans une ferme	*on a farm*
dans un hôpital	*in a hospital*	à bord d'un avion	*on a plane*
dans un magasin	*in a shop*		

Les passions	***Passions***		
Ma passion, c'est …	*My passion is …*	le sport/le théâtre	*sport/theatre/drama*
la cuisine/la mode	*cooking/fashion*	les ordinateurs/les voitures	*computers/cars*

J'aimerais …	***I would like to …***		
Je voudrais/J'aimerais travailler …	*I would like to work …*	seul(e)	*alone/on my own*
dans un bureau	*in an office*	en équipe	*in a team*
dans un magasin	*in a shop*	à l'étranger	*abroad*
en plein air	*outside*	Je voudrais faire un métier …	*I would like to do a … job*
avec des enfants	*with children*	créatif	*creative*
avec des animaux	*with animals*	manuel	*manual*
avec des ordinateurs	*with computers*	à responsabilité	*responsible*

Tu voudrais travailler dans quel secteur et pourquoi?	***What area would you like to work in and why?***		
Je voudrais travailler dans …	*I would like to work in …*	(bien) organisé(e)	*(well) organised*
le sport et les loisirs	*sport and leisure*	actif/-ve	*active*
le commerce	*business*	créatif/-ve	*creative*
la médecine et la santé	*medicine and health*	ambitieux/-euse	*ambitious*
l'audiovisuel et les médias	*audiovisual and media*	sérieux/-euse	*serious*
l'informatique et les télécommunications	*IT and telecommunications*	travailleur/-euse	*hard-working*
		sociable	*sociable*
l'hôtellerie et la restauration	*the hotel and catering industry*	timide	*shy*
Je suis …	*I am …*	J'aime …	*I like …*
indépendant(e)	*independent*	le contact avec les gens	*(having) contact with people*
intelligent(e)	*intelligent*	travailler en équipe	*working in a team*
motivé(e)	*motivated*	J'aimerais avoir un métier bien payé.	*I would like to have a well-paid job.*

Mes projets d'avenir	***My plans for the future***		
Je veux/J'espère/Je voudrais …	*I want/I hope/I would like …*	faire du bénévolat/du travail bénévole	*to do voluntary work*
passer mes examens	*to take my exams*	me marier ou me pacser	*to get married or enter into a civil partnership*
réussir mes examens	*to pass my exams*	avoir des enfants	*to have children*
prendre une année sabbatique	*to take a gap year*	habiter/m'installer avec mon copain/ma copine	*to live/move in with my boyfriend/girlfriend*
voyager/visiter d'autres pays	*to travel/visit other countries*		
faire un apprentissage/devenir apprenti(e)	*to do an apprenticeship/ become an apprentice*		
aller à l'université/continuer mes études à la fac(ulté)	*to go to university/continue my studies at university*		

Tu parles quelles langues? / *Which languages do you speak?*

Je parle couramment …	*I speak … fluently.*
Je parle assez/très bien …	*I speak … quite/very well.*
Je parle un peu …	*I speak a little …*
Je parle seulement …	*I only speak …*
Je parle mal …	*I speak … badly.*
… est ma langue maternelle.	*… is my native language/ mother tongue.*

J'apprends (actuellement) …	*I am (currently) learning …*
l'allemand/l'anglais	*German/English*
l'arabe/l'espagnol	*Arabic/Spanish*
le français/le gujarati	*French/Gujarati*
le hindi/l'italien	*Hindi/Italian*
le japonais/le mandarin	*Japanese/Mandarin*
le polonais/le portugais	*Polish/Portuguese*
le roumain/le russe	*Romanian/Russian*
l'ourdou	*Urdu*

Comment utilises-tu des langues étrangères? / *How do you use foreign languages?*

J'utilise des langues étrangères …	*I use foreign languages …*
pour faire des réservations par téléphone	*to make reservations on the phone*
pour écrire des e-mails	*to write emails*
pour parler avec des clients et des collègues à l'étranger	*to speak to customers and colleagues abroad*
pour commander quelque chose à manger	*to order something to eat*
pour demander mon chemin	*to ask for directions*
pour communiquer avec des clients qui ne parlent pas le français	*to communicate with customers who don't speak French*
pour faire des annonces	*to make announcements*
pour donner des renseignements aux passagers	*to give information to passengers*
pour aider des touristes et répondre à leurs questions	*to help tourists and answer their questions*

Gagner de l'argent / *Earning money*

Tu as un petit boulot?	*Do you have a part-time job?*
Que fais-tu pour gagner de l'argent?	*What do you do to earn money?*
J'aide à la maison.	*I help at home.*
Je passe l'aspirateur.	*I do the vacuuming.*
Je fais la vaisselle.	*I do the dishes.*
Je lave la voiture (de mon père).	*I wash the car (my dad's car).*
Je tonds la pelouse (de mes grands-parents).	*I mow the lawn (my grandparents' lawn).*
Je promène le chien.	*I walk the dog.*
J'ai un petit boulot.	*I have a part-time job.*
Je sers les clients.	*I serve customers.*
Je remplis les rayons.	*I fill the shelves.*
Je fais du baby-sitting (pour mes voisins).	*I babysit (for my neighbours).*
Je livre des journaux.	*I deliver newspapers.*
Je gagne/Je reçois …	*I earn/I receive/get …*
Mon père/Ma mère me donne …	*My father/mother gives me …*
Mes parents me donnent …	*My parents give me …*
quinze euros/dix livres …	*fifteen euros/ten pounds …*
… par heure/jour/semaine/mois	*… per hour/day/week/month*

Postuler à un emploi / *Applying for a job*

une annonce	*an advert*
on recherche …	*we are looking for …*
responsabilités	*responsibilities*
qualifications	*qualifications*
compétences	*skills*
expérience	*experience*
atouts	*strengths*
remplir un CV	*to fill in a CV*
écrire une lettre de motivation	*to write a covering letter*
faire une vidéo	*to make a video*

Mon stage / *My work experience*

J'ai fait un stage …	*I did work experience …*
dans un bureau	*in an office*
dans un garage	*in a garage*
dans un hôtel	*in a hotel*
dans un magasin de mode	*in a clothes shop*
dans un salon de coiffure	*in a hairdressing salon*
dans une banque	*in a bank*
J'ai servi les clients.	*I served customers.*
J'ai rangé les vêtements.	*I tidied the clothes.*
J'ai aidé les mécaniciens.	*I helped the mechanics.*
J'ai appris à changer des pneus.	*I learned to change tyres.*
J'ai tapé des documents.	*I typed documents.*
J'ai fait des photocopies.	*I made photocopies.*
J'ai lavé les cheveux des clients.	*I washed customers' hair.*
J'ai fait du café.	*I made coffee.*
J'ai passé l'aspirateur.	*I did the vacuuming.*
J'ai répondu au téléphone.	*I answered the phone.*
J'ai pris des réservations.	*I took bookings.*
J'ai envoyé des e-mails.	*I sent emails.*

C'était une bonne expérience? / *Was it a good experience?*

C'était …	*It was …*
amusant/bien	*fun/good*
génial/intéressant	*great/interesting*
passionnant	*exciting*
une bonne expérience	*a good experience*
difficile/ennuyeux	*difficult/boring*
fatigant/monotone	*tiring/monotonous*
(complètement) nul	*(completely) rubbish*
une mauvaise expérience	*a bad experience*
Mon patron/Ma patronne était …	*My boss was …*
gentil(le)/trop sévère.	*kind/too strict.*
Mes collègues (n')étaient (pas) (très) sympa.	*My colleagues were (not) (very) nice.*
J'ai beaucoup appris.	*I learned a lot.*
Je n'ai rien appris.	*I didn't learn anything.*

Les mots essentiels / *High-frequency words*

si	*if*
bien	*well*
mal	*badly*
vraiment	*really*
plutôt	*quite/rather*
seulement	*only*
déjà	*already*
à part	*apart from*
Je n'aime pas … et je n'aime pas … non plus.	*I don't like … and I don't like … either.*

L2

Semana 1

!A currar!

Vocabulario Vale Higher

¿En qué trabajas?	What is your job?		
Soy… / Es…	*I am… / He/She is…*	profesor(a)	*teacher*
Me gustaría ser…	*I would like to be…*	recepcionista	*receptionist*
abogado/a	*lawyer*	socorrista	*lifeguard*
albañil	*bricklayer / builder*	soldado	*soldier*
amo/a de casa	*housewife / househusband*	veterinario/a	*vet*
azafato/a	*flight attendant*	Es un trabajo…	*It's a … job*
bailarín(a)	*dancer*	artístico / emocionante	*artistic / exciting*
bombero/a	*firefighter*	exigente / importante	*demanding / important*
camarero/a	*waiter / waitress*	fácil / difícil	*easy / difficult*
cantante	*singer*	manual / monótono	*manual / monotonous*
cocinero/a	*cook*	variado / repetitivo	*varied / repetitive*
contable	*accountant*	con responsabilidad	*with responsibility*
dependiente/a	*shop assistant*	con buenas perspectivas	*with good prospects*
diseñador(a)	*designer*	con un buen sueldo	*with a good salary*
electricista	*electrician*	Tengo que… / Suelo…	*I have to… / I tend to…*
enfermero/a	*nurse*	cuidar a los clientes / pacientes / pasajeros	*look after the customers / patients / passengers*
escritor(a)	*writer*		

Semana 2

fontanero/a	*plumber*	contestar llamadas telefónicas	*answer telephone calls*
fotógrafo/a	*photographer*	cuidar las plantas y las flores	*look after the plants and flowers*
funcionario/a	*civil servant*	enseñar / vigilar a los niños	*teach / supervise the children*
guía turístico/a	*tour guide*	hacer entrevistas	*do interviews*
ingeniero/a	*engineer*	preparar platos distintos	*prepare different dishes*
jardinero/a	*gardener*	reparar coches	*repair cars*
mecánico/a	*mechanic*	servir comida y bebida	*serve food and drink*
médico/a	*doctor*	trabajar en un taller / en un hospital / en una tienda / a bordo de un avión	*work in a workshop / in a hospital / in a shop / aboard a plane*
músico/a	*musician*	vender ropa de marca	*sell designer clothing*
peluquero/a	*hairdresser*	viajar por todo el mundo	*travel the world*
periodista	*journalist*		
policía	*police officer*		

¿Qué tipo de persona eres?	What type of person are you?		
Creo que soy…	*I think I'm…*	organizado/a	*organised*
ambicioso/a	*ambitious*	paciente	*patient*
comprensivo/a	*understanding*	práctico/a	*practical*
creativo/a	*creative*	serio/a	*serious*
extrovertido/a	*extroverted / outgoing*	trabajador(a)	*hardworking*

Semana 3

fuerte	*strong*	valiente	*brave*
inteligente	*intelligent*		

¿Qué haces para ganar dinero?	What do you do to earn money?		
¿Tienes un trabajo a tiempo parcial?	*Do you have a part-time job?*	los sábados	*on Saturdays*
Reparto periódicos.	*I deliver newspapers.*	antes / después del insti	*before / after school*
Hago de canguro.	*I babysit.*	cuando necesito dinero	*when I need money*
Trabajo de cajero/a.	*I work as a cashier.*	cuando mi madre está trabajando	*when my mum is working*
Ayudo con las tareas domésticas.	*I help with the housework.*	cuando me necesitan	*when they need me*
Cocino.	*I cook.*	cada mañana	*each / every morning*
Lavo los platos.	*I wash the dishes.*	una vez / dos veces a la semana	*once / twice a week*
Paso la aspiradora.	*I do the vacuuming.*	Gano … euros / libras a la hora / al día / a la semana.	*I earn … euros / pounds per hour / day / week.*
Plancho la ropa.	*I iron the clothes.*	Me llevo bien con mis compañeros.	*I get on well with my colleagues.*
Pongo y quito la mesa.	*I lay and clear the table.*	Mi jefe/a es amable.	*My boss is nice.*
Paseo al perro.	*I walk the dog.*	El horario es flexible.	*The hours are flexible.*
Corto el césped.	*I cut the lawn.*		
Lo hago…	*I do it…*		

Mis prácticas laborales	Work experience		
Hice mis prácticas laborales en…	*I did my work experience in…*	iba en transporte público	*I went by public transport*
Pasé quince días trabajando en…	*I spent a fortnight working in…*	llevaba ropa elegante	*I wore smart clothes*
un polideportivo	*a sports centre*	ponía folletos en los estantes	*I put brochures on the shelves*
una agencia de viajes / una granja	*a travel agency / a farm*	sacaba fotocopias	*I did photocopying*
una escuela / una oficina	*a school / an office*	Mi jefe/a era…	*My boss was…*
una fábrica de juguetes	*a toy factory*	Mis compañeros eran…	*My colleagues were…*

Semana 4

una tienda benéfica / solidaria	*a charity shop*	Los clientes eran…	*The customers were …*
la empresa de mi madre	*my mum's company*	alegre(s)	*cheerful*
El primer / último día conocí a / llegué…	*On the first / last day I met / I arrived…*	(des)agradable(s)	*(un)pleasant*
		(mal)educado/a(s)	*polite (rude)*
Cada día / Todos los días…	*Each / Every day…*	El trabajo era duro.	*The job was hard.*
archivaba documentos	*I filed documents*	Aprendí…	*I learned*
ayudaba…	*I helped…*	muchas nuevas habilidades	*lots of new skills*
cogía el autobús / el metro	*I caught the bus / underground*	a trabajar en equipo	*to work in a team*
empezaba / terminaba a las …	*I started / finished at…*	a usar…	*to use…*
hacía una variedad de tareas	*I did a variety of tasks*	No aprendí nada nuevo.	*I didn't learn anything new.*

Semana 4 Parte B

¿Por qué aprender idiomas?	Why learn languages?
Aumenta tu confianza.	*It increases your confidence.*
Estimula el cerebro.	*It stimulates the brain.*
Mejora tus perspectivas laborales.	*It improves your job prospects.*
Te abre la mente.	*It opens your mind.*
Te hace parecer más atractivo.	*It makes you appear more attractive.*
Te ayuda a…	*It helps you to…*
Te permite…	*It allows you to…*
apreciar la vida cultural de otros países	*appreciate the cultural life of other countries*
conocer a mucha gente distinta	*meet lots of different people*
conocer nuevos sitios	*get to know new places*
encontrar un trabajo	*find a job*
descubrir nuevas culturas	*discover new cultures*
establecer buenas relaciones	*establish good relationships*
hacer nuevos amigos	*make new friends*
mejorar tu lengua materna	*improve your first language*
solucionar problemas	*solve problems*
trabajar o estudiar en el extranjero	*work or study abroad*
Me hace falta saber hablar idiomas extranjeros.	*I need to know how to speak foreign languages.*
(No) Domino el inglés.	*I (don't) speak English fluently.*
Hablo un poco de ruso.	*I speak a bit of Russian.*

Semana 5

Solicitando un trabajo	Applying for a job
Se busca / Se requiere…	*… required.*
(No) hace falta experiencia.	*Experience (not) needed.*
Muy señor mío	*Dear Sir*
Le escribo para solicitar el puesto de…	*I'm writing to apply for the post of…*
Le adjunto mi currículum vitae.	*I'm enclosing my CV.*
Le agradezco su amable atención.	*Thank you for your kind attention.*
Atentamente	*Yours sincerely/faithfully*
Me apetece trabajar en…	*Working in… appeals to me.*
(No) Tengo experiencia previa.	*I (don't) have previous experience.*
He estudiado / trabajado…	*I've studied / worked…*
He hecho un curso de…	*I've done a course in…*
Tengo…	*I have…*
buen sentido del humor	*a good sense of humour*
buenas capacidades de comunicación / resolución de problemas	*good communication / problem-solving skills*
buenas habilidades lingüísticas	*good language skills*

Un año sabático	A gap year
Si pudiera tomarme un año sabático…	*If I could take a gap year…*
Si tuviera bastante dinero…	*If I had enough money…*
apoyaría un proyecto medioambiental	*I would support an environmental project*
aprendería a esquiar	*I would learn to ski*
ayudaría a construir un colegio	*I would help to build a school*
buscaría un trabajo	*I would look for a job*
enseñaría inglés	*I would teach English*
ganaría mucho dinero	*I would earn a lot of money*
haría un viaje en Interrail	*I would go Interrailing*
iría a España, donde…	*I would go to Spain, where…*
mejoraría mi nivel de español	*I would improve my level of Spanish*
nunca olvidaría la experiencia	*I would never forget the experience*
pasaría un año en…	*I would spend a year in…*
trabajaría en un orfanato	*I would work in an orphanage*
viajaría con mochila por el mundo	*I would go backpacking around the world*

Semana 6

¿Cómo viajarías?	How would you travel?
Cogería el / Viajaría en autobús / autocar / avión / tren.	*I would catch the / travel by bus / coach / plane / train.*
Es más barato / cómodo / rápido.	*It's cheaper / more comfortable / quicker.*
Puedes…	*You can…*
ver vídeos mientras viajas	*watch videos whilst you travel*
dejar tu maleta en la consigna	*leave your suitcase in the left-luggage office*
Hay muchos / pocos atascos / retrasos… en las autopistas / las carreteras	*There are lots of / few traffic jams / delays… on the motorways / roads*
Los billetes son carísimos.	*The tickets are extremely expensive.*
Los conductores están en huelga.	*The drivers are on strike.*
Odio esperar en la parada de autobús.	*I hate waiting at the bus stop.*
Tengo miedo a volar.	*I'm scared of flying.*

Viajando en tren	Travelling by train
El tren con destino a…	*The train to…*
efectuará su salida… de la vía / del andén dos	*will leave / depart… from platform two*
el (tren) AVE	*high-speed train*
la taquilla	*the ticket office*
Quisiera un billete de ida a…	*I would like a single ticket to…*
Quisiera un billete de ida y vuelta a…	*I would like a return ticket to…*
¿De qué andén sale?	*From which platform does it leave?*
¿A qué hora sale / llega?	*What time does it leave / arrive?*
¿Es directo o hay que cambiar?	*Is it direct or do I have to change?*

El futuro	The future
Me interesa(n)…	*…interest(s) me.*
Me importa(n)…	*…matter(s) to me.*
Me preocupa(n)…	*…worry/worries me.*
el desempleo / el paro	*unemployment*
el dinero / el éxito	*money / success*
ser feliz	*be happy*
tener hijos	*have children*
trabajar como voluntario/a	*work as a volunteer*
Cuando…	*When…*
gane bastante dinero…	*I earn enough money…*

Semana7

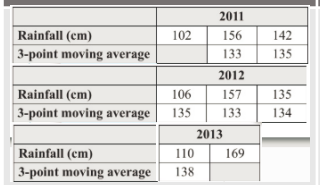
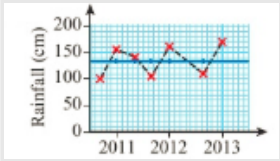
el fracaso / el matrimonio	*failure / marriage*
la responsabilidad	*responsibility*
la independencia / la pobreza	*independence / poverty*
los niños / las notas	*children / marks*
Espero…	*I hope to…*
Me gustaría …	*I would like to…*
Pienso…	*I plan to/intend to…*
Quiero…	*I want to…*
Tengo la intención de…	*I intend to…*
Voy a…	*I am going to…*
aprender a conducir	*learn to drive*
aprobar mis exámenes	*pass my exams*
casarme	*get married*
conseguir un buen empleo/trabajo	*get a good job*
estudiar una carrera universitaria	*study a university course*
montar mi propio negocio	*set up my own business*
sacar buenas notas	*get good marks*
me enamore…	*I fall in love…*
sea mayor…	*I'm older…*
tenga … años…	*I'm … years old…*
vaya a la universidad…	*I go to university…*
termine este curso / el bachillerato / la formación profesional / la licenciatura…	*I finish this course / my A Levels / my vocational course / my degree*
buscaré un trabajo	*I will look for a job*
compartiré piso con…	*I will share a flat with…*
compraré un coche / una casa	*I will buy a car / house*
iré a otro insti / a la universidad	*I will go to another school / to university*
me casaré	*I will get married*
me iré de casa	*I will leave home*
seguiré estudiando en mi insti	*I will carry on studying at my school*
seré famoso/a	*I will be famous*
me tomaré un año sabático	*I will take a gap year*
trabajaré como…	*I will work as…*

Important Ideas

Time series graphs are useful for studying the trend and seasonal variation
Trend lines can be used to predict future values.
You can find estimates of a probability by repeating an experiment many times
You can use a variety of diagrams to represent all the different outcomes possible of events

Vocabulary

Time series	Graphs which show variation over time
Trend	The overall behaviour over time
Trend line	Shows the tend of data over time ignoring any seasonal variation
Moving average	A sequence of averages that smooths out variations in data. Used to show trends.
Expected (relative) frequency	How often we expect something to happen based on trials.
Risk	The probability of loss
Two-way table	A way of presenting data with two variables
Sample space diagram	A table showing all possible outcomes of two combined events
Tree diagram	A diagram with branches used to work out probabilities of combined events
Venn diagram	A diagram using circles to represent sets. The position and overlap of the circles indicates the relationships between the sets.

Question	Answer
Time series	
	
Plot the time series Plot the moving averages Draw the trend line Describe the trend	The trend is flat
Experimental probability	
Sami spins a coin 250 times. He gets 110 heads (a) Work out the experimental probability of getting a head (b) Write down the experimental probability of getting a tail	(a) 110/250 (b) 140/250
Risk	
 Work out the risk of a knee injury in each sport Estimate the number of knee injuries next season, which has 35 games	Football 0.16 Hockey 0.083 Rugby 0.325 3 (rounded from 2.9)

Key Facts & Formula

Moving averages	
Expected (relative) frequency	Uses trials to estimate the probability of something happening next.
Equation of a trend line	**$Y = ax + b$** where ***b*** is the intercept on the y-axis and ***a*** is the gradient of the line.
Experimental probability	**Number of times the event happens ÷ total number of trials**
Estimate	**Total number of trials x probability** The more times an experiment is repeated the more accurate the estimate will be. Increasing sample size leads to better estimates
Risk	**Risk of a fault x number of items sold**

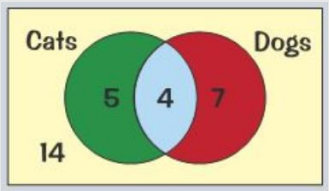
Important Ideas

Index numbers are often used to compare price changes over time.

The probability of one event may affect the probability of another.

Vocabulary

Independent events	Events are independent if the outcome of one does not affects the probability of another occurring.
Conditional probability	When the probability of a second event depends on the first.
Index numbers	A way of tracking changes in value through time.
Weighted index numbers	A measure of how a set of items changes in value.
Retail price index (RPI)	Shows changes in the cost of living. Used to set interest rates for student loans.
Consumer price index (CPI)	Shows changes in the cost of living (not including mortgage payments). Used to index benefits, tax credits and pensions in the UK
Gross domestic product (GDP)	The main measure of economic output based on the value of goods and services produced by a country or region.
Crude rates	A simple way to compare population statistics such as births, deaths and employment levels
Standardised rates	Enables valid comparisons between distributions

Question	Answer
Conditional probability	
 Using the Venn diagram above, find the probability that a randomly chosen household does not own a dog, given the household owns a cat.	$P(\text{no dog} \mid \text{cat})$ $= \frac{\text{Number of households with cats but no dog}}{\text{Number of households with cats}}$ $= \frac{5}{9}$
Index numbers	
Year | 2013 | 2014 | 2015 Index Number | 100 | 85 | 109 The index numbers in the table show the average monthly rent for a flat, using 2013 as the base year. a) In which year did the average monthly rent decrease? b) The average monthly ret in 2013 was £530 Calculate the average monthly rent for the years 2014 and 2015.	(a) Average monthly rate decreased in 2014 (85 < 100) (b) 2014: $85 = \frac{\text{price in 2014}}{£530} \times 100$ $\Rightarrow$ price in 2014 = £450.50 2015: $109 = \frac{\text{price in 2015}}{£530} \times 100$ $\Rightarrow$ price in 2015 = £577.70

Key Facts & Formula

Independent events	$P(A \text{ and } B) = P(A) \times P(B)$
Conditional probability	$P(A \text{ and } B) = P(A) \times P(B\mid A)$
Index number	$\frac{\text{value}}{\text{value in base year}} \times 100$
Weighted index numbers	$\frac{\sum(\text{index number} \times \text{weight})}{\sum \text{weights}}$
Chain base index number	$\frac{\text{value this year}}{\text{value last year}} \times 100$

Box 1. **Business Research**

Area of research: - What is business research?

Businesses need to carry out research to find out information that will help them have a successful business.

They need to understand their **customers** and **competitors**. This will help you to decide about **current and potential demand**.

This would help them to increase sales by:

- understanding their customers
- producing a product or service the customer wants
- making sure there is a market to sell to
- knowing how much products or services to supply
- target their advertising
- identify new markets to sell

Legal requirements:

If you are setting up a new business, you must be sure that you are operating within the law.

- **Legal entity: -** New businesses must be registered according to UK law and the business structure you have chosen.
- **Tax and VAT: -** Businesses must pay tax and if applicable VAT. They must register with HMRC.
- **Health & Safety: -** There are many legal requirements in place to ensure that customers and employees are safe and are protected.
- **Business insurance: -** All businesses must have insurance to protect themselves and their customers.
- **Customer protection: -** Customers are protected by legislation to ensure the quality of goods and services they receive. Customers are also protected against purchasing fake items which may not meet UK safety standards.
- **Data protection: -** There is strict legislation in place to protect customers from misuse of their personal data. Businesses must ensure they have all the necessary protections in place or face a heavy fine.
- **Planning consents: -** Businesses that have premises and want to make alterations must make sure they meet all the planning and local authority regulations.

Box 2. **Resource Planning**

Physical resources:

1. **Premises -** When you start a new business the location of the business premises will be one of the first questions to answer.

You will need to decide:

- what is your budget for your premises
- an address to register your business
- where you wish to work
- whether to rent or buy a business premises
- how big the premises would be
- will you need staff/ customer parking
- does it need to be near public transport
- does it need to be near the customer base

2. Fixtures and fittings - Once you have decided upon your location, you need to think about the inside of the building.

You will need to decide:

- what is your budget on fixtures and fittings
- necessities to carry to business e.g. display cabinets, tables, chairs
- the image you want to present to customers
- legal requirements e.g. toilets
- colour schemes and branding

3. **Equipment -** What do you need to run your business? This will depend on if you are manufacturing a product, selling a product or providing a service.

It could include:

- Stock- products to sell
- Tills
- IT equipment including phones, computers, printers, laptops
- Production equipment e.g. machinery
- Sector specific equipment

Box 3.

Physical resources: - How do we transport goods?

Road: - cars, lorries, bikes, by foot
Rail: - trains, trams
Air: - planes, helicopters, drones
Sea/water: - boats (could include sea, river, canals)

Raw Materials: - a raw material is the basic material used to make a good or product.

If you are making a product you will need to consider the raw material you need, where they will come from and where you will source them from.
This may impact on the location of your business as you need to consider transport costs of the raw materials to the location where you will manufacture your goods/products.

Technological resources

Choosing how to take payments: - The UK is the third in the world of the countries embracing a 'cashless society'. **(**https://www.telegraph.co.uk/money/future-of-money/10-cashless-countries-world-does-uk-rank/**)**

Therefore, the ability to take card payments is crucial for any new business.

The business needs to consider many issues:

- How will it take payments - face to face or over the internet or telephone?
- How many people will take payments?
- How many sites will need to take payments?
- Where will sales take place, could payments be taken in customers homes?

1. **Card and NFC readers: -** NFC stands for **N**ear **F**ield **C**ommunication which is a set of communication devices, one which is usually portable. They are used to take card payments. NFC is used for contactless payments.

You may use this with your Smart phone to make contactless card payments or load your boarding pass for a air travel.

2. Till: - A physical device to record and store payments including cash.

3. EPOS: - Electronic Point Of Sale and is an electronic way customers can pay for goods or services .

Box 4. **Technological resources**

Definitions:

- **Digital manufacturing** is a method of production in which computer technology manufacturers produce with little or no involvement from people.
- **Digital communications systems** are, for example, the internet or smart phones
- **IT infrastructure** refers to the business entire collection of IT equipment including, for example, computers, hardware , software, phones and tills.

IT infrastructure: - This could be one of the most expensive investments in equipment some businesses will make. If a business gets it wrong then it could be very difficult to change or put right.

It can include:

- Hardware
- Software
- Telephone systems
- Electronic tills
- Cyber security
- Network
- Wi Fi
- Email communications
- Website

Internal Growth:

Definitions:

- **Diversification: -** Business enlarging or varying its range of products or services. For example, a restaurant adding take away service for its customers.
- **Geographical expansion: -** The process of a business enlarging or varying field of operation. For example, a restaurant opening a new restaurant in a different town.
- **Horizontal Growth: -** Horizontal growth means expanding in the same area you already provide services or products. This can include buying a similar business to reduce competition and gain/increase their customers.

It is a strategy used by many businesses to expand their size, market share and achieve economies of scale. An example of horizontal growth **is the purchase of Instagram by Facebook.**

Box 5. **Internal Growth continue ….**

➢ **Vertical Growth: - Vertical growth** means expanding in the production process. For example, Apple is an excellent example of vertical growth. They designed the products and them grew vertically to:

- Manufacture the goods
- Distribute the goods
- Sell the goods
- After sales services including insurance and
- repairs

Why did they do this?

It gave them control of the market minimize the competition and reduce costs as they control the cost of manufacturing and distributing themselves.

External Growth: - Mergers and takeovers

A merger is when two companies decide to join together, like for example when Halifax and Bank of Scotland combined to form HBOS.

Mergers are usually agreed by two businesses to their mutual advantage. The two businesses join to together make one new legal entity.

Why do businesses do this?

- To **reach new markets**. For example, a clothes firm who offer mid-range clothes may merge with a high end clothes business. They both benefit as they now have access to each other's customers.
- **Better services for customers**. For example, a bank may merge with an insurance company to offer the different range of services in one place which is more convenient to the customer and will make it more likely they will purchase the services.

A takeover is more hostile. This is when a company (usually a larger one) buys out a rival. Kraft Foods bought out Cadbury's in early 2010 for £12 billion. In the UK, the term refers to the acquisition of a public company whose shares are listed on a stock exchange, in contrast to the acquisition or merger of a private company.

Sometimes a business may not want to merge with another. However, another larger Public Limited Company (PLC) may then force a takeover situation.

This is usually done by acquiring shares in the smaller business until the larger company has control over the Board of Directors and can force the takeover.

Box 6. **External Growth continue….**

Joint Ventures: - A joint venture is when two or more businesses join together for a specific project or business activity.

Sometimes joint ventures create a new business (Ltd company or partnership) and in other cases they retain their individual status but create a joint venture agreement (or contract).

Joint ventures are often created for single purpose like production or research.

Benefits of a joint venture:

- Access to new markets or distribution networks
- Combined resources and expertise
- Increased capacity
- Sharing of risks and costs
- Access to greater resources like staff technology or finance

Joint ventures are very popular within businesses operating in different countries like travel or transport industries.

Methods of recruitment:

Internal vacancies	External vacancies
• transfers	• headhunting
• notice board	• newspapers
• newsletter	• trade journals
• website	• careers fairs
• intranet	• shop windows
	• recruitment agencies
	• web based

Internal Recruitment Methods

Internal vacancies

- **Transfers** – a member of existing staff could be 'transferred' to another office, department or location where there is a vacancy
- **Notice board** – this can be displayed within the building so staff can see what jobs are available in the company
- **Newsletter** - this can be circulated to all staff. It can be used to keep up to date with current vacancies within the company.
- **Website** – jobs can be advertised on the company website so staff can see internal vacancies
- **Intranet** – this is a restricted website which only staff can access. It could be used to display internal staff vacancies.

Subject-specific vocabulary

Substance	This generic term includes alcohol and other drugs that may be legal or illegal
Substance use disorder or 'addiction'	Substance use disorder is the clinical term used to describe what is commonly referred to as addiction. It features a cluster of symptoms including the strong internal drive to use substances or impaired ability to control substance use
Dependency	A state in which a person relies upon a substance to feel or function as normal. This can be physical and/or psychological
Problematic use	This describes use of a substance in which a person is dependent or they use the substance recreationally in a way that increases the risk of harm
Trafficking	The criminal act of trading illegal drugs. Discussion around this topic may raise discussion of exploitation
Cessation	The process of reducing and stopping the use of a substance. This may be done independently or with the support of a cessation service

Effects of substances

Production

- poor working conditions or pay for individuals in the production process
- environmental impacts including the energy requirements for cultivation

Importation

- disproportionate exploitation of individuals from a position of socio-economic disadvantage
- environmental impacts of transport

Supply

- exploitation of vulnerable groups including children
- damage to the reputation of communities in which substances are sold
- financing of other criminal activity

Use

- varying levels of harm to health and wellbeing, finances and employment, relationships and safety
- legal consequences
- wider impacts upon legal and health services

Managing risk and influence

Self-regulation

- pacing drinking to reduce overall alcohol consumption
- considering healthy coping strategies
- choosing not to use substances

Social strategies

- assertive 'no thanks' to offers
- establishing expectations with friends
- staying in pairs in independent situations
- assertive explanation of reasons for not using substances

Locate support

- locating first aid services
- contacting law enforcement services
- discussing support with parents/family
- contacting young people's support services/organisations

External support services

FRANK
talktofrank.com 03001236600
Information, help and advice about drugs

NHS Smokefree
nhs.uk/smokefree
NHS smoking cessation support service

We Are With You
wearewithyou.org.uk
Help and advice to reduce or stop the use of alcohol and other drugs

Turning Point
turningpoint.co.uk
Support service for a range of issues including substances and mental health

Nacoa
nacoa.org.uk 08003583456
Information and support for anyone affected by a parent's drinking

Childline
childline.org.uk 0800 1111
Confidential support service
CALLS DO NOT APPEAR ON PHONE BILL

Influences on decision making

Internal

Influences that come from the person themselves such as:

- own perceptions, attitudes and beliefs
- whether actions fit with one's own values or goals

External

Influences that come from a person's surroundings such as:

- actions/attitudes of friends or celebrities
- culture, school ethos or family beliefs/expectations
- media influences