Topic: Indices		Year 10	Tier H	Term 1

What do I need to know?

- Use the three basic index laws to simplify algebraic expressions.
- Calculate with both positive and negative indices.
- Calculate values involving fractional indices.

How do I recognise this topic?

- Check for powers and indices on numbers and/or letters.
- Check to see if the "base number" is the same. E.g.: x^3 and x^5 have the same base number (x) but x^2 and y^5 do not.
- If dealing with fractional and/or negative indices, the word "evaluate" tends to require a simplified numerical answer.

Step by Step Guide / General Tips

- The 3 basic index laws need to be memorised, these are:

1. $x^a \times x^b = x^{a+b}$ (multiplying/add rule)
2. $x^a \div x^b = x^{a-b}$ (dividing/subtraction rule)
3. $(x^a)^b = x^{a\times b}$ (one involving the brackets -> multiply the powers)

- The negative index only affects the base number, it "flips" the fraction. If the base number is an integer (whole number), then you can convert it to a fraction by writing it out of 1. E.g.: 4 is the same as $\frac{4}{1}$.
- When dealing with fractional indices, understanding the purpose of each part of the fraction is important:
  - The denominator is the "root" of that number, typically the numbers 2 or 3.
  - The numerator is the "power" of that number, typically the numbers 1, 2, 3 and 4 and rarely 5.
- It is recommended to deal with the denominator first, to make the base number smaller, then raise to the power of the numerator.

Worked Example

Simplify the following expressions.

a) $2^3 \times 2^6$	b) $5^7 \div 5^4$	c) $(8^2)^5$
$x^a \times x^b = x^{a+b}$ (multiplying/add rule)	$x^a \div x^b = x^{a-b}$ (dividing/subtraction rule)	$(x^a)^b = x^{a\times b}$ (one involving the brackets)
$2^3 \times 2^6$	$5^7 \div 5^4$	$(8^2)^5$
2^{3+6}	5^{7-4}	$8^{2\times 5}$
2^9	5^3	8^{10}

Evaluate the following

a) 2^{-3}	b) $9^{\frac{3}{2}}$	c) $8^{-\frac{2}{3}}$
Ignore the negative sign and the whole thing over 1.	Root the denominator. Power of the numerator.	Combine the previous two results.
$\frac{1}{2^3}$	$\sqrt{9} = 3$	$\sqrt[3]{8} = 2$ $(root)$
$2^3 = 2 \times 2 \times 2$	$3^3 = 27$	$2^2 = 4$ $(power)$
$2^{-3} = \frac{1}{2\times 2\times 2} = \frac{1}{8}$	$9^{\frac{3}{2}} = 27$	$4^{-1} = \frac{1}{4}$ $(negative)$

Topic: Surds		Year 10	Tier H	TERM 1

What do I need to know?

- To simplify surds.
- To add, subtract, multiply and divide surds.
- To expand brackets involving surds.
- To rationalise the denominator of a fraction involving a surd.

How do I recognise this topic?

- Surds are typically non-square numbers inside a square root sign. (E.g.: $\sqrt{2}$, $\sqrt{10}$, etc)
- Surds are normally involved in non-calculator exam questions which involve Pythagoras and trigonometry.
- When a question asks for an **exact answer** and part of the calculation involves square rooting.

General Tips

- Try to simplify any surds beforehand, so they have the same surd component.
- Quick recall of square numbers will help with simplifying surds.
- Sometimes it is helpful to replace the surd with a letter like x to better understand the simplifying process. (E.g: $2\sqrt{5} + 7\sqrt{5} - 4\sqrt{5} \rightarrow 2x + 7x - 4x = 5x$ $(convert\ back) \rightarrow 5\sqrt{5}$)

Worked Example

Simplify/rationalise the following

a) $\sqrt{8}$	**b)** $\sqrt{8} \times \sqrt{2}$	**c)** $\sqrt{8} + \sqrt{18}$
Split into two factors, one of them being a square number	Multiply/divide as expected	Simplify the surds first
$\sqrt{4 \times 2}$	$\sqrt{8 \times 2} = \sqrt{16}$	$\sqrt{8} = 2\sqrt{2}, \sqrt{18} = 3\sqrt{2}$
$\sqrt{4} \times \sqrt{2}$	Simplify whenever possible!	Simplify further
$2 \times \sqrt{2} = 2\sqrt{2}$	$\sqrt{16} = 4$	$2\sqrt{2} + 3\sqrt{2} = 5\sqrt{2}$

d) $\sqrt{2}(\sqrt{3} + 2)$	**e)** $\frac{1}{\sqrt{2}}$	**f)** $\frac{1}{1+\sqrt{2}}$
Multiply the factor ($\sqrt{2}$) by each part of the bracket, then combine at the end	**Rationalise** the denominator by multiplying the fraction by the surd on the denominator	**Rationalise** the denominator by multiplying by the conjugate, then simplify as much as possible
$\sqrt{2} \times \sqrt{3} = \sqrt{6}$	$\frac{1}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$	$\frac{1}{1+\sqrt{2}} \times \frac{1-\sqrt{2}}{1-\sqrt{2}}$
$\sqrt{2} \times 2 = 2\sqrt{2}$	Multiply fractions and simplify as needed	$\frac{1(1-\sqrt{2})}{(1+\sqrt{2})(1-\sqrt{2})}$
$\sqrt{6} + 2\sqrt{2}$	$\frac{1 \times \sqrt{2}}{\sqrt{2} \times \sqrt{2}}$	$\frac{1-\sqrt{2}}{1-2} = \frac{1-\sqrt{2}}{-1} = -1 + \sqrt{2}$

Topic: Sine and Cosine rule		Year 10	Tier H	TERM 1

What do I need to know?

- Use the sine and cosine rules to solve 2D and 3D problems.
- Calculate the area of a triangle using 1/2absinC.
- Calculate the area of a triangle given the length of two sides and the included angle.

How do I recognise this topic?

- Look for the following key words: **cosine (cos), sine (sin), rule, area, opposite, adjacent, vertex, side, included.**
- You will probably be given a **non** right-angled triangle and be asked to find a missing **angle** or **side** or to work out the **area.**

General Tips

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

For missing side: $\frac{a}{\sin A} = \frac{b}{\sin B}$

For missing angle: $\frac{\sin A}{a} = \frac{\sin B}{b}$

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

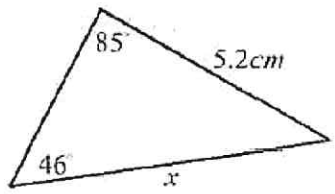
For missing side: $a^2 = b^2 + c^2 - 2bc\cos A$

For missing angle:

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

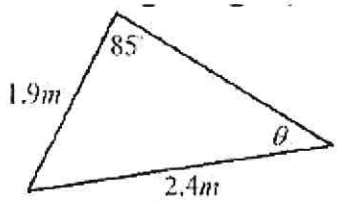
Worked Example

Using the **Sine Rule:**



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

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

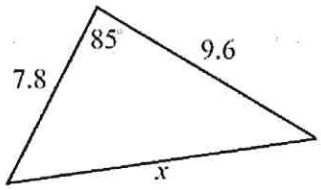


$$\frac{\sin\theta}{1.9} = \frac{\sin 85}{2.4}$$

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

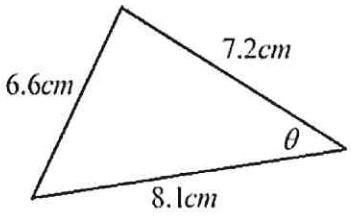
$$\theta = sin^{-1}(0.789) = 52.1°$$

Using the **Cosine Rule:**



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

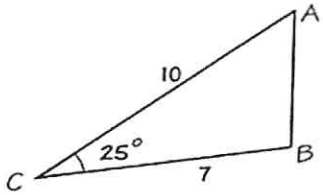
$x = 11.8$



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

$$\theta = 50.7°$$

Finding the **area of a triangle:**



$$A = \frac{1}{2}ab\sin C$$

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

$$A = 14.8$$

Topic: Linear Graphs	Year 10	Tier H	TERM 1

What do I need to know?

- 1 Using Y + mx + c to answer exam style questions.
- 2 Understand how to find the equation of a straight line.
- 3. How to find the gradient and the Y-Intercept.
- 4 Drawing and Constructing straight line graphs. ,Completing the table of Values.
- 5 Plotting Linear graphs from a table of values.

How do I recognise this topic?

- 1 Wil be used with linear Graphs.
- 2 Y = mx + C
- 3 A table of Values .

Step by Step Guide / General Tips

$y = mx + c$

gradient y-intersect

'm' is equal to the GRADIENT of the graph
'c' is the value WHERE IT CROSSES THE Y-AXIS and is called the Y-INTERCEPT.

Worked Example

Doing the table of values.

Draw graph of Y = 2x-3 for values of X from -2 to 4

1. Choose 3 easy values.. Use x values given, Try and avoid Negatives to make it easier for yourself.

x	0	2	4
y			

2.Find the values of of Y by putting Each X Value into the equation.

x	0	2	4
y	-3	1	5

When $x = 0$, $y = 2x - 3 = (2 \times 0) - 3 = -3$

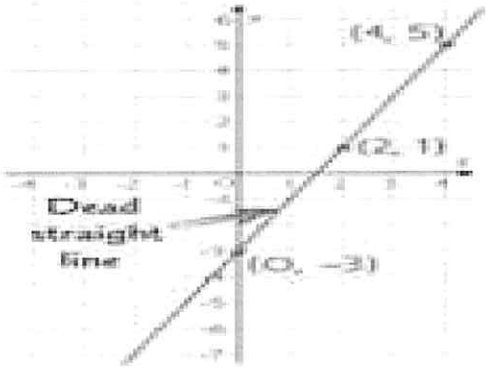
When $x = 4$, $y = 2x - 3 = (2 \times 4) - 3 = 5$

Plotting the points and Drawing the graph.

Plot each pair coordinates from the table.

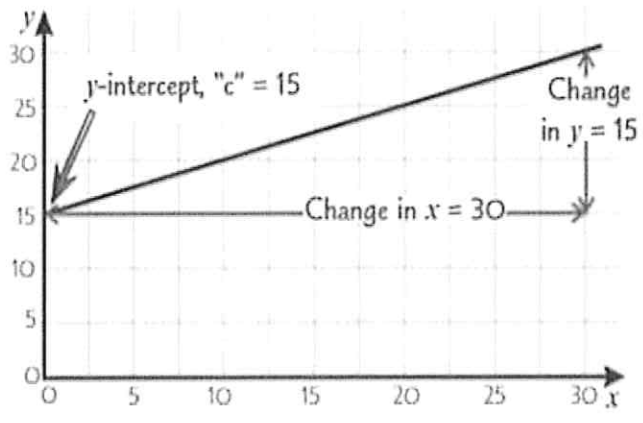
(0,-3), (2, 1) and (4, 5)

Draw a straight line through your points.



EXAMPLE: Find the equation of the line on the graph in the form $y = mx + c$.

1. Find 'm' (gradient) $m = \frac{\text{change in } y}{\text{change in } x} = \frac{15}{30} = \frac{1}{2}$
   It's an uphill graph, so the gradient is positive.
2. Read off 'c' (y-intercept) $c = 15$
3. Use these to write the equation in the form $y = mx + c$. $y = \frac{1}{2}x + 15$



Topic: Powers and Indices		Year 10	Tier F	TERM 1

What do I need to know?

- Recall squares of numbers up to 15 x 15 and the cubes of 1, 2, 3, 4, 5 and 10, also knowing the corresponding roots
- Solve equations such as $x^2 = 25$, giving both the positive and negative roots.
- Use index laws for multiplication and division of integer powers.

How do I recognise this topic?

- Look for Keywords: Power; Index; Base; Root; Square; Cube.
- Look for the root symbol $\sqrt{\ }$ and cube root symbol $\sqrt[3]{\ }$
- Look for indices in the question e.g. x^2

General Tips

- When multiplying – add the powers
- When dividing – subtract the powers
- When raising to a power – multiply the powers
- Any number to the power 0 always equals 1.
- First 15 square numbers: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225
- First 5 Cube Numbers and 10 cubed: 1, 8, 27, 64, 125 and 1000

Laws of indices - summary

- $a^m \times a^n = a^{m+n}$
- $a^m \div a^n = a^{m-n}$
- $(a^m)^n = a^{mn}$
- $a^0 = 1$

Worked Example

Law 1: multiplying numbers in index form

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

- Example 1: Simplify $8^3 \times 8^4$
- $= 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8$
- $= 8^7$

$$5^7 \times 5^4 = 5^{11}$$

Law 2: dividing numbers in index form

$$a^x \div a^y = a^{(x-y)}$$

- Example 2: Simplify $3^6 \div 3^4$
- $= \frac{3\times3\times3\times3\times3\times3}{3\times3\times3\times3}$
- $= 3^2$

$$6^5 \div 6^2 = 6^3$$

Law 3: indices in brackets

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

- Example 1: Simplify $(3^5)^3$
- $= 3\times3\times3\times3\times3 \times 3\times3\times3\times3\times3 \times 3\times3\times3\times3\times3$
- $= 3^{15}$

$$(4^{12})^3 = 4^{36}$$

Special rules. 1

Any number to the power of 0 is equal to 1

$35^0 = 1$ $41^0 = 1$

Special rule 2:

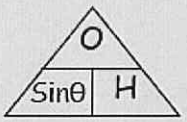
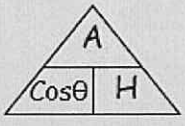
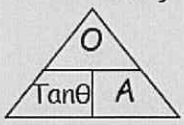
Any number to the power of 1 is the same as the original number

$12^1 = 12$ $0.4^1 = 0.4$

Topic: Trigonometry		Year 10	Tier F	Term 1

What do I need to know?

- Label a right angle triangle with the key words "hypotenuse", "opposite" and "adjacent".
- Calculate unknown lengths of a right angle triangle using trigonometry.
- Calculate unknown angles of a right angle triangle using trigonometry.
- Recall and apply the exact trigonometric values.
- Learn the formula to the right.

SOH	CAH	TOA
$Sin\,\theta = \frac{Opp}{Hyp}$	$Cos\,\theta = \frac{Adj}{Hyp}$	$Tan\,\theta = \frac{Opp}{Adj}$
		

How do I recognise this topic?

- Involves a right angle triangle and another angle that is not 90°.
- Involves the maths functions "sin", "cos" and "tan".

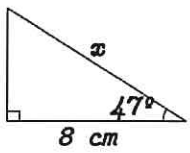
Step by Step Guide

1. Label the triangle with the key words.
2. Choose the appropriate trigonometric ratio.
3. Draw the formula triangle.
4. Cover what you need and use the triangle to work it out.
5. If working out an angle, press "shift" on the calculator before the appropriate trigonometric ratio.

Worked Example

Calculate a Length

Calculate the value of x.



Give your answer correct to 1 decimal place.

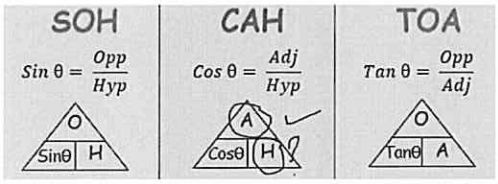
The answer is 11.7 cm

We use cos because we are involving the adjacent (8 cm) and the hypotenuse (x) of the triangle.

$$\cos 47 = \frac{8}{x}$$

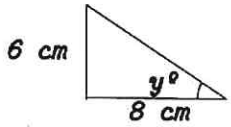
$$x = \frac{8}{\cos 47}$$

$$x = 11.7$$



Calculate an Angle

Determine the value of y.



Give your answer correct to 1 decimal place.

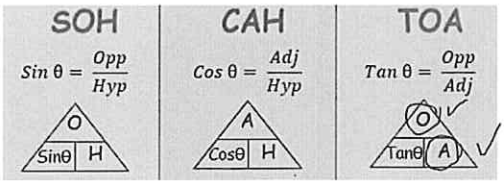
The answer is 36.9 °

We use tan because we are involving the opposite (6 cm) and the adjacent (8) of the triangle.

$$\tan y = \frac{6}{8}$$

$$y = \tan^{-1}\left(\frac{6}{8}\right)$$

$$y = 36.9$$



Topic: Algebra		Year 10	Tier F	Term 1

What do I need to know?

- 1 Understand how to Simplify expressions in their simplest form.
- 2 Multiplying and dividing algebraic terms.
- 3 Multiplying out brackets effectively

How do I recognise this topic?

- 1 Recognising a Term.
- 2 q + q + q + q = 4q

Step by Step Guide / General Tips

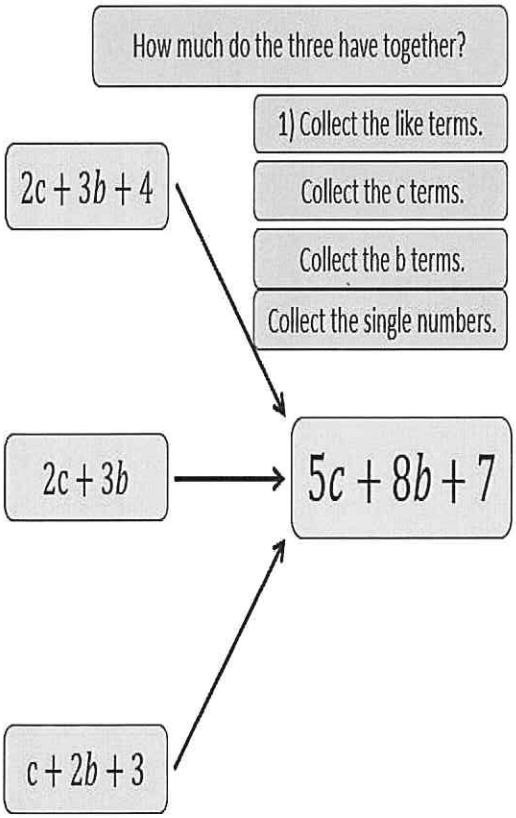
1.Simplifying.
To simplify and an Algebraic expression made up of the same terms simply add them up.
If you have a mixture of Terms you must collect the Like terms.

2. Multiplying & Dividing tips.
1. ABC means a x b x c and 3a means 3 x a.
2. a/b means a ÷ b
3. Powers tell you how many letters are multiplied $r^5 = r \times r \times r \times r \times r$.

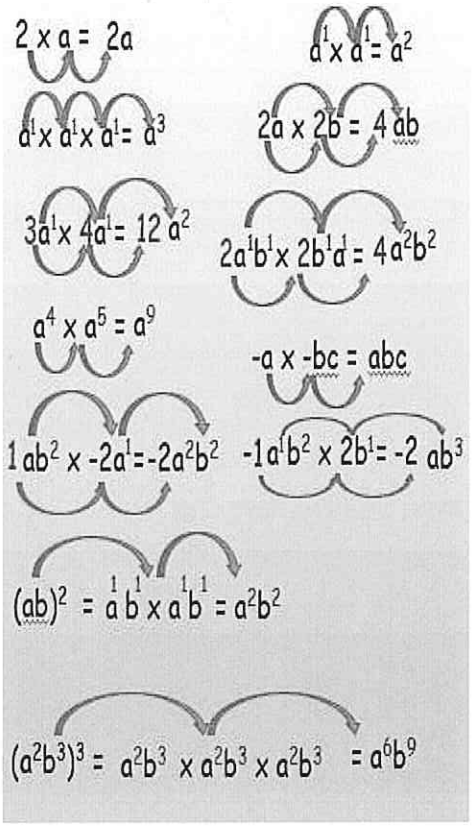
3. Brackets
The main thing to remember is that the thing on the outside multiples each separate term on the inside of the bracket.

Worked Example

1. Simplifying.



2. Multiplying.



3. Brackets.

Expand $4(3y + 7) = 12y + 28$

×	$3y$	$+7$
4	$12y$	$+28$

Expand $a(b - 6) = ab - 6a$

×	b	-6
a	ab	$-6a$

Expand $3x(2y - 1) = 6xy - 3x$

×	$2y$	-1
$3x$	$6xy$	$-3x$

Topic: Linear Graphs	Year 10	Tier F	TERM 1

What do I need to know?

- 1 Using Y + mx + c to answer exam style questions.
- 2 Understand how to find the equation of a straight line.
- 3. How to find the gradient and the Y-Intercept.
- 4 Drawing and Constructing straight line graphs. ,Completing the table of Values.
- 5 Plotting Linear graphs from a table of values.

How do I recognise this topic?

- 1 Wil be used with linear Graphs.
- 2 Y = mx + C
- 3 A table of Values .

Step by Step Guide / General Tips

$y = mx + c$

gradient y-intersect

'm' is equal to the GRADIENT of the graph
'c' is the value WHERE IT CROSSES THE Y-AXIS and is called the Y-INTERCEPT.

Worked Example

Doing the table of values.

Draw graph of Y = 2x-3 for values of X from -2 to 4

1. Choose 3 easy values. Use x values given, Try and avoid Negatives to make it easier for yourself.

x	0	2	4
y			

2.Find the values of of Y by putting Each X Value into the equation.

x	0	2	4
y	−3	1	5

When $x = 0$, $y = 2x - 3 = (2 \times 0) - 3 = -3$

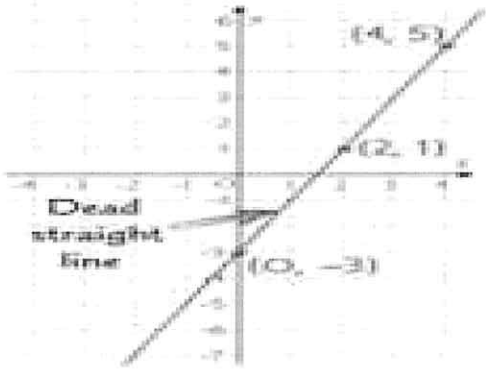
When $x = 4$, $y = 2x - 3 = (2 \times 4) - 3 = 5$

Plotting the points and Drawing the graph.

Plot each pair coordinates from the table.

(0,-3), (2, 1) and (4, 5)

Draw a straight line through your points.



EXAMPLE: Find the equation of the line on the graph in the form $y = mx + c$.

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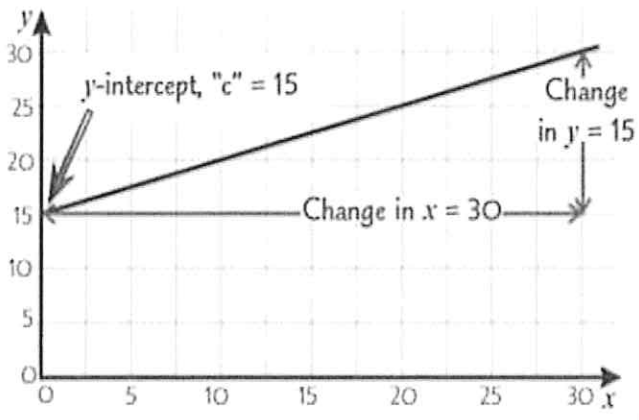
   It's an uphill graph, so the gradient is positive.

2. Read off 'c' (y-intercept) $c = 15$

3. Use these to write the equation in the form $y = mx + c$. $y = \frac{1}{2}x + 15$



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Geography – Coastal Processes

Keywords	
1.Swash	The flow of water up a beach as a wave breaks on the shore
2.Backwash	The flow of water back into the sea after a wave has broken on the beach
3.Waves	Movement of water caused by wind, often seen travelling up the beach
4.Tides	Twice daily rise and fall of the sea caused by gravitational pull of the moon and sun
5. Longshore drift	Angled prevailing winds cause swash to by angled and backwash to be perpendicular to the coastline, transporting sediments along the beach making long, thin beaches.
6. Prevailing wind	The most common or prominent wind direction in an area
7. Fetch	The distance travelled by wind or waves across open water
8.Hydraulic Action	Waves or water in the river which crashes against the cliff or river banks compressing the water and air into cracks and forcing the rocks apart
9.Abrasion/corrasion	When waves pickup rocks from the sea or river bead or beach and smash them against the cliff or river banks
10.Attrition	Sand and pebbles are picked up and smash against one another wearing them down into smaller and more rounded particles
11.Soultion/Corrosion	Minerals such as calcium carbonate are slowly dissolved in water
12.Traction	Material being dragged along the surface by the water
13.Saltation	Material being bounced along the surface by the moving water
14.Suspension	Material floating in the water as it moves
15.Solution	Rock material dissolved in the water it will return to its solid state as the water evaporates
16.Geology	The study of rock type and structure e.g. granite is igneous
17.Weathering	Subaerial processes which wear away rocks e.g. freeze-thaw or plant roots
18.Mass movement	Movement of large quantities of rock or soil down a cliff or slope
19.Wave cut notch	A slot cut by wave action at the bottom of a cliff
20.Cave	A wave cut inlet at the bottom of a cliff
21.Arch	An offshore pillar of rock linked to the mainland at the top
22.Stack	An isolated offshore pillar of rock
23.Wave-cut platform	A flat area of land at sea level left as a cliff retreats
24.Cliff	A steep rockface along the coastline
25.Headland	Narrow land that projects from the coastline because it is resistant to erosion
26.Bay	Less resistant rock is eroded between headlands, beaches often build up from deposition
27.Tombolo	A depositional feature which connects an island or sand bar to the mainland
28.Gullying	Vertical cutting in cliffs composed of weak rock and caused by rainwater erosion
29.Load	The material carried by water as it erodes
30.Spit	A feature formed by longshore drift at a change in coastline direction when deposition continues into the sea
31.Estuary	Tidal area at the river mouth with fresh and salt water

32. Erosion

Hydraulic action – the force of the water hitting the coast forces air in cracks and breaks rock off.

Abrasion – when the sediment carried by the ocean scrapes the coastline/cliff, dislodging particles into the flow of water. Can also be called corrasion

Attrition – when stones carried by the sea knock against each other, gradually making stones smaller and less rounded.

Solution – happens along limestone or chalk coastlines, the rock is slowly dissolved. This is because it is soluble in mildly acidic river water. Also known as corrosion.

34. Weathering

Biological – break down of rock by plants, animals or microbes. Plant roots can grow or animals can burrow in cracks. As they grow bigger, the roots can push open the cracks and make them wider and deeper. Eventually pieces of rock may fall away. This includes people walking.

Chemical – break down of rock due to chemical reactions. All rain is slightly acidic so causes solution of rock, particularly sedimentary rocks like chalk. Igneous rocks like quartz are much more resistant so they are weathered very slowly. Air pollution and an increase in CO_2 in the atmosphere can make rain more acidic.

Physical/mechanical – A physical force acts on the rock to break it down. Freeze thaw is where water goes into cracks of rocks and the air temperature drops below freezing and expands by 9 - 10% putting pressure on the rock. If this repeatedly happening, the rock shatters into angular fragments. This cannot happen with salt water as it does not freeze. Onion-skin weathering is rocks are repeatedly warmed and cooled, causing it to expand and contract so the outside layer peels away. This is common in deserts which have extreme day and night temperatures.

36. Deposition

Energy - The energy of the waves and currents carries sediment and when the energy is dissipated, the sediment is dropped. Large sediments are only moved in heavy storms.

Velocity - If the speed of water flow is too slow to move the rock fragments, they are deposited.

Volume - Smaller eroded material is deposited at a distance from the shore as it is lighter however heavier sediment moves shorter distances (gravity settling).

33. Transportation

The four main processes of transportation are:

Traction – large particles rolled on the sea bed.

Saltation – 'bouncing' of particles too heavy to suspend.

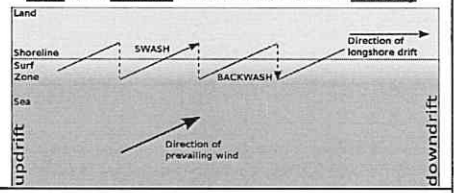
Suspension – small sediment held in the ocean (floating).

Solution – dissolved load.

The size and total amount of sediment that can be carried will depend on the conditions – low pressure depressions increase wave action and therefore more transportation takes place.

Longshore Drift

- Beach material is carried up the shore at the angle of the prevailing wind. This is the swash. When the wave breaks, the water backwash returns to the sea at right angles to the coast, pulled by gravity.
- This backwash carries the beach material with it only to be picked up by another breaking wave and so the process continues.
- It is broken when it meets a built feature like a port or a natural feature like a river estuary.



35. Mass movement

Slumping - This is where a mass of loosely consolidated materials or rock layers moves a short distance down a slope. Can be rotational.

Landslide - Massive/rapid movements of a mass sliding. They can occur after periods of heavy rain when the water saturates overlying rock, making it heavy and liable to slide.

Mudflows - They occur on steep slopes over 10°. Rapid, sudden movement after heavy rain when there is not enough vegetation to hold the soil in place. Saturated soil flows over impermeable sub soil, causing great devastation and endangering lives.

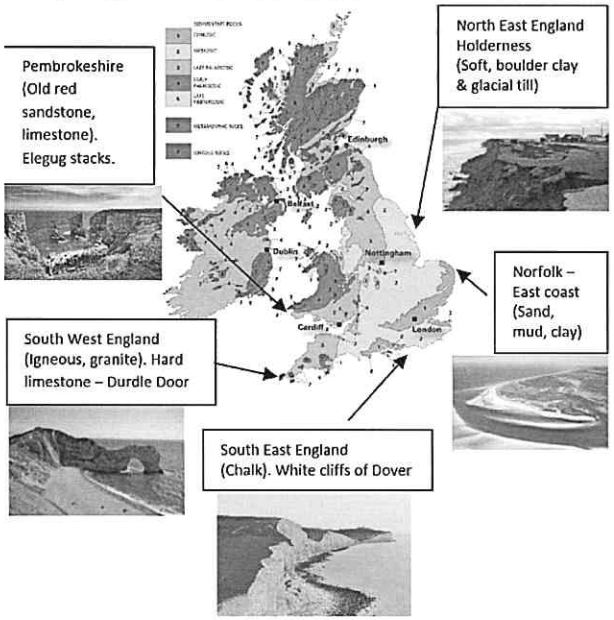
Coasts Revision Questions

36. Describe the processes that erode coastlines.
37. Describe how a cliff may be weathered.
38. Describe how sediment is transported along a coastline.
39. Describe how sediments are deposited at the coast.
40. Explain how 'onion-skin weathering' weathers rocks.
41. Why might freeze-thaw weathering be rare along UK coastlines?
42. What is the difference between traction and saltation transportation?
43. What is longshore drift caused by?
44. How does longshore drift move sediment?
45. Explain how biological, chemical and physical weathering differ.
46. Explain how large amounts of land move when erosion or weathering takes place.
47. Explain what gravity settling is.
48. Explain how a change in velocity leads to deposition.
49. What is the difference between a landslide and a mudflow?

Geography – Coastal Features

Geology

1. UK geology and distinctive landscapes



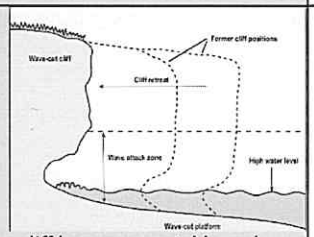
2. **Igneous rocks –** created through volcanic activity, they have a crystalline structure with no bedding planes or strata so it is very strong and has a slow rate of erosion (only hydraulic action and abrasion) which means there is a gradual wearing away of rock (hundreds of years).
3. **Sedimentary rocks –** created through erosion of igneous rock, the sediments are transported by wind or water and then deposited in the ocean. Layers build up over thousands of years, fossils are often found as skeletons sink to the bottom of ocean in between layers. There are pores and layers (strata) in sedimentary rock so they have a rapid rate of erosion and extreme erosion from destructive waves can occur overnight. Hydraulic action easily weakens the rock along the joints in the bedding plane. Solution easily dissolves sedimentary rocks like chalk.
4. **Metamorphic rocks –** are sedimentary rocks that have been changed over time through heat and pressure. You can often see the layers (strata) from the sedimentary rock, but they are now distorted and warped. The rock is condensed and air/water is squeezed out of the rock so even though there are weak joints in the bedding plane, there is still a slow rate of erosion. Hydraulic action erodes at the exposed bedding planes and any trapped sediments can erode through abrasion.

Erosional Landforms

5. Headlands and Bays

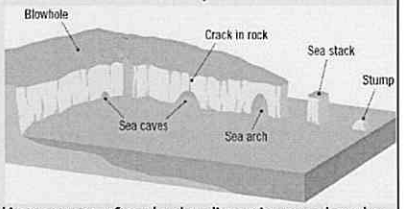
An erosional feature which occurs on discordant coastlines (patterns of different rock types, perpendicular to the coast). The different rock types have different rates of erosion (differential erosion) so more resistant rocks protrude from the coast and less resistant rocks erode at a faster rate and bays are created.

6. Wave-cut platform



- The sea attacks the base of the cliff between the high and low water mark.
- A wave-cut notch is formed by erosional processes such as abrasion and hydraulic action - this is a dent or undercutting at the base of the cliff.
- As the notch increases in size, the cliff becomes unstable and collapses, leading to the retreat of the cliff face.
- The backwash carries away the eroded material, leaving a wave-cut platform. The process repeats. The cliff continues to retreat.

7. Crack – cave – blowhole - arch – stack - stump



Crack – hydraulic action exploits a weak joint in the bedding plane

Cave - A wave-cut inlet of a cliff, caused by a crack becoming larger through hydraulic action and abrasion.

Blowhole – as water is forced into caves, often hydraulic action erodes the top of the cave and can break through to the top of the headland. Water at high tide and in storm conditions may then spray through the hole like a whale, which is where it gets the name 'blowhole' from.

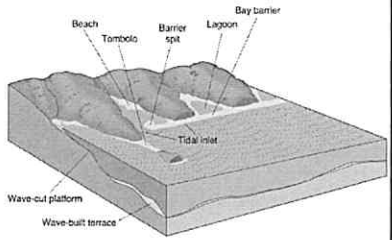
Arch - An offshore pillar of rock linked to the mainland at the top, created as the back of the cave is eroded through hydraulic action, abrasion and solution on some coastlines.

Stack - An isolated offshore pillar of rock, created because the base of an arch continually becomes wider through further erosion, and the top is weathered, until its roof becomes too heavy and collapses into the sea.

Stump – the stack is undercut at the base by destructive waves, which have a weak swash and strong backwash, until it collapses to form a stump.

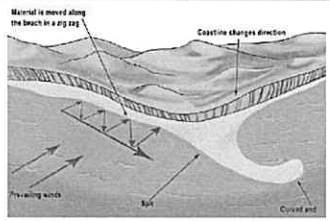
Depositional Landforms

8. Beach



Beaches are made up from eroded material that has been transported from elsewhere and then deposited by the sea. For this to occur, waves must have limited energy, so beaches often form in sheltered areas like bays. Constructive waves build up beaches as they have a strong swash and a weak backwash.

9. Spit



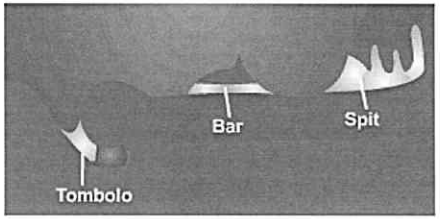
An extended stretch of beach material that projects out to sea.

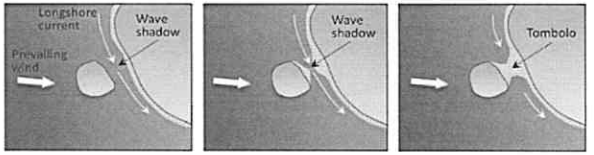
- Sediment is carried by longshore drift in the same direction as the prevailing wind.
- When there is a change in the shape of the coastline, deposition occurs. A long, thin ridge of material is deposited.
- A hooked end can form if there is a change in wind direction.
- Waves cannot get past a spit, therefore the water behind a spit is very sheltered. Silts are deposited here to form salt marshes or mud flats.

10. Bars and Tombolo

Bar - Both form like spits but a bar is a spit that connects two headlands together, which traps a shallow saltwater lake behind it called a lagoon. The lagoon may be filled up with sediment and is not a permanent feature.

Tombolo - A tombolo is a spit joining an island to mainland. The spit can form as above, but the island also helps the tombolo to form as it dissipates wave energy, waves are refracted around the island and causes deposition behind the island.





Coasts Practice Questions

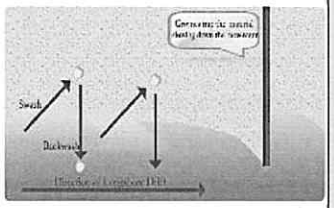
11. Explain how rock type can influence coastal erosion rates.
12. Explain how geology changes around the UK.
13. Explain how rates of erosion change around the UK.
14. Explain how discordant coastlines create headlands and bays.
15. What is the difference between constructive and destructive waves?
16. Explain what a wave-cut notch is.
17. Explain how a wave-cut platform is created.
18. Explain how a crack in a headland can become a stump.
19. Explain how deposition creates beaches.
20. Explain how longshore drift creates s spit, bar and tombolo.

Geography – Coastal Management

Hard engineering

Building structures either parallel to the coast or at right-angles to it

1. Groynes



They build up sand to keep it on the beach so that it helps to protect the base of the cliff more from destructive waves by breaking them. They are cost effective, especially as they require little maintenance. They block longshore drift. Rock groyne - £125,000 each average. Timber groyne - £100,000 average.

2. Gabions e.g.

The Gabion is a metal cage filled with rocks by about 1 metre x 1 metre square. They are used by stacking them to form a simple wall. They are there to absorb wave energy and protect the base of the cliff. They are relatively cheap (£350 per square metre) but have a short life span.

3. Rock armour/Riprap

3 tonne boulders of resistant rock (gneiss rock, impermeable) pile up at the base of the cliff. The air pockets between these boulders help to dissipate the force of the wave to help break it. Highly effective, average cost of between £1,000 and £3,000 per m but can cost up to £10,000 per metre.

4. Sea walls

The turbulent waves (the circular motion) get thrown back after hitting the stone wall. They work by keeping strong waves away from the bottom of the cliff to prevent notches forming. They can cost £10,000 per metre to be built but on average are £5,000 per m.

Shoreline Management Plan (SMP)

A detailed set of strategies for the future management of a shoreline

5. A shoreline management plan (SMP) sets out policies to assist decision-making on flooding from the sea and coastal erosion risk management over the next 20, 50 and 100 years. A cost-benefit analysis is a consideration of the balance between the advantages and disadvantages of implementing a particular strategy

6. Hold the line e.g. Scarborough

Using coastal protection methods to prevent erosion e.g. sea walls and groynes. Used to protect towns which are high value.

7. Retreat the line e.g. Medmerry, Sussex realignment

Accepting that erosion will take place and putting strategies in place that will protect the people as it happens. Happens with low value land.

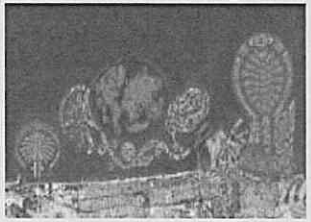
Factors considered in the cost – benefit analysis: 1. the value of property threatened and 2. population living along the stretch of coast.

8. Do nothing e.g. Holderness farmland

This involves no action at all. This is because the value of land behind the cliff is not worth being protected as it does not threaten lives.

Cost of replacing infrastructure destroyed by the eroding coast and the effect of destruction on overall economy is not great enough to protect the coast.

9. Advance the line e.g. Dubai coastline



It is building new defences that are further out in the sea in an attempt to reduce the stress on current defences and possibly extend the coastline slightly. Dubai's coastline consists of 3 artificial small island groups to minimise erosion on the original beach.

Soft engineering

In the UK the placing of material in front of the coast or regrading the cliff

10. Beach nourishment e.g. Skegness

This is the process by which sand is replaced along the beach. It is done by taking material from the sea bed and dumping it onto shore. Replenishing the beach makes it more effective at dispersing the energy of the waves by replacing the material lost by longshore drift. £10 per m^3 sand (needs thousands m^3 sand)

11. Beach stabilisation e.g. Skegness

It involves shaping the beach in a particular way so that it absorbs more energy during storms by using bulldozers. During storms, destructive waves tend to move the sediment down the beach towards the sea exposing the cliff to wave attack and erosion. This process moves material back up the beach to reflect wave energy. Up to £2000 per 100m.

12. Wetlands, Medmerry, Sussex

It encourages salt marshes and mudflats allowing some parts of the coast to flood in order to grow vegetation. By allowing small areas of the coast to flood and develop vegetation, other land is protected from flooding. This is also good for wildlife. Sacrificing areas means the only cost is the land.

13. Offshore reefs or breakwaters e.g. Norfolk

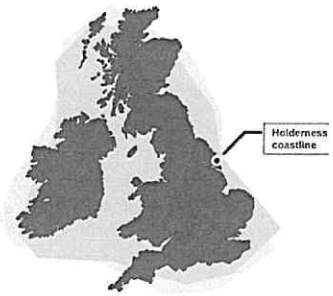
Structures parallel to the shore that reduce the amount of wave energy reaching a protected stretch of shoreline, reducing the amount of coastal erosion. They are large-scale projects so cost millions of £'s.

Coasts Practice Questions

14. What is the difference between hard and soft engineering?
15. Explain 2 examples of hard engineering.
16. Explain 2 examples of soft engineering.
17. What does SMP stand for? Why would a stretch of coastline need an SMP?
18. Why might a stretch of coastline need both hard and soft engineering?
19. The Holderness coastline needs protecting from rapid erosion. Explain which 3 types of coastal engineering you would recommend and why. Then explain which 3 types of coastal engineering you would not recommend and why.
20. The Holderness coastline needs an SMP. Which of the 4 SMP types would you recommend and why?
21. The Holderness coastline needs an SMP. Which of the 4 SMP types would you not recommend and why?

Geography – Holderness case study

Location and Erosion



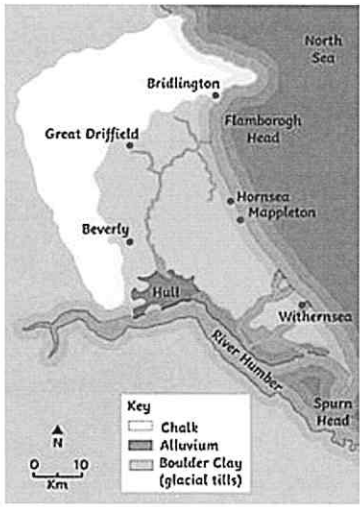
1. Location - The Holderness coastline is on the east coast of England, north of the Humber estuary and south of Flamborough Head.

2. Rate of erosion - There is a large fetch (distance wind travels unopposed to create friction on water and build up waves) of 800 miles from Scandinavia.

3. The headland is made up of chalk, which is a relatively strong sedimentary rock so Flamborough head protrudes from the rest of the coastline.

4. The cliffs are made up of extremely soft boulder clay which is an unconsolidated material, rather than solid rock. Boulder clay is 'glacial till' which means during the last glacial advance, ice travelling south from the Arctic pushed sediments up to the UK coastline, filling in the gaps in geology. The sediments have only been there for 12,000 years so they have not formed sedimentary rock yet, meaning it has a rapid erosion rate.

5. Most beaches are narrow and created by destructive waves so they have a lower gradient and are less effective at stopping waves hitting the cliffs behind. Longshore drift also carries sediments south along the coastline from Flamborough to Spurn Point where deposition occurs.



Landforms

6. Cave, arch, stack, wave cut platform, headland at Flamborough Head

Firstly, a joint in the cliff is widened by weathering such as freeze thaw. As waves attack the joints and erode them through abrasion and hydraulic action they turn firstly into a cave then erode through the headland to form an arch. Eventually, the top of the arch collapses to form a stack and that is eroded down to leave a stump. Over time the whole process repeats and a wave-cut platform is left behind.

7. Bay at Bridlington

Soft boulder clay is eroded quicker than hard rocks like limestone. As the soft rock retreats, it creates a sheltered area between two headlands. When material is eroded from the headlands by abrasion and hydraulic action it is carried into the areas which are sheltered from winds and more powerful waves and the material is deposited on a beach as there is no energy to transport them.

8. Cliff slumping (mass movement) at Great Cowden

Waves erode a notch at the base of a cliff. The material above is undercut and the boulder clay starts to slip down under the weight of gravity. One-layer sliding will create friction on another and drag that down. This will lead to rotational slumping. Over time the cliff retreats back as it is eroded by abrasion and hydraulic action. This will leave a hard, rocky platform called a wave-cut platform.

9. Spit at Spurn Head

Eroded material is transported down the coast by longshore drift. When the coastline changes shape across the Humber estuary the material continues to be transported across the river. Energy is lost as river and sea water currents collide and material is deposited across the estuary. The spit builds up and is curved by sea currents. A salt marsh develops with mud flats in the sheltered area behind the spit.

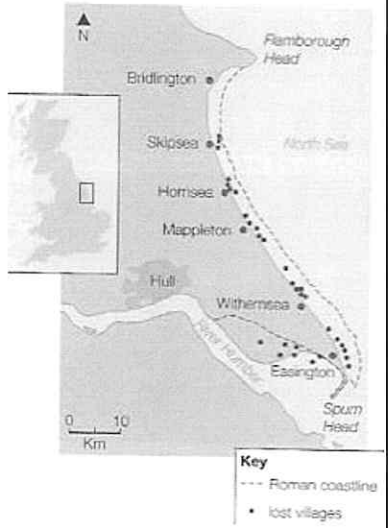
Management

10. Bridlington – sea wall and groynes. The sea wall deflects away wave energy and stops a notch being created at the base of the cliff. These are needed at Bridlington as there is a large tourist industry with many hotels and restaurants to protect along with a population of 40,000 people.

11. Mappleton – rock groynes, rip-rap, beach nourishment. Coastal defences are needed to protect the holiday parks for tourism (caravan sites), the B1242 coast road to Bridlington and businesses such as the local garage which employs 20 people. Beach nourishment increases friction on the waves so they cannot hit the cliffs and rock groynes build up a beach by stopping longshore drift and this again will increase friction on the waves which slow them down and stop them hitting the cliffs. This can reduce longshore drift so areas like Easington and Kilnsea get less beach material and are more at risk of erosion.

12. Great Cowden and Kilnsea – do nothing. Chosen as the area is only small villages and farmland and it the cost-benefit analysis shows that it is not financially sensible to spend millions of pounds to protect property of a lower value.

13. Easington – rip-rap – chosen to protect the BP gas terminal. The terminal is the main reason the cost-benefit analysis is passed as Easington terminal receives gas which is then distributed across the Midlands. Gneiss rock stops the waves eroding a notch.



Coasts Practice Questions

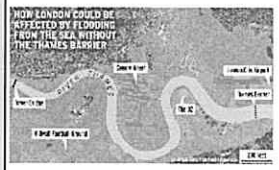
14. Describe the location of the Holderness coastline.
15. Describe the geology of the Holderness coastline.
16. What is glacial till and why is it eroded so quickly?
17. Describe the relief of Holderness.
18. Using an example you have studied, explain how different landforms can form along one stretch of coastline.
19. Explain how erosion, longshore drift and deposition can create different landforms along one stretch of coastline.
20. Using an example you have studied, explain how management may vary along one stretch of coastline.
21. Explain why a sea wall may be used to protect a coastline.
22. Explain why 'do nothing' SMP is used along some fast eroding coastlines.
23. Explain why multiple types of coastal management may be used in one area.
24. Give 3 examples of places or infrastructure that need protecting against rapid coastal erosion.
25. Explain why some stakeholders may not agree with chosen coastal management strategies.
26. Explain why there may be conflict between stakeholders when making decisions on coastal management.
27. Why might coastal management be unsustainable in the future?

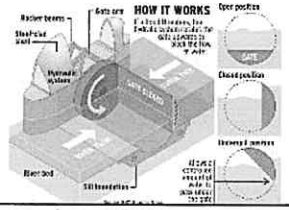
Geography – Coasts and Climate Change

Location

UK (Thames Barrier)– HIC

1. The Thames Gateway is on the south east of England to the east of London. The River Thames flows into the very southern part of the North Sea, with places like Southend-on-Sea on the northern shoreline.



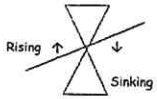


Maldives - LIC

8. The Maldives are a string of 1,190 islands running in a north-south line of 800km. They are south west of India in the Arabian Sea and the Equator runs through the southern islands of the Maldives.
   Population of 350,000, ½ of population lives in Malé, capital city. LIC ranked at 165th out of 192 countries.

Causes

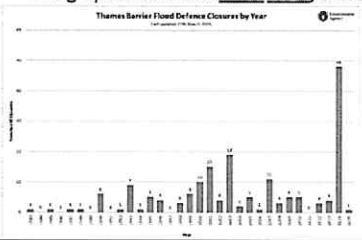
2. **More intense rainfall** - Warmer sea temperatures aid more rapid evaporation forming larger clouds which give more intense rainfall and river floods.
3. **Thermal expansion** - This is where water in the sea expands due to rising temperatures. This means the water takes up more room and sea levels rise, especially at high tides.
4. **Post glacial rebound** - The north west of Scotland is still rebounding after the release of weight from ice sheets in the last Ice Age 10,000 years ago. The UK is pivoting due to this which means that south east England is sinking, so high tides flood larger areas.
5. **Coastline shape** - The funnel shape of the Thames estuary means that water is pushed up into London during high tides and storms and this water becomes deeper and floods as the channel becomes narrower.



9. **Thermal expansion** - This is where water in the sea expands due to rising temperatures. This means the water takes up more room and sea levels rise, especially at high tides.
10. **Low lying land** - 80% of land under 1m above sea level, no land is over 3m above sea level. 0.5m sea level rise would mean 77% of the land in the Maldives would be underwater. 1m sea level rise would mean the Maldives would be uninhabitable.
11. **Storms** - Most flooding in Maldives occurs when high spring tides coincide with storms.

Impacts

6. The graph shows that since 1994, there have been far more closures of the Thames Barrier due to both river floods and high tides. Global warming affects both of these.



Places protected by the Thames Barrier - London docklands, Olympic Park, South Park – Globe Theatre, Tate Modern, Houses of Parliament, St. Paul's Cathedral, 500,000 homes, 400 schools, 300km roads, 16 hospitals, 35 tube stations

Some of these buildings are priceless and cost/benefit is easy to meet.

12. Malé, the capital city, is surrounded by 3m concrete sea walls. These were partly funded by $60 million aid from Japan. This sea wall will hold back the sea for the next few decades. It needs constant repairs paid for from tourist taxes. Other islands do not have sea walls.
13. Drinking water is in short supply in the Maldives. 87% of the population gets fresh water by collecting rainwater. Groundwater sources in the islands have become contaminated by saltwater incursion due to higher sea levels and are now undrinkable. It is unsustainable to bring in water from abroad.
14. The tourist industry accounts for 90% of the government's tax revenue. The Boxing Day tsunami of 2004 destroyed many beaches and resorts and it has taken many years to restore this damage. Future rises in sea level would have a similar effect.

Future

7. **Thames Estuary 2100 Plan details**
   - Review and replace existing embankments, sea walls and sluices.
   - Use managed realignment such as at Tollesbury, Essex, to create salt marshes which can store flood water or storm surge water and relieve pressure on more valuable areas. Increase inter-tidal habitats (salt marshes) by 876 ha.
   - Consider building a new Thames Barrier further east. Cost £6 billion - £7 billion.
   - £1.5bn in the first 25 years until 2034 on maintenance of existing protection, habitat creation and planning
   - £1.8bn in the next 15 until 2049 on raising existing barriers
   - £2.7-3.74bn until 2100 depending on the success of the previous stages

15. **Options for management include:**
   - Keep publicising their plight to get people in other countries to take measures to reduce climate change as Maldives have not caused climate change, developed nations have.
   - New resorts to be adapted by being built on stilts.
   - Raise tourist taxes to pay for more sea walls.
   - Develop other high value industries, e.g. software design.
   - Look at the lifestyle of the Bajau people who live on the sea in Borneo.
16. Large-scale plans:
   - Floating islands moored to the sea bed with cables. One floating island to be a golf course accessed by a tunnel on the sea bed. Islands will be made in India and towed to the Maldives.
   - The Maldivian President has said that if the Maldives are completely flooded, then the population will need to leave and he said they could all move to Australia, making them climate refugees.

Coasts Revision Questions

17. How is coastal flooding impacting London?
18. Explain how climate change may impact coasts around the world.
19. Compare how climate change may impact a HIC and an LIC.
20. Explain how a HIC may manage future flood risk.
21. Explain how an LIC may manage future flood risk.
22. Explain how future flooding risk may be managed.
23. How sustainable will coastal flood management be in the future?
24. Explain why soft engineering methods are not sustainable for the Maldives or London.
25. Explain why hard engineering methods may not be enough for the Maldives.
26. Why will there be more climate refugees in the future?

1.5.1 System Software – Operating Systems

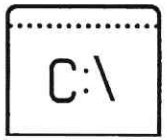
The purpose and functionality of operating systems:

- ❑ User interface
- ❑ Memory management and multitasking
- ❑ Peripheral management and drivers
- ❑ User management
- ❑ File management

	COMMAND LINE INTERFACE	GUI
Ease of use	✗	✓
Flexibility	✓	✗
Heavy use of system resources	✗	✓

OPERATING SYSTEMS act as an interface between the user and the computer hardware.
Operating systems have three main types of interface;
COMMAND LINE INTERFACE (which uses text based commands) **GRAPHICAL USER INTERFACE** (which uses icons and pointers) and **VOICE INPUT** (allows voice to control the device)

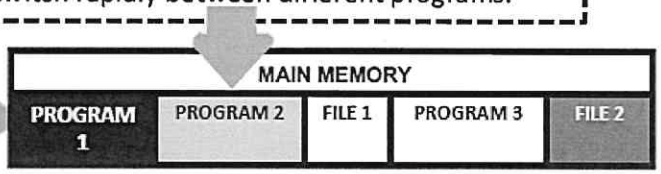
GUI



USER MANAGEMENT
Operating Systems enable different users to log onto a computer and settings for the individual can be retained.
A network administrator can allocate accounts to users and set access rights for different users in the network.
This enables security to be managed.

MEMORY MANAGEMENT
One of the most important roles of the OS is MEMORY MANAGEMENT and MULTITASKING.
Multitasking allows multiple files and programs to be resident in memory at one time. This allows users to switch rapidly between different programs.

A computer's memory is organised into "**blocks**". The OS moves programs and files in and out of main memory as and when they are needed.



PERIPHERAL MANAGEMENT
Operating Systems manage the way in which hardware interacts with software.
A **peripheral** is a piece of hardware that is not directly connected to the CPU – such as a keyboard, a mouse or even a hard disk drive.
An Operating System managed all of the peripheral devices that are connected to the computer – this allows them to be disabled, or **drivers** be updated.

DRIVERS
A piece of software used to control a piece of hardware.
Drivers allow a peripheral device to be connected to a computer and it be used by an Operating System.
You may get drivers for graphics cards, mouse, sound card, network interface cards.
Drivers are OS specific and are regularly updated by companies

FILE MANAGEMENT
Like memory management, the Operating System must identify where files are stored for long term storage on for e.g. the hard disk drive or a solid state drive.

- The user does not need to know the specific track, sector and surface address – but the Operating System does in order to accurately locate a file on the hard disk drive.

Features e.g.

- Naming of files
- Allocating to folders
- Creating, moving, copying, modifying and deleting files
- Searching for files.

1.5.2 System Software – Utility Software

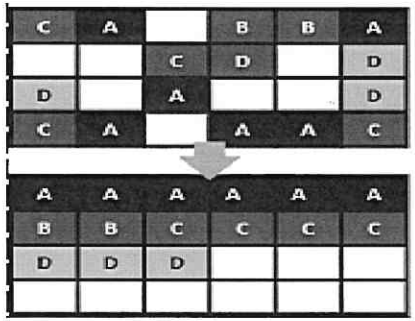
The purpose and functionality of utility software
Utility system software:
- ❑ Encryption software
- ❑ Defragmentation
- ❑ Data compression

UTILITY SOFTWARE
Utility system software helps to maintain or configure a computer. Many useful utilities are installed along with the operating system, but extra utility software can be installed to perform additional tasks.
- Utility programs are designed to do just one or two tasks.
- Utility software interacts with the computers hardware E.g. the Disk Drive.
- Utility programs are inbuilt in to the Operating System.

DATA COMPRESSION utilities can be used to reduce the size of a file. This is useful when sending files electronically.
Files compressed with this type of software need to have their contents extracted (using the same utility) before they can be used again.
Reducing the size of the file by performing an algorithm on the original data. There are two main types of compression:
- **Lossless**
  - The original file can be re-created as no data is lost.
- **Lossy**
  - Some of the original data is lost and the original file can not be re-created.

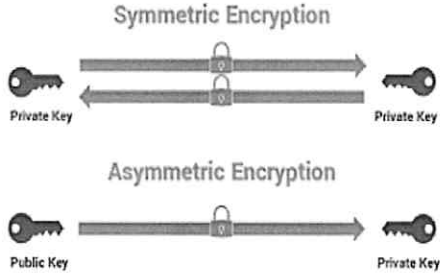
DEFRAGMENTATION SOFTWARE
When a hard disk drive is new – files get added onto the disk in order – very much like starting with a blank piece of paper and adding to it
- As files are deleted – this leaves gaps
- When new files are saved – the files fill the gaps and become fragmented
- This can slow the system down as the files need to be accessed from different areas
- Defragmentation software groups fragmented files back together

How it works –
- The parts of the files are moved on the hard disk are moved so that they are stored consecutively
- All the free space is moved so that its al together making it easier for storing data later.
- Once defragmented the files can be accessed easier and the different parts of the file are all together.

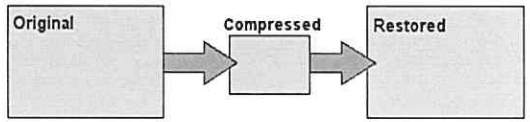


REVISION NOTE
SSDs do not need to be defragmented since electrical storage works differently to magnetic

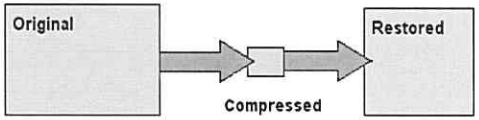
ENCRYPTION SOFTWARE uses **ALGORITHMS** to turn **PLAINTEXT** files into **CIPHERTEXT**. This means that the contents of an encrypted file cannot be read without the use of the **KEY** that was used to encrypt it.
There are two **types of encryption** in widespread use today: symmetric and asymmetric **encryption**. The name derives from whether or not the same key is used for **encryption** and decryption.



LOSSLESS



LOSSY



1.6.1 Ethical, Legal, and Environmental Impact

Impacts of digital technology on wider society including:

- ❑ Ethical issues
- ❑ Legal issues
- ❑ Cultural issues
- ❑ Environmental issues
- ❑ Privacy issues

Legislation relevant to Computer Science:

- ❑ The Data Protection Act 2018
- ❑ Computer Misuse Act 1990
- ❑ Copyright Designs and Patents Act 1988
- ❑ Software licences (i.e. open source and proprietary)

REVISION NOTE
You need to be bale to talk about each of these in detail, considering both advantages and disadvantages of each

ETHICS= Our principles, the things that influence our choices and behaviours
CULTURE = Our way of life, including customs and beliefs

NEWS
✓ Lots of up-to-date news sources
✗ Which are real, which are "fake news"?

PRIVACY ISSUES
- Do you own your own data?
- Should governments and law enforcement have complete access?
- What are COOKIES? Should you allow websites to access them?

THE RATINGS CULTURE
Easy to find, give and share opinions
People can become obsessed with how they are perceived

ETHICAL IMPACT

HEALTHCARE

✓ Use of AI to diagnose illness
✗ Poorer nations cannot afford technology

DRIVERLESS CARS
✓ Can auto-navigate and do not get tired on long journeys
✗ Will computers cause accidents?

ETHICAL ISSUES SOCIAL MEDIA

✓ Great for keeping in touch
✗ Can be used for bullying/trolling

THE COPYRIGHT DESIGNS AND PATENTS ACT 1988
An act of law designed to provide protection for creators of books, software music and video, against illegal copying, piracy and distribution.

© COPYRIGHT – material cannot be used/distributed without permission

CC CREATIVE COMMONS – material can be used without permission (though credit may need to be given)

COMPUTER MISUSE ACT 1990
There are three main principles of the Computer Misuse Act. It is an offence to:
1. access computer material without permission, e.g. looking at someone else's files
2. access computer material without permission and with intent to commit criminal offences, e.g. hacking into your bank's computer and increasing the money in your own account
3. alter computer data without permission, e.g. writing a virus to destroy someone else's data

THE 8 PRINCIPLES OF THE DATA PROTECTION ACT 2018
- ✓ Fair, lawful & transparent processing
- ✓ Purpose limitation
- ✓ Data minimisation
- ✓ Accuracy
- ✓ Data retention periods
- ✓ Data security
- ✓ Accountability

SOFTWARE LICENSES

	Open Source	Proprietary	Freeware
Is licensed	✓	✓	✓
Can be edited by users	✓	✗	✗
License is free	✓	✗	✓
Users can make and sell their own version	✓	✗	✗

2.3.1 Defensive design

Defensive design considerations:

- Anticipating misuse
- Authentication

Input validation

Maintainability:

- Use of sub programs
- Naming conventions
- Indentation
- Commenting

Authentication is a coding method to check that a user is who they say they are and allowed to accesses the program.
This can be as simple as the user entering a user name and password which is compared against a stored user name and password.
If they match then the user is authenticated.

Input Validation is a check made by a computer to ensure that the data entered is sensible or reasonable.
It cannot check that it is correct because a user may lie or make a mistake.
It attempts to ensure that it is within certain limits or rules.

Type of check	How it works	Example
Check digit	The last 1 or 2 digits in a code are used to check the other digits are correct	Bar code readers in supermarkets use check digit
Format check	Checks the data is in the correct format	A national insurance number is in the form LL 99 99 99 L where L is any letter and 9 is any number
Length check	Checks to make sure the data isn't to short or long	Phone numbers are 11 characters or passwords that need to be more than 6 characters
Lookup table	Looks for acceptable values in a table	There are seven possible days in the week
Presence check	Checks to make sure data has been entered into a field	In most databases the key field can not be left blank
Range check	Check the value falls within a specific range	Number of hours worked must be less than 50 but more than 0
Spell check	Looks up words in a dictionary	MS word uses red lines to underline misspelt words

Defensive program design will consider and **anticipate misuse.**
Misuse may be in the form of a brute force attack on the program.

- Many programs and systems only allow a user to enter a password three or four times before it locks out the system.

The program should be able to identify when a user keeps inputting the same data.
Consider Twitter which allows you to send the same tweet only once.

- If you send the same Tweet twice the program identifies this and removes the tweet, sending you an error message.

Authentication can also be physical.
Programs often requires a **key code:**

- this is generated by an app on a users phone
- the user then enters this as extra security.

Online banking requires a user to enter details into a webpage:

- a number is generated which is entered into a key device.
- this returns a number code which is entered into the webpage as well
- without the second part of the code the user is not authenticated.

This is know as **2-factor authentication.**

If a program is to be defensive against attacks, it has to be maintained and up to date.
API (Application Program Interface) and code changes, which means that programs will need to adapt to complement new requirements.

Code is indented for a number of reasons:
To group together a function, The code does not use a { syntax and indentation is used instead, If altering a function in the future it can be easily found, Makes the program much easier to read and understand.

There are two main types of sub programs:

- procedure
- function.

Procedures carry out a set of instructions and do no not return a value.
A function is a similar to a procedure but it will return a value.
The main benefit that is fact sub programs give a program structure.

Comments in programs serve a number of purposes:
To inform them reader of a bug or issues, To explain the code and its function in more detail, To stop a line of section of code from executing
Common symbols used for commenting are
', #, */, //, /**

To make code easier to follow, programmers follow standard **naming Conventions.**
When creating identifiers they should be meaningful and easy to read.
e.g. First_Name is much better than firstname.

2.3.2 Testing

The purpose of testing

Types of testing:

- Iterative
- Final/terminal

Identify syntax and logic errors

Selecting and using suitable test data:

- Normal
- Boundary
- Invalid/Erroneous

Refining algorithms

What is an error? An error in a program is sometimes called a Bug.
This is because Grace Hopper discovered a moth in a computer which was stopping it from functioning correctly.
Bugs cause the program to run incorrectly and are usually caused by an error in the coding.
Not all errors will stop a program from running.

The purpose of Testing is to find bugs and find them as early as possible and make sure they get fixed.
To ensure the program meets the requirements of the customer.
An important part of computer programming which involves checking a program for errors.

Runtime errors cause programs to crash even if there appears to be nothing wrong with the program code.
They are only detected once the program is executed.
Examples could be:

- running out of memory
- dividing by zero.

Final Testing – The program goes is tested once at the end of development.
Everything is tested in one go.
Iterative testing - a program is tested and then changes are made as it goes through the development cycle again. It may go through this process a few times to make sure it is exactly what the customer wants.

Syntax errors are mistakes in the way that the code is written.
Syntax break the rules of the programming language.
Translators can only execute a program if it is syntactically correct.
Common syntax errors include:

- spelling mistakes
- incorrect use of punctuation
- use of capital letters.

Logic errors: a logic error is a bug in a program that causes it to operate incorrectly.
Logic errors may not make a program terminate or crash.
Logic errors usually produce unexpected results.
Logic errors may not always be easy to spot.

```
stocklevel = input("Enter stock level")
    if stocklevel >= 5 or <= 25 then
        print(Not in demand)
    else
        print(In demand)
    endif
```

Logic Error
Will still run but wont give expected result

Syntax Error
will not run as rules of the language are broken

When testing the program it is important to use a range of test data:

- normal
- boundary
- invalid/erroneous

Invalid/Erroneous will cause the same error – it will be **rejected** by the program.
Normal and boundary data will be **accepted** by the program.

Normal – Data that is correct
Boundary – The minimum/maximum values of the data that could be entered for example for teenagers 13 and 19.
Invalid– Values higher or lower than the expected range, for teenagers greater than 19.
Erroneous - incorrect values that the program should not accept such as entering 'Dave' in an age field.

Refining algorithms: Now that you understand what invalid and erroneous data is, you should create programs that do not accept these values.

- Writing code which anticipates a range of possible inputs.
- Those inputs could be invalid data or erroneous data.
- Making sure "bad" data doesn't crash the program.
- Making sure prompts to the user are descriptive and helpful.
- Making sure only data of the correct "data type" are entered.
- Checking and handling missing or blank data

One common option is to use simple exception handing commands available in most languages.

History Year 10 Topic 1: The Weimar Republic, 1918-29

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 –opposition from the left
4	**1919 June** Signing of the Treaty of Versailles
5	**1919 August** Weimar Constitution finalised
6	**1920**KappPutsch –opposition from the right
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.
17	**Stab in the back theory**–the German Army had been stabbed in the back by the politicians who signed the armistice

18. Treaty of Versailles	
Blame	Germany had to accept blame for starting the war –article 231
Money	Germany had to pay £6,600b In reparations for the damage caused during the war
Army	Germany's army and navy were massively reduced in size Army only 100,000 no tanks or aircraft, or submarines
Land	Germany lost territory on all sides, and its colonies in Africa, Alsace-Lorraine to France, no Anschluss (union) with Austria)

Key People		
1	Kaiser Wilhelm II	Leader of Germany—abdicated 9th November 1918.
2	Philipp Scheidmann	Leading member of the Social Democratic Party (SPD). Proclaimed that the Kaiser had gone and there was a new German Republic.
3	Max von Baden	Chancellor—stood down on the 9th November 1918.
4	Paul von Hindenburg	President of Germany between 1925 and his death in 1934.
5	Friedrich Ebert	Leader of the SPD. Became Chancellor 9th November 1918.
6	General Groener	10th November 1918—made an agreement with Ebert that the army would work with the government to keep communists out of power.
7	Rosa Luxemburg	Leader of the Spartacist Revolt. Killed on 16th January 1919.
8	Karl Liebknecht	Leader of the Spartacist Revolt. Killed on 16th January 1919.
9	Wolfgang Kapp	Led the right-wing Kapp Putsch uprising.
10	Charles G. Dawes	An American banker who created the Dawes Plan to resolve Germany's non-payment of reparations.
11	Owen Young	An American banker who led the committee which created the Young Plan, to further help Germany manage reparation payments.
12	Otto Dix	Expressionist painter whose scenes of German life were critical of German society.
13	Erich Mendelsohn	Famous architect—designed Einstein Tower in Potsdam which was very unusual and futuristic.
14	Fritz Lang	Film director famous for *Metropolis* in 1926. A government-funded film about life and technology in the 20th century.
15	Gustav Stresemann	Chancellor between August and November 1923, and foreign secretary from August 1923—1929.

Key Terms		
1	Communism	An extreme form of government, representatives of the workers set up government and take ownership of all land, property and resources in a country.
2	Abdication	A leader, like a King, giving up their throne or position.
3	Constitution	The rules which set out how a country is run.
4	Trade Union	Groups of workers formed to protect workers rights in a variety of jobs.
5	Spartacist	Left-wing uprising against Weimar Republic—supported Communists.
6	Kaiser	The German Emperor.
7	Chancellor	The head of the government in Germany
8	Diktat	The Treaty of Versialles was a Diktat as the terms were imposed on Germany, not negotiated with them.
9	Dolchstoss	'Stabbed in the back' - how Germans viewed the Treaty of Versailles.
10	November Criminals	Leaders of the new German republic who signed the Treaty of Versailles.
11	Freikorps	'Free corps' formed of thousands of demobilised soldiers after WW1.
12	Hyperinflation	Prices went up due to shortages of goods = inflation. The government printed more money, which made prices rise further = hyperinflation.

History Year 10 Topic: Hitler's rise to power, 1919-1933

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.	
Timeline		
2	**February 1919**	Anton Drexler founded the DAP (German Worker's Party)
3	**12/09/1919**	Hitler attended his first DAP meeting—only 23 people attended.
4	**19/09/1919**	Hitler joined the DAP.
5	**1920**	Hitler renames DAP to NSDAP – The National Socialist German Workers' Party. Hitler was head of party propaganda.
6	**December 1920**	DAP buy the Volkischer Beobachter 'People's Observer' newspaper.
7	**July 1921**	Hitler becomes leader of the DAP.
8	**August 1921**	Hitler introduces the SA (Strumabteilung)
9	**08/11/1923**	The Munich Putsch
10	**11/11/1923**	Hitler arrested
11	**1924**	Hitler put on trial for high treason—found guilty but released after 9 months.
12	**1925**	*Mein Kampf* (My Struggle) published.
13	**1926**	Bamberg Conference—Hitler arranged conference to address the splits in the DAP.
14	**1928**	Nazis win 12 seats in Reichstag
15	**03/10/1929**	Gustav Stresemann died.
16	**24/10/1929**	'Black Thursday' - the Wall Street Crash
17	**1930**	Nazis won 107 seats in Reichstag.
18	**March 1932**	Hindenburg stood for reelection—won a majority but not over 50%.
19	**April 1932**	Hindenburg had to stand for reelection again—won 53% of the vote.
20	**30/05/1932**	Chancellor Bruning resigns—von Papen became Chancellor.
21	**July 1932**	Reichstag elections—Nazis win 230 seats in Reichstag.
22	**November 1932**	Reichstag elections—von Papen was sacked and Nazis won 196 seats in Reichstag.
23	**December 1932**	Von Schleicher became Chancellor.
24	**30/01/1933**	Hitler became Chancellor.
Key Concepts		
25	**25 Point Programme** union of all Germans, No Treaty of Versailles, Citizenship to only those with German Blood, businesses to be nationalized.	
26	**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.	
27	**Stable Stresemann** caused problems for the popularity of the Nazi Party. When times were good, voters were not attracted to the Nazi policies.	
28	**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. Support grew from all classes (big businesses, middle-class and working-class) as well as farmers, young people and eventually women.	
29	**The Backstairs Intrigue** - At a time when Nazi popularity at the polls was decreasing, Hitler was handed power by political elites who feared Communist takeover and Civil War.	

Key Words		
1	**NSDAP**	The Nazi Party
2	**Iron Cross Award**	Given for bravery in war.
3	**Volk**	The notion of pure German people
4	**25 Point Programme**	The political manifesto of the Nazi Party
5	**Volkischer Beobachter**	People's Observer, a Nazi newspaper
6	**Fuhrerprinzip**	Belief that one person should run a Party
7	**Swastika**	Emblem of the Nazi Party
8	**SA or Sturmabteilung**	Private army of the Nazi Party
9	**Aryan**	Pure German people
10	**Anti-Semitism**	Hatred of the Jewish people
11	**Mein Kampf**	Hitler's autobiography (My Struggle)
12	**Putsch**	An attempt to get power illegally
13	**Blood Martyrs**	16 Nazis who died at the Munich Putsch
14	**Gaue**	Local party branches.
15	**Gauleiter**	Local leaders of each party branch.
16	**SS or Schutzstaffel**	Hitler's bodyguards
17	**KPD**	German Communist Party
18	**Propaganda**	A way of controlling public attitudes. Use newspapers, posters, radio, films etc to shape peoples ideas.
19	**Roter Frontkampferbund**	The Communist's own private army
20	**Nationalism**	A political outlook in which all policies are organized to make the nation stronger and more independent.
21	**Socialism**	A political outlook which stresses that a country's land, industry and wealth should all belong to the workers of the country.
22	**Paramilitary force**	A private group run like a military force.

Key People		
1	**Paul von Hindenburg**	The President of the Republic from 1925 until his death in 1934.
2	**Adolf Hitler**	Leader of the Nazi Party 1921-45. Became Chancellor in 1933.
3	**Gustav Stresemann**	Chancellor in 1923 and Foreign minister 1923-29.
4	**Heinrich Bruning**	Chancellor March 1930 — May 1932.
5	**Kurt von Schleicher**	Chancellor December 1932—January 1933. Recommended the appointment of Hitler as Chancellor.
6	**Franz von Papen**	Chancellor May—November 1932, Vice Chancellor to Hitler 1933—1934.
7	**Rudolf Hess**	Became Hitler's deputy in the DAP.
8	**Hermann Goering**	Had been a fighter pilot in WW1—leading DAP member.
9	**Julius Streicher**	Publisher—founded another Nazi newspaper, *Der Sturmer (The Stormer).*
10	**Ernst Rohm**	Ex-army officer—popular with ex-soldiers.
11	**Anton Drexler**	Founder of the DAP—leader from 1919-1921.
12	**Gustav von Kahr**	Leader of the state government of Bavaria.
13	**Hans von Seisser**	Head of the Bavarian police.
14	**Otto von Lossow**	Head of the German Army in Bavaria.
15	**General Ludendorff**	Famous German General—led the Munich Putsch with Hitler.
16	**Joseph Goebbels**	Nazi Party member who rose to prominence in the Rhineland

History

Year 10

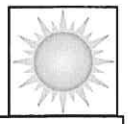
Topic 1: The Weimar Republic, 1918-29

Timeline		
	October 1918	Crews in the German navy mutinied. Refused to follow order in Kiel and Hamburg.
	07/11/1918	In Munich workers declared a general strike and protested in the streets—led by a Jewish communist, Kurt Eisner.
	09/11/1918	Kaiser Wilhelm II abdicates, the chancellor Max von Baden handed over to Friedrich Ebert, leader of the SPD.
	10/11/1918	Ebert suspended the old Reichstag. He also made an agreement with General Groener for the army to help the government to keep the communists out of power.
	11/11/1918	Matthias Erzeberger signed the armistice—formally agreeing the end of WW1.
	December 1918	German Communist Party was established.
	06/01/1919	Spartacist Revolt—a left-wing uprising. A general strike with over 100,00 workers took place in Berlin.
	16/01/1919	Rosa Luxemburg and Karl Liebknecht, leaders of the Spartacist Revolt were arrested and killed by the Freikorps.
	19/01/1919	Elections took place—they were a success, 82% of the electorate voted. Moderate parties were most popular.
0	February 1919	The National Assembly met for the first time—they had to meet in Weimar as there was so much unrest and violence in Berlin.
1	28/06/1919	The Treaty of Versailles was signed in Paris.
2	31/07/1919	The National Assembly agreed a new constitution by 262 votes to 75.
3	1919	Hugo Hasse—one of Ebert's Council of People's Representatives was murdered.
4	March 1920	The Kapp Putsch—a right-wing uprising.
5	1921	Matthias Erzberger—the politician who signed the surrender in 1918 was shot and killed.
6	June 1922	Walther Rathenau—the Weimar foreign minister was machine-gunned to death in Berlin.
7	December 1922	Germany failed to send coal to France, from the Ruhr coalfields—this was part of the reparations agreement.
8	January 1923	The French sent troops into the Ruhr, they confiscated raw materials, manufactures goods and industrial machinery.
9	1923	Hyperinflation crisis. Price of bread; 1919 = 1 mark, 1922 = 100 marks, 1923 = 200,000 billion marks.
0	August 1923	Gustav Stresemann becomes chancellor and solves problems of 1923.
1	November 1923	Stresemann set up a state-owned bank, the Rentenbank and they issued the new currency, the Rentenmark.
2	April 1924	The Dawes Plan—set up by American banker Charles Dawes was asked to resolve Germany's non-payment of reparations.
3	August 1924	An independent national bank, the Reichsbank was given control of the Rentenmark.
4	1925	President Ebert died—He was replaced by Hindenburg.
5	01/12/1925	Stresemann signed the Locarno Pact; a treaty between Germany, Britain, France, Italy and Belgium.
6	September 1926	Germany were allowed to join the League of Nations.
7	August 1928	Germany and 61 other countries signed the Kellogg-Briand Pact—promising the countries would not use war to achieve foreign policy aims.
8	August 1929	Young Plan—reduced total reparations debt from £6.6 billion to £2 billion, and they had an extra 59 years to pay.
9	03/10/1929	After 6 years as foreign minister, Stresemann had a heart attack and died.

Key People		
1	Kaiser Wilhelm II	Leader of Germany—abdicated 9th November 1918.
2	Philipp Scheidmann	Leading member of the Social Democratic Party (SPD). Proclaimed that the Kaiser had gone and there was a new German Republic.
3	Max von Baden	Chancellor—stood down on the 9th November 1918.
4	Paul von Hindenburg	President of Germany between 1925 and his death in 1934.
5	Friedrich Ebert	Leader of the SPD. Became Chancellor 9th November 1918.
6	General Groener	10th November 1918—made an agreement with Ebert that the army would work with the government to keep communists out of power.
7	Rosa Luxemburg	Leader of the Spartacist Revolt. Killed on 16th January 1919.
8	Karl Liebknecht	Leader of the Spartacist Revolt. Killed on 16th January 1919.
9	Wolfgang Kapp	Led the right-wing Kapp Putsch uprising.
10	Charles G. Dawes	An American banker who created the Dawes Plan to resolve Germany's non-payment of reparations.
11	Owen Young	An American banker who led the committee which created the Young Plan, to further help Germany manage reparation payments.
12	Otto Dix	Expressionist painter whose scenes of German life were critical of German society.
13	Erich Mendelsohn	Famous architect—designed Einstein Tower in Potsdam which was very unusual and futuristic.
14	Fritz Lang	Film director famous for *Metropolis* in 1926. A government-funded film about life and technology in the 20th century.
15	Gustav Stresemann	Chancellor between August and November 1923, and foreign secretary from August 1923—1929.

Key Terms		
1	Communism	An extreme form of government, representatives of the workers set up government and take ownership of all land, property and resources in a country.
2	Abdication	A leader, like a King, giving up their throne or position.
3	Constitution	The rules which set out how a country is run.
4	Trade Union	Groups of workers formed to protect workers rights in a variety of jobs.
5	Spartacist	Left-wing uprising against Weimar Republic—supported Communists.
6	Kaiser	The German Emperor.
7	Chancellor	The head of the government in Germany
8	Diktat	The Treaty of Versailles was a Diktat as the terms were imposed on Germany, not negotiated with them.
9	Dolchstoss	'Stabbed in the back' - how Germans viewed the Treaty of Versailles.
10	November Criminals	Leaders of the new German republic who signed the Treaty of Versailles.
11	Freikorps	'Free corps' formed of thousands of demobilised soldiers after WW1.
12	Hyperinflation	Prices went up due to shortages of goods = inflation. The government printed more money, which made prices rise further = hyperinflation.

Half Term 1 – Holidays



Quiz 1.1 Going on holiday present tense

Normalerweise fahre ich mit dem Flugzeug nach…	Normally I fly by plane to…….
Im Herbst / im Frühling…	In autumn / in spring
In den Ferien fahre ich mit dem Schiff nach…….	In the holidays I travel by boat to….
, weil das Wetter immer schön ist	Because the weather is always nice
, weil ich den Strand liebe	Because I love the beach
Ich schwimme gern im Meer	I like to swim in the sea

Quiz 1.2 – Time manner place

Ich fahre mit dem Bus nach Frankreich	I travel by bus to France
Ich fliege mit dem Flugzeug nach Amerika	I fly by plane to America
Ich reise mit dem Schiff in die Schweiz	I travel by boat to Switzerland
Ich fahre mit meiner Familie nach Italien	I travel with my family to Italy
Wir fliegen mit dem Flugzeug nach Spanien	We fly by plane to Spain
Wir fahren mit dem Auto nach Griechenland	We travel by car to Greece

Quiz 1.3 – activities you can do on holiday and places to visit

Ich besichtige die Kirche / die Hauptstadt / das Schloss	I visit the church / capital city / castle
Der Wald ist neben dem Flughafen	The forest is next to the airport
Man kann zum Strand gehen	You can go to the beach
Man kann im Meer schwimmen	You can swim in the sea
Die Gegend hat viel für Touristen	The area has lots for tourists
Das Stadion ist im Stadtzentrum	The stadium is in the town centre

Quiz 1.4 – weather

Es ist sonnig / kalt / heiss	It is sunny / hot / cold
Die Temperatur ist warm	The temperature is warm
Es regnet viel im Frühling	It rains a lot in Spring
Es schneit im Winter	It snows in winter
Es ist sonnig im Sommer und im Herbst	It is sunny in summer and in Autumn

Quiz 1.5 – Past tense activities

Ich habe einen Stadtbummel gemacht	I did a stroll around the town
Ich habe Volleyball am Strand gespielt	I play volleyball on the beach
Ich habe Zeit mit Familie verbracht	I spent time with family
Ich bin im Hotel geblieben	I stayed in the hotel
Wir **haben** Frühstück gegessen	We ate breakfast
Wir **sind** zum Strand gegangen	We went to the beach

Parallel texts

Normalerweise auf *Urlaub* fliege ich mit meiner Familie nach Griechenland. Wir bleiben in einem schönen Hotel mit Freibad. Das gefällt mir, weil ich die Sonne liebe.	Normally on holiday fly I with my family to Greece. We stay in a nice hotel with outdoor pool. The pleases me because I the sun love.
Letzten Sommer sind wir nach Framkreich geflogen. Es war unglaublich, weil das Wetter so sonnig war	Last Summer we to France flew. It was unbelievable because the weather so sunny was
und es hat nicht geregnet. Ich fand den Urlaub entspannend, weil ich gern Zeit mit meiner Familie verbringe.	and it had not rained. and found the holiday relaxing, because I like time with my family spending.
Ich bin zum Strand gegangen und wegen des Wetters bin ich im Meer geschwommen. Der Blick war einfach herrlich! Ich denke, dass mein Familienurlaub unvergesselich war.	I to the beach went and because of the weather I in the sea swam. The view was simply gorgeous! I think that my family holiday unforgettable was.
Nächsten Sommer möchte ich in die Schweiz fahren, um Deutsch zu lernen. Jedoch wenn ich Geld hätte, würde ich an die Ostsee fahren. Das wäre ausgezeichnet!	Next Summer would I like to in the Switzerland travel in order German to learn. However if I the choice had would I in to the Baltic sea travel. That would be excellent!

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Half Term 2 – Holidays

Quiz 2.1 Past tense with Time Manner Place

Ich bin mit dem Flugzeug nach Italien geflogen	I flew by plane to Italy
Ich bin mit dem Auto nach Spanien gereist	I travelled to Spain by car
Ich bin mit meiner Familie mit der Bahn nach Deutschland gefahren	I travelled with my family to Germany by train
Wir sind mit dem Schiff an die Küste gefahren	We travelled by boat to the coast

Quiz 2.2 – Past tense weather

Es war unglaublich warm und sonnig	It was unbelievably warm and sunny
Es hat nie geregnet	It never rained
Es hat geschneit jedoch mag ich den Schnee	It snowed however I like the snow!
Als es heiss war, bin ich zum Strand gegangen	When it was hot, I went to the beach
Das Wetter war jeden Tag herrlich	The weather was gorgeous every day
Wegen des Wetters habe ich gefaulenzt	Because of the weather I lazed around

Quiz 2.3 – Steps to success

obwohl es teuer ist/war	Although it is/was expensive
Meines Erachtens ist das ausgezeichnet	In my opinion it's excellent
Wegen des Wetters	Due to the weather
Die Temperaturen waren empfehlenswert	The temperature was highly recommended!!
Nachdem ich das gemacht hatte, hatte ich	After I had done that, I …
Wenn ich die Wahl hätte, würde ich nochmal hingehen	If I had the choice, I would go there again

Quiz 2.4 - Future / Conditional tense

Ich werde nach Deutschland fahren	I will travel to Germany
Dieses Jahr will ich in die Schweiz fliegen	This year I want to fly to Switzerland
Mein idealer *Urlaub* wäre in Amerika	My ideal holiday would be in America
Ich würde jeden Tag zum Strand gehen	I would got to the beach every day
Wenn ich mehr Zeit hätte, würde ich in die Karibik fahren	If I had more time I would travel to the Caribbean
Wenn ich viel Geld hätte, würde ich nochmal hinfahren	If I had lots of money, I would go there again
Das wäre einfach *unvergesslich*	That would be simply unforgettable

Don't forget to learn from your vocab book regularly!

Parallel texts – 150 word task example

***where you normally go on holiday and what you can do there**

***what you did last year on holiday with your family**

Normalerweise fahre ich mit dem Flugzeug mit meiner Familie nach Spanien, weil das Wetter immer heiss und schön ist. Ausserdem übernachten wir in einem Luxushotel, wo ich mich gut entspannen kann. Unser Hotel liegt direkt am Strand, jedoch befindet sich die Stadtmitte nicht so weit vom Strand, daher können wir alle zusammen mit dem Auto hinfahren. In der Stadt gibt es viele Unterhaltungsmöglichkeiten, zum Beispiel einen Markt und alte Gebäude, die man besichtigen kann. Ausserdem gibt es eine Hauptstraße, Geschäfte, eine alte Kirche und eine Moschee. Es gibt auch viele gute Restaurants, wo Touristen Frühstück oder Abendessen kaufen können. Ich liebe diesen Ort, da es immer beschäftigt ist, deshalb langweilt man sich nie!	Normally travel I with the plan with my family to Spain, because the weather always hot and lovely is. In addition, stay overnight we in a luxury hotel, where I myself well relax can. Our hotel lays directly on the beach, however finds itself the town centre not so far from the beach, therefore can we all together with the car travel there. In the town there are lots of entertainment opportunities, for example a market and old buildings, which one view can. In addition there is a man street, shops, an old church and a mosque. There are also lots of good restaurants, where tourists breakfast or dinner buy can. I love this place, because it always busy is, therefore bores onself never.

Write your own model here

Year 10 French Half-Term 1 – Holidays

Quiz 1.1 – saying where you normally go on holiday

Normally I go to Spain / France / Switzerland	Normalement je vais **en** Espagne / **en** France / **en** Suisse
I travel by boat / by train / by car / by bus	Je voyage **en** bateau / **en** train / **en** voiture / **en** bus/car
we stay in **an apartment** near **the coast**	Nous restons dans **un appartement** près de **la côte**
we lodge in **a castle** in **the Alps**	Nous logeons dans **un château** dans **les Alpes**
I go **on holiday abroad** in order to relax	Je vais **en vacances à l'étranger** pour me relaxer / pour me détendre
I like **to swim** in **the sea in summer.**	J'aime **nager** dans **la mer en été.**

Quiz 1.2 – saying where you went on holiday last year and activities you did

Last year **I went** to America	L'année dernière **je suis allé(e)** aux États-Unis.
We travelled by plane and **it was rapid**	**Nous avons voyagé** en avion et **c'était rapide**
After having arrived, **we explored** the town	Après être arrivés, **nous avons exploré** la ville
We visited the monuments historical	**Nous avons visité** les monuments historiques
I bought a glass as a souvenir.	**J'ai acheté** un verre comme souvenir
We ordered our lunch at a restaurant.	**Nous avons commandé** notre déjeuner au restaurant.

Quiz 1.3 – Holidays in the future

Next year **I would like to travel** to Morocco	L'année prochaine, **je voudrais voyager** au Maroc
I would like to explore the region	**J'aimerais explorer** la région
After my exams I will **go abroad**	Après mes examens je vais **aller à l'étranger**
I want to stay in a hotel luxurious	**Je veux** rester dans un hôtel luxueux
In my opinion **it will be** magnificent...	À mon avis, **ça sera** magnifique...
...because **it will do** hot there	...car **il** y **fera** chaud

Example 90 word task: You are writing a blog about your holiday. Describe

- Your preferred holiday destination
- The activities you did last year
- Where you would like to go on holiday in the future

My favourite holiday destination, it's Spain because it's hot there and I love Spanish cuisine. In addition, I love to travel to the sea in order to relax and get a tan. Last year on holiday we went explored the town and we bought souvenirs. After having done that, we ate in lots of restaurants and swam in the pool In my opinion it was fun. We also visited the monuments historical because we love history. Next year I would like to travel to Italy because I would like to eat cuisine Italian. I intend to stay in a hotel luxury on the beach. In my opinion, that would be magnificent.	Ma destination de vacances préférée, c'est l'Espagne car il y fait chaud et j'adore la cuisine espagnole. En plus, j'adore voyager au bord de la mer pour me relaxer et me bronzer. L'année dernière en vacances nous avons exploré la ville et nous avons acheté des souvenirs. Après avoir fait cela, nous avons mangé dans beaucoup de restaurants et nagé dans la piscine. Je pense que c'était amusant. Nous avons aussi visité les monuments historiques car nous aimons l'histoire. L'anée prochaine j'aimerais voyager en Italie parce que je voudrais manger la cuisine italienne. J'ai l'intention de rester dans un hôtel luxueux à la plage. A mon avis, ça serait magnifique.

Example 150 word task: You are writing to your French friend about holidays. Discuss -

- Where you go and what you normally do on holiday
- Your ideal holiday destination

Normally we go on holiday to France because I love the French culture and I can speak the language. We there travel by boat because it's cheap although it is a long journey. After having arrived, we explore usually the town because there are plenty of monuments historical and I love History, therefore it's an interesting activity for me. After having done that, we eat in a French restaurant to taste the cuisine. For example, last year I ate snails. I would say that it was bad because it was disgusting, however I also ate frogs legs and I found them delicious. My holiday destination ideal would be abroad where it's hot. If I had the money, I would travel to Portugal in summer each year so that I can relax on the beach. Furthermore, I would buy a villa by the sea where there would be a lot of activities to do. As far as I'm concerned, that would be magnificent because I could not only relax but also stay active.	Normalement nous allons en vacances en France car j'adore la culture française et je peux parler la language. Nous y voyageons en bateau vu que c'est bon marché, bien que ça soit un long voyage. Après être arrivés, nous explorons d'habitude la ville car il y a plein de monuments historiques et j'adore l'histoire, donc c'est une activité intéressante pour moi. Après avoir fait cela, nous mangeons au restaurant français pour goûter la cuisine. Par exemple, l'année dernière, j'ai mangé des escargots. Je dirais que c'était mauvais car c'était dégoûtant, toutefois, j'ai aussi mangé des cuisses de grenouilles et je les ai trouvées délicieuses. Ma destination de vacances idéale serait à l'étranger où il fait chaud. Si j'avais de l'argent, je voyagerais au Portugal en été chaque année pour que je puisse me relaxer à la plage. D'ailleurs, j'achèterais un villa au bord de la mer où il y aurait beaucoup d'activités à faire. En ce qui me concerne, ça serait magnifique vu que je pourrais non seulement me relaxer, mais aussi rester actif/ve.

Year 10 French Half-Term 2 – Holidays

Quiz 2.1 – weather

En été, **il y a** toujours **du soleil** en Espagne.	In summer, **there is** always **sun** in Spain.
Je déteste **la pluie**!	I hate **the rain**!
En vacances normalement **il fait chaud**.	On holiday usually **it is hot**.
L'année prochaine dans les Alpes **il neigera.**	Next year in the Alps **it will snow.**
Il y fera froid.	**It will do cold** there.
L'été prochain **il y aura du vent.**	Next summer **there will be wind.**

Quiz 2.2 – holiday accommodation

Normalement je reste dans **un hôtel** dans **l'ouest** de **la France.**	Normally I stay in a **hotel** in the **West** of **France.**
L'accueil est toujours chaleureux.	The **welcome** is always warm.
De **la chambre** je peux voir **la piscine, la mer** et **la plage.**	From **the bedroom** I can see **the pool, the sea** and **the beach.**
Il y a aussi **une belle vue** du **jardin.**	There is also a **beautiful view** of the **garden.**
Dans mon **hôtel** il y a un restaurant où on peut manger le **dîner.**	In my **hotel** there is a restaurant where you can eat **dinner.**
L'année prochaine je voudrais rester dans **une auberge de jeunesse.**	Next year I would like to stay in **a youth hostel**.

Quiz 2.3 – PALMCOW

Sur la photo il y a.../je peux voir...	In the photo there is.../I can see...
Ils sont contents.	They are happy.
Ils sont en vacances.	They are on holiday.
À mon avis, ils visitent la ville.	In my opinion, they are visiting the town.
Il y a du soleil.	It is sunny.
Sur la photo il ya un homme, une femme et un enfant.	In the photo there is a man, a woman and a child.

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Absolute BTEC PE- Component 3 LAA

A1 Physical Components of Fitness

1.Component	Explanation	Suitable Sport or PA
Aerobic Endurance	The ability to exercise at moderate intensity for extended periods of time.	Events/sports lasting more 30 minutes.
Muscular Endurance	The ability of a given muscle to exert force, consistently and repetitively, over a period of time	Events/sports lasting more 30 minutes.
Muscular Strength	The ability of a muscle to exert a maximal or near maximal force against an object.	Activities requiring force, e.g., throwing events
Flexibility	The ability of a joint or series of joints to move through an unrestricted, pain free range of motion.	Activities requiring a wide range of movement around a joint, e.g., gymnastics, martial arts.
Body Composition	The percentage of fat, bone, and muscle in your body.	Low body fat: gymnastics, long distance running. High muscle mass: sprinters, power activities.
Speed	The ability to move the body in one direction as fast as possible.	Activities requiring fast movement, e.g., sprinting

Absolute BTEC PE- Component 3 LAA

A1 Skill Related Components of Fitness

2.Component	Explanation	Suitable Sport or PA
Power	The product of force multiplied by distance, divided by time.	Activities requiring explosive movement e.g., gymnastics, basketball.
Agility	The ability to rapidly change body direction, accelerate, or decelerate.	Activities requiring quick changes of direction, e.g., dodging the opposition in a team game, freestyle skiing.
Co-ordination	The body's ability to perform smooth and efficient movements	Any activity requiring the movement of two or more body parts and can include the use of sporting equipment, e.g., hand, eyes, and tennis racquet to connect with the tennis ball.
Balance	The ability to retain the centre of mass above the base of support when stationary (static balance) or moving (dynamic balance).	An activity requiring the control of the distribution of weight or to remain upright and steady.
Reaction time	How fast an athlete can respond to stimulus.	Any activity where a quick decision or response to a stimulus is needed.

Principles of Training		
Frequency	The number of training sessions completed over a period of time, usually per week. How often.	e.g. Training muscular strength 2/3 sessions a week
Intensity	How hard an individual will train.	e.g. working at 90% HR therefore training anaerobically.
Time	How long an individual will train for.	60 minute session.
Type	The method of training or exercises to meet the requirements.	Weight training to improve strength

A2 Additional Principles of Training		
Progressive Overload	In order to progress, training needs to be demanding enough to cause the body to adapt, improving performance.	Extra stress is needed on the bodies system for adaptations to take place.
Specificity	Training should meet the needs of the sport, or physical/skill-related fitness goals to be developed.	To ensure that the correct component of fitness is being trained so that improvements take place.
Individual Differences	Training should meet the needs of an individual.	For example if they are older or overweight you will need more low impact exercises.
Adaptations	Changes to the body due to increased training loads.	e.g. increasing your strength through a weight training programme.
Reversibility	If training stops, or the intensity of training is lowered, fitness gains from training is lost.	Overtraining, when too much training takes place can cause injury. When you stop training muscle mass can be lost.
Variation	Altering types of training to avoid boredom and maintain motivation to train.	Keep motivation and enjoyment. Less likely to become bored. Provides challenges. Reduces injury through using the same muscles.
Rest and Recovery	To allow the body to recover and adapt.	To prevent injury, ensure training adaptations take place, recover before the next session.

A3 Measurements/ Calculations and Formulas

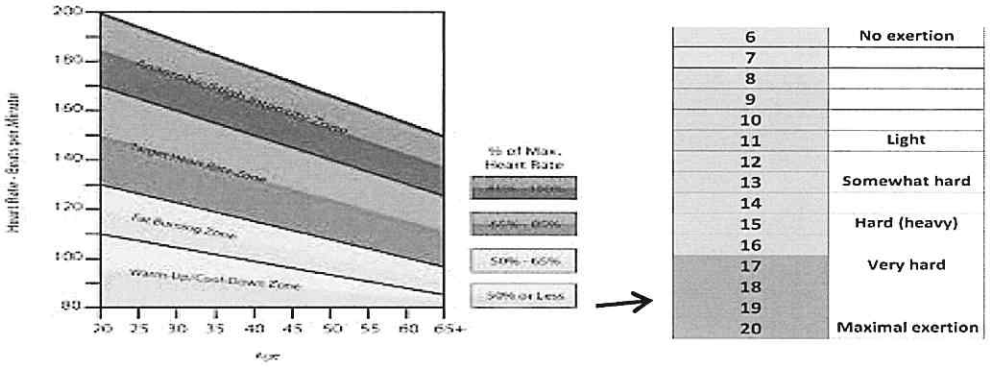
Intensity	
HR- How many times the heart beats within a minute, Beats Per Minute (BPM)	Count radial pulse with two fingers For 15 seconds x 4 = HR
Max HR- An average of what someone's maximum heart rate is depending on their age.	220- Age = Max HR
Training Zones- The target ranges (of heart rate, pace or perceived exertion) that will be used to prescribe workout intensity	MAX HR Divided by 100 x the training zone % Example 16 year old – 204/100 x 85 = 204/100 x 65 =
Strength and Endurance Calculation	
1RM (1 Repetition Max) Used to measure muscular strength	How much weight can be lifted in one repetition.
15RM (15 Repetition Max) Used to measure muscular endurance	How much weight can be lifted in fifteen repetitions.
Borg Scale- Rating of Perceived Exertion (RPE) Scale	
Borg Scale is a way of measuring physical activity intensity level. Perceived exertion is how hard you feel like your body is working.	Rate yourself on a scale of 6-20 depending on your perceived exertion. This value is then x10 for example 12on the scale would equal 120BPM.

Used to:

Monitor Heart Rate- Record Calories- Energy usage- Identify Training Zones

A3 Target Zones

Anaerobic Training Zone 85%-100%	Used for improving speed, power, muscular strength
Aerobic Training Zone 65%- 85%	Used for improving aerobic endurance and muscular endurance



Technology to Measure Exercise Intensity

Heart Rate Monitors	
Smart Watches	
Apps	

Investigate IMPORTNACE of fitness testing to determine fitness levels

B1 Reasons for Fitness Testing

1. **Gives baseline data:** If an athlete completes a test at the beginning and then at the end of their training programme, they can monitor their performance and see if they are improving.
2. **Design training programmes:** Athletes and coaches can use the results of fitness test and plan training programmes specifically to improve their weaknesses.
3. **Determine if training programmes are working** Tests can be used as a mid-point in training programmes.
4. **Results can give a performer something to aim for:** They can provide goal setting aims and give them motivation to improve.

B1 Pre-Test Procedures

1. **Calibration of equipment:** Equipment should be checked for wear and tear and damage; measuring must be completed with a tape measure and secured do the distance doesn't change throughout the test.
2. **Complete informed consent:** Informed consent is completed by the participant and allows them to understand what and how they will be tested and know they can remove themselves from the test at any time.
3. **Complete physical activity readiness questionnaire (par-q):** This is completed to ensure the participant is fit and healthy to take part in the test.
4. **Participant pre fitness test check e.g. Prior exercise participation:** This includes checking jewellery, clothing, trainers and completing a warmup.

B1 Validity of Results

1. Validity refers to whether a test measures what it aims to measure. If we are aiming to test flexibility however when we are performing the sit and reach and bending our legs the test becomes invalid.
2. Often in our tests to ensure it is valid we perform the test three times to see if we are getting similar results each time.
3. For example, the standing long jump can be completed three times and the highest score taken. However, this cannot happen with the copper run due to the length of the test and the impact it will have on the reliability of the test as the participant will be tired during the second and third time.

B1 Reliability of Test

B1 Factors affecting reliability:

1. **Calibration of equipment:** For example, if person administering the test has not measured out the 400m Cooper run correctly, when the athlete uses the nominal data their scores will be incorrect.
2. **Motivation of the participant:** If the participant is unwell or isn't trying their best, they will not receive accurate results.
3. **Conditions of the testing environment (inside versus outside conditions)** If the ground is wet when testing agility, it will be hard for the participant to change direction without falling over.
4. **Experience of the person administering the test – compliance with standardised test procedure.** If the administrator stops the stopwatch at the correct time the results will be incorrect.

B1 Absolute BTEC PE - Component 3 LAB

B1 Practicality

1. **Cost:** Specialist equipment and facility hire can be expensive to carry out the tests.
2. **Time taken to perform the test:** Tests like the cooper run and multistage fitness test can take a long time to perform.
3. **Time taken to set up the test:** Measuring for test such as the Cooper run, Sprint test and Illinois test can be difficult and time consuming.
4. **Time taken to analyse data:** Collecting and analysing large cohorts of data can be very time consuming and if you are conducting more than one type of test.
5. **Number of participants:** Some tests require specific equipment and if you have 30 participants to complete the test however on one piece of equipment this is not practical.

B1 Interpretation of Fitness Test Results

In your exam you will need the following skills

1. To be able to compare results to normative published data: normative data is results taken from people of similar ages and finding out what the average norm is for that age and sex. For Example normative data for the cooper run, female and a range of ages. Not all tests have normative data is they aren't common/ popular tests

Age	Excellent	Above Average	Average	Below Average	Poor
13-14	>2000m	1900-2000m	1600-1899m	1500-1599m	<1500m
15-16	>2100m	2000-2100m	1700-1999m	1600-1699m	<1600m
17-20	>2300m	2100-2300m	1800-2099m	1700-1799m	<1700m
20-29	>2700m	2200-2700m	1800-2199m	1500-1799m	<1500m
30-39	>2500m	2000-2500m	1700-1999m	1400-1699m	<1400m
40-49	>2300m	1900-2300m	1500-1899m	1200-1499m	<1200m
>50	>2200m	1700-2200m	1400-1699m	1100-1399m	<1100m

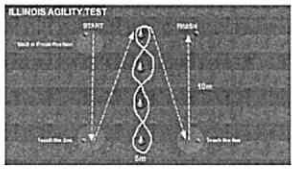
2. Analyse and evaluate test results: Understanding where an athlete's success and weaknesses are based on the results of their tests.

3. Make recommendations for improvements to fitness performer based on test results: This could be a specific type of training which is linked to the

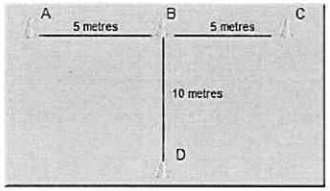
B2 Absolute BTEC PE - Component 3 LAB:

Fitness test methods for components of Skill-related fitness

Agility



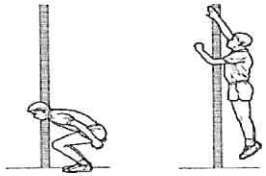
Illinois agility run test



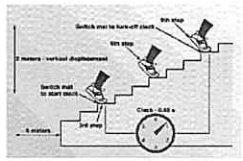
T Test

The Illinois and T test are used to examine the participant's ability to change direction at speed and remain in an upright position.

Power



Vertical Jump Test

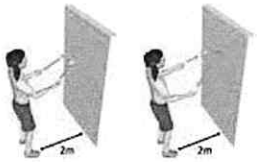


Margaria- Kalamen Test

Standing Long/Broad Jump

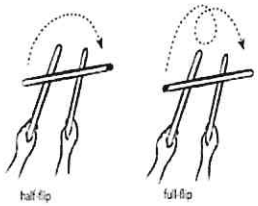
These tests are used to examine explosive movements of the legs.

Coordination



Alternate hand wall toss test.

30 seconds



Stick flip test

These tests are used to examine the participants ability to move two or more body parts at the same time smoothly and efficiently, to allow effective application of technique, such as catching the ball or stick.

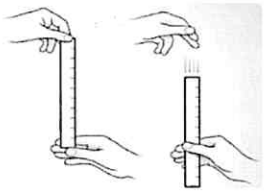
Balance

Y balance test

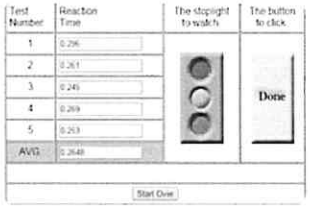
Stork Stand test

These tests are used to examine the participants ability to maintain centre of mass over the base of support, useful to maintain positions in performance sports (static balance) or when on the move in any other sporting examples (dynamic balance).

Reaction Time



Ruler drop test



Online reaction time test

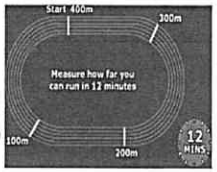
These tests are used to examine how quickly the athlete can respond to a stimulus. In one test the ruler is the stimulus and the quicker athlete catches the ruler. The stimulus on the online test are the lights and the computer examines the speed in which the athlete presses the button.

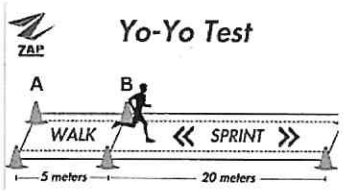
B3 Absolute BTEC PE - Component 3 LAB:

Fitness test methods for components of Physical fitness

Aerobic Endurance

Multistage Fitness test/ 12 min cooper run/ Harvard step/ Yo yo Test





These tests are used to examine the participants ability of the cardiovascular system to provide the muscles with nutrients and oxygen over a long period of time.

Flexibility

Calf muscle flexibility test

Sit and reach test

Shoulder flexibility test

Each of these tests are used to examine the range of movement at a joint, shoulder hip and ankle joint. There is a range of tests as different sports require flexibility in different joints in the body.

Muscular Endurance

Timed Plank

Sit up Test

Press up Test

Each test examines how many times the different muscles groups can contract in a length of time.

Body Composition

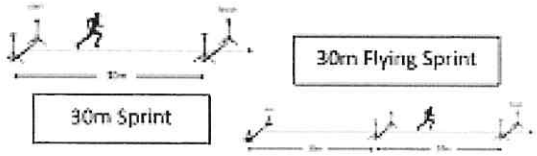
Muscular Strength

Hand Grip Dynamometer

1 Rep Max

These tests are done to examine the amount of force that can be applied against a resistance. For example, the dynamometer tests for strength of grip lower arm and bicep muscle. 1RM test the maximum weight lifted in 1 repetition.

Speed



Two test which both examine distance divided by time to reduce the time taken to move the body or body parts. In this case the fast movements of the arms and legs.

30m Sprint form standing start.

The flying sprint tests the athlete at full speed.

Fitness training methods for physical components of fitness

Appropriate physical fitness training methods that could be used for specific sports participants for different ages and different sporting abilities

Flexibility			**Muscular Endurance**		
Static Active	The performer applies internal force to stretch and lengthen the muscle	Quadricep stretch 	Free weights	High repetitions and low loads	e.g. Bicep curl 10 kg X 15 reps
Static Passive	Requires the help of another person or an object, e.g. A wall to apply external force causing the muscle to stretch	Wall calf stretch 12-20 seconds 	Fixed resistance machines	High repetitions and low loads	e.g. Squat 20 kg X 20 reps
Proprioceptive Neuromuscular Facilitation (PNF)	The technique involves the use of a partner or immovable object, isometric muscle contractions to inhibit the stretch reflex.		Circuit training	Using body resistance exercises or weights with low loads and high repetitions.	Series of different exercise stations can be made sport specific E.g. Press ups, sit ups , squats and lunges.
Muscular Strength Training			**Speed**		
Free Weights	High loads and low repetitions	e.g. Bicep curl 15 kg X 6 reps	Acceleration Sprints	Pace is gradually increased from a standing or rolling start to jogging, then to striding, and then to a maximal sprint	Long jumper run up 
Resistance Machines	High loads and low repetitions	e.g. leg press 60 kg X 6 reps	Interval Training	Work period followed by a rest or recovery period. For speed short, high intensity work periods, increasing the number of rest periods and increasing work intensity.	100m 
Aerobic Endurance			Resistance Drills	Hill runs, parachutes, sleds, bungee ropes, resistance bands	Rugby players 
Continuous Training	Steady pace and moderate intensity for a minimum period of 30 minutes	Jogging 30 minutes on a treadmill between 60-80% Ma HR.			
Fartlek Training	The intensity of training is varied by running at different speeds and/or over different terrain	Jogging 10-minute, sprint 1 minute, run 2 min repeat for 30 minutes.	**Aerobic Endurance**		
Interval training	Work period followed by a rest or recovery period o for aerobic endurance decrease the number/length of rest periods and decrease work intensity (compared to speed training)	Netball players walking back into position after a team has scored.	Circuit Training	Use of a number of stations/exercises completed in succession with minimal rest periods in between to develop aerobic endurance.	Step ups. Shuttle runs and skipping to develop aerobic endurance with minimal rest.

Fitness training methods for skill related components of fitness

Agility		
Speed Agility and Quickness training (SAQ)	drills used to develop physical ability and motor skills.	A football agility SAQ course with changes of direction
Co-ordination		
Co-ordination Training	Use of specific training exercises using two or more body parts together.	Hand eye- coordination moving the tennis racket to the tennis ball at the right time.
Balance		
Dynamic Balance Training Static Balance Training	Use of specific training exercises that require balancing on a reduced size base of support. 	e.g. lunging, standing on one leg and kicking, single leg lunging.  e.g. Handstand, yoga, gymnastics, Pilates.

Power		
Plyometrics Training	lunging, bounding, incline press-ups, barrier hopping and jumping.	Hopping/ bounding/ two footed jumps
Reaction time		
Reaction Time Training	Use of specific training exercises to practise quick responses to an external stimulus.	Sprinter responding quickly to the sound of a gun in a sprint start.

C4: Choosing training methods

- Demands of the sport: focus on area of sport or components of fitness involved.
- Cost of equipment: specialist equipment may be needed such as fixed resistance machines.
- Location of training: specific facilities may be needed such as swimming pool.
- Ease of set up: some methods involve setting up e.g. circuit training
- Number of participants: may be limited amounts of space to access

C5: Provision for taking part in fitness training methods

Type of provision	Explanation	Advantages	Disadvantages
Public sectors	include local authorities and school provision	-Funded by local council -Low cost -Accommodate large groups	-Lack of equipment -Poor facilities
Private sector	provided by organisations who aim to make a profit	-specialist services -latest training equipment	-expensive to join -members pay month or yearly -Aime at certain groups of people other than public
Voluntary sector	activities provided by volunteers who have a common interest in the participant.	-fitness or competitive sports -low cost -coaches usually have experience	-opportunities in only one sport -Basica facilities or equipment -Limited training times as they normally don't own the facility.

The effects of long-term fitness training on the body systems

How training methods affect the different body systems, which can lead to adaptations to improve specific components of fitness.

Aerobic Endurance Training:

- Adaptations to the cardiovascular and respiratory systems
- Cardiac hypertrophy
- Decreased resting heart rate
- Increased strength of respiratory muscles
- Capillarisation around alveoli.

Flexibility Training:

- Adaptations to the muscular and skeletal systems
- Increased range of movement permitted at a joint
- Increased flexibility of ligament and tendons
- Increased muscle length.

Muscular Endurance Training:

- Adaptations to the muscular system
- Capillarisation around muscle tissues increased muscle tone.

Muscular Strength and Power Training:

- Adaptations to the muscular and skeletal systems
- Muscle hypertrophy
- Increased tendon and ligament strength
- Increased bone density.

Speed Training:

- Adaptations to the muscular system
- Increased tolerance to lactic acid.

Requirements for Each of the Following Fitness Training Methods

To ensure a fitness training plan is carried out safely and effectively it must include the following.

- **Warm-Up:** prior to taking part in the fitness training method – pulse raiser- increase heart rate and body temperature, mobility- increase range of movement and stretch; reduce the risk of injury, prepare the body for exercise.
- **Cool Down:** after taking part in the fitness training method – gradually lower pulse and breathing rate to resting levels; remove lactic acid; stretch to help return muscles to pre-exercise length.
- **Fitness Training Method:** linked to the associated component of fitness.
- **Application of the basic (FITT) and additional principles of training:** to each fitness training method.
- **Application of appropriate training intensities**: to fitness training methods.

Additional requirements for each of the fitness training methods

Advantages and disadvantages

- To include number of people that can take part
- Cost of equipment
- Ease of set up, access to venue/location of training
- Risk of injury to the performer if performed incorrectly, effectiveness of training for given sports performer
- Specificity to component of fitness
- Replicating demands of the sport

D Absolute BTEC PE - Component 3 LAC

D1 Personal Information to Aid Training Fitness Programme Design

Aims – details of what they would like to achieve for the selected sport.

Objectives – how they intend to meet their aims using an appropriate component of fitness and method of training.

Lifestyle and physical activity history.

Attitudes, the mind and personal motivation for training.

D2 Use Personal Information to Aid Training Programme Design.

Selection of appropriate training method/activity for improving/maintaining the selected components of physical and/or skill-related fitness.

Application of the FITT principles and additional principles of training.

D3 Motivational Techniques for Fitness Programming

Motivation – the internal mechanisms and external stimuli that arouse and direct behaviour.

Two types of motivation:
Intrinsic- From within e.g. I want to go to the gym because its good for me.
Extrinsic – from the outside e.g. Rewards

Principles of setting goals to increase and direct motivation.

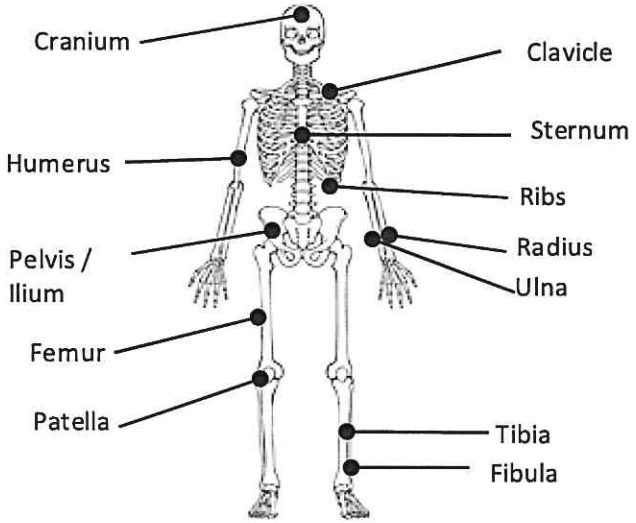
Personal goals – (SMARTER):
Specific: The goal must be specific to what you want to achieve, e.g. I want to improve upper body strength
Measurable: Goals must be stated in a way that is measurable, I want to increase my chest press 1RM to 100kg.
Achievable: The person has to have access to training and the time to take part in it in order to meet the goal.
Realistic: It must be possible to actually reach this goal and not expect improvements beyond what can be achieved in the time frames and current fitness or ability or ability level of the person setting the goals.
Time: Their must be a set time or deadline on the goal. This means you can review your success. It is best you put the date you wish to achieve the goal by.
Exciting: The goal must be something the person really wants to achieve and have an impact on their sports performance in order for them to be motivated to attend their regular training and work hard while training to achieve the goal.
Recorded: The results should be written down so the performer can see how close they are to achieving their goal and how long it takes to reach it

Goals:
Short-term goals (set over a short period of time, between one day and one month)
Long-term goals (what they want to achieve in the long term, and the best way of doing this).

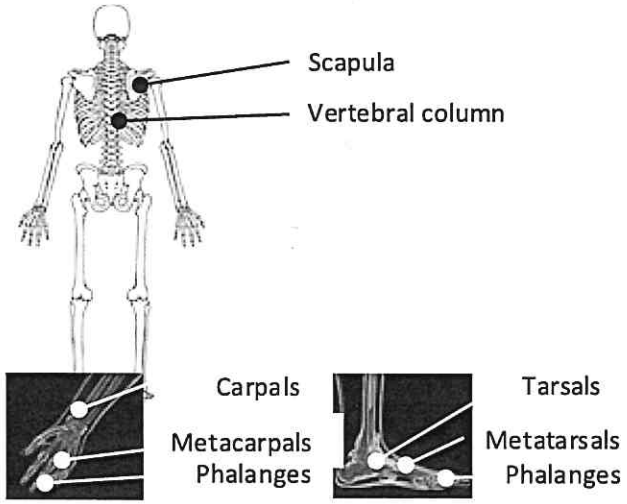
- Influence of goal setting on motivation: Provide direction for behaviour, maintain focus on the task in hand
- Benefits of motivation on the sports performer: Increase participation
- Maintain training and intensity Increased fitness Improved performance.

PAPER 1 **ALL SAINTS' ABSOLUTE 1.1 GCSE Physical Education – The structure and functions of the skeletal system**

1. Structure of the skeletal system



Structure of the skeletal system



3. Synovial Joints

These are **freely movable** joints where the joint surfaces are covered in **cartilage**, they are connected by a fibrous tissue capsule (joint capsule) and lined with fluid (synovial fluid).

Synovial membrane – secretes the synovial fluid

Synovial fluid– found within the joint capsule to prevent friction between the articulating bones

2. Function of the skeleton

Support - It gives the body **support**, enabling us to stand. The bones of the body are held together by **ligaments**. The skeleton provides a framework for the muscles, which are attached to bones by **tendons**.

Posture- The skeleton acts as a framework. Muscles are firmly attached to bones forming our body shape and holds us upright.

Movement - to allow **movement** of the body – by providing areas or sites for muscle attachment. This also provides for a system of levers that helps us move.

Protection - to give protection to the vital internal organs – such as heart, lungs, spinal cord and the brain. For example, the cranium protects the brain when heading a football.

Blood cell production – The ends of long bones and some other bones eg the ribs, humerus, femur and even vertebrae bones, contain red bone marrow. This is where the red blood cells are produced which carry oxygen.

Storage of minerals – such as phosphorous, calcium, potassium and iron. Iron helps in the transport of oxygen to working muscles and calcium is needed to

4. Key Terms : Cartilage: This is a soft connective tissue. The role of cartilage is to reduce friction and act as a shock absorber for the joint. This is important for athletes, for example a Triple jumper to protect the joint on landing. Another example is *It helps act as a shock absorber when applying a large force when tackling in football. In long distance running, not having fiction will allow the joint to move smoothly.*

Ligaments – attaches bone to bone to add joint stability. When performing a bicep curl they stabilises the joint. (keeps the joint together)

Tendons – attaches muscles to bone and contributes to joint movement as a result of muscle contraction. They help transmit the power needed to move bones. E.g. when extending the knee the quadriceps contract. It also pulls on the bone to create movement. Ligaments and tendons become more pliable meaning they are flexible/elastic or can stretch.

5. Synovial Joint 1: Ball and Socket joint

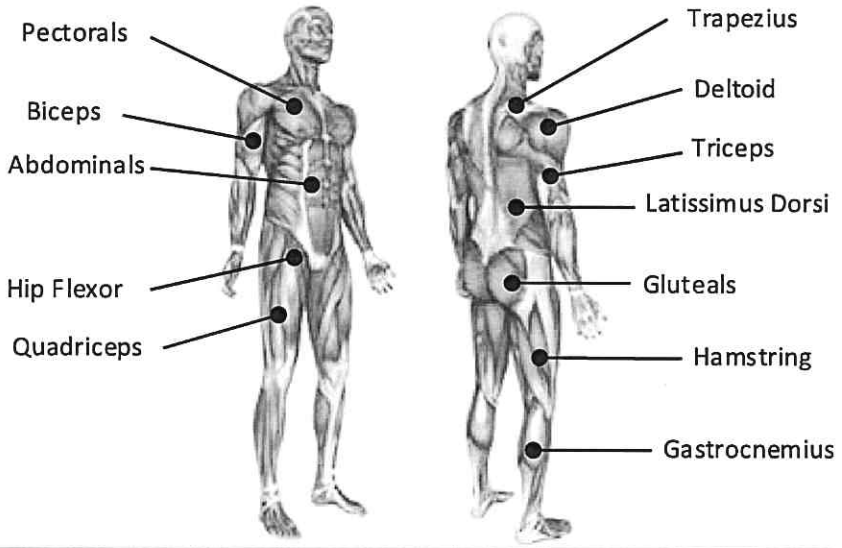
Movement	Practical example at the shoulder/ Hip
Flexion	Shoulder: Lifting the arms out of the water during the backstroke in swimming.
Extension	Hip- A rugby player extends the hip in preparation for kicking through the ball, to get maximum power.
Rotation	Shoulder-A tennis player uses external rotation at the shoulder joint during the backswing of the serve.
Abduction	Hip- A gymnast with her leg lifted to the side of the body shows abduction
Adduction	Shoulder- A rugby player tackling another player will hold on to the player by adducting their arms as they tackle.
Circumduction	Shoulder- A swimmer during the front crawl arm action will take their arm out and round and back into the water. Circumduction is a combination of rotation, adduction, abduction, flexion and extension

6. Synovial Joint 2: Hinge Joint

Type of movement	At the knee: Femur– Tibia	At the elbow : Humerus– Ulnar/ Radius
Flexion- Reduced angle of a joint.	Bending your leg at the knee when preparing to make a pass in football.	Bending your elbow joint when lifting a dumb bell in a bicep curl.
Extension- Increased angle at a joint.	When a basketball player drives up to the basket from bent legs to straight, extension occurs at the knee	When making a basketball set shot the elbow straightens as you release the ball and extension occurs at the elbow joint.

PAPER 1 ALL SAINTS ABSOLUTE 1.2 GCSE Physical Education – The structure and functions of the muscular system

1. Structure of the muscular system



Tips: You must know all muscles, including a sporting example for each.
For example the deltoid causes abduction of the shoulder, when performing the outward action of a star jump.
The quadriceps created extension, when striking a football.

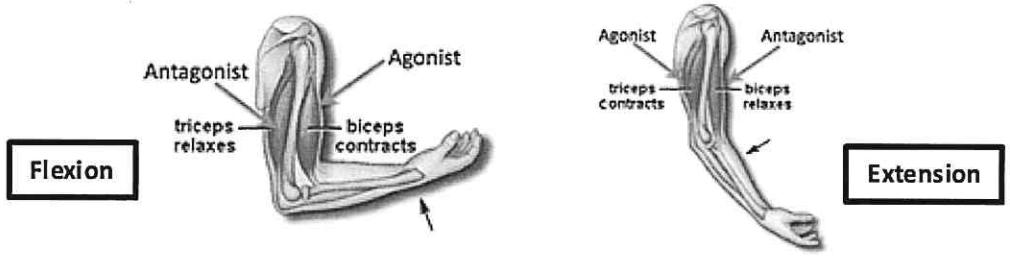
Key terms

1. **Tendon-** Tough tissue connects muscle to bone. When the muscle contracts it pulls the bone to create movement
2. **Hypertrophy-** Increase in size of skeletal / Cardiac muscle. Develops through strength training.

The **short term effects** of exercise on the muscles:

1. Working muscles produce heat
2. Increased muscle fatigue due to lactic acid accumulation
3. Blood is re-distributed to working muscles (blood shunting)
4. Increase in cross sectional size

2. Antagonistic pairs - Muscles are arranged in antagonistic pairs.
As one muscle contracts (shortens) its partner relaxes (lengthens) *i.e. Biceps and Triceps.*



Agonist = the muscle that contracts to produce movement.
Antagonist = the muscle that relaxes to allow the movement to occur.
Fixator = Stabilises joint / body part / limb **OR** assists agonist to work effectively **OR** prevents unintended movements

Examples in the body:

- Biceps & Triceps
- Quadriceps & Hamstring
- Hip Flexor & Gluteus Maximus

3. The roles of muscles in movement

To produce movement muscles either shorten, lengthen or remain the same length when they contract. Muscles work in pairs: as one muscle contracts, the other relaxes. Muscles that work together like this are called **antagonistic pairs.** This type of action enables the body to move with stability and control.

4. Examples of antagonistic pairs

Example: When a darts player prepares to throw a dart he decreases the angle at his elbow joint (flexion). When his elbow is bent the biceps are the agonist and triceps are the antagonist.
When he releases the dart he increases the angle at his elbow joint (extension). When his arm is straight the triceps are the agonist and the biceps are the antagonist.

Hamstrings and quadriceps – at the knee joint, which is a hinge. The hamstrings contract and the quadriceps relax and the knee joint flexes. As the knee joint extends, the quadriceps (quads) contract and the hamstrings relax. E.g. when performing a free kick in Football.

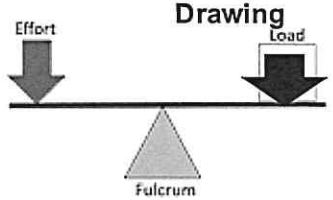
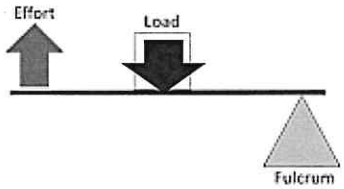
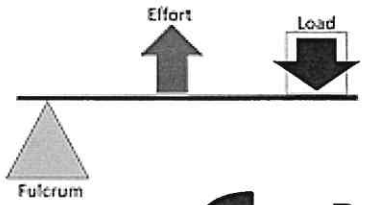
Link of the muscular and skeletal system – both systems work together to produce movement. *i.e. a contracting muscle pulls on a bone which changes the angle at a joint.*

PAPER 1 ALL SAINTS' ABSOLUTE 1.3 GCSE Physical Education – Movement analysis

1. Levers – Levers are important in movement because they allow efficiency and force to be applied to the body's movements.

Fulcrum (F)	Effort (E)	Load (L)
A fixed pivot point	The source of energy that will be applied	The weight/resistance to be moved

2. Classes of lever

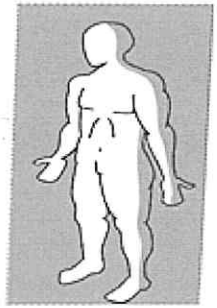
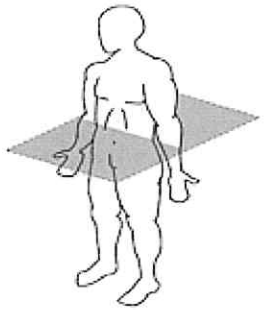
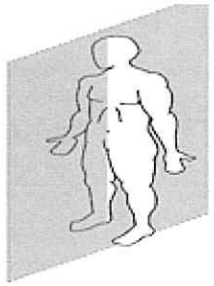
Example	Drawing	
First class lever:		E.g. The neck joint when heading a ball in Football
Second class lever:		E.g. The ankle joint when kicking a football with your ankle or Striking a take off board in long Jump.
Third class lever:		E.G The elbow joint when performing a bicep curl. Extension of the knee when kicking a ball.

Remember FLE-1,2,3

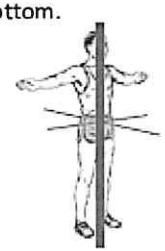
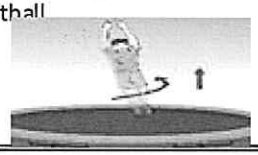
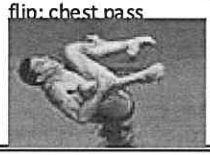
Mechanical advantage The ability to move large loads with a small amount of effort.
The effort arm for the lever must be longer than the load arm.
- All 2nd class lever systems have MA
- 1st class levers can have MA if the fulcrum is nearer the load than the effort
- 3rd class levers do not have MA

Example description:
First class levers – the fulcrum (sometimes called the pivot) is located between the effort force and the load force on the lever arm which are acting down. An example of this type of lever is the neck joint.
Practical example: At the neck – heading a ball in football.

3. Planes – imagery lines that divide the body into two.

Frontal plane Front to back	Transverse plane Top to bottom	Sagittal plane Side to side (L to R)
A vertical plane but this divides the body into **Front** and **back. Creates Abduction and Adduction e.g. jumping jacks, star jumps, cartwheel.** 	A horizontal plane that divides the body into **upper** and **lower** halves. Creates rotation. e.g. bowling in cricket, full twist in trampolining. 	A vertical plane that divides the body into **right** and **left** sides. Creates flexion and extension e.g. kicking, running, lunging, bicep curl, sit ups, forward roll, football throw in, squats, deadlifts. 

4. Axes – imagery lines that the whole body turns around. **Remember:** Axis must pass through centre of body.

Frontal axis	Longitudinal axis	Transverse axis
Runs through the body horizontally from the back to front.  Example: Cartwheel 	Runs through the body vertically from the top to bottom.  Example: Full twist, log roll, spinning kick, pirouette, spin in ice skating, pivot in netball 	Runs through the body horizontally from the left to righ  Example: Flexion/extension e.g. Somersault; forward/backward roll; kicking a ball; front/back flip; chest pass 

PAPER 1 ALL SAINTS ABSOLUTE 1.5 GCSE Physical Education – Short Term effects of exercise

The **short term** effects are what happens to the body's systems as we exercise.

Muscular system

1. The immediate effects of exercise on the muscular system involve an increase in the temperature of muscles and metabolic activity or metabolism.
2. There is also an increase in the production of lactic acid in the muscles depending on the type of exercise. This increase in the production of lactic acid is a result of prolonged high-intensity exercise when there is a lack of oxygen in the muscles.
3. Increase rate of diffusion in the capillaries
4. Increase speed of contraction

The respiratory system

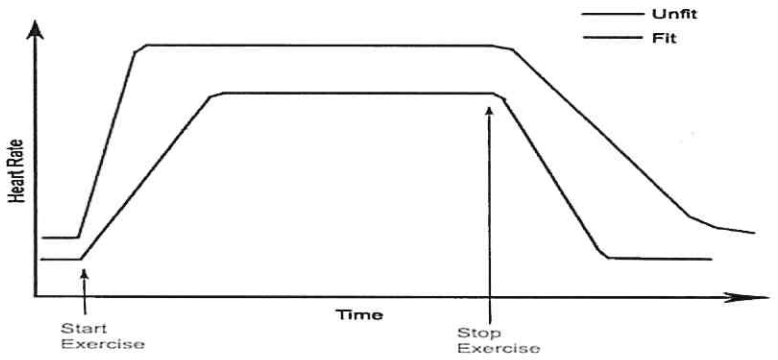
1. The short-term response of the respiratory system to exercise includes a rise in the respiratory rate (breathing rate) due to the body's demands for more oxygen.

2. Respiratory / intercostal / diaphragm muscles work harder / contract stronger / contract faster

3. Tidal volume (TV) also **increases** during exercise or increased breathing depth. This is the volume of air either inspired or expired per breath.

4. Minute ventilation/volume also **increases** during exercise- This is the volume of air that is inspired and expired in one minute.

5. Increase in gaseous exchange/diffusion.



The cardiovascular system

1. In the short term, the heart rate is raised just before exercise and will increase during exercise to ensure that there is enough supply of oxygen to the working muscles and that waste products, such as carbon dioxide, are removed.
2. The raising of the heart rate before exercise is called the anticipatory rise.
3. When exercise begins the heart rate will rise rapidly. As exercise continues, the heart muscle also becomes warmer.
4. Increase Cardiac output
5. Increase Stroke volume
6. Increases blood flow/oxygen transport to (working) muscles directs blood away from other organs OR less blood to other organs
7. Increase in blood pressure due to the increase in demand for oxygen (from the working muscles)
8. Increase in blood lactate/lactic acid/CO_2 because muscles are working
9. Blood temperature increases
10. Vascular shunt **OR** vasodilation of blood vessels to muscles **OR** vasoconstriction of blood vessels to other organs **OR** less blood to other organs
11. Blood vessels near skin dilate.

When exercise stops, the heart rate will fall rapidly and the level of adrenaline falls, along with a drop in temperature of the heart. The heart rate then returns to around its pre-exercise rate.

During exercise, the working skeletal muscles require more and more oxygen. The increase in stroke volume, cardiac output and heart rate enables more oxygen to be delivered, but this is often not enough and therefore the vascular shunt mechanism takes effect.

Key Vocabulary

1. Anticipatory rise- This is the raising of the heart rate before exercise begins. It is caused through the release of adrenaline, which is a hormone.
2. Adrenaline- This is a hormone released from the adrenal glands and its major action is to prepare the body for 'fight or flight'.
3. Vascular shunts- Occur when more blood is distributed to the working muscles and less to the non-essential organs. The vascular shunt mechanism involves two processes. When exercising 80% of the blood will be shunted to the working muscles, and 20% to the organs. This is due to the demand of oxygen required.

-> The graph to the left demonstrates the change in HR for a fit and unfit person.

Lactic acid can cause fatigue and tiredness, pain/soreness/discomfort or aches in muscles and a decrease in performance/ causes pain or soreness/ decrease performance.

PAPER 1 ALLSAINTS ABSOLUTE 1.5 GCSE Physical Education – Aerobic/Anaerobic and long term effects of exercise

1. Aerobic and Anaerobic exercise – two methods of energy production by the body (Energy: the capacity to do work)
Two factors determine which method is used: **Intensity & duration**

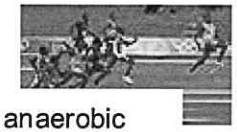
2. Aerobic energy production – takes place in the presence of oxygen

glucose + oxygen ⟹ energy + carbon dioxide + water

Exercise intensity is moderate/low and continuous for 3+minutes, oxygen is used with no oxygen debt and lactic acid not produced. E.g. marathon runner, triathlon, long distance cyclist.
Aerobic capacity - Ability to take in and use oxygen / ability of (heart and lungs) to get oxygen to the muscles **OR** the ability to continuously exercise without tiring.

3. Anaerobic energy production – takes place in the absence of oxygen

glucose ⟹ energy + lactic acid



Short bursts of exercise for up to 30 seconds. Intensity of anaerobic activity is high as muscle contraction are powerful & quick time. No or little oxygen used and oxygen debt is created as a result lactic acid is produced. E.g. *100m sprinter/long jump/50m swimmer* ***or*** long jump, triple jump, high jump **or** javelin, shot, discus, hammer **or** pole vault

4. Cardiovascular system Long term effects of exercise

1. **Lower resting** heart rate
   - Bradycardia
   - Heart doesn't need to work as hard / more efficient
2. **Larger / stronger** heart **OR** (cardiac) hypertrophy
   - Stronger contractions
3. **Increase** in stroke volume
   - At rest and high intensity
   - More blood pumped from the heart in one beat
4. **Increase** in **maximum** cardiac output
   - Higher volume of blood ejected from left ventricle in one minute **during high intensity exercise**
5. **Capillarisation OR Increased** capillary density
   - Improved circulation
   - Greater surface area for gaseous exchange **OR** more efficient / faster diffusion
   - More oxygen to muscles **OR** faster removal of CO_2 / lactic acid
6. **More efficient** vascular shunt mechanism
   - More blood to (working) muscles / body
7. **Lower** blood pressure
   - Less strain on the heart / blood vessels
   - Reduced risk of heart complications / strokes / heart attacks
8. **Increase** in red / white blood cells
   - (red) more haemoglobin / haemocrit
   - (red) Increased oxygen carrying capacity to supply working muscles
   - (white) better able to fight infections / disease
9. **Increased** plasma / blood volume
   - Decrease in blood viscosity
   - Blood flow is easier through blood vessels
10. **Faster / shorter** recovery rate

5. Respiratory system: Long term effects of exercise

1. Increased capillarisation – better blood supply around the alveoli.
2. Increased surface areas of alveoli – results in better gaseous exchange (oxygen delivery and waste product removal)
3. Increased strength of diaphragm and intercostal muscles – this increased tidal volume and vital capacity.
4. Increase in Tidal volume
5. Increase minute ventilation
6. Decrease in lung disease/healthier lungs
7. Reduced resting respiratory rate
8. Increase in pulmonary ventilation.

6. Skeletal system Long term effects of exercise

1. Increased bone density – stronger bones reduce the risk of injuries.
2. Reduced risk of osteoporosis.
3. Increased strength of ligaments and tendons – allows the body to change direction quickly without injury occurring. This also allows more force on a joint due to it being stronger.

7. Muscular system: Long term effects of exercise

1. Muscular hypertrophy – increase muscle mass. Increase size or number of muscle fibres
2. Increase strength of tendons
3. Greater speed of contraction
4. Increase size and number of mitochondria – produces more energy aerobically.
5. Increased tolerance to lactic acid/greater removal of lactic acid – reduces muscle fatigue.
6. Increase in muscular endurance /able to work for longer/less prone to fatigue
7. Increase strength of respiratory muscles e.g. intercostal ,muscles allowing more air to forcibly enter the lungs.
8. Greater flexibility / increased elasticity
9. Increased stores of glycogen / PC
10. Less prone to injury /faster recovery from injury / quicker recovery rate

Absolute BTEC PE- Component 3 LAA

A1 Physical Components of Fitness

1.Component	Explanation	Suitable Sport or PA
Aerobic Endurance	The ability to exercise at moderate intensity for extended periods of time.	Events/sports lasting more 30 minutes.
Muscular Endurance	The ability of a given muscle to exert force, consistently and repetitively, over a period of time	Events/sports lasting more 30 minutes.
Muscular Strength	The ability of a muscle to exert a maximal or near maximal force against an object.	Activities requiring force, e.g., throwing events
Flexibility	The ability of a joint or series of joints to move through an unrestricted, pain free range of motion.	Activities requiring a wide range of movement around a joint, e.g., gymnastics, martial arts.
Body Composition	The percentage of fat, bone, and muscle in your body.	Low body fat: gymnastics, long distance running. High muscle mass: sprinters, power activities.
Speed	The ability to move the body in one direction as fast as possible.	Activities requiring fast movement, e.g., sprinting

Absolute BTEC PE- Component 3 LAA

A1 Skill Related Components of Fitness

2.Component	Explanation	Suitable Sport or PA
Power	The product of force multiplied by distance, divided by time.	Activities requiring explosive movement e.g., gymnastics, basketball.
Agility	The ability to rapidly change body direction, accelerate, or decelerate.	Activities requiring quick changes of direction, e.g., dodging the opposition in a team game, freestyle skiing.
Co-ordination	The body's ability to perform smooth and efficient movements	Any activity requiring the movement of two or more body parts and can include the use of sporting equipment, e.g., hand, eyes, and tennis racquet to connect with the tennis ball.
Balance	The ability to retain the centre of mass above the base of support when stationary (static balance) or moving (dynamic balance).	An activity requiring the control of the distribution of weight or to remain upright and steady.
Reaction time	How fast an athlete can respond to stimulus.	Any activity where a quick decision or response to a stimulus is needed.

Principles of Training		
Frequency	The number of training sessions completed over a period of time, usually per week. How often.	e.g. Training muscular strength 2/3 sessions a week
Intensity	How hard an individual will train.	e.g. working at 90% HR therefore training anaerobically.
Time	How long an individual will train for.	60 minute session.
Type	The method of training or exercises to meet the requirements.	Weight training to improve strength

A2 Additional Principles of Training		
Progressive Overload	In order to progress, training needs to be demanding enough to cause the body to adapt, improving performance.	Extra stress is needed on the bodies system for adaptations to take place.
Specificity	Training should meet the needs of the sport, or physical/skill-related fitness goals to be developed.	To ensure that the correct component of fitness is being trained so that improvements take place.
Individual Differences	Training should meet the needs of an individual.	For example if they are older or overweight you will need more low impact exercises.
Adaptations	Changes to the body due to increased training loads.	e.g. increasing your strength through a weight training programme.
Reversibility	If training stops, or the intensity of training is lowered, fitness gains from training is lost.	Overtraining, when too much training takes place can cause injury. When you stop training muscle mass can be lost.
Variation	Altering types of training to avoid boredom and maintain motivation to train.	Keep motivation and enjoyment. Less likely to become bored. Provides challenges. Reduces injury through using the same muscles.
Rest and Recovery	To allow the body to recover and adapt.	To prevent injury, ensure training adaptations take place, recover before the next session.

A3 Measurements/ Calculations and Formulas

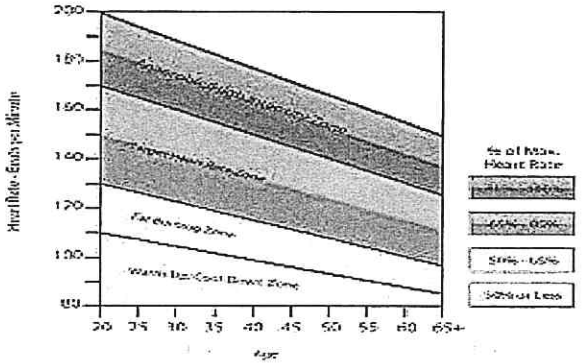
Intensity	
HR- How many times the heart beats within a minute, Beats Per Minute (BPM)	Count radial pulse with two fingers For 15 seconds x 4 = HR
Max HR- An average of what someone's maximum heart rate is depending on their age.	220- Age = Max HR
Training Zones- The target ranges (of heart rate, pace or perceived exertion) that will be used to prescribe workout intensity	MAX HR Divided by 100 x the training zone % Example 16 year old – 204/100 x 85 = 204/100 x 65 =
Strength and Endurance Calculation	
1RM (1 Repetition Max) Used to measure muscular strength	How much weight can be lifted in one repetition.
15RM (15 Repetition Max) Used to measure muscular endurance	How much weight can be lifted in fifteen repetitions.
Borg Scale- Rating of Perceived Exertion (RPE) Scale	
Borg Scale is a way of measuring physical activity intensity level. Perceived exertion is how hard you feel like your body is working.	Rate yourself on a scale of 6-20 depending on your perceived exertion. This value is then x10 for example 12on the scale would equal 120BPM.

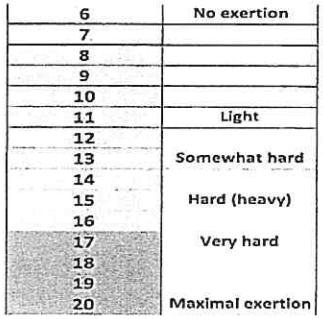
Used to:

Monitor Heart Rate- Record Calories- Energy usage- Identify Training Zones

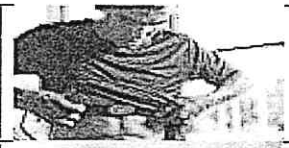
A3 Target Zones

Anaerobic Training Zone 85%-100%	Used for improving speed, power, muscular strength
Aerobic Training Zone 65%- 85%	Used for improving aerobic endurance and muscular endurance





Technology to Measure Exercise Intensity

Heart Rate Monitors	
Smart Watches	
Apps	

Investigate IMPORTNACE of fitness testing to determine fitness levels

B1 Reasons for Fitness Testing

1. **Gives baseline data:** If an athlete completes a test at the beginning and then at the end of their training programme, they can monitor their performance and see if they are improving.
2. **Design training programmes:** Athletes and coaches can use the results of fitness test and plan training programmes specifically to improve their weaknesses.
3. **Determine if training programmes are working** Tests can be used as a mid-point in training programmes.
4. **Results can give a performer something to aim for:** They can provide goal setting aims and give them motivation to improve.

B1 Validity of Results

1. Validity refers to whether a test measures what it aims to measure. If we are aiming to test flexibility however when we are performing the sit and reach and bending our legs the test becomes invalid.
2. Often in our tests to ensure it is valid we perform the test three times to see if we are getting similar results each time.
3. For example, the standing long jump can be completed three times and the highest score taken. However, this cannot happen with the copper run due to the length of the test and the impact it will have on the reliability of the test as the participant will be tired during the second and third time.

B1 Pre-Test Procedures

1. **Calibration of equipment:** Equipment should be checked for wear and tear and damage; measuring must be completed with a tape measure and secured do the distance doesn't change throughout the test.
2. **Complete informed consent:** Informed consent is completed by the participant and allows them to understand what and how they will be tested and know they can remove themselves from the test at any time.
3. **Complete physical activity readiness questionnaire (par-q):** This is completed to ensure the participant is fit and healthy to take part in the test.
4. **Participant pre fitness test check e.g. Prior exercise participation:** This includes checking jewellery, clothing, trainers and completing a warmup.

B1 Reliability of Test

B1 Factors affecting reliability:

1. **Calibration of equipment:** For example, if person administering the test has not measured out the 400m Cooper run correctly, when the athlete uses the nominal data their scores will be incorrect.
2. **Motivation of the participant:** If the participant is unwell or isn't trying their best, they will not receive accurate results.
3. **Conditions of the testing environment (inside versus outside conditions)** If the ground is wet when testing agility, it will be hard for the participant to change direction without falling over.
4. **Experience of the person administering the test – compliance with standardised test procedure.** If the administrator stops the stopwatch at the correct time the results will be incorrect.

B1 Absolute BTEC PE - Component 3 LAB

B1 Practicality

1. **Cost:** Specialist equipment and facility hire can be expensive to carry out the tests.
2. **Time taken to perform the test:** Tests like the cooper run and multistage fitness test can take a long time to perform.
3. **Time taken to set up the test:** Measuring for test such as the Cooper run, Sprint test and Illinois test can be difficult and time consuming.
4. **Time taken to analyse data:** Collecting and analysing large cohorts of data can be very time consuming and if you are conducting more than one type of test.
5. **Number of participants:** Some tests require specific equipment and if you have 30 participants to complete the test however on one piece of equipment this is not practical.

B1 Interpretation of Fitness Test Results

In your exam you will need the following skills

1. To be able to compare results to normative published data: normative data is results taken from people of similar ages and finding out what the average norm is for that age and sex. For Example normative data for the cooper run, female and a range of ages. Not all tests have normative data is they aren't common/ popular tests

Age	Excellent	Above Average	Average	Below Average	Poor
13-14	>2000m	1900-2000m	1600-1899m	1500-1599m	<1500m
15-16	>2100m	2000-2100m	1700-1999m	1600-1699m	<1600m
17-20	>2300m	2100-2300m	1800-2099m	1700-1799m	<1700m
20-29	>2700m	2200-2700m	1800-2199m	1500-1799m	<1500m
30-39	>2500m	2000-2500m	1700-1999m	1400-1699m	<1400m
40-49	>2300m	1900-2300m	1500-1899m	1200-1499m	<1200m
>50	>2200m	1700-2200m	1400-1699m	1100-1399m	<1100m

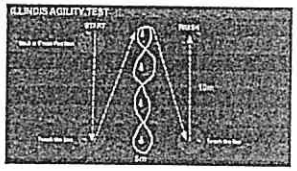
2. Analyse and evaluate test results: Understanding where an athlete's success and weaknesses are based on the results of their tests.

3. Make recommendations for improvements to fitness performer based on test results: This could be a specific type of training which is linked to the

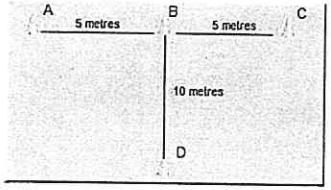
B2 Absolute BTEC PE - Component 3 LAB:

Fitness test methods for components of Skill-related fitness

Agility



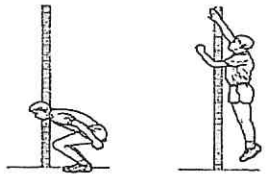
Illinois agility run test



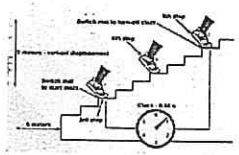
T Test

The Illinois and T test are used to examine the participant's ability to change direction at speed and remain in an upright position.

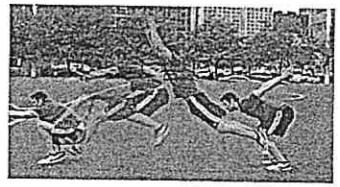
Power



Vertical Jump Test



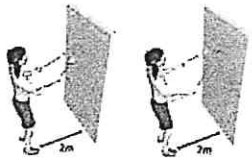
Margaria- Kalamen Test



Standing Long/Broad Jump

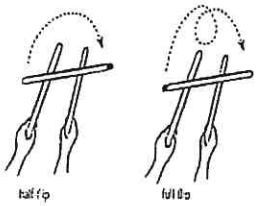
These tests are used to examine explosive movements of the legs.

Coordination



Alternate hand wall toss test.

30 seconds



Stick flip test

These tests are used to examine the participants ability to move two or more body parts at the same time smoothly and efficiently, to allow effective application of technique, such as catching the ball or stick.

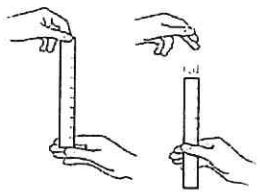
Balance

Y balance test

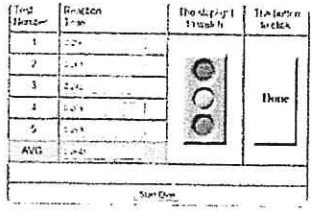
Stork Stand test

These tests are used to examine the participants ability to maintain centre of mass over the base of support, useful to maintain positions in performance sports (static balance) or when on the move in any other sporting examples (dynamic balance).

Reaction Time



Ruler drop test



Online reaction time test

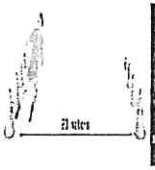
These tests are used to examine how quickly the athlete can respond to a stimulus. In one test the ruler is the stimulus and the quicker athlete catches the ruler. The stimulus on the online test are the lights and the computer examines the speed in which the athlete presses the button.

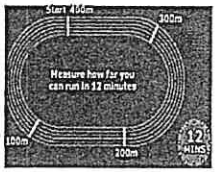
B3 Absolute BTEC PE - Component 3 LAB:

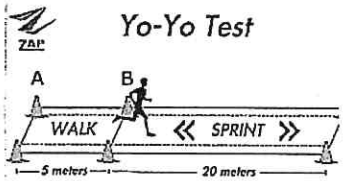
Fitness test methods for components of Physical fitness

Aerobic Endurance

Multistage Fitness test/ 12 min cooper run/ Harvard step/ Yo yo Test

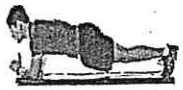






These tests are used to examine the participants ability of the cardiovascular system to provide the muscles with nutrients and oxygen over a long period of time.

Muscular Endurance



Timed Plank

Sit up Test

Press up Test

Each test examines how many times the different muscles groups can contract in a length of time.

Muscular Strength

Hand Grip Dynamometer 1 Rep Max

These tests are done to examine the amount of force that can be applied against a resistance. For example, the dynamometer tests for strength of grip lower arm and bicep muscle. 1RM test the maximum weight lifted in 1 repetition.

Flexibility

Calf muscle flexibility test

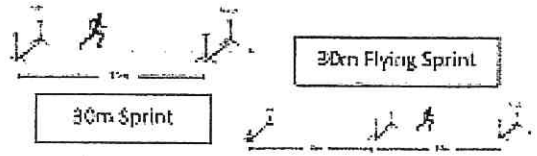
Sit and reach test

Shoulder flexibility test

Each of these tests are used to examine the range of movement at a joint, shoulder hip and ankle joint. There is a range of tests as different sports require flexibility in different joints in the body.

Body Composition

Speed



Two test which both examine distance divided by time to reduce the time taken to move the body or body parts. In this case the fast movements of the arms and legs.

30m Sprint form standing start.

The flying sprint tests the athlete at full speed.

Fitness training methods for physical components of fitness

Appropriate physical fitness training methods that could be used for specific sports participants for different ages and different sporting abilities

Flexibility					
Static Active	The performer applies internal force to stretch and lengthen the muscle	Quadricep stretch 	**Muscular Endurance**		
Static Passive	Requires the help of another person or an object, e.g. A wall to apply external force causing the muscle to stretch	Wall calf stretch 12-20 seconds 	Free weights	High repetitions and low loads	e.g. Bicep curl 10 kg X 15 reps
Proprioceptive Neuromuscular Facilitation (PNF)	The technique involves the use of a partner or immovable object, isometric muscle contractions to inhibit the stretch reflex.		Fixed resistance machines	High repetitions and low loads	e.g. Squat 20 kg X 20 reps
			Circuit training	Using body resistance exercises or weights with low loads and high repetitions.	Series of different exercise stations can be made sport specific E.g. Press ups, sit ups, squats and lunges.
Muscular Strength Training			**Speed**		
Free Weights	High loads and low repetitions	e.g. Bicep curl 15 kg X 6 reps	Acceleration Sprints	Pace is gradually increased from a standing or rolling start to jogging, then to striding, and then to a maximal sprint	Long jumper run up 
Resistance Machines	High loads and low repetitions	e.g. leg press 60 kg X 6 reps	Interval Training	Work period followed by a rest or recovery period. For speed short, high intensity work periods, increasing the number of rest periods and increasing work intensity.	100m 
Aerobic Endurance			Resistance Drills	Hill runs, parachutes, sleds, bungee ropes, resistance bands	Rugby players 
Continuous Training	Steady pace and moderate intensity for a minimum period of 30 minutes	Jogging 30 minutes on a treadmill between 60-80% Ma HR.	**Aerobic Endurance**		
Fartlek Training	The intensity of training is varied by running at different speeds and/or over different terrain	Jogging 10-minute, sprint 1 minute, run 2 min repeat for 30 minutes.			
Interval training	Work period followed by a rest or recovery period o for aerobic endurance decrease the number/length of rest periods and decrease work intensity (compared to speed training)	Netball players walking back into position after a team has scored.	Circuit Training	Use of a number of stations/exercises completed in succession with minimal rest periods in between to develop aerobic endurance.	Step ups. Shuttle runs and skipping to develop aerobic endurance with minimal rest.

Fitness training methods for skill related components of fitness

Agility			Power		
Speed Agility and Quickness training (SAQ)	drills used to develop physical ability and motor skills.	A football agility SAQ course with changes of direction	**Plyometrics Training**	lunging, bounding, incline press-ups, barrier hopping and jumping.	Hopping/ bounding/ two footed jumps
Co-ordination			Reaction time		
Co-ordination Training	Use of specific training exercises using two or more body parts together.	Hand eye- coordination moving the tennis racket to the tennis ball at the right time.	**Reaction Time Training**	Use of specific training exercises to practise quick responses to an external stimulus.	Sprinter responding quickly to the sound of a gun in a sprint start.
Balance					
Dynamic Balance Training Static Balance Training	Use of specific training exercises that require balancing on a reduced size base of support.	e.g. lunging, standing on one leg and kicking, single leg lunging. e.g. Handstand, yoga, gymnastics, Pilates.			

C4: Choosing training methods

- Demands of the sport: focus on area of sport or components of fitness involved.
- Cost of equipment: specialist equipment may be needed such as fixed resistance machines.
- Location of training: specific facilities may be needed such as swimming pool.
- Ease of set up: some methods involve setting up e.g. circuit training
- Number of participants: may be limited amounts of space to access

C5: Provision for taking part in fitness training methods

Type of provision	Explanation	Advantages	Disadvantages
Public sectors	include local authorities and school provision	-Funded by local council -Low cost -Accommodate large groups	-Lack of equipment -Poor facilities
Private sector	provided by organisations who aim to make a profit	-specialist services -latest training equipment	-expensive to join -members pay month or yearly -Aime at certain groups of people other than public
Voluntary sector	activities provided by volunteers who have a common interest in the participant.	-fitness or competitive sports -low cost -coaches usually have experience	-opportunities in only one sport -Basica facilities or equipment -Limited training times as they normally don't own the facility.

The effects of long-term fitness training on the body systems

How training methods affect the different body systems, which can lead to adaptations to improve specific components of fitness.

Aerobic Endurance Training:

- Adaptations to the cardiovascular and respiratory systems
- Cardiac hypertrophy
- Decreased resting heart rate
- Increased strength of respiratory muscles
- Capillarisation around alveoli.

Flexibility Training:

- Adaptations to the muscular and skeletal systems
- Increased range of movement permitted at a joint
- Increased flexibility of ligament and tendons
- Increased muscle length.

Muscular Endurance Training:

- Adaptations to the muscular system
- Capillarisation around muscle tissues increased muscle tone.

Muscular Strength and Power Training:

- Adaptations to the muscular and skeletal systems
- Muscle hypertrophy
- Increased tendon and ligament strength
- Increased bone density.

Speed Training:

- Adaptations to the muscular system
- Increased tolerance to lactic acid.

Requirements for Each of the Following Fitness Training Methods

To ensure a fitness training plan is carried out safely and effectively it must include the following.

- **Warm-Up:** prior to taking part in the fitness training method – pulse raiser- increase heart rate and body temperature, mobility- increase range of movement and stretch; reduce the risk of injury, prepare the body for exercise.
- **Cool Down:** after taking part in the fitness training method – gradually lower pulse and breathing rate to resting levels; remove lactic acid; stretch to help return muscles to pre-exercise length.
- **Fitness Training Method:** linked to the associated component of fitness.
- **Application of the basic (FITT) and additional principles of training:** to each fitness training method.
- **Application of appropriate training intensities:** to fitness training methods.

Additional requirements for each of the fitness training methods

Advantages and disadvantages

- To include number of people that can take part
- Cost of equipment
- Ease of set up, access to venue/location of training
- Risk of injury to the performer if performed incorrectly, effectiveness of training for given sports performer
- Specificity to component of fitness
- Replicating demands of the sport

D1 Personal Information to Aid Training Fitness Programme Design

Aims – details of what they would like to achieve for the selected sport.

Objectives – how they intend to meet their aims using an appropriate component of fitness and method of training.

Lifestyle and physical activity history.

Attitudes, the mind and personal motivation for training.

D2 Use Personal Information to Aid Training Programme Design.

Selection of appropriate training method/activity for improving/maintaining the selected components of physical and/or skill-related fitness.

Application of the FITT principles and additional principles of training.

D3 Motivational Techniques for Fitness Programming

Motivation – the internal mechanisms and external stimuli that arouse and direct behaviour.

Two types of motivation:

Intrinsic- From within e.g. I want to go to the gym because its good for me.

Extrinsic – from the outside e.g. Rewards

Principles of setting goals to increase and direct motivation.

Personal goals – (SMARTER):

Specific: The goal must be specific to what you want to achieve, e.g. I want to improve upper body strength

Measurable: Goals must be stated in a way that is measurable, I want to increase my chest press 1RM to 100kg.

Achievable: The person has to have access to training and the time to take part in it in order to meet the goal.

Realistic: It must be possible to actually reach this goal and not expect improvements beyond what can be achieved in the time frames and current fitness or ability or ability level of the person setting the goals.

Time: Their must be a set time or deadline on the goal. This means you can review your success. It is best you put the date you wish to achieve the goal by.

Exciting: The goal must be something the person really wants to achieve and have an impact on their sports performance in order for them to be motivated to attend their regular training and work hard while training to achieve the goal.

Recorded: The results should be written down so the performer can see how close they are to achieving their goal and how long it takes to reach it

Goals:

Short-term goals (set over a short period of time, between one day and one month)

Long-term goals (what they want to achieve in the long term, and the best way of doing this).

- Influence of goal setting on motivation: Provide direction for behaviour, maintain focus on the task in hand
- Benefits of motivation on the sports performer: Increase participation
- Maintain training and intensity Increased fitness Improved performance.

Religious Education - Foundational Theology

Origins and Meaning

The Origin of the Universe

1. Creation ex nihilo – Out of Nothing

Catholics believe that:

God created the universe **from nothing** (ex nihilo).

This belief is based on **St Augustine's Confessions XII, 7**, where he writes that God did not use any pre-existing material.

Creation is seen as:

- **Deliberate** – God chose to create.
- **Good** – Everything God made is good.
- **Ordered** – The universe has purpose and structure.

"You, O Lord, made something in the beginning which is of yourself, in which you created heaven and earth." – *St Augustine*

Christian Views on Creation

2. Catholic vs Other Christian Views

Catholic View: Accepts both Genesis and scientific theories, interpreting Genesis symbolically.

Fundamentalist View: Takes Genesis literally – the world was created in 6 days.

Conflict: Literalists reject evolution and the Big Bang, while Catholics see no contradiction.

Science and Faith

3. Big Bang Theory – Stephen Hawking

- **Hawking**: The universe began from a singularity – no need for a creator.
- **Catholic Response**:
- The Big Bang describes **how** the universe began, not **why**.
- Pope Pius XII supported the Big Bang as compatible with faith.

4. Evolution – Darwin and Dawkins

- **Darwin**: Life evolved through natural selection.
- **Dawkins**: Evolution is purely random and unguided.
- **Catholic View**:
- Evolution is accepted **as long as God is seen as the ultimate cause**.
- **Pope John Paul II (1996)**: Evolution is "more than a hypothesis" but must include the **spiritual soul** created by God.

Human Life and Dignity

5. Imago Dei – In the Image of God

- Humans are made in God's image (Genesis 1:27).
- **St Catherine of Siena** (The Dialogue): "You are taken with love for her, for by love you created her."
- This means:
- Every person has **infinite value**.
- Life is **sacred** from conception to natural death.

Views on the Value of Life

6. Abortion and the Sanctity of Life

- **Catholic View**: Life begins at conception – abortion is wrong.
- **Fundamentalist Christians**: Share similar views.
- **Non-religious views**: May support abortion based on personal choice or quality of life.

7. Humanist Critique – Peter Singer

- **Speciesism**: Singer argues that valuing human life above all others is biased.
- **Catholic Response**:
- Humans are unique due to their **soul and moral responsibility**.
- All life is valuable, but human life has a special dignity.

Beliefs: Creation

8. Genesis Accounts

- **Genesis 1**: God creates the world in 6 days – powerful and transcendent.
- **Genesis 2**: God forms man from dust – personal and intimate.
- Together, they show:
- God is both **majestic** and **loving**.
- Humans are **stewards** of creation.

9. Caring for the Planet

- **Catholic View**: Stewardship – protect the Earth as God's creation.
- **Humanist View**: Care for the planet for future generations.
- **Shared Value**: Environmental responsibility.

Sources: The Bible

10. Catholic Understanding of Revelation and Inspiration

Revelation refers to how God makes Himself known to humanity. Catholics believe:

- God reveals Himself **fully in Jesus Christ**, the Word made flesh.
- Scripture is **divinely inspired**—the **Holy Spirit guided human authors** to write what is true and good.
- Inspiration means **"God-breathed"** (cf. 2 Timothy 3:16), showing that while the Bible was **written by humans, its message is from God.**

Structure and Origins of Scripture

- The Bible is a **library of books** written over centuries.
- It includes different **literary forms**: history, poetry, prophecy, law, wisdom, and apocalyptic writing.
- The **Old Testament** focuses on God's covenant with Israel; the **New Testament** reveals Jesus and the early Church.
- Catholics **interpret Scripture** through Tradition and the Magisterium, not just literal reading.

Different Christian Views on Genesis

Genesis 1 and 2:

- Genesis 1: God creates the world in six days, culminating in humanity.
- Genesis 2: Focuses on human relationships, morality, and the soul.

Interpretation Differences:

- Catholic and Liberal Christians:
  - View Genesis as symbolic and theological, not scientific.
  - Emphasize the truths about God's nature (omnipotent, omnibenevolent) and human purpose (Imago Dei, stewardship).
  - Accept scientific theories like evolution and the Big Bang as compatible with faith.
- Fundamentalist Christians:
  - Interpret Genesis literally as historical and scientific fact.
  - Reject evolution and see Genesis as a factual account of creation.

Significance of Literary Form in Genesis

- Understanding Genesis as myth or allegory allows deeper theological reflection.
- It teaches:
  - God is the source of all life.
  - Humans are created Imago Dei (in God's image).
  - Creation is good and purposeful.
  - Humans have free will and moral responsibility.

Forms: Art and Symbolism

11. Michelangelo's Creation of Adam

Location: Ceiling of the Sistine Chapel, Vatican City
Artist: Michelangelo Buonarroti
Date: Painted between 1508–1512

Key Revision Points

- The painting is **not a literal image** of creation but a symbolic representation of the **relationship between God and humanity**.
- It reflects the Catholic belief in **Imago Dei** – that humans are made in the **image and likeness of God** (Genesis 1:27).
- It shows that **life is a gift** from God, and that humans are **dependent on Him** for their existence.
- The painting expresses the **dignity of human life** – Adam is shown as beautiful and strong, reflecting the **goodness of creation**.
- Michelangelo uses **art to teach theology** – this is an example of **how art can be a source of authority** in the Catholic tradition.

What the Painting Shows

Feature	Meaning and Symbolism
God	Shown as an old but strong man, surrounded by angels. Reaching out to Adam with energy and purpose. **This shows God as the powerful creator.**
Adam	Lying back, relaxed, waiting to receive life. His body mirrors God's, **showing that humans are made in the image of God (Imago Dei).**
The Hands	The almost-touching fingers of God and Adam are the most famous part. This moment shows God giving life to humanity. **It also shows that humans are dependent on God.**
The Cloud Shape	Some believe the shape around God looks like a brain, symbolising **God as the source of wisdom and reason**. Others say it looks like a womb, showing **God as the giver of life.**
The Gap Between Fingers	The small space between the fingers shows that while humans are close to God, they are not equal to Him. **It also shows the free will God gives to humans.**

12.Tree of Life Mosaic – San Clemente

Location: Basilica of San Clemente, Rome
Date: 12th Century
Medium: Mosaic (tiny coloured tiles)

Key Revision Points

- The mosaic uses **symbols instead of words** to teach Christian beliefs – this is an example of **art as a source of authority.**
- The cross as the Tree of Life shows that Jesus' death is **not the end**, but the **start of new life** for all believers.
- The **Alpha and Omega** remind Christians that God is **outside of time** – He is eternal.
- The **Chi-Rho** shows that Jesus is **the Christ**, the chosen one sent by God.
- The **Lamb and Dove** represent Jesus and the Holy Spirit, showing the **presence of the Trinity** in the artwork.
- The mosaic reflects the belief that **Christ is the New Adam** – just as Adam brought sin into the world, **Jesus brings salvation**.
- The vines show that the Church is alive and growing, and that **all Christians are connected to Christ.**

What the Mosaic Shows

Symbol	Meaning and Symbolism
Tree of Life	The cross is shown as a tree, linking the death of Jesus to the idea of new life. **It shows that Jesus' death brings eternal life.**
Alpha (A) and Omega (Ω)	These are the first and last letters of the Greek alphabet. **They show that God is eternal – the beginning and the end (Revelation 22:13).**
Chi-Rho (☧)	An early Christian symbol made from the first two letters of "Christ" in Greek. **It represents Jesus as the Messiah.**
Lamb	Symbol of Jesus as the Lamb of God, **who was sacrificed for the sins of the world.**
Dove	**Represents the Holy Spirit,** often shown with a halo or rays of light.
Vines and Branches	These grow from the Tree of Life and spread across the mosaic. **They symbolise the Church growing** from Christ, and the idea that believers are connected to Jesus (John 15:5).

Practices: Loving and Serving

13. Imago Dei and Catholic Social Teaching

What It Teaches

Teaching	**Meaning and Impact**

All people have dignity	Every person is made in the image of God (*Imago Dei*), which means they are valuable, unique, and worthy of respect.
Equality	All humans share the same nature and origin. Discrimination based on race, gender, religion, or background is wrong.
Justice	Catholics are called to work for fairness in society, making sure everyone's rights are protected.
Peace	Peace is not just the absence of war – it means living in harmony, where everyone's dignity is respected.
Reconciliation	Catholics should help heal broken relationships – between people, communities, and nations.
Love and Brotherhood	True peace comes from love, which goes beyond justice. Catholics are called to treat everyone as brothers and sisters.

Key Quotes from *Gaudium et Spes*

- "All men possess a rational soul and are created in God's likeness."
- "Every type of discrimination… is to be overcome and eradicated."
- "Peace is not merely the absence of war… it is the fruit of love."

Key Revision Points

- ***Imago Dei*** means all people are made in God's image – **this is the foundation of Catholic Social Teaching.**
- Catholics must **defend human dignity** and **fight against injustice.**
- Working for peace and reconciliation is **part of living out the Gospel.**
- Organisations like **CAFOD** and **SVP** put these teachings into action by **helping the poor and promoting justice**.
- ***Gaudium et Spes*** is a key Church document from the Second Vatican Council that explains how **Catholics should live in the modern world.**

14. Interfaith Dialogue

What the Church Teaches

Group	Catholic Approach
Other Christians	The Church encourages unity and cooperation with other Christian denominations (e.g. Anglican, Orthodox, Protestant). This is called **ecumenism**.

Other Religions	The Church respects all that is true and holy in other religions, especially **Judaism** and **Islam**, which also believe in one God.
Non-religious groups	Catholics are called to engage respectfully with **Humanists, Atheists**, and others who seek truth and justice, even without religious belief.

Nostra Aetate – Key Teachings

- All people are part of the **human family** and deserve respect.
- The Church **rejects nothing that is true and holy** in other religions.
- It encourages **dialogue and understanding**, not conflict.
- It highlights shared values like **peace, justice, and compassion**.
- It calls for an end to **discrimination and hatred**, especially religious prejudice.

Key Revision Points

Interfaith dialogue means talking and working with people of different religions to build peace and understanding.

- The Church teaches that **truth can be found in other religions**, and that Catholics should learn from and respect others.
- *Nostra Aetate* is a key Vatican II document that changed how the Church relates to other faiths.
- Catholics are encouraged to **work together** with people of all beliefs to solve global problems like poverty, war, and climate change.
- Interfaith dialogue supports the idea of **Imago Dei** – that all people are made in the image of God and deserve dignity.

15. Charity in Action

Key Catholic Teaching: *"Love your neighbour as yourself"* – Mark 12:31

Catholic Social Teaching Themes: Human dignity, solidarity, care for creation

CAFOD

Full Name: Catholic Agency for Overseas Development

What it does:

- Works in **over 30 countries** to help people living in poverty.
- Provides **clean water, food, education, and emergency aid**.
- Campaigns for **justice and climate action**.
- Encourages Catholics in the UK to **live simply** and support global neighbours.

Why it matters:

- Puts into action the belief in **universal human dignity**.
- Reflects the Catholic duty to **care for the poor and vulnerable**.
- Supports the idea of **global solidarity** – we are one human family.

SVP

Full Name: St Vincent de Paul Society

What it does:

- Works **locally** to help people in need – the elderly, homeless, lonely, or struggling families.
- Offers **home visits, food parcels, furniture, and friendship**.
- Encourages young people to get involved through **SVP Youth**.

Why it matters:

- Shows **love of neighbour** in everyday life.
- Helps people feel **valued and supported** in their own communities.
- Reflects the belief that **faith must be lived out through action**.

Key Revision Points

- Both CAFOD and SVP are examples of **faith in action**.
- They reflect core Catholic values:
  - **Love of neighbour**
  - **Respect for creation**
  - **Human dignity**
- These charities are inspired by **Catholic Social Teaching** and the belief that all people are made in the **image of God (Imago Dei)**.
- Supporting charity is part of the **mission of the Church** and a way to bring about **justice and peace** in the world.

B3 – Infection and Response

1. DEFINITIONS

Communicable	A disease that can be transmitted (spread). E.g. chicken pox, common cold and HIV.
Non-communicable	A disease that cannot be transmitted. E.g. cancer, diabetes and heart disease.
Pathogen	A micro-organism which can cause disease. They are bacteria, viruses, fungi and protists.
Antigen	A molecule found on the surface of cells, including pathogens, that triggers an immune response in the body
Antibody	Produced by white blood cells in response to an antigen
Antitoxin	Produced by white blood cells to neutralise toxins
Phagocyte	A type of white blood cell that engulfs and ingest pathogens (phagocytosis)
Lymphocyte	A type of white blood cell that produces antibodies
Immune	When a body is not affected by a pathogen
Vaccination	Using a vaccine (an inactive form of a pathogen) to create immunity
Antibiotic	Drug that kills bacteria
Painkiller	Drug that stops pain
Placebo	Drug which does not contain the active ingredient
Risk factor	Something that increases the likelihood of developing a disease or condition
Causal mechanism	A factor that has been found to cause a change in another factor

2. HEALTH

Health is the state of physical and mental wellbeing.

Causes of ill health:

- Communicable diseases
- Non-communicable diseases
- Poor diet
- Stress and life situations

Different types of disease may interact:

- Defects in the immune system mean that an individual is more likely to suffer from infectious diseases.
- Viruses living in cells can be the trigger for cancers, e.g. HPV can trigger cervical cancer
- Immune reactions initially caused by a pathogen can trigger allergies such as skin rashes and asthma.
- Severe physical ill health can lead to depression and other mental illness.

3. COMMUNICABLE DISEASES

Disease	Pathogen	Symptoms	Spread by	Prevention	Treatment
Measles	Virus	Red rash and fever	Breathing in droplets from coughs/sneezes	Vaccination	No cure – only management of symptoms
HIV	Virus	Flu-like symptoms, develops into AIDS	Bodily fluids e.g. blood or sexual contact	Using barrier protection, e.g. condoms	Antiretroviral drugs
Tobacco Mosaic Virus (plants)	Virus	'Mosaic' pattern of discolouration on the leaves reduces photosynthesis and growth	Direct contact between infected and healthy plants, or via contaminated tools, clothing, or hands	Destroy infected plants	No treatment
Salmonella	Bacteria	Fever, cramps, vomiting, diarrhoea	Contaminated food	Vaccinating poultry, cooking food thoroughly	Antibiotics or management of symptoms
Gonorrhoea	Bacteria	Yellow/green discharge, pain when urinating	Sexual Contact	Using barrier protection, e.g. condoms	Antibiotics
Rose Black Spot (plants)	Fungus	Black spots on leaves. Reduces photosynthesis	Wind or water	Remove and destroy infected leaves	Fungicides
Malaria	Protist	Recurrent episodes of fever	Insect bites (mosquitoes)	Mosquito nets, insect repellent, preventing mosquitos breeding	Antimalarial drugs

Bacteria may produce poisons (toxins) that damage tissues and make us feel ill.
Viruses live and reproduce inside cells, causing cell damage.

4. ANTIBIOTICS AND PAINKILLERS

- Antibiotics - kill bacteria (a specific antibiotic is used for a specific bacteria) THEY DO NOT KILL VIRUSES e.g. penicillin
- Antibiotics cannot kill viruses because viruses live inside cells
- Painkillers - stop pain (don't kill microbes, just help with symptoms) e.g. paracetamol

5. DISCOVERY OF DRUGS

Traditionally drugs were extracted from plants and micro-organisms.

Most new drugs are synthesised by chemists in the pharmaceutical industry.

- Digitalis- heart drug- originated from foxgloves
- Aspirin- painkiller- originated from willow
- Penicillin- antibiotic- originated from *Penicillium* mould (discovered by Alexander Fleming)

6. DEVELOPMENT OF DRUGS

Testing for:

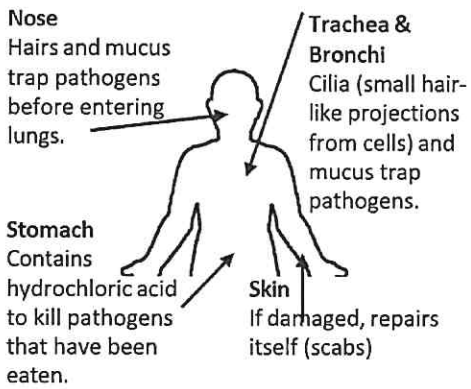
- Side-effects (is it safe?)
- Efficacy (does it work?)
- Dosage (how much is needed?)

Stage		Description
1	preclinical	Tested on cells and tissues. Side effects? Efficacy?
2		Tested on animals. Side effects?
3	clinical	Tested on humans. Dosage gradually increased up to optimum. • 1st on healthy volunteers, Side effects? • 2nd on patients with the illness. Efficacy? Dosage?

In double blind-trials some patients are given a placebo (a drug which does not contain the active ingredient). Neither the patient or observer knows whether they have been given the drug or the placebo.

7. HUMAN DEFENCE SYSTEMS

Non- specific defence system:



Specific defence system:

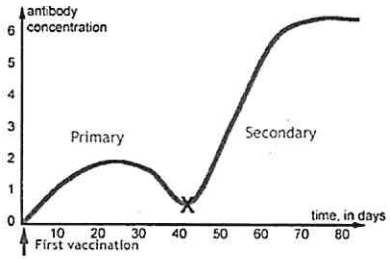
If a pathogen enters the body the immune system tries to destroy the pathogen.

White blood cells help to defend against pathogens by:

- Phagocytosis – engulfing the pathogen
- Producing antibodies – specific to the antigen
- Producing antitoxins – to neutralise toxins

8. VACCINATION

1. Inject a small quantity of an inactive form of the pathogen into the body. This pathogen will have antigens on its surface.
2. White blood cells are stimulated to produce antibodies which are complementary to the antigens.
3. The antibodies bind to the antigens and cause the pathogens to clump together.
4. Phagocytes engulf the pathogens.
5. Memory cells are produced.
6. If the same pathogen now enters the body, the white blood cells can respond quickly and prevent infection - the person is now **immune**. They make MORE of the SPECIFIC antibodies, MORE QUICKLY, and they stay in body for LONGER.



9. DISEASE RISK FACTORS

Risk factors increase the chance of a disease. A causal mechanism has been proven for some risk factors, but not in others. Many diseases are caused by the interaction of a number of factors:

- Diet, smoking and exercise affect cardiovascular disease.
- Obesity is a risk factor for Type 2 diabetes.
- Alcohol can affect liver and brain function.
- Smoking can cause lung disease and lung cancer.
- Smoking and alcohol can affect the development of unborn babies.
- Carcinogens, including ionising radiation, are risk factors in cancer.

10. CANCER

Cancer is caused by a random mutation which changes cells, leading to uncontrolled growth and division.

Benign tumours are growths of abnormal cells which are contained in one area, usually within a membrane. They do not invade other parts of the body.

Malignant tumours are cancers. They invade neighbouring tissues and spread to different parts of the body in the blood where they form secondary tumours.

Scientists have identified lifestyle risk factors for various types of cancer. There are also genetic risk factors for some cancers.

B4 – Bioenergetics (Photosynthesis, Respiration, Metabolism & Exercise)

1. PHOTOSYNTHESIS

Photosynthesis as an **endothermic** reaction in which energy is transferred from the environment to the chloroplasts by light.

Carbon dioxide + Water → Glucose + Oxygen

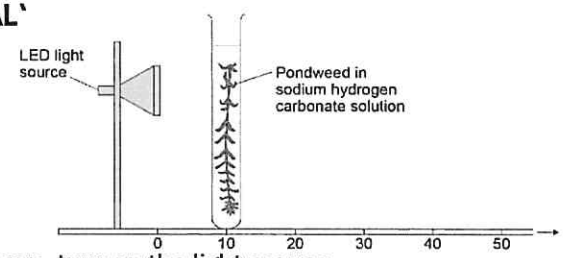
$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

2. USES OF GLUCOSE

Plants use the glucose produced in photosynthesis for:

- Respiration
- Converted into insoluble starch for storage
- Converted to fat or oil for storage
- Converted to cellulose, which strengthens the cell wall
- Combined with nitrates to produce amino acids for protein synthesis.

3 MEASURING THE RATE OF PHOTOSYNTHESIS (REQUIRED PRACTICAL`



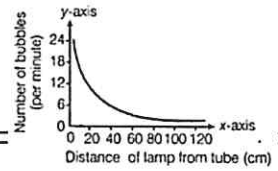
1. Set up apparatus as shown, turn on the light source
2. Count and record the number of oxygen bubbles produced in 1 minute
3. Repeat 3 times, calculate a mean
4. Move the test tube in 10cm intervals away from the light source and repeat.

Independent variable: distance from light
Dependent variable: number of bubbles
Control variables: temperature (LED light), carbon dioxide concentration (sodium hydrogen carbonate solution), length of pondweed, type of pondweed, volume of water

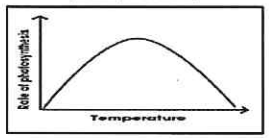
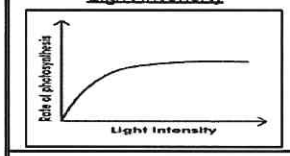
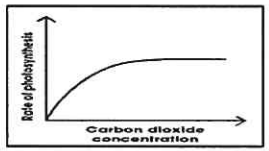
4. INVERSE SQUARE LAW (HIGHER ONLY)

Light intensity is inversely proportional to distance squared. This means that:

- If the distance is doubled then the number of bubbles is quartered.
- If the distance is halved then the number of bubbles is 4 times greater.



5. FACTORS THAT AFFECT PHOTOSYNTHESIS

Factor	Describe how the rate of photosynthesis is affected:	Explain how the rate of photosynthesis is affected:
Temperature 	As temperature increases, the rate of photosynthesis increases, up to a point, then the rate of photosynthesis decreases again.	A higher temperature provides more energy for the reaction. However, if the temperature increases too much, then the enzymes become denatured and the rate of reaction will decrease.
Light intensity 	As light intensity increases so does the rate of photosynthesis, the rate then levels off.	A higher light intensity provides energy for the reaction. The rate levels off as another factor is limiting the rate of photosynthesis (such as CO_2/temperature)
CO_2 concentration 	The rate of photosynthesis will increase when a plant is given higher concentrations of carbon dioxide, the rate then levels off.	A higher CO_2 concentration means there are more reactants for the process. The rate levels off as another factor is limiting the rate of photosynthesis (such as light intensity/ temperature)
Amount of chlorophyll	The higher the quantity of chlorophyll, the higher the rate of photosynthesis,	The more chlorophyll present the more light that can be absorbed for photosynthesis.

Whichever factor is in the shortest supply is called the **limiting factor** – as it is the one limiting the rate of photosynthesis

(Higher Only) Greenhouses reduce the effect of limiting factors by increasing the light (24 hours artificial light), temperature (heaters), carbon dioxide concentration (burning fuel), irrigation (water) to increase yield.

6. RESPIRATION

Respiration is an **exothermic** process that happens in mitochondria to **release** energy.

Energy is needed for animals to:

- Contract muscles (movement)
- Maintain a steady body temperature (keeping warm)
- Carry out chemical reactions to build up larger molecules

7. AEROBIC RESPIRATION

Requires oxygen
More energy is released

Glucose + Oxygen → Carbon dioxide + Water

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

8. ANAEROBIC RESPIRATION IN MAMMALS

Does not require oxygen
Less energy is released

Glucose → Lactic Acid

9. LACTIC ACID

Build up of lactic acid causes muscles to become fatigued and stop contracting efficiently.

Higher Only
Blood takes lactic acid from muscles to the liver where it is converted back into glucose.

Oxygen debt is the extra oxygen which is needed after exercise to react with the lactic acid and remove it from the cells.

10. ANAEROBIC RESPIRATION IN YEAST & PLANTS

Glucose → Carbon Dioxide + Ethanol

This is called Fermentation when it occurs in yeast.

The carbon dioxide is used in baking to cause bread to rise.

The ethanol is used in the brewing industry for beer and wine-making

11. RESPONSE TO EXERCISE

Response:	Explanation:
Heart rate increases & heart beats harder	• Pump blood faster around the body • Carry more oxygen to working muscles • Working muscles use this oxygen to carry out aerobic respiration, to release energy
Breathing rate/breath volume increase	• More oxygen enters the blood, to travel to the working muscles, to carry out aerobic respiration. • Oxygen can break down lactic acid.

12. METABOLISM

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

Examples of metabolic processes:

- Conversion of glucose to starch, glycogen and cellulose.
- The formation of lipid molecules from a molecule of glycerol and three molecules of fatty acid
- Combining glucose and nitrate ions to form amino acids which are then used to synthesise (make) proteins.
- Respiration
- Breakdown of excess proteins to form urea for excretion

C4 Chemical Changes

1. Definitions

oxidation	Gaining of oxygen
Reduction	Losing oxygen
Displacement reaction	More reactive element takes place of less reactive element
ore	A rock with enough metal in it that makes it worth extracting
Ionic equation	An equation which shows the ions present
Neutralisation reaction	Reaction between an acid and base
acid	Molecule that contains H^+
base	An insoluble substance that can neutralise an acid
alkali	Base that dissolves in water and contains OH^-
electrolysis	Using electricity to break down an ionic compound into it's ions
electrolyte	Solution that is able to conduct electricity
Molten	melted
Aqueous	Dissolved in water

HT only

Oxidation (in terms of electrons)	Loss of electrons
Reduction (in terms of electrons)	Gain of electrons
Redox reaction	Reaction where something is oxidised whilst something else is reduced
Strong acid	completely ionised in aqueous solution
Weak acid	only partially ionised in aqueous solution
Half equation	Equation that contains electrons to represent oxidation or reduction

2. Oxidation and Reduction

Metal + oxygen → Metal oxide

Eg

magnesium + oxygen → magnesium oxide

The metal gains oxygen in an oxidation reaction

Metal oxide + carbon → metal + carbon dioxide

Eg

Iron oxide + carbon → iron + carbon dioxide

The iron oxide has been reduced as oxygen has been removed

3. Reactivity Series

- When metals react with other substances the metal atoms form positive ions.
- The reactivity of a metal is related to its tendency to form positive ions.
- Metals can be arranged in order of their reactivity in a reactivity series
- A more reactive metal will replace a less reactive metal in a compound in a **displacement reaction**
- Eg

Potassium + magnesium chloride → potassium chloride + magnesium

Potassium is more reactive than magnesium

Potassium takes place of magnesium

4. Extraction of Metals

Extraction = remove metal from an ore or a compound

The lower the position of a metal in the reactivity series, the easier it is to extract.

- Potassium, Sodium, Calcium, Magnesium, Aluminium, (Carbon) — Extract through Electrolysis
- Zinc, Iron, Tin, Lead — Extract by burning with carbon
- Copper — Extract by burning in air
- Silver, Gold — Occur native in the ground

5. Ionic equations (HT only)

Ionic equations are an equation to show which ions are present. Any ionic compounds in an equation are split into the ions.

(Remember an ionic compound is made from a metal and non-metal. The metal forms a positive ion and the non-metal forms a negative ion)

Example:

$Cl_2 + 2KBr \rightarrow 2KCl + Br_2$

Steps: identify ionic compounds: KBr, KCl

Br_2 and Cl_2 are covalent so do not contain ions

What ions do the compounds break into: K^+, Br^-, K^+, Cl^-

Now rewrite the equation:

$Cl_2 + 2K^+ + 2Br^- \rightarrow 2K^+ + 2Cl^- + Br_2$

Cross out any ions that appear on both sides of the equation

6. Acids and metal reactions

Metal + acid → salt + hydrogen

E.g. iron + sulfuric acid → iron sulfate + hydrogen

salt

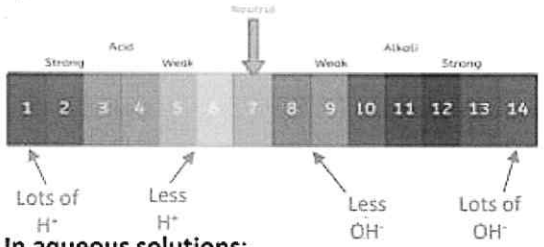
To name salt :
1st name Metal
2nd name Acid used

Naming Salts

Acid used	Salt produced
Hydrochloric	Chloride
Sulfuric	Sulfate
Nitric	Nitrate

7. pH scale and neutralisation

- Shows how acidic or alkaline solution is.
- pH 1-6 = acid
- pH 7 = neutral
- pH 8-14 = alkali



In aqueous solutions:
Acids – produce H^+ ions
Alkalis – produce OH^- ions

In neutralisation reactions:
$H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$

8. Acids and alkali reactions

- Example of a neutralisation reaction
- **Acid + alkali → salt + water**

Example:

Hydrochloric acid + sodium hydroxide → sodium chloride + water

salt

$HCl + NaOH \rightarrow NaCl + H_2O$

9. Acids + metal carbonate reactions

- Example of a neutralisation reaction
- Acid + carbonate → salt + water + carbon dioxide

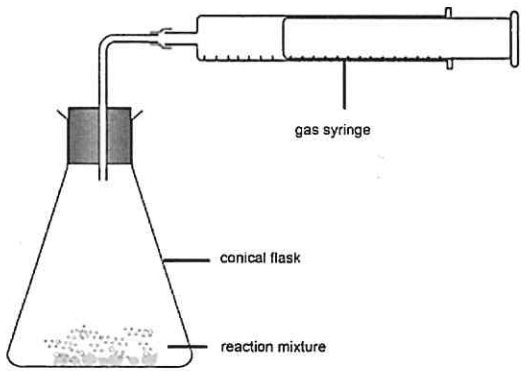
sulfuric acid + calcium carbonate → calcium chloride + water + carbon dioxide

salt

$H_2SO_4 + CaCO_3 \rightarrow CaSO_4 + H_2O + CO_2$

10. Collecting and measuring gas

Most accurate way is to collect gas using a gas syringe.



11. Strong and weak acids (HT only)

Strong acid- Completely ionised in aqueous solutions
e.g. hydrochloric, nitric and sulfuric acids.
e.g. $HCl \rightarrow H^+ + Cl^-$

Weak acid- Only partially ionised in aqueous solutions
e.g. ethanoic acid, citric acid

e.g. $CH_3COOH \rightleftharpoons CH_3COO^- + H^+$
$\rightleftharpoons$ = reversible reaction

Hasn't fully turned into ions – only partially

Concentration = how much is dissolved in every cm^3
As pH decreases by 1 unit, hydrogen ion concentration of solution increases by factor of 10

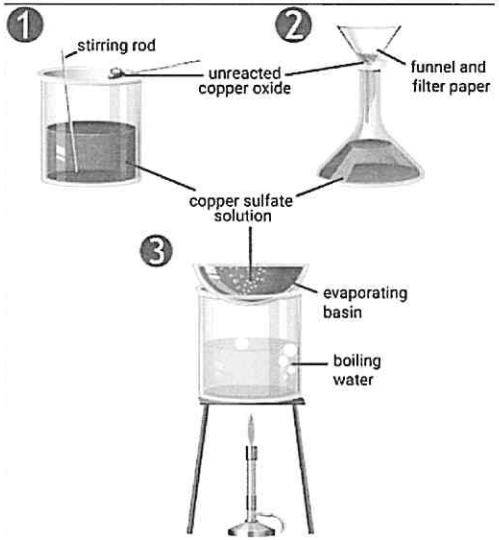
12. Required Practical – making soluble salts

(example making copper sulphate from **copper oxide** and **sulphuric acid**)

These **reactants** need to be changed if question asks you to make a different salt

Method

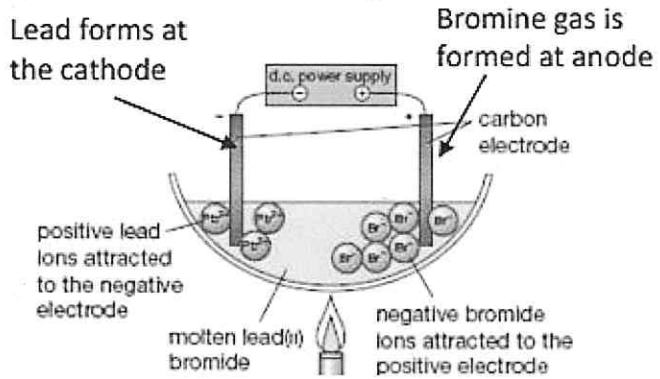
1. Using measuring cylinder measure 20cm^3 **sulphuric acid** and pour into a beaker
2. Using spatula add **copper oxide** to the acid and stir
3. Keep adding until no more oxide will dissolve (it is in excess)
4. Using a filter funnel and filter paper – filter excess copper oxide.
5. Evaporate some of the filtrate using a water bath until crystals begin to form
6. Leave to cool and crystallise



13. Electrolysis of molten solutions

- Molten = melted so the ions can move
- Metal is produced at the negative electrode (cathode)
- Non-metal (usually a gas so bubbles are seen) is produced at the positive electrode (anode)

Example: Lead Bromide - $PbBr_2$



14. Electrolysis of aqueous solutions

- Ionic compound is dissolved in water (aqueous) so the ions can move
- Water breaks down into it's ions H^+ and OH^- when an electric current passes through it
- Only 1 ion is discharged at each electrode:

Rules

+ ANODE Attracts – ions ('Anions')	- CATHODE Attracts + ions ('Cations')
If – ions are group 7 i.e. chloride Cl^- bromide Br^- iodide I^- Then the groups 7 element is produced as a gas	If + ions (metals) are MORE REACTIVE than hydrogen K, Na, Ca, Mg, Zn, Fe Then **HYDROGEN** is produced
If – ions are NOT Group 7 Eg sulphate SO_4^{2-} nitrate NO_3^- carbonate CO_3^{2-} OXYGEN is produced.	If + ions (metals) are LESS REACTIVE than hydrogen Cu, Ag, Au Then the METAL is produced

15. Half equations

During electrolysis:
At positive electrode: negative ions lose electrons (oxidation)
At negative electrode: positive ions gain electrons (reduction)

Examples

Cathode - $2H^+ + 2e^- \rightarrow H_2$

Gained 2 electrons (reduction) — molecules of hydrogen gas produced

Anode – $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$

molecules of oxygen produced — Lost electrons (oxidation)

Cathode – $Cu^{2+} + 2e^- \rightarrow Cu$

Gained electrons (reduction) — Copper atoms are formed at the cathode

Anode – $2Cl^- \rightarrow Cl_2 + 2e^-$

chlorine molecules are formed — Lost electrons (oxidation)

C5 Energy Changes

1. Definitions

Endothermic	energy is taken in from the surroundings so the temperature of the surroundings decreases
Exothermic	energy is transferred to the surroundings so the temperature of the surroundings increases
Activation energy	minimum amount of energy needed to start the reaction

2. Exothermic and endothermic reactions

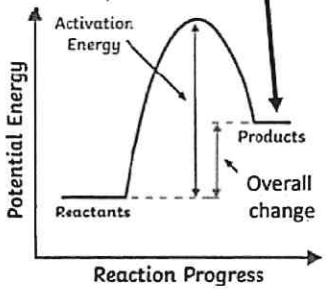
Endothermic	Exothermic
• Temperature of reaction mixture DECREASES Examples: • Ice packs • Thermal decomposition	• Temperature of reaction mixture INCREASES Examples: • Combustion • Respiration • neutralisation

To determine if reaction is endothermic or exothermic, carry out experiment in a polystyrene cup monitoring the temperature using a thermometer

3. Reaction profile - endothermic

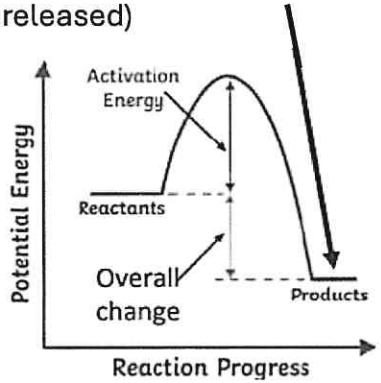
- Energy level diagrams show **difference in energy** between reactants and products.
- Endothermic = Energy of products is **higher than** reactants (energy is absorbed)
- **Activation Energy** = minimum amount of energy needed to start the reaction
- **Energy change** = the difference in energy between reactants and products.

You may need to draw and label this in the exam!



4. Reaction profile – exothermic

Energy of products is lower than reactants (energy is released)

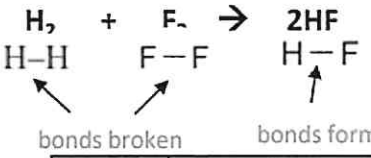


5. HT only – bond energy calculations

Overall energy change = difference between energy needed to break bonds and the energy **released** when bonds formed.

To calculate energy change :

Energy change = bonds broken – bonds formed



Bond	Bond Energy / kJ mol^{-1}
F—F	158
H—H	436
H—F	568

Bonds broken =	Bonds formed
436 + 158	2 x 568
593	1136

Overall energy change = 593 – 1136

= -543 kJ/mol Exothermic

More energy is released in bond making than is required for bond breaking.

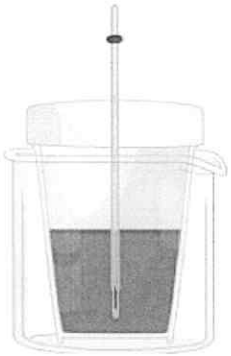
6. Required practical

Hypothesis

The energy change in the reaction between acid and alkali depends on the volume of alkali added.

Equipment

- Polystyrene cup and lid
- Thermometer
- 250cm^3 beaker
- Measuring cylinder
- Liquid reactants



Variables

Independent – Volume of sodium hydroxide
Dependent – Temperature change
Control – Volume of hydrochloric acid, concentration of acid, concentration of sodium hydroxide

Experiment carried out in a polystyrene cup with a lid to reduce heat loss

Method (example for hydrochloric acid and sodium hydroxide)

1. Using measuring cylinder to measure 30cm^3 hydrochloric acid and put in polystyrene cup
2. Stand cup inside beaker to make stable.
3. Use a thermometer to measure the temperature of acid and record.
4. Using measuring cylinder – 5cm^3 sodium hydroxide → polystyrene cup
5. Fit the lid and gently stir with thermometer through hole.
6. When reading stops on thermometer, record temperature in table.
7. Repeat, each time adding 5cm^3 more sodium hydroxide up to a maximum of 40cm^3.
8. Calculate the temperature change on each attempt.
9. Repeat the experiment 3 times and calculate a mean temperature change for each volume of sodium hydroxide.

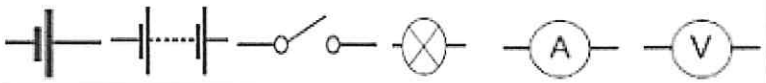
Energy changes could also be investigated using:

1. Changing the **mass of metal** added to acid and measuring the **temperature increase**
2. Changing the **type of metal** added to acid and measuring the **temperature increase**
3. Dissolving different **masses of potassium nitrate** into water and observing the **temperature decrease.**

P2 Electricity

Box 1: Circuit symbols

Cell	Battery	Switch	Lamp	Ammeter	Voltmeter
Store of chemical energy	Two or more cells in series	Breaks circuit, stopping current	Lights when current flows	Measures current	Measures potential difference



Diode	LED	LDR	Fuse	Resistor	Variable resistor	Thermistor
Current flows one way	Emits light when current flows	Resistance low in bright light	Melts when current is too high	Affects the size of current flowing	Allows current to be varied	Resistance low at high temp

Box 2: circuit definitions and units

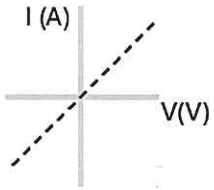
Current (Amps - A)– Rate of flow of charge
Potential Difference
(Volts - V)– Energy used by a cell
Resistance (Ohms - Ω)– Opposition to current
Charge (Coulombs - C) – Work is done when charge flows

Box 3: Ohm's law

Ohm's law states :
"Current is directly proportional to voltage"

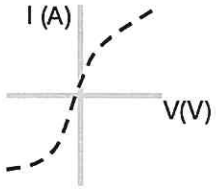
Shown on a graph this looks like:

- Straight Line
- Through Origin



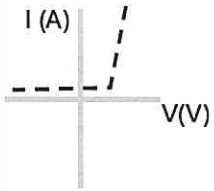
6. Non-Ohmic Conductors

Filament bulb



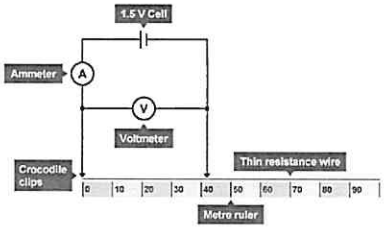
As temperature increases, resistance increases

Diode



Resistance is very high in one direction

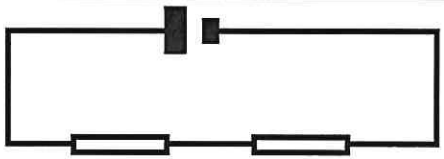
Box 4: Measuring how resistance of a wire changes with length **(Required Practical)**



1. Connect the circuit as shown in the diagram above
2. Connect the crocodile clips to the resistance wire, 100 centimetres (cm) apart
3. Record the readings from the ammeter and voltmeter
4. Move one of the crocodile clips closer until they are 90 cm apart.
5. Record the new readings on the ammeter and the voltmeter.
6. Repeat the previous steps reducing the length of the wire by 10 cm each time down to a minimum length of 10 cm.
7. Use the results to calculate the resistance of each length of wire by using R = V/I, where R is resistance, V is voltage and I is current
8. Plot a graph of resistance against length for the resistance wire.

Box 7: Circuit Rules

Series



Current

Series – The same in every part of the circuit

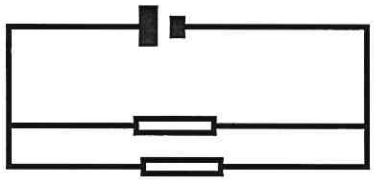
Potential Difference

Series – Shared between components

Resistance

Series – Add up all resistances to get the total

Parallel



Current

Parallel – Split between the branches

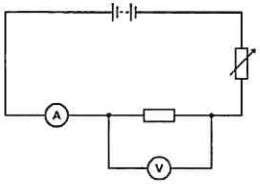
Potential difference

Parallel – The same in each branch

Resistance

Parallel – Resistance decreases when another branch is added. The current has another path to flow through.

Box 8: Investigating the I-V characteristics of electrical components **(Required Practical)**

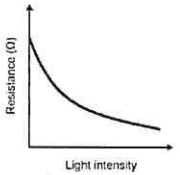


1. Connect the circuit as shown in the first diagram.
2. Ensure that the power supply is set to zero at the start.
3. Record the reading on the voltmeter and ammeter
4. Use the variable resistor to alter the potential difference
5. Record the new readings on the voltmeter and ammeter.
6. Repeat steps three to four, each time increasing the potential difference slightly.
7. Reverse the power supply connections and repeat steps two to six.
8. Plot a graph of current against potential difference for each component
9. Repeat the experiment but replace the fixed resistor with a bulb

Box 9: Uses of resistors

LDR

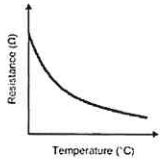
The resistance of a LDR depends on light intensity. At low light levels, the LDR has a high resistance. As the light intensity increases, the resistance decreases.



LDR

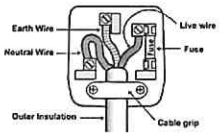
The resistance of a thermistor depends on its temperature.

At low temperatures, the thermistor has a high resistance. As the temperature increases, the resistance decreases.



Box 10: Domestic electricity

UK Mains is:
AC – 50 Hz
230 V



Plugs

Live (Brown) 230V: Carries the current into the appliance.

Neutral (Blue) 0V: Completes the circuit – provides a route for the current to flow out of the appliance.

Earth (Green) 0V: Carries the current safely to Earth if there is a fault in the appliance

Fuse: Melts if the current gets too high – protects the circuit.

Box 11: Dangers of electricity

If there is a potential difference between a person and a conductor, a current will flow through the conductor into the Earth

Box 12: Measuring resistance

- Measure the current and potential difference.
- Use V = I x R (rearranged) to calculate the resistance.
- Change the component and measure again

Box 13: National Grid

A system of cables and transformers linking power stations to consumers.

Step-Up Transformer

Increase voltage to reduce current. Less energy is lost as heat. This is more efficient.

Step-Down Transformer

Reduces voltage to make it safe for domestic use.

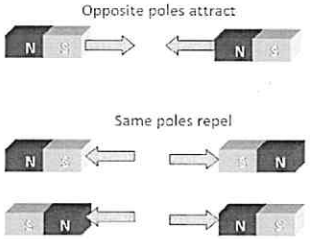
P7 - Magnetism

Box 1 – Introduction to magnets

The poles of a magnet are the places where the magnetic forces are strongest.

When two magnets are bought together they exert a force on each other:

- Like poles (N,N / S,S) repel
- Opposite poles attract



The Magnetic materials are:

- Iron
- Cobalt
- Nickel
- Steel

Box 2 – Definitions

Permanent magnet - a magnet which produces its own magnetic field.

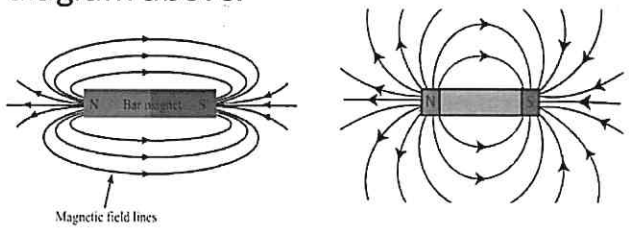
Induced magnet - becomes magnetic when it is placed in a magnetic field. When removed from a magnetic field it loses most / all of its magnetism quickly.

Compass - a small bar magnet. The needle points in the direction of the Earth's magnetic field.

Box 3 – Magnetic fields

Magnetic Field - the region around a magnet where a force acts on another magnet or on a magnetic material (iron, steel, cobalt and nickel).

The direction of a magnetic field line is from the north pole of a magnet to the south pole of the magnet – as shown in the diagram above.

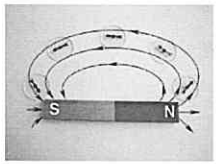


How can we find out the shape of a magnetic field?

Magnetic field shape shown using tiny "plotting compasses"

Follow the field lines until they go off the page or come back to the magnet

Plot as many field lines as possible

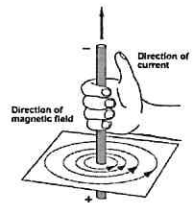


Box 4 – Electromagnetism

When a current flows through a conducting wire a magnetic field is produced around the wire – the direction of the magnetic field can be shown by the **right hand grip** rule.

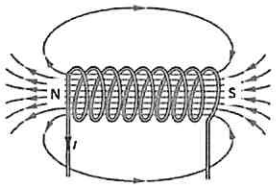
Increasing the Field Strength:

- Increase the current
- Move closer to the wire

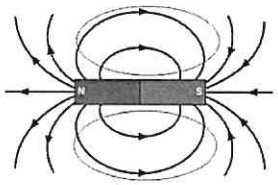


Box 5 – Solenoids

Solenoid – "A coil of wire." This increases the strength of the magnetic
field created by the current.
The magnetic field around a solenoid is similar to a bar magnet.



Solenoid



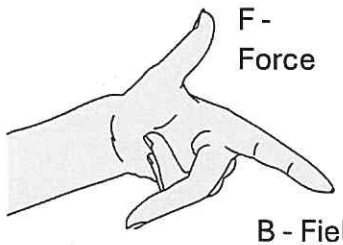
Magnet

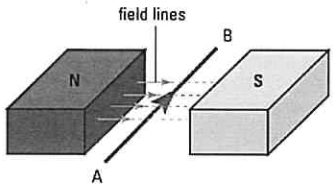
Electromagnets
Adding an IRON CORE to a solenoid, increasing current and adding more turns will make the field stronger

Box 6 – Flemings left hand rule **(HT)**

Fleming's Left Hand Rule
Motor Effect - When a conductor carrying a current is placed in a magnetic field the magnet producing the field and the conductor exert a force on each other.

To increase the force / movement of the object two variable can be changed:
1. Increase the current
2. Increase the strength of the magnet





This wire should experience a downwards force.

Box 7 – Calculating Magnetic force **(HT)**

$$F = B \times I \times l$$

Force	**Magnetic flux density**	**Current**	**Length of wire**

Units:
Force – Newtons (N)
Flux Density – Tesla (T)
Current – Amps (A)
Length – Metres (m)

Box 8 – Electric motors **(HT)**

- The current flows through the coil.
- One side of the coil experiences an upwards force.
- The other side of the coil experiences a downwards force.
- These forces produce a moment which causes the coil to rotate.
- The split ring commutator reverses the current in the coil every half-turn, ensuring that the coil is always rotated in the same direction.