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English: 'An Inspector Calls' by J. B. Priestley

Characters		
Inspector Goole	Priestley's mouthpiece; advocates social justice; serves as the Birlings' conscience	Socialist, moralistic, righteous, powerful, intimidating, unconventional, mysterious, imposing, sardonic, omnipotent
Mr. Arthur Birling	Businessman; capitalist; against social equality; a self-made man (new-money)	Capitalist, arrogant, foolish, Panglossian, emasculate, prejudice, ignorant, selfish, stubborn, vainglorious
Mrs. Sybil Birling	Husband's social superior; believes in personal responsibility	Arrogant, cold-hearted, insincere, prejudice, naïve, conformist, bitter, controlling, remorseless
Sheila Birling	Young girl; comes to change views and pities Eva; feels regret	Transformative, remorseful, socialist, pseudo-inspector, sensitive, astute, strong-minded, empowered
Eric Birling	Young man, drinks too much; forces himself on Eva Smith; regrets actions	Rebellious, reckless, immature, insubordinate, compulsive, desperate, disgraced, dualistic, irresponsible
Gerald Croft	Businessman; engaged to Sheila; politically closest to Birling	Aristocratic, evasive, secretive, dishonest, disingenuous, oleaginous, chivalric, privileged, pragmatic
Eva Smith	Unseen in play; comes to stand for victims of social injustice (changes her name to Daisy Renton)	Suffragist, victim, emblematic, allegorical, vulnerable, desperate, socialist, moralistic, principled

Plot	
Act 1	Set in April 1912, Brumley, Midlands, UK. The Birling family and Gerald Croft are celebrating Sheila Birling's engagement to Gerald with a dinner. Mr Birling lectures his son, Eric Birling, and Gerald about the importance of every man looking out for himself if he wants to get on in life. Edna (the maid) announces that an inspector has arrived. Inspector Goole says that he is investigating the death of a young woman who committed suicide, Eva Smith. Mr Birling is shown a photograph of Eva, after initially denying recognising the woman in the photo, he remembers firing her in 1910 for organising a strike over workers pay. Sheila recalls also having Eva sacked about her manner when served by her in an upmarket department store. The Inspector reveals that Eva Smith changed her name to Daisy Renton. Gerald reveals to Sheila he had an affair with Daisy Renton.
Act 2	Gerald explains to The Inspector that he had an affair with Eva, but hasn't seen her since he ended their relationship back in Autumn 1911. Sheila gives her engagement ring back to Gerald. The Inspector turns his attention to Mrs Sybil Birling, she confesses that she also had contact with Eva, but Eva gave herself a different name to Mrs Birling. Eva approached a charity chaired by Mrs Birling to ask for help. Eva was desperate and pregnant but help was refused by Mrs Birling because she was offended by the girl calling herself 'Mrs Birling'. She tells Eva that the baby's father should be made entirely responsible. She also tells Inspector Goole that the father should be held entirely responsible and should be made an example of.
Act 3	Eric is revealed as the father. He stole money from Mr Birling's office to provide money to Eva. The Inspector delivers his final speech. After he leaves, the family begin to suspect that he was not a genuine police inspector. A phone call to the Chief Constable confirms this. Next, they phone the infirmary to be informed that no suicide case has been brought in. Mr Birling, Mrs Birling and Gerald congratulate themselves that it was all a hoax and they continue can continue as before. This attitude upsets Sheila and Eric. The phone rings. Mr Birling announces to the family that a girl has just died on her way to the infirmary, a police inspector is coming to question them

Word	Definition
Dramatic Irony	When the audience know more than the characters on stage
Setting	The place where the text is set
Monologue	When a character does a long speech on stage
Tone	The way in which a character might speak a line
Polemic	A strong verbal or written attack on someone or something
Euphemism	When someone talks about something unpleasant by using a more pleasant and nicer term
Capitalist	A political system based on people owning their own wealth and looking after themselves
Socialist	A political system based on people believing in shared wealth and responsibility
Bourgeoisie	The upper classes
Hierarchy	The order in which people exist within a social system
Prejudiced	Having or showing a dislike or distrust that is derived from a biased opinion
Patriarchal	A system of government that is controlled by men
Remorse	Sorrow or sadness when you do something wrong. Guilt.

Key concepts and context: Think about...	
1912	Set just before WWI and the sinking of the Titanic. A moment of rising international tensions and industrial expansion. End of Victorian era saw the demise of the rigid class system. Labour Party, founded in 1900, gaining momentum. The Russian Revolution began in 1917.
1945	People were recovering from six years of warfare, danger and uncertainty. Class distinctions greatly reduced as a result of two world wars. Women had a more valued place in society. Desire for social change. Following WW2, Labour Party won a landslide victory over Winston Churchill and the Conservatives.
Wealth, Power and Influence	The Birlings and the Crofts are representative of the wealthy upper-class. They all misuse their social influence to benefit themselves. Their actions adversely affect the vulnerable people in society.
Blame and Responsibility	Who is to blame for Eva's death? Each of the Birlings contribute to a chain of events leading to the destruction of Eva Smith. What responsibilities do the characters have to each other? To society?
Public v Private	How do the public lives, the facades, of the Birlings juxtapose their private personas? What are their motivations for this? What are the repercussions, and for who?
Morality and Legality	What are the moral and legal laws of the society depicted in the play? How do they interweave? What actions do the characters undertake that are wrong, morally or legally?
Class Politics	How do the ideologies of capitalism and socialism collide in the play? Which characters are representative of which political allegiance? Is there a correlation between a character's political beliefs and their behaviours?
Prejudice	What are the prejudices held by the Birlings? What are their inherent views regarding class and status? How do they act on these prejudices, and what are the consequences?
Young v Old	What differences are evident between the younger and older generation? They react and behave differently throughout the play – why? What are their attitudes towards each other? What do they learn? Which characters change, and how?

ACT	Order of the Inspector's Questioning
Act 1	Sheila and Gerald's engagement is celebrated.
Act 1	Birling says there will be no war; references Titanic
Act 1	Inspector arrives; a young girl has committed suicide.
Act 1	Birling threw her out after strike; Sheila had her fired for laughing.
Act 2	Gerald had an affair with Daisy Renton
Act 2	Mrs. Birling refused to give charity to Eva; blames father.
Act 3	Eric's involvement revealed; possible rape hinted at.
Act 3	Inspector leaves. Gerald returns; met policeman, no Inspector G
Act 3	Telephone rings; an inspector is coming.

Key Notes
Priestley asks his audience to examine their individual and collective responsibility to society. He wants a welfare state .
The hypocrisy of middle-class Edwardian society is uncovered: appearance & reputation matter more than reality & morality .
Priestley criticises the selfishness of capitalism and wants a fairer, socialist future after the horrors of two world wars..
Priestley shows the older generation to be set in their ways, while the young are open to change .
Eva Smith is the embodiment of young, working-class women who were oppressed by the middle/upper classes .
The play demonstrates that when workers do not have full employment rights they cannot fight back

Character Quotes	
Birling's Confidence	'We're in for a time of steadily increasing prosperity'
Birling on society	'The way some of these cranks talk and write now, you'd think everybody has to look after everybody else'
Sheila's recognition	'but these girls aren't cheap labour – they're people''
Sheila's regret	'it's the only time I've ever done anything like that, and I'll never, never do it again to anybody'
Sheila on the inspector	'we all started like that – so confident, so pleased with ourselves until he began asking us questions'
Sheila on Eric	'he's been steadily drinking too much for the last two years'
Inspector on guilt	'I think you did something terribly wrong – and that you're going to spend the rest of your life regretting it'
Mrs Birling defends herself	'she was claiming elaborate fine feelings and scruples that were simply absurd in a girl in her position'
Eric explains	'I'm not very clear about it, but afterwards she told me she didn't want me to go in but that – well, I was in that state when a chap easily turns nasty – and I threatened to make a row'
The inspector says	'but each of you helped to kill her. Remember that'
Inspector's message	'there are millions and millions and millions of Eva Smiths and John Smiths still left with us, with their lives, their hopes and fears, their suffering, and chance of happiness, all intertwined with our lives, with what we think and say and do. We don't live alone.'

Thematic Quotes

Social responsibility	"We are responsible for each other" <i>Inspector</i> "Public men, Mr Birling, have responsibilities" <i>Inspector</i> "It's what happened to the girl and what we all did to her that mattered." <i>Eric</i>
Capitalism	"These silly capital vs labour agitations." <i>Birling</i> "A man has to make his own way" <i>Birling</i>
Class	"A girl of that class" <i>Mrs Birling</i> "Well, we've several hundred young women there, y'know, and they keep changing." <i>Birling</i>
Age	"the famous younger generation" <i>Birling</i> "What's the matter with that child?" <i>Birling</i> "Just keep quiet, Eric" <i>Birling</i>
Gender & attitudes to women	"I hate those <i>hard-eyed dough-faced women</i> " - <i>Gerald</i> "And you think young women ought to be protected against unpleasant and disturbing things?" <i>Inspector</i> "She had far too much to say, far too much" <i>Birling</i>

- Paper 1 Section B
- Extract question
- No choice of question
- 45 minutes

English Literature: Paper 1

A Christmas Carol

A Christmas Carol – Context

Dickens' Life

Charles Dickens was born in 1812 in Kent and moved to London at the age of 9. When he was 12 years of age, his father was arrested and sent to a debtors' prison. Dickens' mother moved seven of their children into prison with their father but took Charles out of school and arranged for him to live alone outside the prison, working with other child labourers in a terrible job which involved pasting labels on bottles in a blacking (shoe polish) warehouse; he was poorly paid and the conditions were extremely bad. Much of Dickens' writing is influenced by his early experiences.

Social and Historical Context

Dickens was born into a time of great change in the way people lived. The Industrial Revolution was taking place and there was a sudden growth in the cities – the economy shifted from agriculture to industry and trade. As a result, many people who had once lived in rural communities moved to the city in huge numbers, causing overcrowding. Money from industry made the rich richer and the rich/poor gap widened. Workers had to toil for long hours for little money and, out of necessity, children of all ages often did not go to school and worked long hours for little money. Compulsory education was introduced by Queen Victoria so many children were taught to read and write in Victorian times where they would not have been early. However, despite this, most poor children still ended up in low-paid jobs and working in appalling conditions. The housing was dreadful for working class families who often lived in squalor and deprivation where disease spread rapidly. There was no NHS and so poor people rarely had access to any form of medical help if they fell ill. Child mortality was very high. In the poorer quarters of the big cities, almost 1 in 5 children born had died by the age of five. The main cause of death was polluted drinking water, damp, and tuberculosis, which claimed between 60,000 and 70,000 lives in each decade of Queen Victoria's reign. Disease spread rapidly due to over-crowding and also due to the very unhygienic way that the poor had to live as they had little access to clean water. For those who were unable to work and support themselves, there were workhouses. These were not intended to be pleasant places to stay. Men, women, and families were separated and those who were physically able were expected to work for their keep. Like the workhouses there were debtors' prisons (those who were unable to pay a debt went here) such as a Marshlea, where Charles Dickens' father spent time. If you could not look after your family the workhouse was the only option that you had, or your family would be left to starve. There was no system to support those who could not work and so people found themselves with little choice. The wealthy few, on the other hand, lived in luxury with large houses, plenty of money and food. Their children did not work, were educated, and often had expensive toys and nice clothes. The rich had to be seen to be civilised and adhere to a strict set of morals that were considered very important for high society in the Victorian age. Victorians are well known for being prudish and overly polite in their interactions for this reason. However, this was often criticised for being hypocritical, because the rich lived such different lives to the poor and often did little to help them.

A Christmas Carol

During this time of unrelenting social change, Dickens wrote A Christmas Carol. Firstly, he wanted to write a good 'ghost' story - these were extremely popular at the time and he had hoped that this would be a good story for families to enjoy sitting around the fire on a cold winters night. Victorians were extremely interested in the supernatural and many of them firmly believed in ghosts and the idea of spirits visiting them from the dead and so the story would not have seemed at all far-fetched or unrealistic to them. However, he also had the intention of drawing readers' attention to the plight of England's poorest, a recurring theme in many of his novels. As such, the novella can be read as a social criticism, an allegory.

Malthusian Theory

Thomas Malthus was an English demographer and political economist best known for his pessimistic but highly influential views on population growth.

Malthus famously argued that in a world in which economies grew arithmetically and population grew geometrically, mass want would be inevitable. His *Essay on Population* created a school of thought which continues to this day under the banners of Zero Population Growth and Sustainability. The threat of a "population bomb" under which my generation lived was Paul Ehrlich's modern rehashing of the Malthusian argument about the inability of productivity to keep pace with, let alone exceed, population growth.

Characters:

1. Ebenezer Scrooge: Miserly, mean, bitter, materialistic, unsympathetic, indifferent, cold, selfish, isolated, cynical, charitable, value driven, generous, happy, sociable, transformed.

2. Marley's Ghost: Materialistic, self-centred, terrifying, haunting, exhausted, direct, reformed, regretful, hopeful, selfless, wise

3. Bob Cratchit: Uncomplaining, tolerant, courteous, deferential, patient, civil, eager, pleasurable, good-humoured, playful, caring, tender, cheerful, loving, forgiving.

4. Fred: Warm-hearted, empathetic, cheerful, optimistic, even-tempered, insightful, determined, generous, forgiving, jovial, enthusiastic, caring

5. Ghost of Christmas Past: Contradictory, strong, gentle, quiet, forceful, questioning, mysterious

6. Ghost of Christmas Present: Compassionate, abundant, generous, cheerful, jolly, friendly, severe, sympathetic

7. Ghost of Christmas Future: Mysterious, silent, ominous, intimidating, frightening, resolute

8. Tiny Tim: Frail, ill, good, religious

The Plot

Stave One

1. Introduced to Ebenezer Scrooge on Christmas Eve. He is a lonely miser obsessed with money. He has a clerk called Bob Cratchit who is not treated well. We learn Jacob Marley, Scrooge's business partner, died exactly 7 years earlier. Scrooge is irritated that Christmas Day seems to be interrupting his business. Scrooge is visited by his nephew Fred, who invites his uncle to Christmas dinner. Scrooge refuses. Scrooge is visited by two charity workers, asking for donations. Scrooge refuses and exclaims he wants to be left alone. Scrooge allows Bob to have Christmas Day off. Scrooge, when he is home, is visited by the Ghost of Jacob Marley – warning him he will be visited by three more ghosts to help him change his ways.

Stave Two

Scrooge is visited by the Ghost of Christmas Past who takes him to witness his past. Scrooge is taken first to his schoolboy years and he is reminded how his friends would go home from Christmas while he was left at school. We see him with his sister, who one year took him home for the holidays. Next we are shown Scrooge as a young apprentice, working for Fezziwig. Dickens describes the Christmas ball Fezziwig organised for his employees. Finally, Scrooge is taken to see his ex-fiancée, Belle. We see the scene when they break up, as money has taken over Scrooge's life. Scrooge cannot bear to see any more and struggles with the spirit.

Stave Three

Scrooge is then visited by the Ghost of Christmas Present. The spirit shows Scrooge how the Cratchit family celebrate Christmas. Scrooge asked if Tiny Tim will live. The spirit explain unless there are changes, he will die. Scrooge is then taken to see how others celebrate Christmas: miners, lighthouse workers, sailors on a ship and to Fred's house at Christmas, where they are playing games. The spirit then begins to age, and see under the spirit's robes two children: Ignorance and Want. The Ghost of Christmas Future then appears.

Stave Four

The Ghost of Christmas Future is described. The spirit takes Scrooge to see a group of businessmen discussing someone who has died. Scrooge is then taken to see Old Joe, where he is in the process of buying property of the dead man – which have been stolen. Scrooge then returns to Bob Cratchit's house, where it is revealed Tiny Tim has died. Scrooge is then taken to the graveyard and is shown a grave stone and realises this is for him. Scrooge falls to his knees and begs that he will change his ways.

Stave Five

Scrooge wakes up in his own bed. Scrooge wonders how much time has passed and calls to a boy. He then sends the boy to the poulterer for the prize turkey to give to Bob Cratchit, Scrooge meets one of the charity collectors from earlier and whispers to him that he will give a large donation. Scrooge then goes to Fred's house and is welcomed in. He enjoys the dinner and party. On Boxing Day, Scrooge arrives early to work, and plays a trick on Bob. Scrooge then tells him he is going to raise his salary and promises to help Bob's struggling family. Scrooge is described to have completely changed and becomes a 'second father' to Tiny Tim – 'who did not die.'

Key Quotations (AO1):

Stave One

"a squeezing, wrenching, grasping, scraping, clutching, covetous old sinner" – about Scrooge

"Solitary as an oyster" – about Scrooge

'A tight-fisted hand at the grind stone' – about Scrooge

"B'ah! Humbug!" – Scrooge's reaction to Christmas

"Are there no prisons? Are there no workshouses?" – Scrooge's

reaction to the charity men asking for money to support the poor

"If they are to die they had better do it, and decrease the surplus population!" – Scrooge's reaction to hearing that poor people would rather die than go to the workhouse. This quotation links to Malthusian theory (see other side of sheet)

'His face was ruddy and handsome, his eyes sparkled' – Fred (presented as the opposite to Scrooge)

'I wear the chain I forged in life' – Ghost of Marley

Stave Two

'It wore a tunic of the purest white... from the crown of its head

there sprung a bright clear jet of light' – Ghost of Christmas Past

'A lonely boy was sat reading near a feeble fire' – Scrooge as a young boy

"A solitary child, neglected by his friends" – Scrooge as a young boy

"Another idol as displaced me. A golden one." – What Belle tells

Scrooge before she leaves him.

"Your lip is trembling,' said the Ghost, 'And what is that upon your cheek?' – first sign of emotion from Scrooge

Stave Three

'There sat a jolly Giant, who wore a glowing torch...it was clothed in one simple green robe' – Ghost of Christmas Present

'God bless us everyone!' – Tiny Tim's positive attitude

'Tell me Tiny Tim will live...' – Scrooge showing compassion.

"I see a vacant seat" – The Ghost's prediction about Tiny Tim if the future is not changed.

"The whole quarter reeked with crime, with filth, with misery" – A description of one of the poorer parts of London – symbol of poverty.

"This boy is Ignorance. The girl is Want. Beware them both.." – A description of the children, Ignorance and Want.

Stave Four

'The phantom slowly, gravely, silently approached' – Ghost of Christmas Yet to Come

'I fear you more than any spectre I have seen' – Scrooge

'Tell me I may sponge away the writing on this stone!' – Scrooge desperate to change his ways

'I will honour Christmas in my heart' - Scrooge

Stave Five

"I am as light as a feather. I am as happy as an angel. I am as merry as a schoolboy. I am as giddy as a drunken man!"

'I'll raise your salary Bob and endeavour to assist your struggling family' – Scrooge changing his ways.

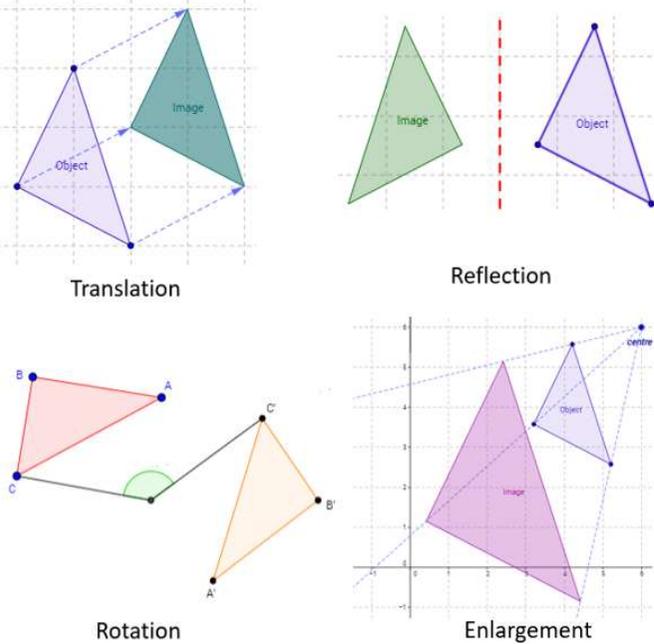
'to Tiny Tim, who did NOT die, he [Scrooge] was a second father' – Scrooge changing his ways

'Wonderful party, wonderful games, wonderful unanimity, won-der-ful happiness!' – repetition shows Scrooge's joy at the end.

Redemption	The act of making up for something that you have done wrong
Benevolence	Kindness and generosity
Charity	Love for others and kindness in your treatment of other people
Humanity	The quality or state of being human
Ignorant	Having littler or no knowledge – being unaware either by accident or by choice
Inferior	Situated lower down from others
Superior	Situated higher up from others
Surplus	An extra amount – the amount that is more than what is needed
Misanthropy	A hatred or distrust of humankind in general
Materialistic	Being overly obsessed with material things and money
Transformed	To change completely
Regretful	To feel regret about your past actions
Empathetic	An ability to understand how people are feeling by putting yourself in their position
Resolute	To be firmly determined
Ominous	Giving a sign of future trouble or evil
Allegory	A story that contains characters and events that reflect a bigger political or social message
Gothic	Having elements of the gothic genre, often reflected in dark and ominous settings, the supernatural and elements of mystery



Transformations



We **translate** a shape by moving it up or down or from side to side, but its appearance does not change in any other way. When we translate a shape, each of the vertices must be moved in exactly the same way. Every translation has a translation vector which gives the direction in which the shape is moved.

When we **reflect** a shape, we 'flip' it over a line of symmetry or 'mirror'.

When we **rotate** a shape, we turn it a certain number of degrees around a fixed point. When describing a rotation, we need to describe the center of rotation, the angle of rotation and the direction of rotation. For a 90-degree rotation around the origin, switch the x, y values of each ordered pair for the location of the new point. When describing **enlargement**, we must state the scale factor and the center of enlargement.

Pythagoras

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

The square of the Hypotenuse of a right-angled triangle is equal to the sum of squares of the other two sides.

If we know the base and the perpendicular, the hypotenuse is equal to $c = \sqrt{a^2 + b^2}$

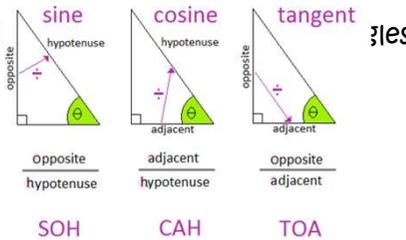
If the hypotenuse and the base are known, then the perpendicular is equal to $b = \sqrt{c^2 - a^2}$

Finally, if the hypotenuse and the perpendicular are known then the base is equal to: $a = \sqrt{c^2 - b^2}$

When you know one angle other than the right angle, θ , the side labeling follows these rules:

- Side opposite to the right angle is the hypotenuse
- Side opposite to the angle (θ) is the opposite. The side that makes the angle θ with the hypotenuse is the adjacent

The relation is as follows:



Simultaneous Equations

$$\begin{aligned} 2x - y &= 2 \\ 2x + y &= 6 \end{aligned}$$

$$\begin{aligned} 2x - y &= 2 \\ -2x - y &= -6 \\ \hline -2y &= -4 \\ y &= 2 \end{aligned}$$

$$\begin{aligned} 2x + y &= 6 \\ 2x + 2 &= 6 \\ 2x &= 4 \\ x &= 2 \end{aligned}$$

Solution: (2,2)

Put the equations into slope-intercept form, 'y = mx + b', to make graphing them easier. Start by graphing 'y = 2x - 2', which has a y-intercept of -2 and a slope of 2. Then graph 'y = -2x + 6', which has a y-intercept of 6, and a slope of -2. The point (2,2) where the lines intersect is the solution to the system of equations

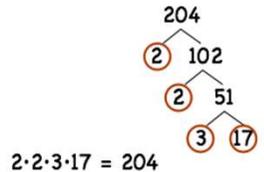
Number Sense

How Do You Find the Prime Factorization of a Number Using a Tree? **Example:** Write the prime factorization of 204

Prime and Composite Numbers

Prime → Factors are 1 and itself
Composite → Not prime
1st 10 Primes: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29

Write the Prime Factorization



EXPONENTS

$$a^b = \underbrace{a \cdot a \cdot a \cdots a}_b$$

exponent or power
b times

special cases:
 $a^1 = a$ $a^0 = 1$
 $2^1 = 2$ $2^0 = 1$

$$2^4 = 2 \cdot 2 \cdot 2 \cdot 2 = 16$$

$$(-2)^3 = (-2) \cdot (-2) \cdot (-2) = -8$$

$$\left(\frac{-x}{y}\right)^4 = \left(\frac{-x}{y}\right) \cdot \left(\frac{-x}{y}\right) \cdot \left(\frac{-x}{y}\right) \cdot \left(\frac{-x}{y}\right)$$

$$2^{-4} = \frac{1}{2^4}$$

$$(-2)^{-3} = \frac{1}{(-2)^3}$$

Product of Powers Rule

$$4^2 \cdot 4^4 = 4^{2+4} = 4^6$$

$$4^2 \cdot 4^4 = 4^{2+4} = 4^6$$

$$a^m \cdot a^n = a^{m+n}$$

$$x^3 \cdot x^5 = x^{3+5} = x^8$$

Standard Form

$$a \times 10^n \text{ where } 1 \leq a < 10 \text{ and } n \rightarrow \text{integer}$$

$$5.63 \times 10^5$$

$$2.005 \times 10^{-7}$$

A number in scientific notation has the form a times 10^n

In addition, a must be greater than or equal to 1, but less than 10

And n must be an integer

Quotient of Powers

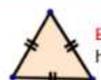
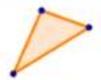
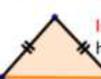
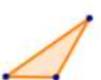
$$\frac{6^5}{6^3} = 6^{5-3} = 6^2 = 36$$

$$\frac{6^5}{6^3} = 1 \cdot 1 \cdot 6 \cdot 6 = 6^2$$

$$\frac{8^2}{8^6} = 8^{2-6} = 8^{-4}$$

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

Triangles

By Side	By Angle
 <p>Equilateral Triangle has three equal sides</p>	 <p>Acute triangle has three angles $< 90^\circ$</p>
 <p>Isosceles Triangle has two equal sides</p>	 <p>Right triangle has one angle $= 90^\circ$</p>
 <p>Scalene Triangle has no equal sides</p>	 <p>Obtuse triangle has one angle $> 90^\circ$</p>

Sequences

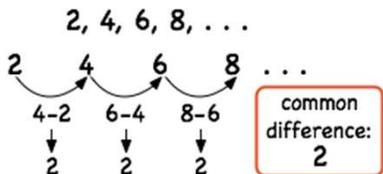
Term in a sequence

A **term** in a sequence is any number in that sequence



A sequence is a set of numbers in a particular order '2, 4, 6, 8, ...' is a sequence of positive even integers The '...' in this sequence means that the pattern continues on to 10, 12, 14 and so on 2, 4, 6, and 8 are terms in this sequence

Find the Common Difference



Example: Find the next four terms in the sequence '2, 4, 6, 8, ...' The common difference, 'd', for this sequence is '2' Adding '2' to the '8' will give us the next term in the sequence, 10. We repeat this process to get '12, 14, 16' So we added the terms '10, 12, 14, 16' to our initial sequence

Solving Equations

Example: Maria's uncle Jack is three times as old as she is. If Jack is 36, how old is Maria?

What is Maria's Age?

1. Choose variable **m** to represent **Maria's age**
2. Find equation from problem that contains **m**
3. Solve for **m**
4. Check our answer

Jack is 3 times older

$$3m = 36$$

Jack's age

$$m = 12 \text{ yrs old}$$

$$3(12) \stackrel{?}{=} 36$$

$$36 = 36 \quad \checkmark$$

Maria is 12 yrs old!

Are These Sequences Arithmetic or Geometric?

a) -6, 1, 8, 15, 22



Common **Ratio**? No
Common **Diff**? Yes
Check: **Arithmetic**

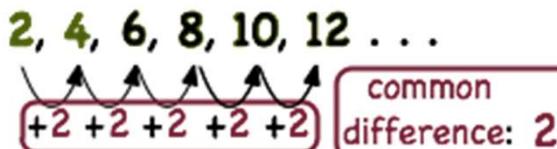
b) 324, 108, 36, 12, 4



Common **Ratio**? Yes
Check: **Geometric**

Arithmetic Sequence

A pattern of numbers that increase or decrease at a **constant amount**

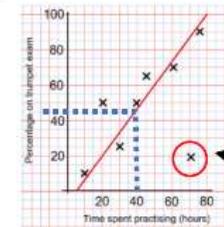


Scatter graphs and correlation

Using a line of best fit

Interpolation is using the line of best fit to estimate values inside our data point.

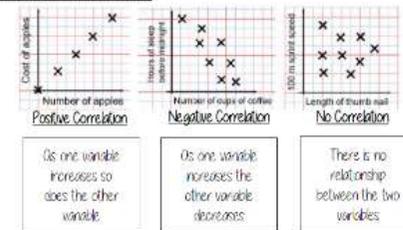
e.g. 40 hours revising predicts a percentage of 45



Extrapolation is where we use our line of best fit to predict information outside of our data
This is not always useful – in this example you cannot score more than 100%. So revising for longer can not be estimated

This point is an 'outlier' It is an outlier because it doesn't fit this model and stands apart from the data

Linear Correlation



Scatter graphs
Plot bi-variate data. ...is it correlation or causation?

Equations with two unknowns

$$a + 2b = 23$$

Solve for **a**

$$a + 2b = 23$$

$$- 2b \quad - 2b$$

$$a = 23 - 2b$$

Solve for **b**

$$a + 2b = 23$$

$$- a \quad - a$$

$$\frac{2b}{2} = \frac{23 - a}{2}$$

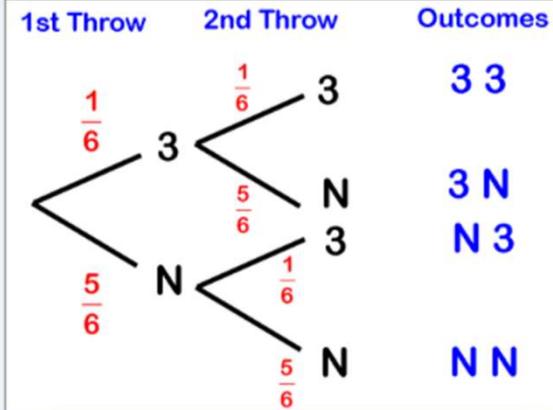
$$b = \frac{23 - a}{2}$$

'a' and 'b' are variables. Subtract '2b' from both sides to solve for 'a'. The equation becomes 'a = 23-2b' We can't combine anything on the right-hand side because they are not like terms. We have 'a' in terms of 'b'. Subtract 'a' from both sides to solve for 'b'. Divide both sides by 2 to get 'b' alone. We have found 'b' in terms of 'a'.



Tree Diagrams

A fair dice is thrown twice. The tree diagram shows the probability of throwing 3, P(3), and the probability of not throwing 3, P(N).



The probability of throwing two 3s.

$$P(33) = \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$$

The probability of throwing one 3.

$$P(3N) = \frac{1}{6} \times \frac{5}{6} = \frac{5}{36}$$

$$P(3N) \text{ or } P(N3) = \frac{5}{36} + \frac{5}{36} = \frac{10}{36}$$

$$P(N3) = \frac{5}{6} \times \frac{1}{6} = \frac{5}{36}$$

$$\frac{5}{36} + \frac{5}{36} = \frac{10}{36}$$

Calculations with Standard Form

$$(4 \times 10^6) \times (2 \times 10^3) = 8 \times 10^9$$

$$(4 \times 10^6) \div (2 \times 10^3) = 2 \times 10^3$$

$$(3 \times 10^6) \times (2 \times 10^{-2}) = 6 \times 10^4$$

$$(4.8 \times 10^6) \div (1.2 \times 10^3) = 4 \times 10^3$$

$$(4 \times 10^6) \times (3 \times 10^3) = 12 \times 10^9 \checkmark$$

$$(1 \times 10^6) \div (2 \times 10^3) = 0.5 \times 10^3 \div 2 = 5 \times 10^2$$

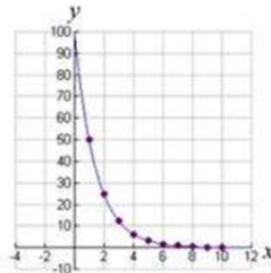
Growth and Decay

$$y = a \cdot b^x$$

Example: $y = 100 \cdot (0.5)^x$

when $a > 0$ and the b is between 0 and 1, the graph will be decreasing (decaying).

For this example, each time x is increased by 1, y decreases to one half of its previous value.



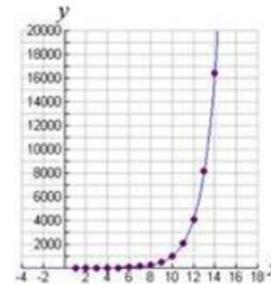
Such a situation is called **Exponential Decay**.

$$y = a \cdot b^x$$

Example: $y = 1 \cdot (2)^x$

when $a > 0$ and the b is greater than 1, the graph will be increasing (growing).

For this example, each time x is increased by 1, y increases by a factor of 2.



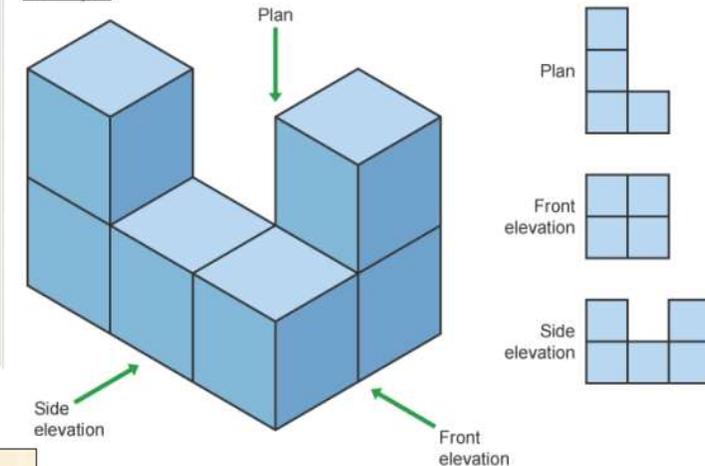
Such a situation is called **Exponential Growth**.

Plans and Elevations

Plans and elevations help us plan and design structures. Architects use these when designing buildings.

- The view from the top (looking down on the structure) is called the plan.
- The views from the front and sides of the structure are called elevations. (The front view is the front elevation and the side view is the side elevation).

Example

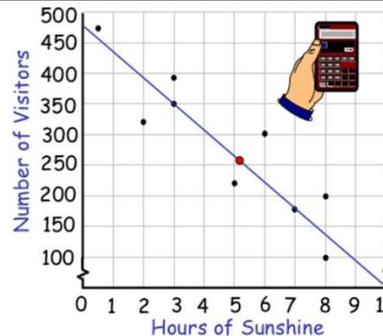


Scatter diagrams and lines of best fit

(2). The table below shows the number of people who visited a museum over a 10 day period last summer together with the daily sunshine totals.

(a) Plot a scatter graph for this data and draw a line of best fit.

Hours Sunshine	6	0.5	8	3	8	10	7	5	3	2
Visitors	300	475	100	390	200	50	175	220	350	320



(b) Draw a line of best fit and comment on the correlation.

If you have a calculator you can find the mean of each set of data and plot this point to help you draw the line of best fit. Ideally all lines of best fit should pass through co-ordinates: (mean data 1, mean data 2) In this case: (5.2, 258)

Compound Interest

£2000 earning **Compound Interest** at **5%** per year for **3** years

Original Amount = 100%
Compound Interest = 5%

$$100\% + 5\% = 105\% = 1.05$$

$$£2000 \times 1.05^3 = £2315.25$$

This is the total amount including interest:

£2315.25

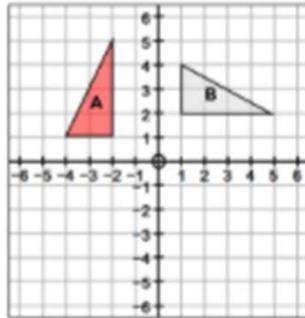


Different transformations

Describing Rotations

State...

1. The centre of rotation
2. The angle of rotation
3. The direction of rotation

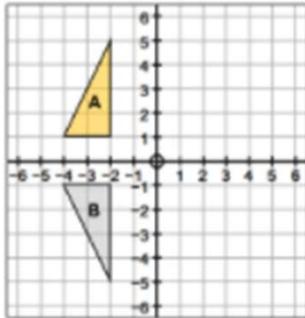


- Centre of rotation is (0,0)
- Angle of rotation is 90°
- Direction of rotation is clockwise

Describing Reflections

State...

1. The line of symmetry

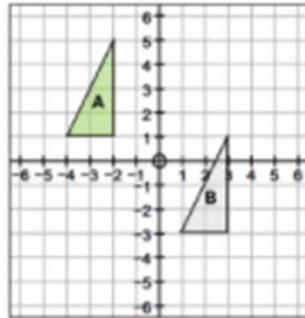


- The line of symmetry is the X axis

Describing Translations

State...

1. Movement left or right
 2. Movement up or down
- Or write the column vector

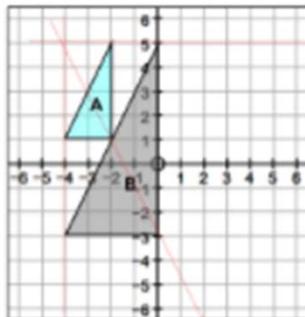


- Translation of 5 to the right and 4 down

Describing Enlargements

State...

1. Centre of enlargement
2. Scale Factor



- The centre of enlargement is (-4, 5)
- The scale factor is 2

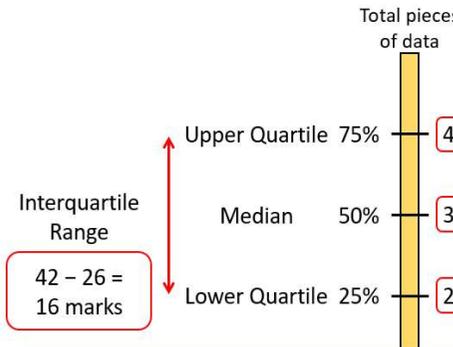
Cumulative Frequency

A cumulative frequency graph allows us to measure the spread of data.

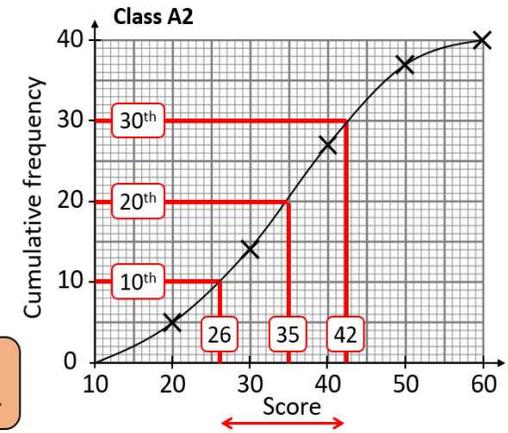
By finding the value at each **quartile** (quarter) of the data, we can find the **median** and the spread of the **middle 50%**.

This measure eliminates extreme values.

Score	Students (Frequency)	Cumulative Frequency
11-20	5	5
21-30	9	14
31-40	13	27
41-50	10	37
51-60	3	40



We take the 20th instead of $(40 + 1) \div 2$ th because grouped data is *already* an estimation.



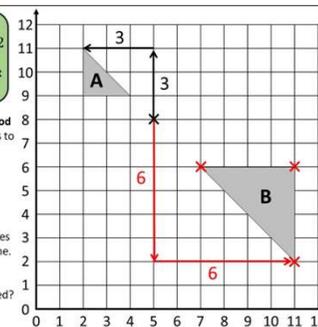
Negative enlargement

Enlarge Shape A by a scale factor of -2 from a centre of enlargement (5,8)

Counting Squares Method
We will count the squares to each vertex, reverse and double the distance for the new vertex.

CHECK 1!
The corresponding vertices should be in a straight line.

CHECK 2!
Are the lengths all doubled?



$$20^2 = HG^2 + 15^2$$

$$HG^2 = 20^2 - 15^2$$

$$HG = \sqrt{175}$$

$$HG = 13.2 \text{ (1dp)}$$

Therefore ...

$$13.2^2 = EG^2 + 7^2$$

$$EG^2 = 13.2^2 - 7^2$$

$$EG = \sqrt{125.24}$$

$$EG = 11.2 \text{ (1dp)}$$

Therefore ...

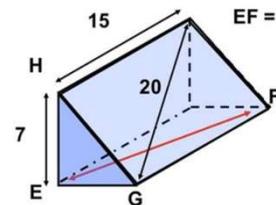
$$EF^2 = 11.2^2 + 15^2$$

$$EF^2 = 350.44$$

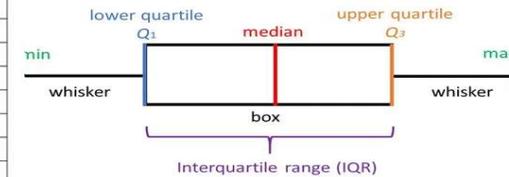
$$EF = \sqrt{350.44}$$

$$HG = 18.7 \text{ (1dp)}$$

3D Pythagoras

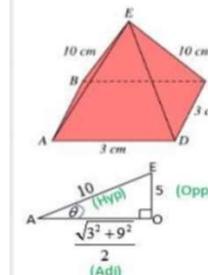


Box Plot



3D Trigonometry

Calculate the angle between the length AE and the base ABCD in the pyramid pictured below, giving your answer to 1 decimal place.



SOH CAH TDA

Point "O" is the centre of the base ABCD.

$$\cos \theta = \frac{a}{h}$$

$$\theta = \cos^{-1} \left(\frac{\sqrt{3^2 + 3^2}}{2 \times 10} \right)$$

$$\theta = \cos^{-1} \left(\frac{\sqrt{18}}{20} \right)$$

$$\theta = 77.75267576$$

$$\theta = 77.8^\circ$$



A **histogram** is a type of frequency diagram used for grouped continuous data. In a histogram for unequal class intervals the area of the bar represents the frequency. The height of each bar is the frequency density.

$$\text{Frequency density} = \frac{\text{frequency}}{\text{class width}}$$

Example 4

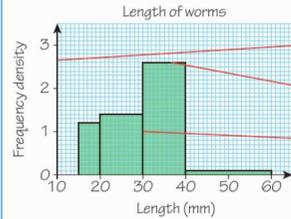
The lengths of 48 worms are recorded in this table.

Length, x (mm)	$15 < x \leq 20$	$20 < x \leq 30$	$30 < x \leq 40$	$40 < x \leq 60$
Frequency	6	14	26	2

Draw a histogram to display this data.

$$6 \div 5 = 1.2, 14 \div 10 = 1.4, 26 \div 10 = 2.6, 2 \div 20 = 0.1$$

Work out the frequency density for each class



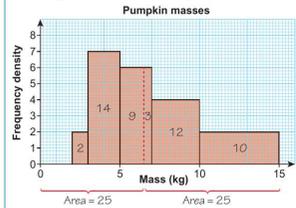
Label the y -axis 'Frequency density'.

The height of each bar is the frequency density for each class.

Draw the bars with no gaps between them.

Example 5

The histogram shows the masses of pumpkins in a farm shop.



Work out an estimate for the median mass.

$$\text{Total frequency} = 1 \times 2 + 2 \times 7 + 2 \times 6 + 3 \times 4 + 5 \times 2 = 50$$

The median is the 25.5th value and lies in the class $5 < m \leq 7$.

Frequency = area = 9, frequency density = 6, Class width = $9 \div 6 = 1.5$

An estimate for the median is $5 + 1.5 = 6.5$ kg

Work out the areas of all the bars to find the total frequency.

Work out which class contains the median.

Use frequency density = frequency / class width to find class width of class from 5 to median.

Add the class width to the lower class boundary.

Changing the subject – complex

Key point 1

When the letter to be made the subject appears twice in the formula you will need to factorise.

Example 2

Make w the subject of the formula $A = wh + lh + lw$

$$A - lh = wh + lw$$

w appears twice in this formula. Subtract lh from both sides to get the terms in w together on one side of the equals sign.

$$A - lh = w(h + l)$$

Factorise the right-hand side, so w appears only once.

$$w = \frac{A - lh}{h + l}$$

Divide both sides by $(h + l)$.

If one event depends upon the outcome of another event, the two events are **dependent events**. For example, removing a red card from a pack of playing cards reduces the chance of choosing another red card.

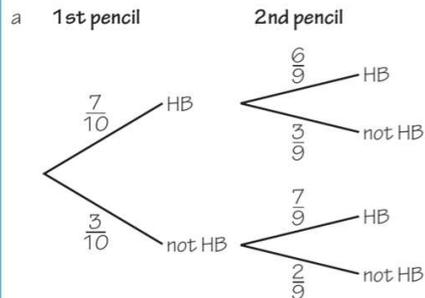
A tree diagram can be used to solve problems involving dependent events.

A **conditional probability** is the probability of a dependent event. The probability of the second outcome depends on what has already happened in the first outcome.

There are 10 pencils in Toby's pencil case. Seven of the pencils are HB pencils.

Toby takes two pencils out of his pencil case.

- Draw a tree diagram to show all the possible outcomes.
- Work out the probability that he picks out at least one HB pencil.



Taking two pencils from the pencil case at the same time is the same as taking one pencil, then another (without replacement).

$A \cap B \cap C$ means the **intersection** of A, B and C.
 $A \cup B \cup C$ means the **union** of A, B and C.
 $P(A \cap B | B)$ means the probability of A and B given B.

Curly brackets $\{ \}$ show a set of values.
 \in means 'is an element of'.

$$P(\text{at least 1 HB}) = 1 - P(\text{no HB})$$

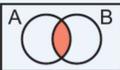
$$P(\text{not HB, not HB}) = \frac{3}{10} \times \frac{2}{9} = \frac{6}{90} = \frac{1}{15}$$

$$P(\text{at least 1 HB}) = 1 - \frac{1}{15} = \frac{14}{15}$$

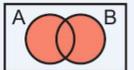
You don't need to simplify probability fractions, but sometimes it makes calculations easier.

Venn Diagrams

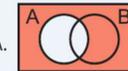
$A \cap B$ means 'A intersection B'. This is all the elements that are in A and in B.



$A \cup B$ means 'A union B'. This is all the elements that are in A or B or both.



A' means the elements *not* in A.



ξ means the universal set – all elements being considered.

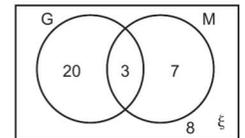
You can calculate probabilities from Venn diagrams.

Example 6

The Venn diagram shows the number of students studying German (G) and Mandarin (M).

A student is picked at random. Work out

- $P(G \cap M)$
- $P(G')$
- $P(G \cup M)$



$$a \quad 20 + 3 + 7 + 8 = 38$$

Work out the total number of students.

$$P(G \cap M) = \frac{3}{38}$$

Number of students in $G \cap M$ / total number of students

$$b \quad P(G') = \frac{7 + 8}{38} = \frac{15}{38}$$

Number of students in G' / total number of students

$$c \quad P(G \cup M) = \frac{20 + 3 + 7}{38} = \frac{30}{38}$$



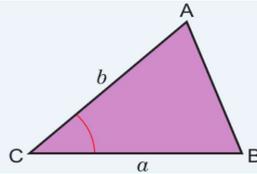
Quadratic nth term

Find the quadratic sequence's next 3 terms and the rule for the nth term, $T_n = an^2 + bn + c$.

$+4 \quad +4 \quad +4 \rightarrow 2a=4 \rightarrow a=2$
 $+6 \quad +10 \quad +14 \quad +18 \quad +22 \quad +26 \quad +30$
 $-3 \quad 3 \quad 13 \quad 27 \quad 45 \quad 67 \quad 93 \quad 123$
 1st term, $T_1 = a + b + c = 3$
 0th term, $T_0 = c \quad 2 + b - 3 = 3$
 $b = 3 - 2 + 3$
 $b = 4$
 nth term, $T_n = 2n^2 + 4n - 3$

T_n	$an^2 + bn + c$
n	0 1 2 3
T_n	c a+b+c 4a+2b+c 9a+3b+c
Δ	a+b 3a+b 5a+b
Δ	2a 2a

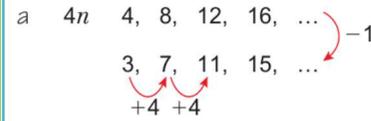
The area of this triangle = $\frac{1}{2}ab \sin C$.
 a is the side opposite angle A.
 b is the side opposite angle B.



The n th term of an arithmetic sequence = common difference $\times n$ + zero term

Example 3

a Work out the n th term of the sequence 3, 7, 11, 15, ... b Is 45 a term of the sequence?



The common difference is 4. Write out the first five terms of the sequence for $4n$, the multiples of 4. Work out how to get from each term in $4n$ to the term in the sequence.

The n th term is $4n - 1$.

b $45 = 4n - 1$
 $46 = 4n$
 $11.5 = n$
 45 cannot be in the sequence because 11.5 is not an integer.

Write an equation using the n th term and solve it.

Key point 3

You can use the quadratic formula

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

to find the solutions to a quadratic equation $ax^2 + bx + c = 0$

Solving quadratics

To rationalise the denominator of $\frac{a}{\sqrt{b}}$, multiply by $\frac{\sqrt{b}}{\sqrt{b}}$. Then the fraction will have an integer as the denominator.

Example 4

Rationalise the denominator.

a $\frac{1}{\sqrt{2}}$
 b $\frac{5}{\sqrt{75}}$

Multiplying by $\frac{\sqrt{2}}{\sqrt{2}}$ is the same as multiplying by 1, so this does not change the value.

a $\frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}$

First simplify $\sqrt{75}$

b $\sqrt{75} = \sqrt{25 \times 3} = 5\sqrt{3}$

Simplify the fraction before rationalising.

$\frac{5}{\sqrt{75}} = \frac{5}{5\sqrt{3}} = \frac{1}{\sqrt{3}} = \frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{3}$

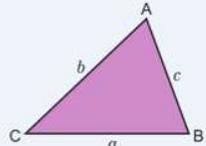
The sine rule can be used in any triangle.

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ Use this to calculate an unknown side.

$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$ Use this to calculate an unknown angle.

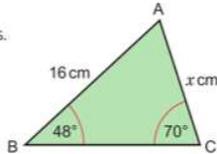
To use the sine rule you need to know one angle and the opposite side. Then:

- if you know another angle, you can work out the length of its opposite side
- if you know another side, you can work out the size of its opposite angle.



Example 3

a Find the value of x .
 Give your answer to 3 significant figures.

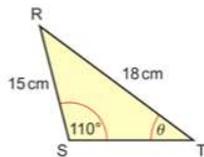


Use the sine rule $\frac{b}{\sin B} = \frac{c}{\sin C}$

Multiply both sides by $\sin 48^\circ$.

a $\frac{x}{\sin 48^\circ} = \frac{16}{\sin 70^\circ}$
 $x = \frac{16 \sin 48^\circ}{\sin 70^\circ} = 12.653 \dots$
 $= 12.7 \text{ cm (3 s.f.)}$

b Find the value of θ .
 Give your answer to 1 decimal place.



Use the sine rule $\frac{\sin T}{t} = \frac{\sin S}{s}$

Multiply both sides by 15.

b $\frac{\sin \theta}{15} = \frac{\sin 110^\circ}{18}$
 $\sin \theta = \frac{15 \sin 110^\circ}{18}$
 $\theta = \sin^{-1} \left(\frac{15 \sin 110^\circ}{18} \right)$
 $= 51.5^\circ \text{ (1 d.p.)}$

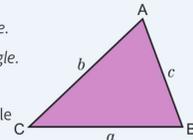
The cosine rule can be used in any triangle.

$a^2 = b^2 + c^2 - 2bc \cos A$ Use this to calculate an unknown side.

$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ Use this to calculate an unknown angle.

You can use the cosine rule to find:

- the length of a side if you know two sides and the included angle
- an unknown angle if you know all three sides.



a Work out the length of the side labelled x .
 Give your answer correct to 3 significant figures.

b Work out the size of angle y .
 Give your answer correct to 1 decimal place.

Sketch the triangle. Label the missing side a , and the others b and c .

Use the cosine rule to find the side.

Use the cosine rule to find the angle.

$a^2 = b^2 + c^2 - 2bc \cos A$
 $x^2 = 7^2 + 6^2 - 2 \times 7 \times 6 \times \cos 58^\circ = 40.486 \dots$
 $x = \sqrt{40.486} = 6.3629 \dots = 6.36 \text{ cm (3 s.f.)}$

$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$
 $\cos y = \frac{6^2 + 7^2 - 10^2}{2 \times 6 \times 7}$
 $y = \cos^{-1} \left(\frac{6^2 + 7^2 - 10^2}{2 \times 6 \times 7} \right) = 100.5^\circ \text{ (1 d.p.)}$

Example 3

Write $x^2 + 2x + 7$ in the form $(x + p)^2 + q$

$[x^2 + 2x] + 7$ Separate the x terms from the constant.

$x^2 + 2x \equiv (x + 1)^2 - 1$ Find the perfect square which will give the correct x^2 and x terms, then subtract the constant to make the identity true.

So $[x^2 + 2x] + 7 = [(x + 1)^2 - 1] + 7$
 $= (x + 1)^2 + 6$ Substitute the identity into the original expression.

Simplify the expression.

So $p = 1$ and $q = 6$ Compare $(x + 1)^2 + 6$ with $(x + p)^2 + q$ and write down the values.

Key point 5

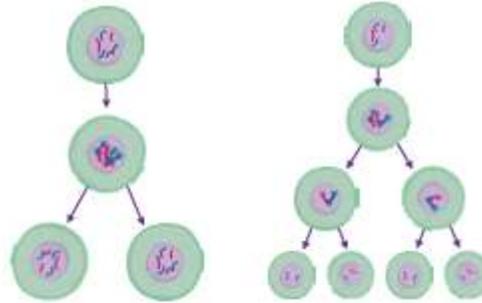
$x^2 + bx + c$ can be written in the form $\left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c$.

This is called **completing the square**.

Inheritance, Variation and Evolution Knowledge Organiser

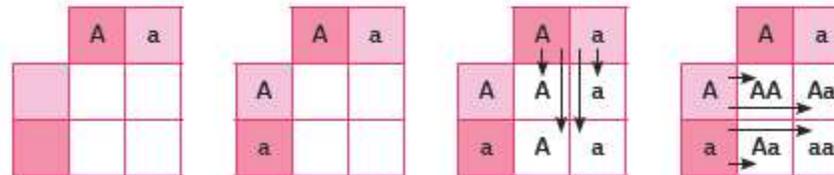
Keywords

- allele** – An alternative form of a gene.
- asexual reproduction** – The production of offspring from a single parent by mitosis. The offspring are clones of the parent.
- chromosome** – Structures that contain the DNA of an organism and are found in the nucleus.
- cystic fibrosis** – A disorder of cell membranes that is caused by a recessive allele.
- DNA** – A polymer that is made up of two strands that form a double helix.
- dominant** – An allele that is always expressed, even if only one copy is present.
- fertilisation** – The fusion of male and female gametes.
- gamete** – Sperm cell and egg cell in animals; pollen and egg cell in plants.
- gene** – A small section of DNA that codes for a specific protein.
- genome** – The entire genetic material of an organism.
- genotype** – The combination of alleles.
- heterozygous** – A genotype that has two different alleles, one dominant and one recessive.
- homozygous** – A genotype that has two of the same alleles. Either two dominant alleles or two recessive alleles.
- meiosis** – The two-stage process of cell division that reduces the chromosome number of the daughter cells. It makes gametes for sexual reproduction.
- mutation** – A change in DNA.
- phenotype** – The characteristic expressed because of the combination of alleles.
- polydactyly** – Having extra fingers or toes. It is caused by a dominant allele.
- recessive** – An allele that is only expressed if two copies of it are present.
- sexual reproduction** – The production of offspring by combining genetic information from the gametes of two parents. Leads to variation in the offspring.



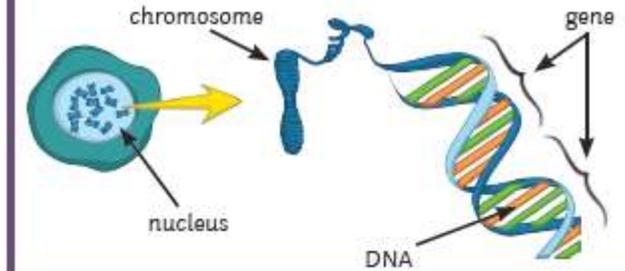
Mitosis	Meiosis
Produces two daughter cells.	Produces four daughter cells.
Daughter cells are genetically identical.	Daughter cells are not genetically identical.
The cell divides once.	The cell divides twice.
The chromosome number of the daughter cells is the same as the parent cells. In humans, this is 46 chromosomes.	The chromosome number is reduced by half. In humans, this is 23 chromosomes.
Used for growth and repair, and asexual reproduction.	Produces gametes for sexual reproduction.

How to Complete a Punnet Square

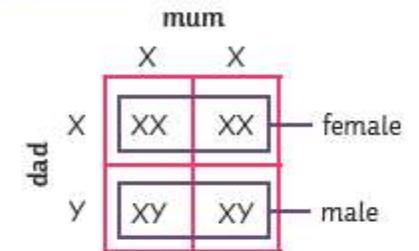


- Step 1:** Put the two alleles from one parent into the boxes at the top. This parent is a heterozygote. This means they have one dominant and one recessive allele.
- Step 2:** Put the two alleles from the second parent into the boxes on the left. This parent is also a heterozygote.
- Step 3:** Put the alleles from the first parent into the two boxes underneath them.
- Step 4:** Put the alleles from the second parent into the two boxes to the right of them.

Science: Biology



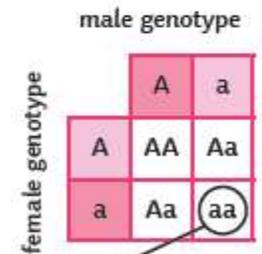
Sex Determination



Females carry two X chromosomes.
Males carry one X and one Y chromosome.

Probability

There are four possible combinations of gametes that offspring can inherit.



One of these four has the genotype aa – that's $\frac{1}{4}$, 25% or 0.25.
The recessive phenotype has a ratio of 1:3 because only one combination will show the phenotype while the other three will not.

Science: Biology

Inheritance, Variation and Evolution Knowledge Organiser

Keywords

embryo screening – Genetic tests carried out on an embryo to see whether it carries a faulty allele.

evolution – A change in the inherited characteristics of a population over time through a process of natural selection.

evolutionary tree – A method used to show how scientists believe organisms are related.

extinction – The permanent loss of all members of a species.

fossils – The remains of organisms from millions of years ago which are found in rocks.

genetic engineering – The process by which scientists manipulate and change the genotype of an organism.

natural selection – The process by which organisms that are better suited to an environment are more likely to survive and reproduce.

selective breeding – Humans selecting animals or plants, that have a required characteristic, for breeding.

speciation – The process by which two species evolve from a single original species by natural selection. The two populations have become so different that they can no longer interbreed to produce fertile offspring.

variation - Differences in characteristics of individuals in a population.

Variation

Variation maybe be due to differences in:

- the genes that have been inherited (genetic causes);
- the conditions in which they have developed (environmental causes);
- a combination of genes and the environment.

Evolution

All species of living things have evolved from simple life forms by natural selection.

- If a variant/characteristic is advantageous in an environment, then the individual will be better able to compete.
- This means they are more likely to survive and reproduce.
- Their offspring will inherit the advantageous allele.



Fossils

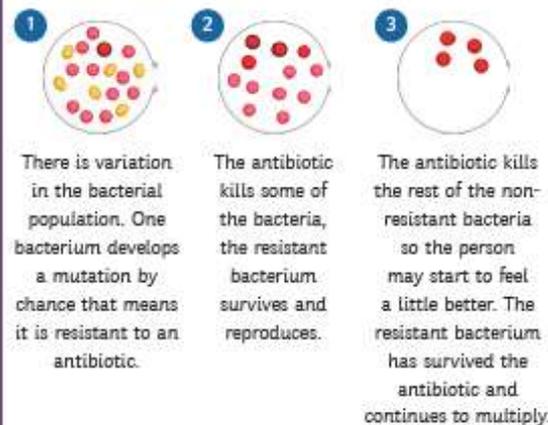
Fossils could be:

- the actual remains of an organism that has not decayed;
- mineralised forms of the harder parts of an organism, such as bones;
- traces of organisms such as footprints or burrows.

Many early life forms were soft-bodied so have left few traces behind.

Fossils help us understand how much or little organisms have changed as life developed on earth.

Resistant Bacteria

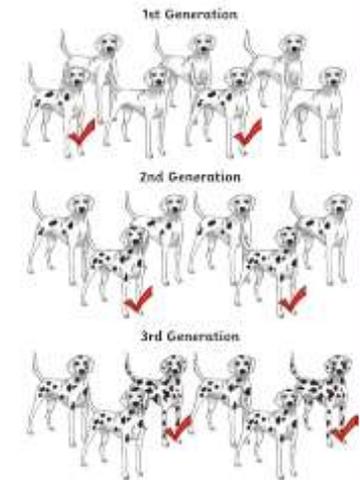


To reduce the rate at which antibiotic-resistant strains appear:

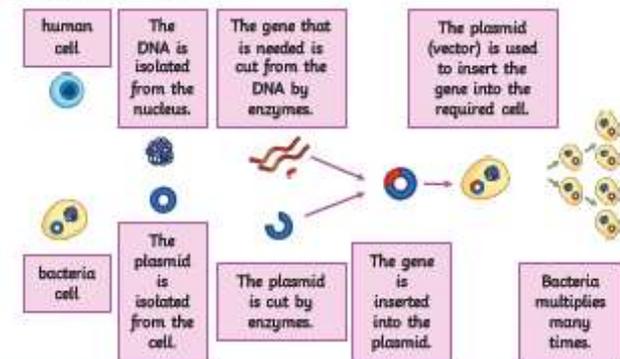
- Antibiotics should only be used when they are really needed, not for treating non-serious or viral infections.
- Patients should complete their courses of antibiotics, even if they start to feel better.
- The agricultural use of antibiotics should be restricted.

Selective Breeding

1. Choose parents who have the desired characteristic.
2. Select the best offspring and breed these to make the next generation.
3. These offspring are then bred again and again, over many generations, until a desired result is achieved.



Genetic Engineering



Classification

Linnaeus classified living things into kingdom, phylum, class, order, family, genus and species.

Organisms are named by the binomial system of genus and species.

Due to evidence from chemical analysis, there is now a 'three-domain system' developed by Carl Woese.

Domain	bacteria	archaea	eukaryota			
Kingdom	eubacteria	archaeobacteria	protista	fungi	plantae	animalia

AQA GCSE Chemistry (Combined Science) Unit 9: Chemistry of the Atmosphere

The Early Atmosphere

Approximately **4.6 billion years ago** the Earth was formed. Scientists have lots of ideas and **theories** about how the atmosphere was produced and the gases within it, but due to the lack of evidence, they cannot be sure.

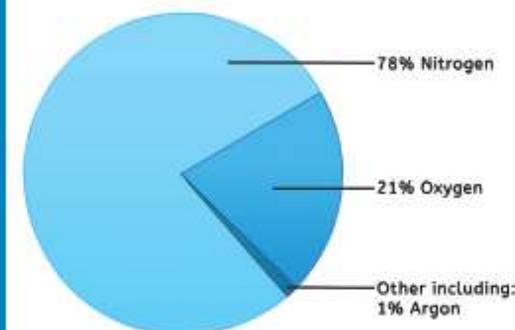
One theory suggested that **intense volcanic activity** released gases that made Earth's early atmosphere very similar to that of Mars and Venus. These planet's atmospheres mainly consist of carbon dioxide with little oxygen.

Nitrogen gas would have also been released from volcanoes and would have built up in the atmosphere.

Water vapour in Earth's early atmosphere would have **condensed** to create the seas and oceans. Carbon dioxide would have dissolved into the water, decreasing the level in the atmosphere.

Percentage of Gases in the Atmosphere

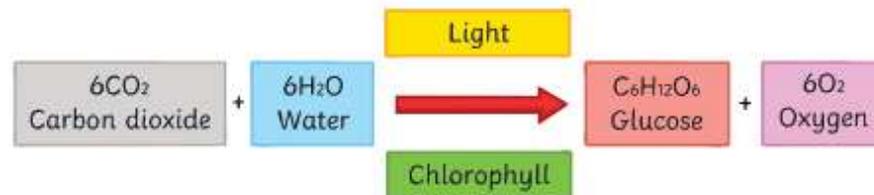
The pie chart below shows the abundance of each gas in our atmosphere.



How Did the Levels of Oxygen Increase?

2.7 billion years ago, algae first produced oxygen. Gradually over time, the levels of oxygen in our atmosphere increased as plants evolved. This was followed by animals as the levels of oxygen increased to a level that would sustain more complex life.

Oxygen is produced by plants in the process of **photosynthesis**.



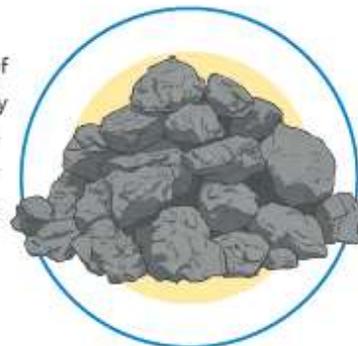
How Did the Levels of Carbon Dioxide Decrease?

Carbon dioxide **dissolves** in water. As water vapour condensed and the oceans and seas formed, the carbon dioxide gas dissolved producing **carbonate compounds**. This process reduced the amount of carbon dioxide in the atmosphere. Carbonate compounds were then **precipitated**: limestone is an example of a sedimentary rock; it has the chemical name calcium carbonate.

Plants in the oceans absorbed **carbon dioxide gas** for **photosynthesis**. The organisms from the food chains that the plants supported were turned into fossil fuels. **Fossil fuels** are **non-renewable** and consist of **coal, crude oil, and gas**, all of which contain carbon.

Crude oil was formed millions of years ago. When aquatic plants and animals died, they fell to the bottom of the sea and got trapped under layers of sand and mud. Over time, the organisms got buried deeper below the surface. The **heat and pressure** rose, turning the remains of the organisms into crude oil or natural gas. Oxidation did not occur due to the lack of oxygen.

Coal is a fossil fuel formed from **giant plants** that lived hundreds of millions of years ago in swamp-like forests. When these plants died, they sank to the bottom of the swamp where dirt and water began to pile on top of them. Over time, pressure and heat increased and the plant remains underwent chemical and physical changes. The oxygen was pushed out and all that remained was coal.



The Human Impact and the Greenhouse Effect

Scientists believe that human activities have resulted in the increased amount of greenhouse gases in the atmosphere. Activities such as **farming cattle** and **farming rice** release huge amounts of **methane** into the atmosphere.

Burning **fossil fuels** in cars and power stations releases large amounts of **carbon dioxide**. With large areas of the rainforest being cut down through **deforestation**, the excess carbon dioxide is not being absorbed by photosynthesis.

However, not everyone believes that humans are causing the rise in greenhouse gases. Some believe that the rise in global temperatures is associated with cycles of climate change and natural factors.

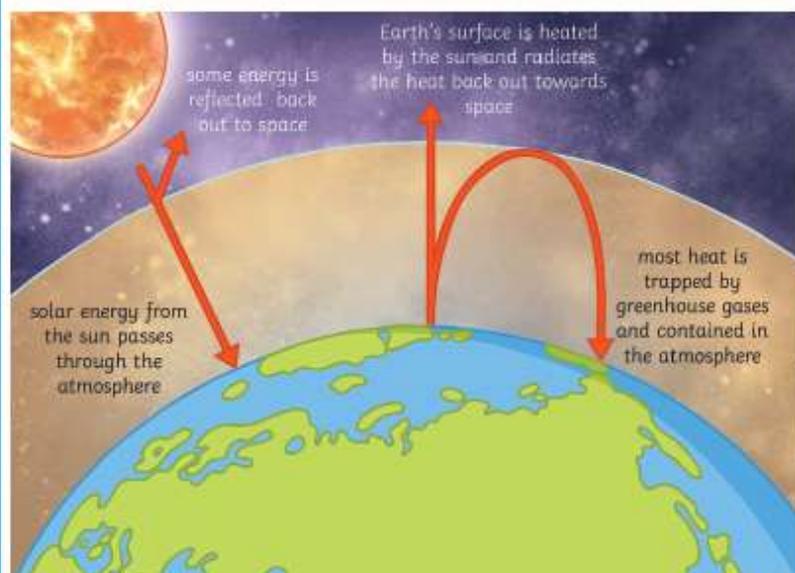
Climate science is often complicated as there are **difficulties** associated with **predicting future global temperatures**. The media present information that can be biased, inaccurate or lacks substantial evidence.

After reading an article on global warming, consider the trustworthiness of the source by considering these factors:

- Is the research done by an expert in that field and do they have the right skills and qualifications to report on the issue?
- Which organisation is reporting the evidence? If it is a newspaper, some stories are sensationalised in order to sell papers.
- Was the research funded by a legitimate organisation and was it conducted in a non-biased way? Think about the methods that were used to obtain the data and the impact the collection and analysis of this data had on the overall result.

AQA GCSE Chemistry (Combined Science) Unit 9: Chemistry of the Atmosphere

The Greenhouse Effect



A greenhouse is a house made of glass and is commonly used by gardeners to help grow plants and keep them warm. As the sun shines through the greenhouse, the air is heated up and becomes trapped by the glass and is prevented from escaping. During daylight, a greenhouse stays quite warm and this lasts into the night.

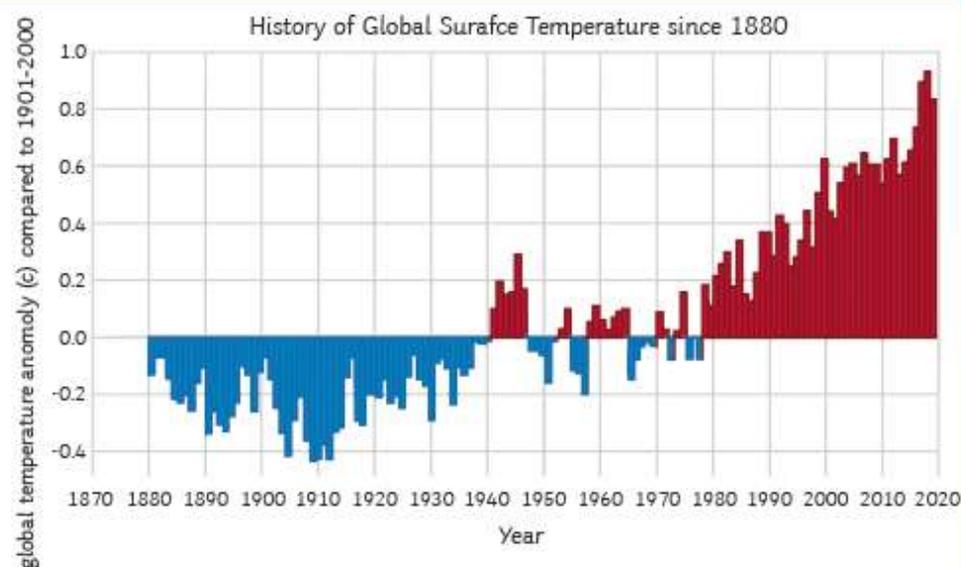
The earth and its atmosphere are very similar to that of a greenhouse. The greenhouse gases in the atmosphere trap the heat and keep the earth warm. The main greenhouse gases are **carbon dioxide**, **water vapour** and **methane**. During the daylight, the sun warms up the earth's surface. During the night, as the earth begins to cool and release the heat back into the atmosphere, some of the heat is trapped by the greenhouse gases in the atmosphere.

If the **greenhouse effect** becomes too **strong**, the earth will get too warm and melt the Arctic ice. As we burn more fossil fuels, the levels of **carbon dioxide** and the other **greenhouse gases** **increase** in our atmosphere which makes the greenhouse effect stronger.

What is the Difference Between Climate Change and Global Warming?

Since the Earth was formed over 4.6 billion years ago, its climate has constantly been changing with several ice ages followed by warmer temperatures. Changes in the Sun's energy reaching the Earth and volcanic eruptions were responsible for the changes until about 200 years ago.

Global warming is different to climate change and is used to explain how the earth's climate has warmed up over the past 200 years. Scientists believe that the warming of the climate is due to the activities of humans.



Carbon Footprint

The carbon footprint is the total amount of **carbon dioxide** and other **greenhouse gases** emitted over the full life cycle of a product, service or event.

An individual's carbon footprint is a calculation of all the activities that that person has taken part in throughout the year.

These activities might involve flying abroad or **travelling** by bus or rail. Each of which might be powered by petrol or diesel. **Heating a home** in winter by using a gas-powered boiler and using electricity to power lights and electronic devices. **Food** also has a **carbon footprint**, for example, beef and rice produces huge amounts of methane when farmed.



Nitrogen

Nitrogen and oxygen react together to make oxides of nitrogen. This occurs inside a **car engine** where there is a high temperature and pressure. Many compounds can be formed when nitrogen reacts with oxygen. The two that are formed inside a car engine are **NO** and **NO₂**.

Nitrogen compounds are grouped together with the general formula **NO_x**. Nitrogen compounds, along with sulfur dioxide, are also responsible for acid rain.

Compounds of nitrogen oxides react in the atmosphere with ultraviolet light from the sun to produce **photochemical smog**. The smog is most noticeable during the morning and afternoon and occurs mainly in densely populated cities.

The presence of smog can have a **major impact on human health**, particularly to those who suffer with **asthma**.

Combustion

Complete combustion occurs when there is **enough oxygen** for a fuel to burn. A hydrocarbon will react with oxygen to produce carbon dioxide and water.

propane + oxygen \rightarrow carbon dioxide + water



Incomplete combustion occurs when there isn't **enough oxygen** for a fuel to burn. The products in this reaction are water and poisonous **carbon monoxide**. Carbon particles (soot) may also be seen.

ethane + oxygen \rightarrow carbon monoxide + water



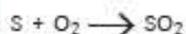
Carbon monoxide is a poisonous gas. It is often called the **silent killer** due to it being colourless and odourless. Carbon monoxide works by binding to the **haemoglobin** in your red blood cells. This prevents them from carrying oxygen to the cells around your body. Carbon monoxide detectors are used to detect levels of the gas in the surrounding air and are often placed near gas-powered boilers to detect gas leaks.

Particulate carbon irritates the lining of the lungs making asthma worse and could cause cancer. **Global dimming** is caused by particulates of carbon blocking out the Sun's rays and may reduce rainfall.

Sulfur Dioxide

Sulfur dioxide is an **atmospheric pollutant**. It is a gas that is produced from the burning of **fossil fuels**. Sulfur dioxide is able to dissolve in rainwater and produces **acid rain**. Acid rain causes damage to forests, kills plants and animals that live in aquatic environments, and damages buildings and statues as the acid rain erodes the stone that they are made from.

sulfur + oxygen \rightarrow sulfur dioxide

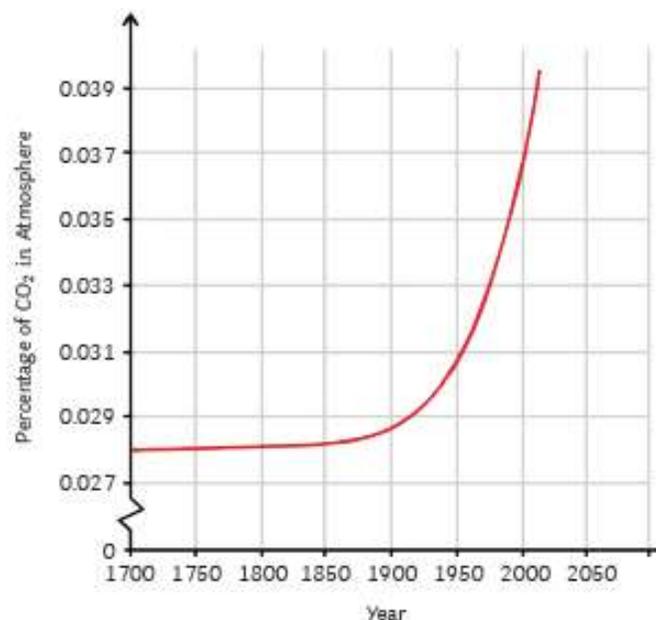


Sulfur dioxide can be further oxidised to form sulfur trioxide.

What is the Link Between Carbon Dioxide and Global Warming?

There is a strong correlation between the percentage concentration of carbon dioxide in the atmosphere and increased global temperatures.

The impact of this is that the polar ice caps are melting, sea levels are rising and habitats and rainfall patterns are changing. The impact of which is already being felt around the globe. The consequences of human activity will affect us all.



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

Sustaining Human Life on Earth

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

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



Earth's Resources

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

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

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

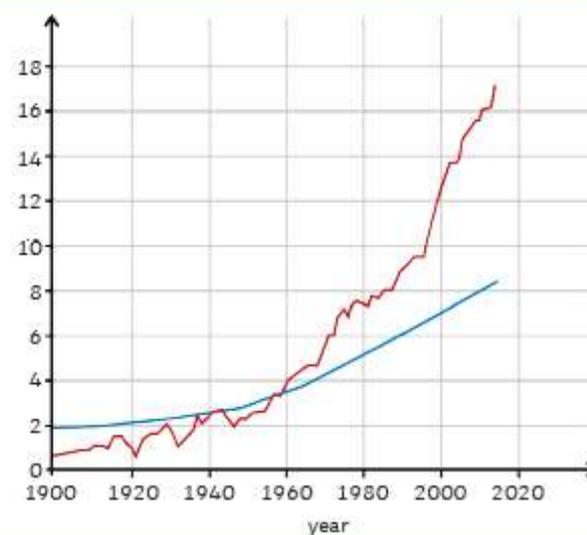
Haber Process and Copper

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

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

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

■ Copper Production (Millions of Tonnes)
■ UN Estimated World Population (Billions)



Water

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

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

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

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

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

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



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

Desalination of Sea Water

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

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

Reverse Osmosis of Salt Water

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

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

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

Water Treatment

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

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

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

Cleaning sewage requires several steps:

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

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

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

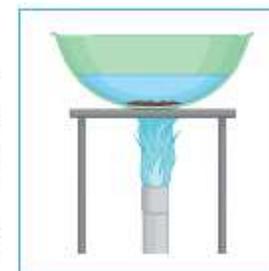
Required Practical 8 – Analysis and Purification of Water Samples from Different Sources

Analysing the pH of Water Samples

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

Analysing the Mass of Dissolved Solids

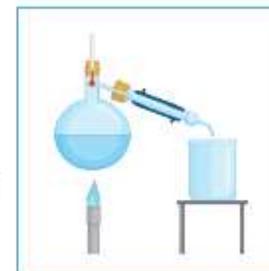
To measure the mass of dissolved solids in a water sample, measure out 50cm³ of the sample using a measuring cylinder. Take the mass of an evaporating basin before heating and record the mass in a table. Place the measured amount of water into an evaporating basin and gently heat over a Bunsen burner until all the liquid has evaporated. Once the evaporating basin has cooled, place it on a top pan balance and record its mass. Calculate the mass of the solid left behind.



Distillation of the Water Sample

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

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



Life-Cycle Assessment (LCA)

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

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

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

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

Life-Cycle Assessment (LCA) (continued)

Stage 2 – Manufacturing and packaging of the product.

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

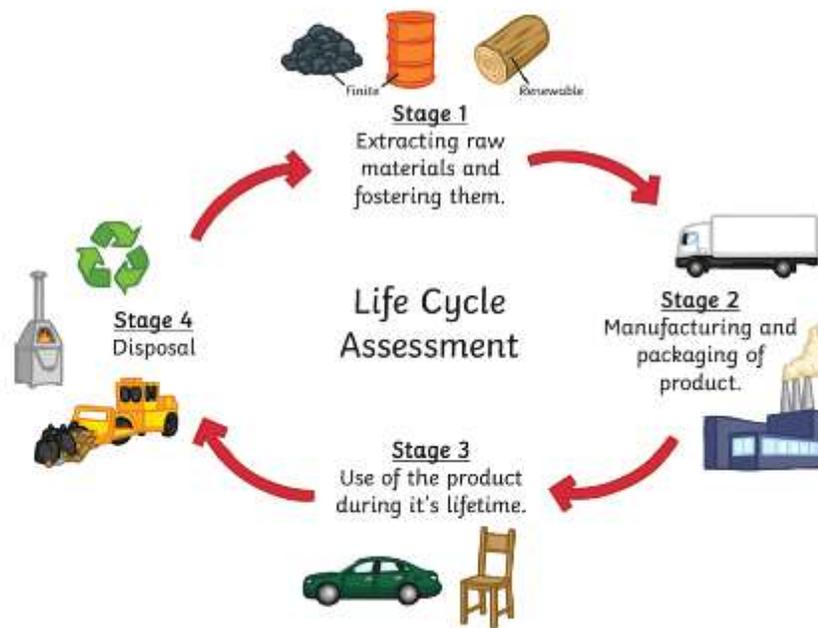
Stage 3 – Use of the product during its lifetime.

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

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

There are different methods of disposal:

1. Landfill – the product is put in a hole in the ground – high environmental impact.
2. Incineration (organic matter) – burning of the product – low environmental impact.
3. Recycling – for example, batteries contain metal compounds that are not good for the environment. By recycling, it means that no new compounds have to be taken out of the ground.



Comparative LCAs

Comparative LCAs are used to evaluate products and to find which one will have a lower environmental impact.

Stage of Life Cycle	Plastic Bag	Paper Bag
Stage 1 – raw material	Uses a finite resource (crude oil). The processes of fractional distillation, cracking and polymerisation all require energy to make crude oil useful.	Made from trees/recycled paper. Making paper from trees requires more energy than recycled paper because trees have to be chopped down. Still uses less energy than making plastics from crude oil.
Stage 2 – manufacture	Cheap to make.	More expensive to make.
Stage 3 – use	Plastic bags have a low environmental impact as they can be used a number of times. In comparison to paper bags, they are much stronger.	Paper bags can only be reused a limited number of times and so have a short lifetime.
Stage 4 – disposal	The downside to plastic bags is that they do not biodegrade easily in landfill. Recycling options are available. If they are not disposed of correctly, plastic bags can have a detrimental impact on the environment and animal habitats.	Paper bags biodegrade easily in landfill sites.

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

Disadvantages of Comparative LCAs

The disadvantage of **comparative LCAs** is that some parts of it require certain judgements to be made.

Different people have different opinions and this is dependent on who completes the LCA and whether a certain level of bias is added. For example, if the LCA is completed by a company that is manufacturing a specific product, they may only discuss **some** of the environmental impact of their product in the LCA. Accurate numerical values, for example, show a company how much energy has been used in the **manufacturing process** or how much **carbon dioxide** was produced when the goods were transported.

Recycling



Many materials are made from **natural resources** that have **limited supplies**. Reusing items such as glass bottles that only need washing and sterilising saves energy and reduces the environmental impact. Not all products can be reused, some need to be recycled before reuse.

There are both advantages and disadvantages to recycling materials.

Advantages

- Fewer resources such as **mines** and **quarries** are needed to remove raw, finite materials from the ground. For example, copper.
- Crude oil, the raw material used in the production of plastics, does not need to be extracted. This, in turn, **avoids** high energy cost processes such as fractional distillation and cracking. If more items are recycled, less would end up in landfill sites.
- The amount of greenhouse gases would reduce as the energy cost of recycling is a lot less than making a new product.

Disadvantages

- Recycling items require collection and transport of the goods to the organisation. This involves using staff, vehicles and the use of fuel.
- Some materials, such as **metals**, can be **difficult to sort**; the amount of sorting is dependent on the purity of the materials or metals and the level of purity required for the final product. For example, copper used in electrical appliances must have a high purity. To achieve this, the copper needs to be processed and then melted down again to make copper wiring.
- Steel that is used in the construction industry does not require such high purity. Often scrap iron is added to the furnace when steel is made. This reduces the need for as much iron ore and reduces the cost of making steel.

Biological Extraction Methods (Higher Tier Only)

Biological methods of extraction are needed as the resources of **metal ores** on earth are in **short supply**. Large scale **copper mining** leaves **scars on the landscape** and produces significant amounts of waste rock that must be disposed of. Biological methods have a lower impact on the environment and make use of waste containing small amounts of copper. The disadvantages of **biological extraction methods** are that they are **slow**, but they do reduce the need to obtain new ore through mining and conserve limited supplies of high-grade ore.

Phytomining

Phytomining involves the use of **plants**. Plants absorb the metal compounds found in the soil. The plants cannot get rid of the copper ions and it builds up in the leaves. The plants are then **harvested, dried** and then placed in a furnace. The ash that is produced from the burning process contains soluble metal compounds that can be extracted. The ash is dissolved in an acid such as hydrochloric or sulfuric and the copper is then extracted by electrolysis or through a **displacement reaction** with iron.

Bioleaching

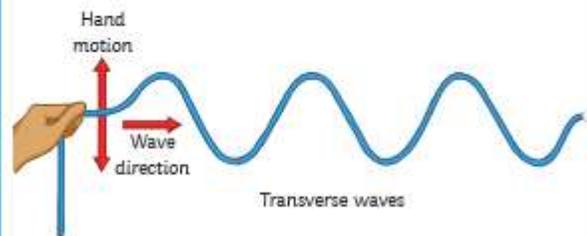
Bioleaching uses **bacteria** to produce an acidic solution called **leachate** which contains **copper ions**. The disadvantage of bioleaching is that it produces **toxic substances** that are **harmful to the environment**. To process the copper, the copper undergoes a displacement reaction with iron. Iron is cheaper and a **more cost-effective** way of producing copper from the leachate.

AQA GCSE Physics (Combined Science) Unit 6: Waves

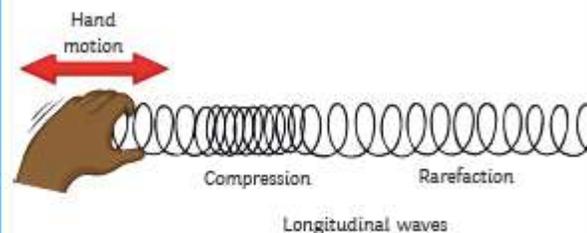
Transverse and Longitudinal Waves

Waves can be either **transverse** or **longitudinal**.

In a transverse wave, the vibrations are at a right angle (**perpendicular**) to the direction of the energy transfer. The wave has **peaks** (or **crests**) and **troughs**. Examples include **water waves** and **light waves**.



In a longitudinal wave, the vibrations are in the same direction (**parallel**) as the energy transfer. The wave has areas of **compression** and **rarefaction**. Examples of this type of wave are **sound waves**.

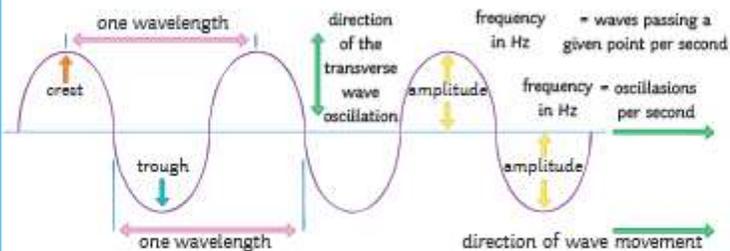


When a wave travels, energy is transferred but the matter itself does not move. Particles of water or air vibrate and transfer energy but do not move with the wave.

This can be shown by placing a cork in a tank of water and generating ripples across the surface. The cork will bob up and down on the **oscillations** of the wave but will not travel across the tank.



Properties of Waves



The **frequency** of a wave is the number of waves which pass a given point every second.

$$\text{time period (s)} = 1 \div \text{frequency (Hz)}$$

$$t = 1 \div f$$

The **wave speed** is how quickly the energy is transferred through a medium (how quickly the wave travels).

$$\text{wave speed (m/s)} = \text{frequency (Hz)} \times \text{wavelength (m)}$$

$$v = f \times \lambda$$

The speed of **sound waves** travelling through air can be measured by a simple method. One person stands a measured distance from a large flat wall, e.g. 100m. The person then claps and another person measures the time taken to hear the echo. The speed of the sound can then be calculated using the equation

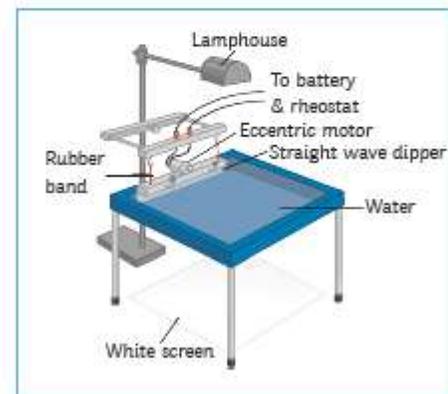
$$\text{speed} = \text{distance} \times \text{time.}$$

Remember the distance will be double because the wave has travelled to the wall and back again. It is important to take several measurements and calculate the average to reduce the likelihood of human error.

Required Practical Investigation 8

Aim: make observations and identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid, and take appropriate measurements.

The ripple tank apparatus shown is the most commonly used for this investigation. It is likely you will work in groups or observe the investigation as a demonstration by your teacher.



Method (assuming the apparatus is already set-up):

Turn on the power and observe the waves. Make any necessary adjustments to the equipment so that the waves are clear to observe (alter the voltage supplying the motor). **N.B. The lowest frequency setting on the motor will ensure that the waves measurements can be made more easily.**

To measure the **wavelength**, use the metre ruler and make an estimate quickly. You may want to use a **stroboscope** and freeze the wave patterns to make measurements.

Record 10 wavelengths and calculate the **average** value.

To measure the wave **frequency**, mark a given point onto the white paper and **count** the number of waves which pass the point within **10 seconds**. Divide your answer by 10 to find the number of **waves per second**.

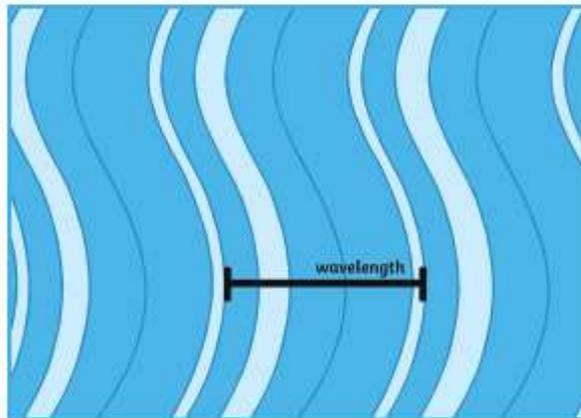
Record 10 frequencies and calculate the **average** value.

To calculate the wave speed, use this formula:

$$\text{speed} = \text{frequency} \times \text{wavelength}$$

AQA GCSE Physics (Combined Science) Unit 6: Waves

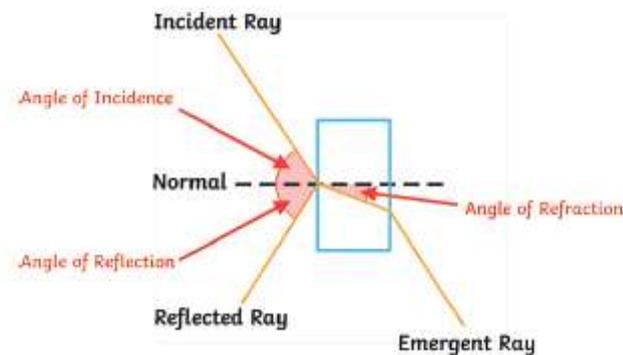
Remember: the wavelength is the distance between one peak (or crest) of a wave and the next peak.



- Using a protractor, measure the angles of incidence, reflection and refraction. Record your results.
- Repeat the experiment by placing a clear acrylic block on the A3 paper in the same position as the glass block.
- The incident ray must follow the same line as before. Draw the reflected and refracted rays and measure using a protractor.
- Collect four sets of results from other members of the class.

The law of reflection states:

angle of incidence = angle of reflection



Risk assessment:

The ray box will become hot during use and may cause minor burns. To prevent this, you should not touch the lamp and ensure you allow time for the ray box to cool after use.

You will be working in a semi-dark environment which means there is a higher risk of trips or falls. You should ensure your working space is clear of bags and coats, and that stools are tucked under desks before you start your investigation.

Required Practical Investigation 10

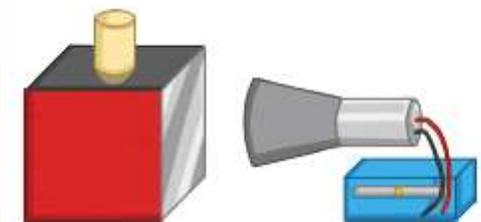
Aim: investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface.

In this investigation, you are finding out which type of surface emits the most **infrared** radiation:

- dark and matt
- dark and shiny
- light and matt
- light and shiny

Method:

- Place the Leslie cube on a heatproof mat.
- Once the kettle has boiled, fill the Leslie cube with hot water.
- Ensuring that the **thermometer** or the **infrared detector** is an **equal distance** from each of the surfaces (in turn) on the Leslie cube, measure the amount of infrared radiation emitted.
- Repeat the experiment twice more to collect three results for each surface.



Required Practical Investigation 9

Aim: investigate the reflection of light by different types of surface and the refraction of light by different substances.

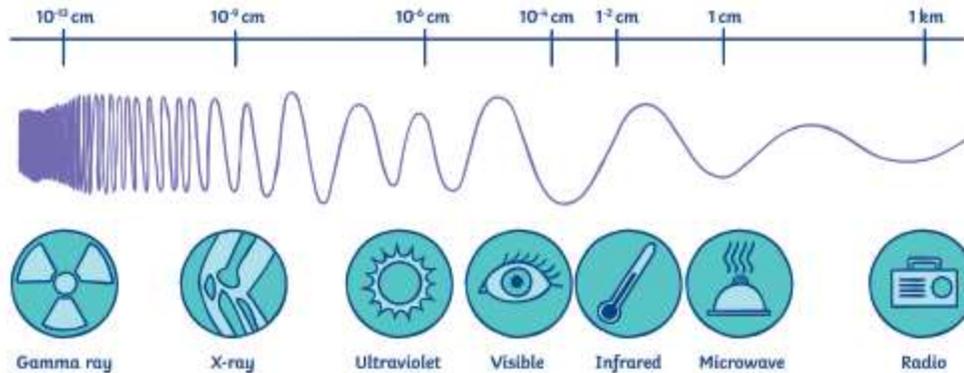
Method:

- In a darkened room, set up the ray box on a flat surface and insert the filter to produce a single ray of light.
- Place a glass block in the centre of a piece of plain A3 paper.
- Draw a line around the glass block.
- Draw a line at 90° to the glass block and label the line normal, as shown in the diagram.
- Position the ray box so the ray of light hits the glass at an angle.
- Using a pencil, draw the incidence, reflected and emergent rays as shown in the diagram.
- Remove the glass block and draw the refracted ray going through the block.

AQA GCSE Physics (Combined Science) Unit 6: Waves

The Electromagnetic Spectrum

Electromagnetic waves transfer energy from a source to an **absorber** as **transverse** waves. The different waves are grouped depending on their **frequency** and form a continuous spectrum known as the **electromagnetic spectrum**. Each of the frequencies of waves travel at the same **velocity** and can pass through a **vacuum** as well as air.



Frequency	Wave	Use	Other Information
Low  High	radio waves	Communication via television and radio, and satellite communications.	Easily transmitted through air and can be reflected to change their direction. Harmless if absorbed by the human body. Are reflected back off the atmosphere and cannot pass through into space.
	microwaves	Communications including satellite communications and cooking food.	When the molecules absorb microwaves, their internal energy increases. This can be harmful when internal body cells become heated by over exposure to microwaves. Can pass through the atmosphere and into space.
	infrared	Short-range communications (remote controls), electrical heaters, cooking food, optical fibres, security systems and thermal imaging cameras.	It can cause burns to skin.
	visible light	Used for lighting, photography and fibre optics.	Frequency range that is detectable by the human eye.
	ultraviolet	Sterilising water and killing bacteria. Detecting forged bank notes.	Causes skin tanning and can lead to burns or skin cancer.
	X-rays	Medical imaging and airport security scanners.	Very little energy is absorbed by body tissues. Instead, it is transmitted through the body. These waves can lead to gene mutation and cancer.
	gamma rays	Sterilising medical equipment or food and treatment for some cancers.	

You can remember the order of the electromagnetic spectrum easily with the phrase:

Roman men invented very unusual X-ray guns.

AQA GCSE Physics (Combined Science) Unit 6: Waves

Properties of Electromagnetic Waves

You should be able to complete or construct a **ray diagram** to show how a wave is **refracted** at the boundary of a different medium.

As the wave moves to a more dense medium (e.g. from gas to solid), it slows down and bends so that the angle from the normal becomes smaller. The angle of incidence is larger than the angle of refraction.

As the wave moves **from** a more dense medium (e.g. from solid to gas), it speeds up and bends so that the angle from the normal becomes larger. The angle of refraction is larger than the angle of incidence.

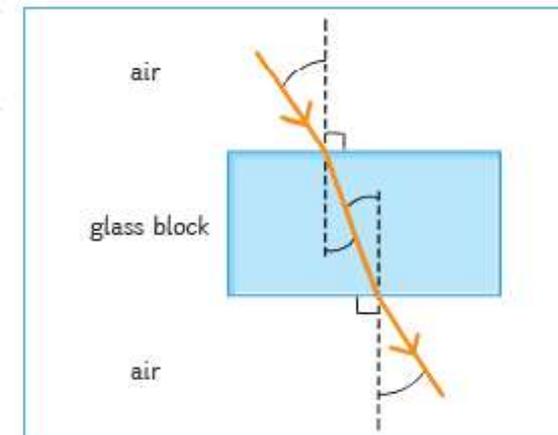
The angle at which a wave enters the glass block is equal to the angle that it leaves the glass block (when entering and leaving the same medium); however, if a wave crosses a boundary between two mediums at an angle of 90° , then it will not change direction but instead carry on in a straight line.

Gamma rays occur as the result of changes to the nuclei of atoms and atoms themselves. It is a form of radiation and the waves can be generated and absorbed across a wide range of frequencies.

UV, **X-rays** and **gamma** are all types of **radiation** and can be **harmful** to human health; they cause damage to human body tissues. The severity of the damage caused depends on the dose of radiation a tissue or cell is exposed to. **Radiographers** and dentists who routinely carry out X-ray examinations wear a device to monitor the amount of exposure and ensure they are within a **safe limit**.

X-rays and gamma rays are **ionising** and can cause **mutations** to genes which may result in **cancer**.

UV waves can cause the skin to burn and age prematurely. UV exposure also increases the risk of developing **skin cancer**.



Radio Waves (Higher tier only)

Oscillations in electrical circuits can produce **radio waves** which when absorbed by a conductor, produce an **alternating current**.

The alternating current has the same **frequency** as the radio wave and so information can be coded for transmission. This is how **television** and **radio** are broadcast.

Geography



5.3.2 What are the key processes of ecosystems at different scales?

How ecosystems function

An **ecosystem** is a community of plants and animals and the environment in which they live. Plants in an ecosystem get their energy from the sun through a process called **photosynthesis**. They use this energy to produce food in the form of leaves, seeds or fruits – so plants are **producers** in the ecosystems. In a UK woodland, the leaves, seeds and fruit are eaten by caterpillars, insects, birds or mice. These are **consumers**. Energy is recycled in an ecosystem through nutrient cycling.

REMEMBER... The **primary producer** is the plant species which fixes energy from the sun. The **primary consumer** is the **herbivore** which eats the primary producer (plant). The **secondary, tertiary, quaternary consumers** are the 2nd, 3rd, 4th consumers (after the primary consumer) and are **carnivores**.

How the nutrient cycle works

Dead leaves and branches fall from a tree. Beetles and earthworms break down the leaves. Bacteria and fungi (decomposers) release nutrients into the soil. Water dissolves the nutrients. The tree takes in the water and nutrients through its roots. Weathering breaks down and releases nutrients into the soil. Nutrient cycles in **hot** climates are rapid because there are high temperatures and abundant water. This encourages rapid rotting and is ideal for bacteria activity and humus creation. Conversely, in cold climates there is little heat and water, which discourages rotting, bacteria activity and humus creation.

Where are tropical rainforests biome located?



Tropical rainforests are found between 5 degrees north and 5 degrees south of the equator. E.g. Amazon Basin (Brazil), West Africa (Southern Nigeria, Congo, Ghana), South East Asia (Indonesia, Thailand, North Eastern Australia).

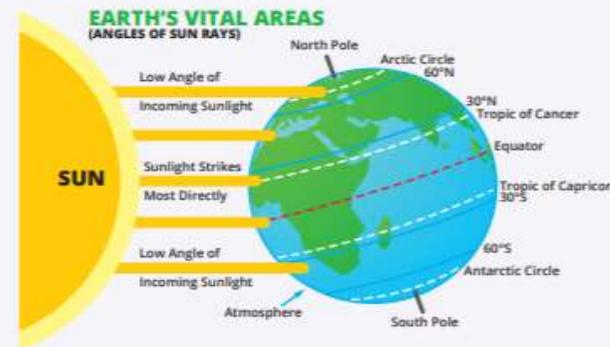
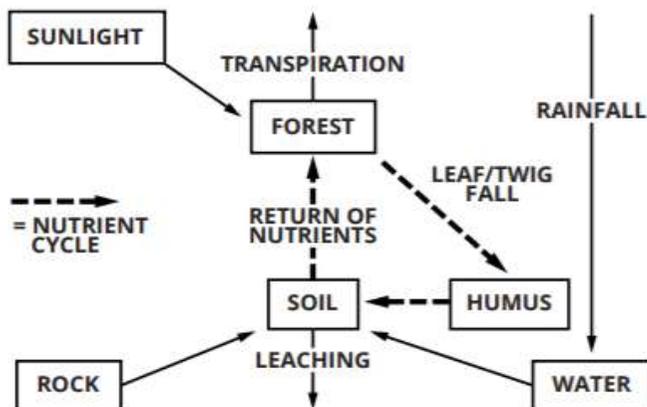
Why?

It is very hot because around the equator the sun is always directly overhead, and the sun's rays are more concentrated and so the area heats up quickly.

Global patterns of ecosystems

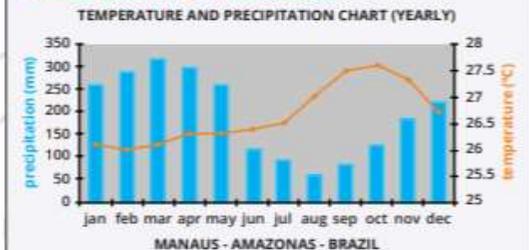
Climate is such an important factor in influencing the natural vegetation and wildlife of a region, and large-scale ecosystems broadly match the world's climate zones. At the global scale, large ecosystems are known as **biomes**. Latitude affects the amount of heat energy on the ground. At the Arctic Circle, solar energy strikes the ground at a low angle and is spread over a large area. At 0° latitude the solar energy strikes the ground at almost a right angle. Energy is concentrated into a small area. Tropical rainforests, savanna, and tundra are examples of **biomes**. The tropical rainforest is an example of a large ecosystem.

The Nutrient Cycle



A climate graph of the tropical rainforest

CLIMATE GRAPH OF THE AMAZON:



This graph shows the average amount of precipitation per year in the Amazon!

Geography

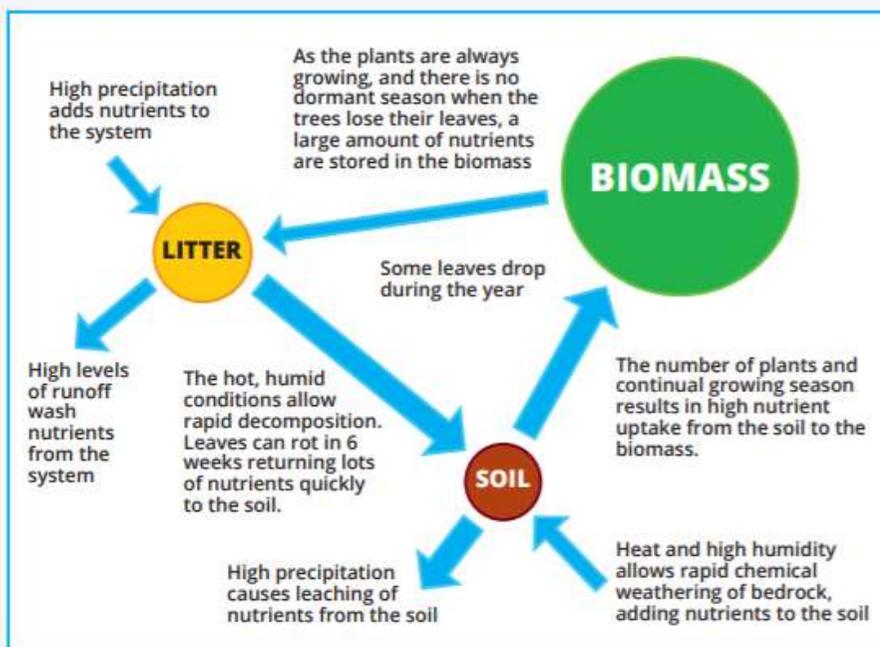


5.3.2 What are the key processes of ecosystems at different scales?

What is the climate of the tropical rainforest?

The tropical rainforest biome has a climate that is hot throughout the year and has high annual rainfall totals. Average temperatures are about 27°C. The heat and abundant rainfall allow rapid plant growth, and trees can reach a height of 40m or more. The rate of plant growth in this biome is rapid and is controlled by factors such as a high amount of sunlight, warmth and water.

The nutrient cycle in the rainforest



REMEMBER... The tropical rainforest ecosystem is only productive when the biomass is allowed to grow. Following deforestation, the addition of dead organic matter (litter) into the system will reduce, and soil will become infertile. In turn, rates of growth for whatever has replaced the natural ecosystem will reduce, and the land quickly become infertile.

Farming land which was once tropical rainforest is not viable in the long term!

The rainforest water cycle

The roots of plants take up water from the ground and the rain is intercepted as it falls, mainly at canopy level. As the rainforest heats up the water evaporated into the atmosphere forms clouds to make the next day's rain. This is convectional rainfall.

The rainforests nutrient cycle.

The rainforest's nutrient cycle is rapid. The hot, damp conditions on the forest floor allow for rapid decomposition of dead plant material. This provides plentiful nutrients that are easily absorbed by plant roots. However, as these nutrients are high in demand from the rainforest's many fast-growing plants, they do not remain in the soil for long and stay close to the surface of the soil.

Students: You would have been asked to study another contrasting biome. Make comparisons between the one you have studied and the tropical rainforest.

Ecosystems on a small scale system ELVASTON CASTLE LOCAL NATURE RESERVE

You will have studied an example of small-scale ecosystem such as a woodland, hedgerow or sand dune. Complete the table to summarise key facts and figures of your example.

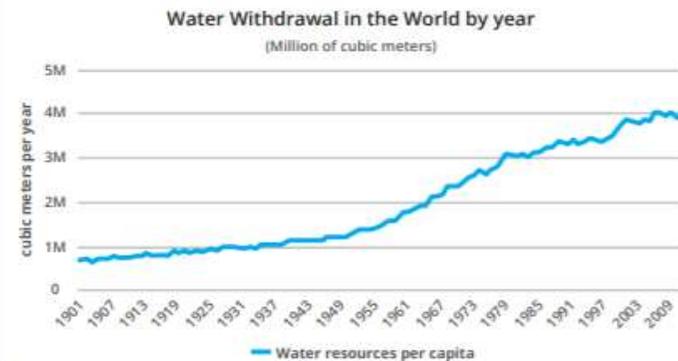
Type of ecosystem	Temperate woodland/pond ecosystem. Home to grass snakes, herons, kingfishers and wide range of bird life, frogs, newts, woodcock, snipe, chubb and rudd, and small trout. Raptors such as buzzards and kestrel are apex predators.
Example of a food chain	Buddlea → Butterfly → Frog → Grass Snake → Kestrel
Nutrient cycle in this ecosystem	Faster in the spring and summer than in winter. Loss of leaf cover and hibernating animals causes the system to become dormant (less cycling) in the colder months.
How human activity has affected biodiversity	Water pollution has led to a loss of fish species which has impacted species numbers further up the food chain. In recent years, habitats have been disturbed by visitors, hence the nature reserve area is fenced-off and not widely advertised. Dogs and bikes are banned.

Geography

6.3.1 How and why is the demand for water changing?

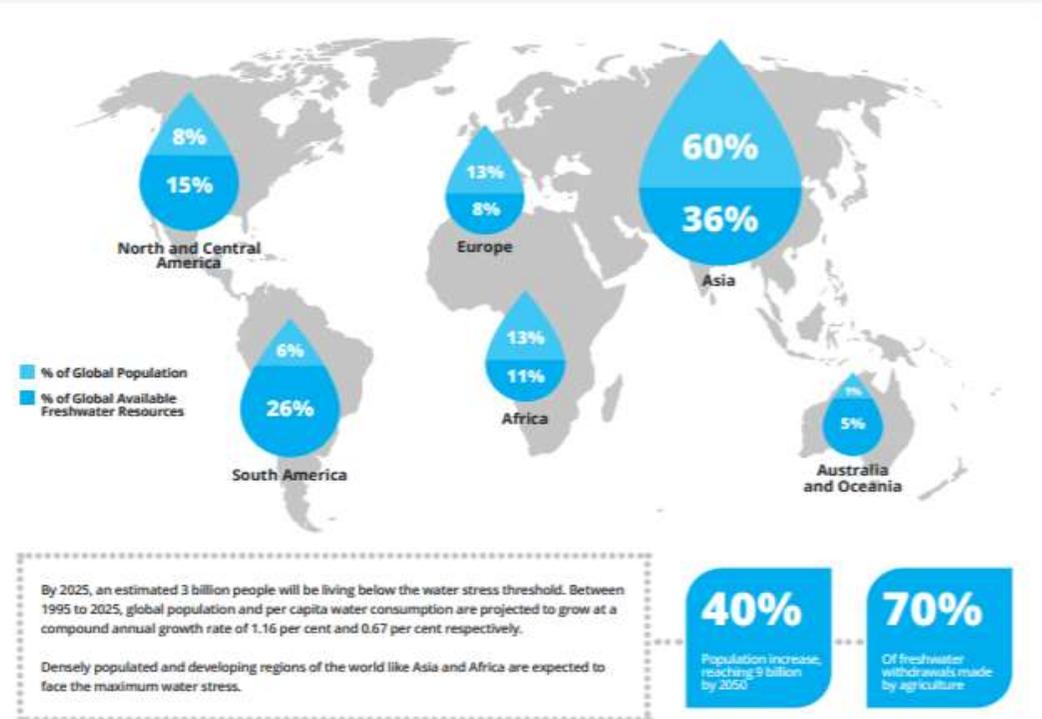
Past and present global water trends

GLOBAL WATER USE



The following map shows the population increase compared to global freshwater resources available

Students: Describe the relationship shown of population increase compared to global availability of freshwater resources.



What do we use water for?

The largest use of water is for agriculture, producing goods and fibre to feed and clothe the growing population. Worldwide, agriculture accounts for 70% of all water consumption, compared to 20% for industry and 10% for domestic use. In industrialised nations, however, industries consume more than half the water available for human use. Belgium, for example, uses 80% of the water available for industry.

REMEMBER... In the UK, we have areas of **surplus** water and areas of **deficit**. The problem is, where we need water the most (densely populated areas such as the South East), we have areas of deficit. Upland areas such as Northwest Scotland, Wales and the Lake District are places where the population density is lower have a surplus. **Water transfer schemes** could be used take water from where there is too much to where there is too little.

Changes in water uses over time

The world population tripled in the 20th century, and water use for human purposes multiplied six-fold. Changes in lifestyle and eating habits in recent years are requiring more water consumption per capita. The production of biofuels has increased sharply in recent years, with significant impact on water demand. Between 1,000 and 4,000 litres of water are needed to produce a single litre of biofuel. Energy demand is also accelerating, with corresponding implications for water demand.

Geography

6.3.1 How and why is the demand for water changing?

What is your water footprint?

Each day we drink between 2 and 4 litres of water. You use a lot more water through washing, bathing, and flushing the toilet – you will use about 95 litres in a five-minute shower, for example. This, however, is only a small fraction of the total amount of water you will use in a day. Our food and clothing contain embedded water. This is water that has been used to grow our food and make our clothes. Each of us uses 2,000-5,000 litres of embedded water a day. So, as consumers we have a water footprint – the impact of our water use on the planet. Our water footprint is a measure of our individual water use and our impact on this vital resource.

Water footprint of different foods you may consume



24,000 litres
1kg of chocolate



15,500 litres
1kg of beef



4,400 litres
1kg of olives



1,500 litres
1kg of sugar



140 litres
1cup of coffee

What is water security and why is it important?

We need water to maintain water supplies, provide hygiene, grow food, and supply industrial processes. Without sufficient water, our health and the development of our economies could suffer.

Water security is an important aim for a country. It means having enough water to maintain the population's health and keep people fed, and for the economy to develop sustainably – without damaging the prospects for future generations. Achieving water security creates enormous benefits.

REMEMBER... International disputes arise where countries rely upon another for their water supply. There are concerns that wars could break-out because of water conflicts. Singapore, for example, has invested heavily in desalination plants (drinking water from sea water) so they don't have to rely as much on water from neighbouring Malaysia.

Why water security is important for countries





History Germany: Nazi economic, social and racial policy



Boycott of Jewish shops

Rearmament begins; Nuremberg laws

Hitler Youth membership compulsory; Berlin Olympics

Kristallnacht

Hitler Youth membership reaches 7 million

1933

1934

1935

1936

1937

1938

1939

KPI 22 Reducing unemployment

Hitler had some success in reducing unemployment in Germany

- ✓ The Nazis built of **autobahns** across Germany, putting **80,000** men back to work and **stimulating** the economy
- ✓ In 1935, **rearmament** began, creating **1.4 million jobs** in the army and many more in **armaments factories**
- ✓ The Nazis introduced the **National Labour Service** which provided work for young men before they were **conscripted** into the army
- ✓ The Nazis claimed success as **unemployment** fell from 6 million in 1932 to almost nothing in 1939, although they did not count Jews, women, or **communists** as unemployed - this was known as 'invisible unemployment'

KPI 23 Policy towards workers

Nazi policies aimed to create loyal and productive workers

- ✓ The **German Labour Front (DAF)** replaced **trade unions** and set wages, although it acted in the interests of bosses, not workers
- The **Strength Through Joy** organisation rewarded productive workers with cheap holidays, trips to the cinema, and evening classes
- ✓ The **Beauty of Labour** helped workers improve conditions in their workplaces or factories by building canteens or sports facilities

KPI 25 Controlling education

Hitler used schools to indoctrinate young people

- ✓ All teachers had to join the **Nazi Teachers Association**
- ✓ All lessons started with a **salute** to Hitler
- ✓ The school curriculum was changed to teach Nazi views:

HISTORY

- the evils of the **Treaty of Versailles**

BIOLOGY

- the study of **Nazi racial theory**
- why **Aryans** were superior to the Jews and other races

PHYSICAL EDUCATION

- All German children do at least 1 hour of **PE** each day

KPI 26 The Hitler Youth Movement

Outside school, the Hitler Youth movement further brainwashed young people

- ✓ At the age of 10, German children were expected to join the **Hitler Youth**
 - Boys wore military uniforms, practiced rifle shooting and grenade throwing, and learnt about Nazi ideas
 - Girls were part of the **League of German Maidens**, where they learnt **domestic skills** like sewing and cooking as part of preparation for **motherhood**
- ✓ Membership was made **compulsory** in 1936 and there were 7 million members by 1939

KPI 24 Women and the Three Ks

The Nazis believed women should perform traditional roles and they introduced policies to encourage this

- ✓ Nazis had a **conservative** view of the role of women that was a reaction to the advances that women had made under the **Weimar Republic**
- ✓ Hitler wanted women to prioritise the **Three Ks**:
 - ✓ **Kinder** (Children), **Kuche** (Kitchen), **Kirche** (Church)
- ✓ The Nazis introduced policies to increase the German **birth rate** so there would be plenty of young people who could join the army in the future
- ✓ Young couples received cheap '**marriage loans**' as long as the wife left her job and stayed at home to look after children
- ✓ Hitler awarded mothers of large families with a **Mother Cross** on his own mother's birthday. Mothers of 8 or more children earned the **gold cross**.
- ✓ The **Lebensborn** programme allowed unmarried women to '**donate**' a baby to Hitler by having a child with an **Aryan SS** member

KPI 27 Treatment of the Jews

Nazi anti-Semitism led to increasing persecution of German Jews

- ✓ The Nazis believed that blond blue-eyed **Aryans** were the **master race**
- ✓ Other groups - such as Jews, gypsies, homosexuals, and the disabled - were viewed as **inferior**
- ✓ In particular, Hitler made Jews **scapegoats** for Germany's problems, blaming them for the defeat in **World War I**, the **Treaty of Versailles**, and the **Great Depression**
- ✓ **Nazi persecution** of the Jews became increasingly serious and **culminated** in the mass murder of 6 million Jews in the **Holocaust**

1933 - the SA organised a **boycott** of Jewish shops and businesses

1935 - the **Nuremberg laws** removed Jews' **citizenship**, stripping them of their right to vote, and making it illegal for Jews and non-Jews to marry

1936 - Hitler paused anti-Semitic attacks during the **Berlin Olympics**

1938 - during **Kristallnacht (Night of the Broken Glass)** the SS attacked Jewish businesses and **synagogues** leading to 100 deaths and 20,000 Jews being sent to **concentration camps**

Key Vocabulary

Aryans	The Nazi master race - blonde haired, blue eyed
Anti-Semitism	Racism towards Jews
Birth rate	The number of births per 1000 people in a year
Boycott	To stop using a service as a form of protest
Citizenship	Being a citizen of a country and having rights there
Concentration camps	Nazi prison camps
Conscripted	Forced to join the army
Compulsory	Something you have to do
Domestic	To do with the house
Holocaust	The mass murder of Jews and other groups by the Nazis 1942-5
Indoctrinate	Brainwash
Invisible Unemployment	Unemployment that isn't counted
Master race	The most advanced group
Persecution	Treating badly, putting in prison, murdering
Productive	Producing a lot of iron, coal, etc
Rearmament	Building the armed forces up again
Scapegoat	Someone who gets the blame
Synagogues	Jewish places of worship



History

Year 10 History Knowledge Organiser- Elizabeth: Early Life

Early life

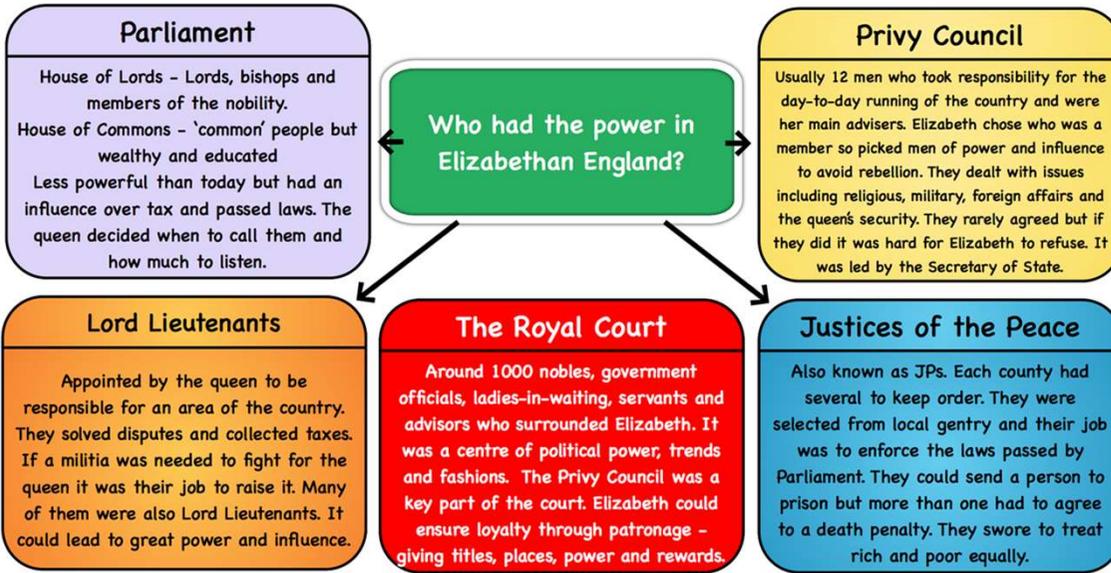
Her father, Henry VIII divorced his 1st wife to marry Elizabeth's mother Anne Boleyn. Anne was executed when Elizabeth was 3 for **treason**. After Henry's death, her brother Edward (Protestant) ruled, followed by her sister Mary (Catholic). Elizabeth became queen in 1558, aged 25.

Key individuals

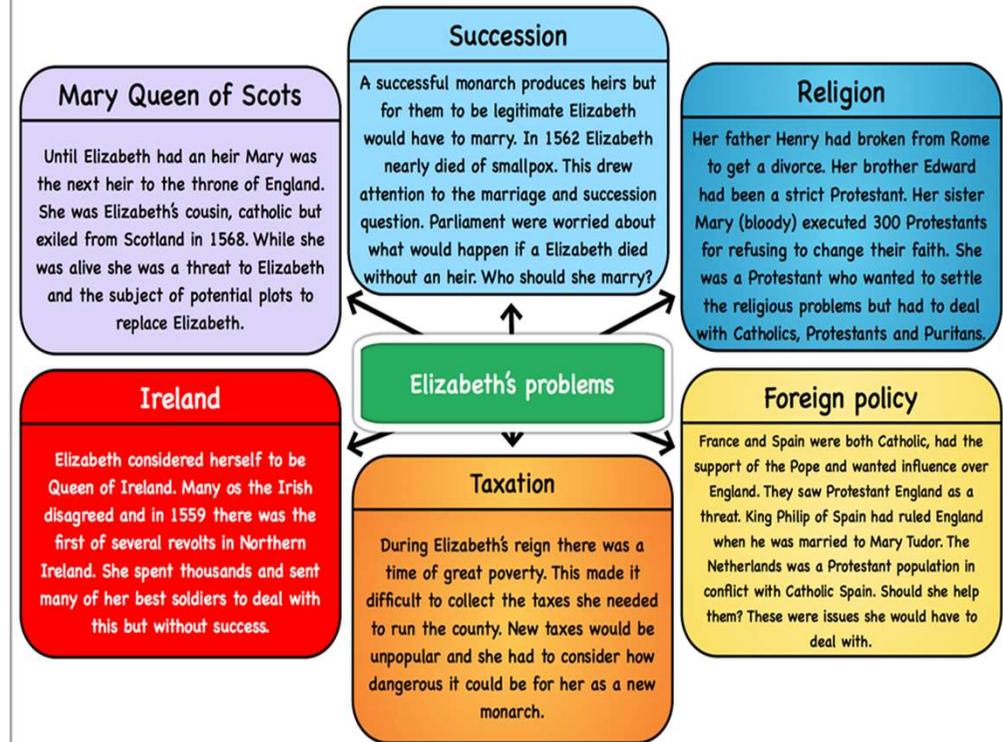
William Cecil: was Elizabeth's most trusted advisor. Served as Secretary of State twice.

Francis Walsingham: one of Elizabeth's closest advisors from 1573 onwards. Served as Secretary of State. Known as Elizabeth's 'spymaster'.

Who had power in Elizabethan England?



Elizabeth's problems



Key Terms	Definitions
Treason	A crime against the king
Parliament	The group which makes laws in England
Militia	A non-professional army called up to fight when needed
Patronage	Giving land, titles or power to gain an individual's support
Foreign affairs	Dealing with other countries
Gentry	The second highest class in England, they might be local JPs or hold other local jobs
Nobility	The highest social class in England, earls, lords & dukes. Given special rights & privileges



History

Marriage & early religious change

Why was marriage important?

Arguments for marriage

- England could gain an **alliance** with a foreign power
- Elizabeth might produce an **heir** and ensure the Tudor line continued
- An **heir** would prevent the Catholic Mary, Queen of Scots from ruling after Elizabeth

Arguments against marriage

- England could fall under the control of a foreign king or prince
- Marrying an Englishman could create problems over who had authority
- Mary's marriage to Philip II of Spain had dragged England into war
- Childbirth was risky



What was Elizabeth's religious settlement?

Elizabeth tried to find a compromise that all her subjects could work with. She chose a **'middle way'**. Therefore there were **Protestant** elements such as allowing priests to marry, services being held in English & her taking the title of 'governor' of the church. However there were **Catholic** elements too. Anyone who refused to attend church would pay a **recusancy fine**). She referred loyalty rather than religious conformity.

Who were the Puritans?

Extreme Protestants who believed that Elizabeth's Church of England was not strict enough

Issues: bishops clothing. Elizabeth told her bishops to wear a white surplice during services. Puritans wanted them to wear ordinary clothing. By 1566, Elizabeth told them to accept or be sacked.

By 1568: most Puritans asked the changes, but a small group called Presbyterians refused.

Prophesyings: prayer meetings held from 1570s. Often included critics of Elizabeth's church, so Elizabeth saw them as dangerous. Archbishop of Canterbury supported them, so Elizabeth suspended him

1580s: Elizabeth became stricter, unlicensed preaching banned, Puritans who did not conform imprisoned & fined. Puritan church broken during this time.

Who were the possible suitors?

Robert Dudley, Earl of Leicester

- Elizabeth's friend from childhood
- English
- Protestant
- BUT: other English nobles might be jealous of his power
- His wife died in mysterious circumstances.

Philip II of Spain

- Wealthiest monarch in the world
- Spanish
- Catholic
- England would gain an alliance
- BUT: the English disliked him
- He had dragged England into an unsuccessful war with France when married to Mary.

Francis, Duke of Anjou & Alencon

- French king's brother
- French
- Catholic
- England would gain an alliance
- BUT: Elizabeth was 46 (probably too old for children)
- The English disliked him

Key Terms	Definitions
Alliance	An agreement with a foreign country to support each other
Heir	The next in line to the throne
Suitor	Possible husbands
Catholic	Believed the Pope was god's representative on earth. Religion of Mary I & Mary, Queen of Scots.
Protestant	Newer form of Christianity, believed a person didn't need a priest to communicate with God & church services should be in English.
Religious Settlement	Elizabeth's attempt to find a religious compromise. Introduced in 1559.
Recusancy fines	Money paid for not attending church



History

Rebellions & later religious changes

Northern Rebellion 1569

Why: many Catholic northern lords angry with Elizabeth's changes to their power (more **Protestant** southern lords on the Council of the North)

Events: Duke of Norfolk plotted to marry Mary, Queen of Scots. Supported by the Earls of Northumberland and Westmorland. Plot was uncovered, Norfolk sent to the Tower of London.

Rebellion continued without him, Took control of Durham cathedral & celebrated mass. Turned towards Tutbury (where M, Q of S was imprisoned). Earl of Sussex raised an army of 14,000 and the rebels broke up.

The papal bull 1570

The Pope excommunicated Elizabeth from the Catholic Church & called on Catholics to end her rule. English Catholics now had to choose between loyalty to Elizabeth or their religion

Ridolfi Plot 1571

Led by Roberto Ridolfi. Wanted to replace Elizabeth with M, Q of S, who would marry Norfolk. This time there would be help from the Netherlands at the same time as another Northern Rebellion took place. Discovered by Walsingham's network of spies. Norfolk executed.



How did Elizabeth's policy towards Catholics change?

Became stricter. 1581: it became **treason** to attend a **Catholic mass & recusancy fines** increased to £20.

1585: treason to have a priest in your home.

1593: Catholics couldn't travel more than 5 miles from their home.

Why did the plots fail?

Spies: Walsingham's spy network meant that few plots got past their earliest stages.

A skilled politician: Elizabeth dealt with her Parliament effectively. She listened to advice but normally got her own way.

Unconvincing alternatives: the other options were M, Q of S or a foreign king such as Philip II of Spain. Neither of these were popular choices.

Punishments: Rebels were tortured & executed. Anyone who challenged Elizabeth could see what the consequences were.

Religious settlement: kept most people happy. It was not always applied strictly in the most Catholic areas.

Key Terms	Definitions
Mass	Catholic religious service
Missionaries	Someone who wants to spread their religious faith
Jesuits	Members of the Catholic Society of Jesus, their aim was to spread their religion.
Seminary	A college for training Catholic priest.

Foreign interference in religion

Missionaries: started arriving in England from the **seminary** in Douai from 1574. They aimed to convert England back to the Catholic faith.

Jesuits: first arrived in 1580 with the aim of returning England to Catholicism. **Jesuit** priests were seen as a threat to Elizabeth's rule & treated harshly. Many executed, including Edmund Campion. He entered England secretly & travelled around preaching. He was arrested after a few months & found guilty of **treason**.



France & Spain's actions

Both countries hoped Elizabeth would be overthrown but neither went to war with her until Spain attacked in 1588. Philip supported the seminary at Douai.

Why did Essex rebel?

1595: became a privy councillor, had a monopoly on sweet wine, developed a rivalry with Robert Cecil, defeated the Spanish in 1596.

1598: nearly drew his sword in a privy council meeting.

1599: sent to Ireland, made a truce with the Irish, knighted his army leaders & then left Ireland without permission.

1601: rebelled, but arrested & then executed.



History

Mary, Queen of Scots

Why was Mary, Queen of Scots a problem for Elizabeth?

1542: became Queen of Scotland at 6 days old

1548: sent to live in France

1558: married the Dauphin of France, Francis

1559: became Queen of France, when her father-in-law died

1560: Francis died, Mary was sent back to Scotland

1565: married Henry, Lord Darnley

1566: Mary's secretary David Rizzio was murdered in front of her. Darnley was probably involved.

1566: gave birth to her son, James

1567: Darnley was murdered in suspicious circumstances. Shortly after Mary married Lord Bothwell who many people thought had been involved in Darnley's murder

July 1567: Mary was forced to abdicate from the throne

1568: she lost a battle against the Protestant lords & ran away to England. She hoped that her cousin Elizabeth would help her get her throne back. Elizabeth put her in prison for the next 19 years

1586: Babington Plot uncovered. This was a plan to assassinate (murder) Elizabeth

1587: executed

What was the Babington Plot?

- A plot to murder Elizabeth & replace her with Mary, Queen of Scots
- Led by Anthony Babington, a Catholic
- Letters were smuggled into Mary hidden in barrels
- BUT Sir Francis Walsingham, Elizabeth's spy master, found out about it
- Mary, Babington and the other plotters were arrested.
- Mary was put on trial & found guilty

Should Elizabeth execute Mary?

NO

- Mary said she was innocent
- Powerful countries like Spain would be angry if Mary was killed
- Mary was a queen, chosen by God.

YES

- There had been lots of plots to replace Elizabeth with Mary, these would carry on for as long as she was alive
- Parliament wanted her killed
- Mary was a Catholic & a threat to the Protestant Elizabeth



Did killing Mary solve Elizabeth's problems?

- Elizabeth's heir was now James VI of Scotland (Mary's Protestant son).
- Catholics viewed Mary as a martyr & saw Elizabeth as a heretic.
- Elizabeth had murdered a queen, why couldn't other people do the same & murder her?

Key Terms	Definitions
Martyr	A person who dies for their beliefs
Heretic	Someone who holds different religious beliefs, that are seen as wrong



History

The voyages of exploration & conflict with Spain



Why is Sir Francis Drake famous?

1577-1580: becomes the first person to **circumnavigate** the globe. He & his cousin, John Hawkins first Englishmen to kidnap Africans & sell them as slaves. Drake was a **privateer** who attacked Spanish ships & stole their cargo.

What new technology was developed?

Lateen sails: triangular sails which made ships faster & easier to steer.
Astrolabe: sailors could judge how far south/north they were.

Where were trade links established?

Attempts were made to find a direct route to India & the Far East to cut out the middlemen. Muscovy Company established in 1555 & given the monopoly of trade with Moscow. East India Company established in 1600 to oversee trade with India. English involvement in the slave trade grew throughout the period.

How successful were attempts to colonise?

1584: Sir Walter Raleigh given permission by Elizabeth to explore, colonise & rule any land not already ruled by a Christian. In return she would receive 1/5 of all the gold & silver found there. Raleigh sent colonists to North America. Colony established at Roanoke but it failed.

How did the voyages benefit England?

Wealth

- Drake stole from Spanish ships & ports
- Hawkins made money for himself & the country though selling slaves
- England started to build the foundations of a trading empire that would grow in future centuries

Power

- Navy grew & was successful
- The navy could be used to dominate smaller countries

Territory

The first attempt to develop a colony failed but more were built in the next few centuries

Why was the Netherlands an issue between England & Spain?

1566: Protestant uprising in several Dutch cities (Philip ruled the Netherlands). Philip sent in soldiers, but this led to more rioting.

Elizabeth sent money to help the rebels & allowed English volunteers to fight. She also allowed the rebel ships to use English ports. She was in a difficult position as she needed to maintain English trade routes as well as not upsetting Philip.

Philip sent a powerful army under the Duke of Alava to put down the rebellion but he was unable to. The Protestant leader of the Dutch rebels, William, Duke of Orange was assassinated in 1584 & Elizabeth sent troops under the command of the Duke of Leicester in 1585. This achieved nothing but was clearly an act of war against Philip.

Key terms	Definitions
Circumnavigate	Travel all the way around the globe
Privateer	A ship's captain with permission to attack foreign ships
Colonies	Areas of other countries ruled by another

Armada plan

- Philip would send an armada of ships from Spain to anchor off the Dutch coast.
- Spanish soldiers would be sailed across to England & march on London.
- Lead by the Duke of Medina-Sidonia, who had no experience of commanding a navy.

English navy

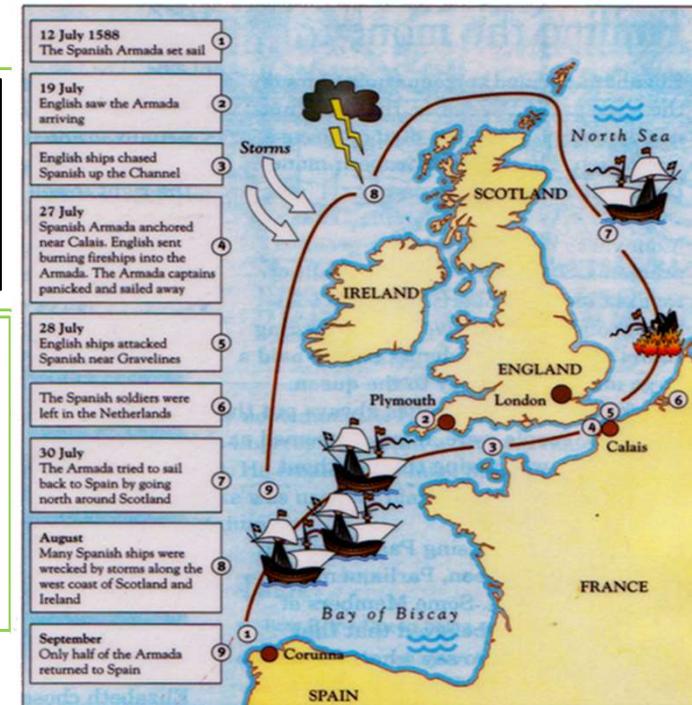
John Hawkins given responsibility for developing Elizabeth's navy. Philip II of Spain also doing the same at this point. English sailors such as Drake & Hawkins involved in many raids of Spanish, such as attack on Cadiz in 1587. Other tactics: fireships & line of battle. Cannons allowed attacks from a distances instead of boarding.

Why did the Armada fail?

English tactics: The fireships broke up the Spanish fleet & mean that individual ships could be attacked. Commanders like Drake were good tacticians. The English ships were faster.

Spanish mistakes: The Spanish ships were slower & less manoeuvrable. The soldiers were not ready when the fleet arrive to pick them up. Many of their cannons were designed to fight on land, not sea.

Weather: many Spanish ships were destroyed on their way home.



The route of the Spanish Armada

History

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Why did Philip attack England in 1588?

Execution of Mary, Queen of Scots

English attacks on Spanish shipping

English troops sent to intervene in the Netherlands

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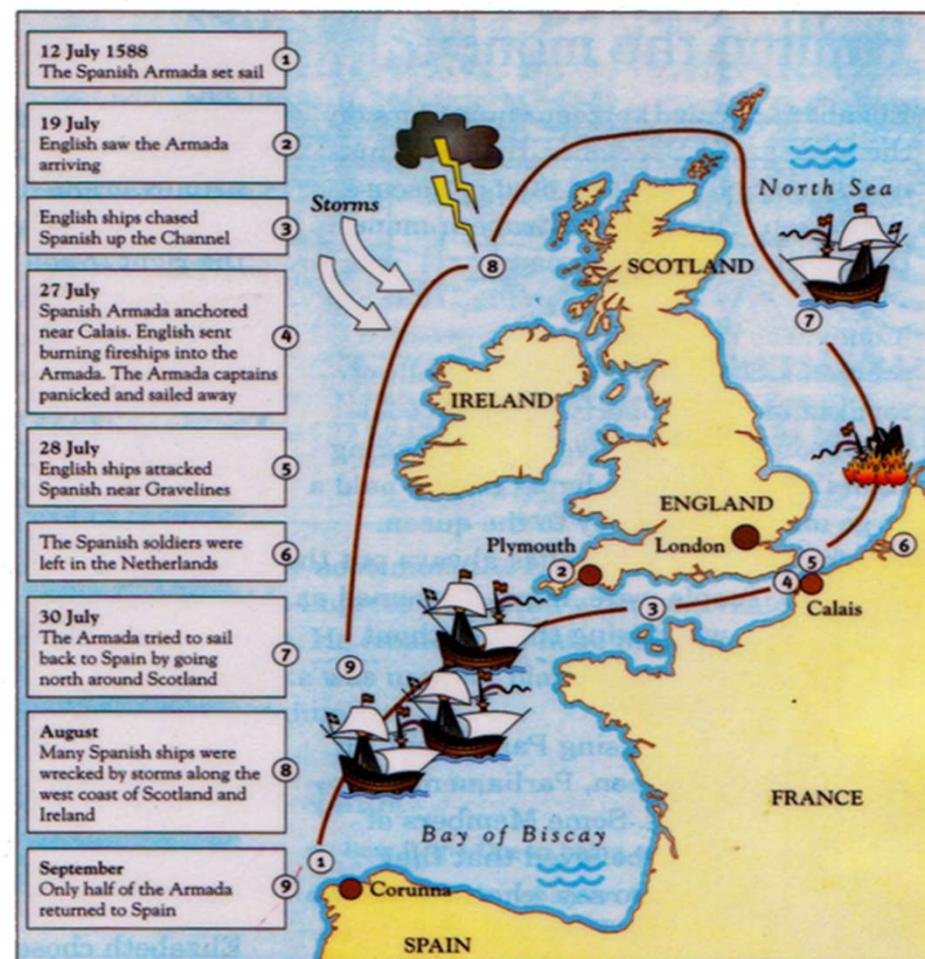
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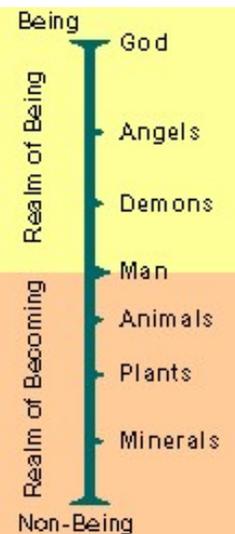


The route of the Spanish Armada

History

Life: wealth & poverty

Great Chain of Being



Nobility

- Second to the queen
- Dukes, earls & barons
- Average income £6,000
- Special privileges e.g. if they committed treason they would be beheaded

Gentry

- Landlords of the countryside
- Average income £10-200
- Some took on roles such as JPs & members of Parliament

Elizabethan country houses

- Gentry had increased prosperity, some built grand houses to demonstrate this.
- Often had references to classical civilisations in their design and decoration.
- Wealth was demonstrated through new technology such as huge glass windows & elaborate furnishings.

Why was poverty increasing?

- Closure of the monasteries
- Henry VIII's decision to **debase** coins
- A series of poor harvests 1594-98
- **Enclosure**
- **Rack renting**



Key Terms	Definitions
Enclosure	The change from arable (crop) farming to sheep, which involving putting a barriers around the land
Debasing	Mixing in less valuable metals into coins
Rack renting	When landlords unfairly increased rents
Deserving poor	The old, sick or young
Undeserving poor	Those who could work but chose not to

Poverty

1495: beggars punished in the stocks

1531: publically whipped, a second offence resulted in a hole burnt in their ear, for a third they were hanged.

Deserving poor: treated with sympathy & given help such as wealthy providing charity.

Undeserving poor: punished

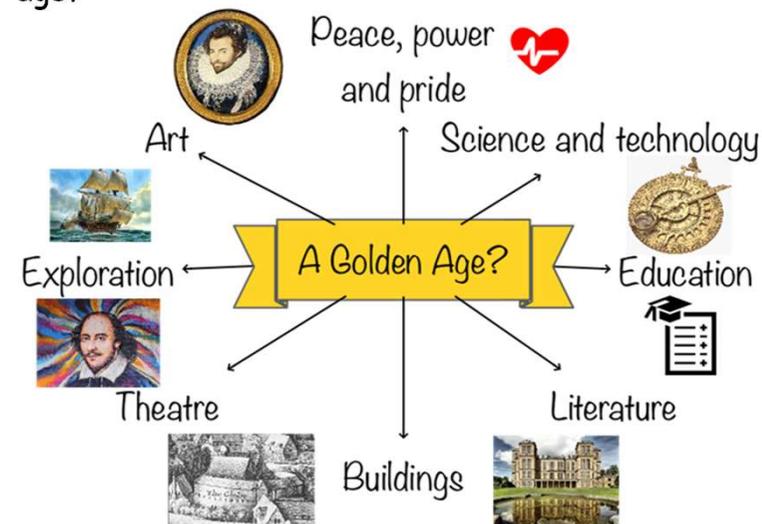
1576: Act for setting the poor on work - local towns given responsibility for looking after the poor. Each town used different methods e.g. York established a House of Correction & beggars had to work. Ipswich a youth training scheme was introduced, so children learnt a trade.

1601: Poor Law - wealthy of each area would be taxed to pay for the care of the poor. Healthy poor would work for their upkeep & any who refused would be sent to the House of Correction

Leisure time

Theatres popular entertainment for all classes. Purpose built theatres such as The Globe & The Rose could hold about 3,000 spectators. Standing was cheaper. Puritans opposed the theatre, seeing it as sinful. People thought large gatherings might spread disease & encourage crime.

Why can the Elizabethan age be seen as a golden age?





History

Year 11 History Knowledge Organiser- Kenilworth Castle

The history of the castle

1559 - Amy Robstart, Dudley's first wife dies in suspicious circumstances
 1563 - given to Robert Dudley by Elizabeth
 1566 - Elizabeth's first visit to Kenilworth
 1570 - Dudley begins to build the gatehouse to impress visitors
 July 1575 - Elizabeth visits for 19 days, Dudley hoped to persuade her to marry him
 1578 - Dudley marries Lettice Knollys, Countess of Essex
 1581 Dudley & Lettice Knollys' son dies

Dudley's changes at Kenilworth

Dudley wanted to be a trendsetter, incorporated ideas from the **Italian Renaissance** and emphasising the history of the existing medieval buildings. From the outside it still looked like a medieval castle & Dudley keep the original buildings such as John of Gaunt's Great Hall.

Create a new set of luxurious rooms for Elizabeth including a private bedroom & withdrawing chamber which was big enough for entertainment such as dancing. A new gatehouse was added to impress visitors.

Estimate that Dudley spent £40,000 on improving the buildings & providing entertainments there on Elizabeth's visits in 1566, 1572 & 1575.

The 1575 progress

Whole court went on progress, most **progresses** lasted 8-12 weeks.

Huge amount of planning involved for weeks before, including where everyone would stay, the amount of food needed and the entertainment.

Saved Elizabeth money as the people who she visited fed the court & allowed Elizabeth to show herself to her people. Dudley arranged a series of dramatic entertainments including plays & paintings to show his 'true love' for the Queen.

Elizabeth left Kenilworth early than expected. Because of bad weather or Dudley had gone too far?

Marriage?

Unable to marry Dudley after his first wife, Amy Robstart died in suspicious circumstances. Rumours continued of an affair between them. Many nobles were against them marrying. Elizabeth never forgave Dudley for marrying again in 1578.

Other possible candidates: Charles, Archduke of Austria (Catholic) & Duke of Anjou (Catholic).

Never married: scared after seeing her father's marriages? Worried about the threat to her authority? Might split the country?

Key Terms	Definitions
Progress	When the monarch toured the country, staying at the homes of the nobility
Italian Renaissance	A period of cultural & artistic changes, which started in Italy.
Mythical	Based on stories or myths
Aviary	Bird cage
Obelisks	A stone pillar

The gardens

Copied Italian designs, incorporated mythical ideas & design to demonstrate Dudley's education & cultural understanding. Symmetrical and divided into 4 quarters. They included a range of new plants such as tulips.

The **aviary** was based on an Italian design, which in turn was copied from a Roman design. There were **obelisks**, statues of gods & fountains.

Dudley's family symbol of the bear & ragged staff used throughout to emphasise his ancestry.

As well as formal gardens there was a park for Elizabeth to hunt deer (allowed Dudley to compare her to the Roman goddess of the hunt, Diana).



Y11 French: School, work & future ambitions

Parle-moi de ton collège.	A	Tell me about your school.
Mon collège s'appelle Da Vinci Academy.	1	My college is called Da Vinci Academy
C'est un collège mixte pour les élèves de onze à seize ans.	2	It's a mixed school for students aged 11-16.
On a de la chance parce que	3	We are lucky because
il y a des excellents labos de sciences,	4	there are excellent science labs,
mais malheureusement il n'y a pas de bibliothèque.	5	but unfortunately there isn't a library.
Si j'étais le directeur/la directrice, il y aurait	6	If I was the headteacher, there would be
une grande piscine car j'adore faire de la natation.	7	a big pool because I love to go swimming.
Quelles matières aimes-tu ?	B	What subjects do you like?
Ma matière préférée c'est l'anglais	8	My favourite subject is English
car le prof est sympa et je l'aime bien.	9	because the teacher is nice and I like him.
Cependant je n'aime pas la chimie	10	However I don't like chemistry
parce que je suis assez faible en sciences	11	because I am quite weak at science
et on a trop de devoirs.	12	and we have too much homework.
Décris les règles au collège.	C	Describe the rules at school.
Selon les règles au collège	13	According to the rules at school
il faut être à l'heure.	14	you must be on time.
On n'a pas le droit d'utiliser son portable,	15	You don't have the right to use your phone,
ce que je trouve frustrant	16	which I find frustrating
parce qu'on n'est pas de bébés.	17	because we are not babies.
Quelles sont les différences entre l'école en France/au Royaume-Uni ?	D	What are the differences between school in France/UK?
En France ils portent leur propres	18	In France they wear their own clothes
tandis qu'au Royaume Uni nous portons l'uniforme scolaire.	19	whereas in the UK we wear school uniform.
Je préfère le système français	20	I prefer the French system
car à mon avis l'uniforme scolaire est inutile.	21	because in my opinion school uniform is useless.
Qu'est-ce que tu faisais à l'école primaire ?	E	What did you do at primary school?
À l'école primaire j'étais membre de la chorale	22	At primary school I was a member of the choir
mais maintenant je suis délégué de classe.	23	but now I am a class representative (on school council).
Avant j'avais beaucoup de temps libre	24	Before I used to have a lot of free time
mais maintenant je dois réviser pour mes examens.	25	but now I must revise for my exams.
Que voudrais-tu faire comme emploi ?	F	What do you want to do as a job?
Après avoir fini mes études	26	After having finished my studies
je voudrais être journaliste	27	I would like to be journalist
parce que c'est bien payé et on peut voyager.	28	because it is well paid and one can travel.
Cependant, je n'aimerais pas être infirmier	29	However, I would not like to be a nurse
car ma mère m'a dit que c'est trop stressant,	30	because my mum told me that it is too stressful,

bien que ce soit gratifiant.	31	although it is rewarding.
Si j'ai des bonnes notes, j'irai à l'université	32	If I have good grades, I will go to university
où j'ai l'intention d'étudier l'histoire	33	where I intend to study history
car j'aurai besoin d'un diplôme.	34	because I will need a degree.
Que voudrais-tu faire à l'avenir ?	G	What do you want to do in the future?
A part le travail, mon rêve serait de	35	Apart from work, my dream would be to
prendre une année sabbatique et faire du bénévolat	36	take a gap year and do voluntary work
parce que j'adore les voyages et	37	because I love travelling and
on peut aider les gens.	38	you can help people.
Un jour j'aimerais me marier et fonder une famille	39	One day I would like to get married and start a family
Ce serait parfait pour moi !	40	That would be perfect for me!
As-tu un petit boulot ?	H	Do you have a part time job?
Pour gagner de l'argent de poche	41	To earn pocket money
je tends la pelouse et je passe l'aspirateur.	42	I mow the lawn and do the hoovering
et mes parents me donnent dix euros par heure.	43	and my parents give me ten euros an hour.
J'aimerais avoir un petit boulot	44	I would like to have a part time job
et livrer les journaux, par exemple,	45	and deliver the newspapers, for example,
car c'est bien payé, mais il faut se lever tôt.	46	because it's well-paid, but you must get up early.
Décris un stage que tu as fait.	I	Describe work experience that you've done.
L'année dernière j'ai fait un stage dans un bureau	47	Last year I did work experience in an office
où j'ai fait des photocopies et j'ai répondu au téléphone.	48	where I made photocopies and I answered the phone
C'était assez ennuyeux et le chef était trop sévère	49	It was quite boring and the boss was too strict
donc je n'ai pas beaucoup appris.	50	so I didn't learn a lot.

Grammar – Higher-level tenses (conditional, imperfect & future simple)

PRESENT (what you do)	IMPERFECT (what you did/used to do)	CONDITIONAL (what you would do)	FUTUR SIMPLE (what you will do)
je suis (I am)	j'étais (I was/used to be)	je serais (I would be)	je serai (I will be)
j'ai (I have)	j'avais (I had/used to have)	j'aurais (I would have)	j'aurai (I will have)
je fais (I do)	je faisais (I did/used to do)	je ferais (I would do)	je ferai (I will do)
je vais (I go)	j'allais (I went/used to go)	j'irais (I would go)	j'irai (I will go)
c'est (it is)	c'était (it was)	ce serait (it would be)	ce sera (it will be)
il y a (there is)	il y avait (there was)	il y aurait (there would be)	il y aura (there will be)

We can combine these tenses to create 1) simple and 2) complex 'si clauses'.

1) PRESENT + FUTUR SIMPLE

e.g. Si j'ai des bonnes notes, j'irai à l'université.
If I have good grades, I will go to university.

Si je fais mes devoirs, je serai plus fort en maths.
If I do my homework, I will be better at maths.

2) IMPERFECT + CONDITIONAL

e.g. Si j'étais le directeur, il y aurait une piscine.
If I was the headteacher, there would be a pool.

Si j'avais l'argent, je ferais le tour du monde.
If I had the money, I would do an around-the-world trip.

Sentence builder – talking about school.

Mon collège s'appelle Da Vinci Academy. My college is called Da Vinci		C'est un collège It's	mixte a mixed school publique/privé a public/private school pour les filles/garçons for girls/boys	pour les élèves de onze à seize ans. for students aged 11-16. avec environ cinq-cents élèves. with around 500 students.		
On a de la chance car il y a We're lucky because there is/are		des grands labos de science big labs une bonne cantine a good canteen		mais malheureusement il n'y a pas de but unfortunately there isn't	piscine a pool gymnase a gym bibliothèque a library	ce qui est dommage. which is a shame.
Si j'étais le directeur/la directrice il y aurait If I was the headteacher there would be		une jolie cour de récréation a pretty playground				
Ma matière préférée c'est My favourite subject is Ce que j'aime le plus c'est What I like the most is J'ai toujours aimé I've always liked J'aime aussi I also like		l'anglais English l'EPS PE l'histoire history la biologie biology la chimie chemistry la géographie geography la physique physics le dessin art le français French les maths maths		parce que je le/la/les trouve facile(s) / fascinant(e)(s) / utile(s). because I find it easy / fascinating / useful. car le/la prof est sympa et je l'aime bien. because the teacher is nice and I like him/her. car je suis doué(e) en maths/sciences/langues. because I'm good at maths/sciences/languages.		
cependant however je n'aime pas I don't like ce que j'aime le moins c'est what I like the least is				parce qu'on a trop de devoirs. because we have too much homework. parce que c'est trop difficile/ennuyeux/inutile. because it's too difficult/boring/useless. car le/la prof est sévère et je le/la déteste. because the teacher is strict and I hate him/her. car je suis faible en maths/sciences/langues. because I'm bad at maths/sciences/languages.		
Selon les règles au collège According to the rules at school	Il faut you must	être à l'heure be on time porter l'uniforme scolaire wear school uniform	ce que je trouve which I find	raisonnable reasonable (in)juste (un)fair logique logical ridicule ridiculous frustrant frustrating	parce que because	c'est/ce n'est pas dangereux/important/illégal. it is/it is not dangerous/important/illegal. l'école, c'est pour apprendre. school is for learning. la mode n'a pas de place à l'école. fashion has no place at school.
	Il ne faut pas you must not Il est interdit de it's forbidden to Il n'est pas permis de it's not allowed to on n'a pas le droit de you don't have the right to	utiliser son portable use your phone de porter des bijoux / de maquillage wear jewellery / make up manquer les cours skip class fumer smoke se droguer do drugs	Je pense que c'est I think it's Je ne pense pas que c'est I don't think it's			
En France In France	ils portent leurs propres vêtements they wear their own clothes ils redoublent they repeat the year if they fail les cours finissent à 17h lessons finish at 5pm ils n'étudient pas la religion. they don't study RE		tandis qu'au Royaume-Uni whereas in the UK		nous portons l'uniforme scolaire. we wear uniform. nous ne redoublons pas. we don't repeat the year. la journée finit plus tôt. the day finishes earlier.	
Je préfère I prefer	le système français the French system		parce que l'uniforme scolaire est inutile. because school uniform is useless.			
	le système britannique the British system		parce que les horaires sont plus raisonnables. because the timings of the day are more reasonable. car le redoublement n'est pas une bonne idée. because repeating the year isn't a good idea.			
À l'école primaire at primary school	j'étais membre de la chorale I used to be a member of the choir j'avais beaucoup de temps libre I used to have a lot of free time		mais maintenant	je suis délégué(e) de classe I am a class representative j'ai trop de devoirs I have too much homework		

Sentence builder – future career & personal ambitions.

N.B. Unlike in English, you don't need an article (i.e. 'un' or 'une') here

COMPLEX PHRASE	NOUN	FUTURE VERB	JOB	CONNECTIVE	REASON
Après avoir fini After having finished	mes études my studies	je voudrais être I would like to be	acteur/actrice actress avocat(e) lawyer boucher/bouchère butcher caissier(ière) cashier chanteur(euse) singer cuisinier(ière) cook facteur/factrice postman fonctionnaire civil servant footballeur(euse) footballer homme/femme d'affaires business man/woman	parce qu' because puisque' since étant donné qu' given the fact that	on peut parler les langues étrangères we can speak foreign languages on peut gagner beaucoup d'argent we can earn a lot of money on peut voyager partout dans le monde we can travel everywhere in the world on peut travailler avec les ordinateurs we can work with computers on peut travailler avec les gens/enfants we can work with people/children on peut aider les gens we can help people.
	mes examens my exams le lycée college l'université university mon apprentissage my apprenticeship mon diplôme my degree	j'aimerais être I would like to be je rêve d'être I dream to be mon ambition est d'être my ambition is to be j'ai envie d'être I fancy being	infirmier(ière) nurse informaticien(ne) IT worker ingénieur engineer journaliste journalist mécanicien(ne) mechanic médecin doctor pilote d'avion pilot pompier fireman professeur teacher secrétaire secretary serveur/serveuse waiter vendeur(euse) shop assistant	parce que/car because puisque since étant donné que given the fact that	c'est bien payé it's well paid c'est gratifiant it's rewarding c'est un métier/emploi intéressant it's an interesting job j'adore la musique I love music le sport sport les voitures cars je suis très bon(ne) en maths / français I am very good at Maths/French
Si j'ai des bonnes notes If I have good grades		j'ai l'intention d'être I intend to be			
SEQUENCERS Aussi / de plus Après Tout d'abord Un jour	also after first of all one day	je voudrais/j'aimerais I would like to j'espère I hope to mon rêve serait de my dream would be to	fonder une famille m'installer avec mon copain/ma copine continuer mes études à l'université (la fac) faire le tour du monde faire du bénévolat devenir apprenti(e) prendre une année sabbatique		start a family move in with my boyfriend/girlfriend continue my studies at university (uni) travel around the world do voluntary work become an apprentice take a gap year

Art - AO1

Develop ideas through investigations and showing understanding of sources



Mood board

Theme – consider your theme, have you got a set idea already or are you happy to collect a wider range of ideas

Use a range of sources – don't find pictures from just one place use different sources like, photographs, wallpapers/fabric samples, lettering, magazines etc...

Pick a style – pull it all together with a colour/theme or style to make your page 'work' as a whole

Apply ideas – your mood board should be a visual representation of your mind map



Mind map

Keywords – add branches to your mind map that include key ideas and words, using one word for each branch will allow you to develop more ideas rather than using a phrase or sentence

Central idea – this is the starting point of your mind map and shows the topic you are exploring. All keywords should link from this idea.

Include images – imagery can convey much more than a word or sentence and can help you to develop your ideas as well



Artist Research and Analysis of Work

There are several things you must include in your research to show understanding of your chosen artist

Bio – a quick gathering of facts with the artists birth/death, style, important works

Collect images – select images of their work that are relevant and images that appeal to you, comment on why you like them

Analysis – To show understanding of the artist you must discuss their work. This will allow you to explore ideas and consider different options before you begin creating your own art work.

Reproduction – either copy a small piece of their work or work in the artist's style to show your understanding of their work

Content – Looking at the subject of the work.

What is it? What exactly can you see? What is happening? What does the work represent?
What does the artist call the work?
Does the title change the way we see the work?
What is the theme of the work?
Landscape, portrait, journey, moment, memory, event, surreal, fantasy, abstract, message.

Form – Looking at the formal elements.

What colours does the artist use? Why? How is the colour organised?
What kind of shapes can you see?
What kinds of lines and marks does the artist use?
What is the surface like? What textures can you see?
What patterns can you see?
How big is the work?
Light, delicate, layered, strong, rough, dark, peaceful, dripped, textured, scale, vivid, bright.

PROCESS – How the work has been developed and made.

What materials and tools have been used?
What is the evidence for how it has been made?
Painted, drawn, woven, printed, cast, stitched, constructed, collaged.

Mood – Looking at the communication of moods and feelings.

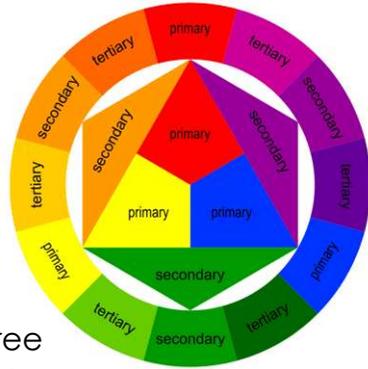
How does the work make you feel?
Why do you feel like this?
Does the colour, texture, form or theme of the work affect your mood?
Quiet, contemplative, thoughtful, hopeful, peaceful, elated, joyful, reflective.

Art - AO2

Refine ideas by experimenting with appropriate media, materials, techniques and processes

You don't have to use a specific media in your project, just show some variation.

For example if an artists uses pen, you could try using, pen, pencil, charcoal, biro, coloured pen etc.



Colour Theory

Primary colours are the three main colours, they can't be made, but are used to mix all of the other colours

Secondary colours are made by mixing two primary colours

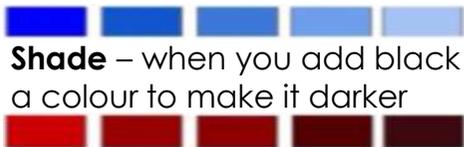
Tertiary colours are made by mixing a primary and a secondary colour

Harmonious colours are next to each other on the colour wheel

Complementary colours are opposite each other on the colour wheel

Tint – when you add white to a colour to make it lighter

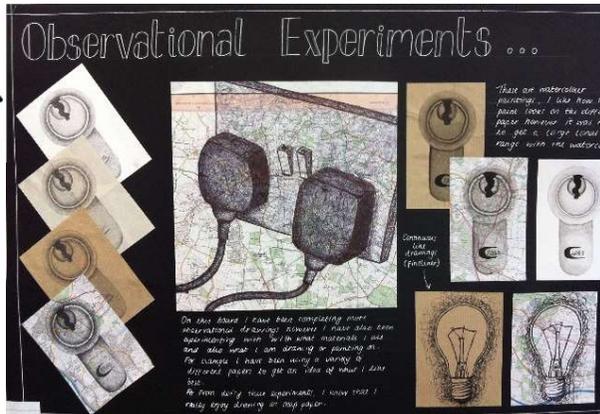
Shade – when you add black to a colour to make it darker



Experimentation

You MUST try things more than once to show improvement and refinement. See how the artist has tried the same sketches in lots of different media and on different surfaces.

Be brave in your use of media, aim to show off your best skills.



Pencil		The basic tool for drawing, can be used for linear work or for shading
Biro		Drawings can be completed in biro and shaded using hatching or cross hatching
Pastel (chalk/oil)		Oil and chalk pastels can be used to blend colours smoothly, chalk pastels give a lighter effect
Coloured pencil		Coloured pencil can be layered to blend colours, some are water soluble
Acrylic paint		A thick heavy paint that can be used smoothly or to create texture
Watercolour		A solid or liquid paint that is to be used watered down and layered
Monoprint		Where ink is transferred onto paper by drawing over a prepared surface
Collograph		A printing plate constructed of collaged materials
Card construction		Sculptures created by building up layers of card or fitting together

Media	The substance that an artist use to make art
Materials	The same as media but can also refer to the basis of the art work eg, canvas, paper, clay
Techniques	The method used to complete the art work, can be generic such as painting or more focus such as blending
Processes	The method used to create artwork that usually follows a range of steps rather than just one skill

Art - A03

Record observations, ideas and understandings as you develop your work

Take your own photographs and work from them as much as possible. Taking your own photographs will allow you to create a more personalised response.



Create both primary and secondary studies.

Create **maquettes** (a miniature scale model) in paper, card, etc to show your ideas.



All ideas and observations **MUST** clearly link to your project/theme. No random art work.

You may want to produce another mood board or mind map as you develop your project and narrow down ideas.



Annotation

Describes writing notes, using images and explain your thoughts to show the development of your work.

You must annotate and reflect on your work as it progresses to show your intentions and ideas.

Step 1 - Describe

What is the image of?

What have you done?

Step 2 - Explain

How was this work made?

How did you produce these effects?

How did you decide on the composition?

Step 3 - Reflect

Why did you use these methods?

Why do some parts of the work 'work' better than others?

Why might you do things differently next time?

How to 'record'

Observational drawing	Drawing from looking at images of objects
Primary observation	Drawing directly from looking at objects in front of you
Secondary observation	Drawing from looking back at images of objects
Photographs	Using a camera or smartphone to take pictures to draw from (this is also classes as a primary observation)
Sketches	Basic sketches and doddles to show undeveloped and initial ideas.
Annotations	Writing about your art work

Art - AO4

Present a personal and meaningful response that realises intentions and shows an understanding of visual language

Telling a story with your art and sketchbook, using your work to convey a message instead of relying on words.

Avoid sticking with your first idea. Sometimes your initial idea is worth pursuing but before a final piece is decided upon you should have considered at least three different design ideas.

Sketchbook checklist

- Have you demonstrated what the starting point, theme or brief means to you personally?
- Have you established a link between the starting point and your chosen sources?
- Have you reflected your understanding of the social and cultural context?
- Is there a clear link between your sources and your own work?
- Is it clear what ideas or techniques from your sources you have developed?
- Have you selected and presented your studies carefully?
- Made use of your discoveries?
- Made clear links between your work and that of other artists, designers and craftspeople?
- Collected images to show your inspiration and stimuli?
- Made use of drawings, sketches, jottings, photographs and experiments with different media?
- Annotated images to explain how they fit into your development process?
- Demonstrated your understanding through correct use of art and design vocabulary?
- Shown experimentation and selection of the most successful results for your project?
- Organised your recordings and presented them to show and explain your decisions?
- Clearly linked all of your work to your starting point?

Thinking about your Final Piece

- Use materials and media that you can control well and have practised with.
- Your final piece should show influences from the artists you have studied
- Remember to think about composition rules when designing your final piece

Present your work well, this doesn't mean fancy background. Just take care on every page.

A rough idea

A basic sketch of a final idea

A visual Maquette

A small image or model created in materials that replicate the end result

Final piece

An image or sculpture pulling all prep work together.



The Formal elements of Art

Tone	How light or dark something is	
Line	A mark which can be long, short, wiggly straight etc...	
Colour	What you see when light reflects off something. Red, blue and yellow are primary colours	
Texture	How something looks or feels e.g. smooth or rough	
Pattern	A symbol or shape that is repeated	
Shape	A 2D area which is enclosed by a line e.g. a triangle	
Form	Something which has 3 dimensions e.g. a cube, sphere or a sculpture	

Art - Drawing

Another method to consider when drawing is using the grid method.

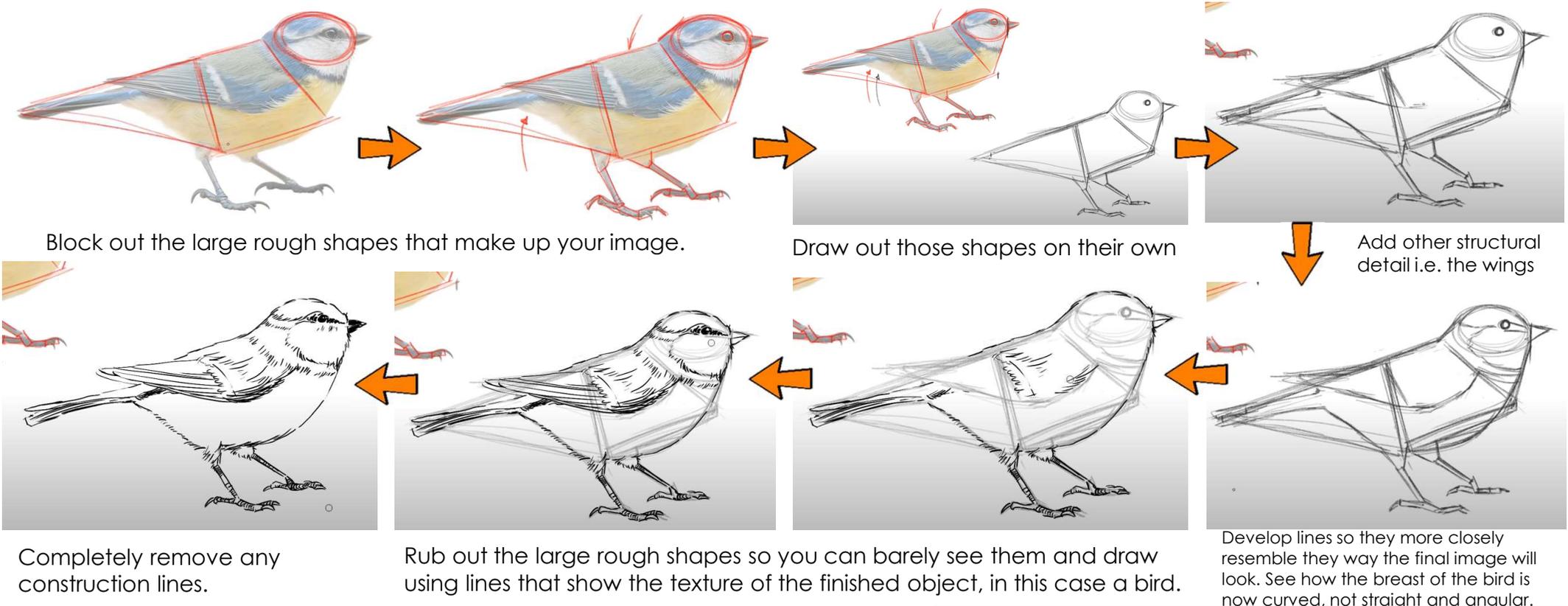
The **Grid method** is a tool used to help you draw whilst keeping everything in proportion. It allows you to break down drawings into lots of small squares. Therefore you can concentrate on smaller sections at a time. The more squares the use the more accurate you can be.



Constructing a drawing is important to ensure you keep correct proportion. Use simplified shapes to develop the structure of your drawing. Start with the largest structures first.

- 1. Large rough shapes** – block out the most basic version of your drawing
- 2. Accurate shapes** - Refine shapes so that they resemble the object more closely
- 3. Detail** – add the detailed sections of the drawing like fine lines etc (then apply tone once drawing is completed)

Take a look at the images below to see how it is done



Block out the large rough shapes that make up your image.

Draw out those shapes on their own

Add other structural detail i.e. the wings

Completely remove any construction lines.

Rub out the large rough shapes so you can barely see them and draw using lines that show the texture of the finished object, in this case a bird.

Develop lines so they more closely resemble they way the final image will look. See how the breast of the bird is now curved, not straight and angular.

Art - Adding Tone

Grades of pencil

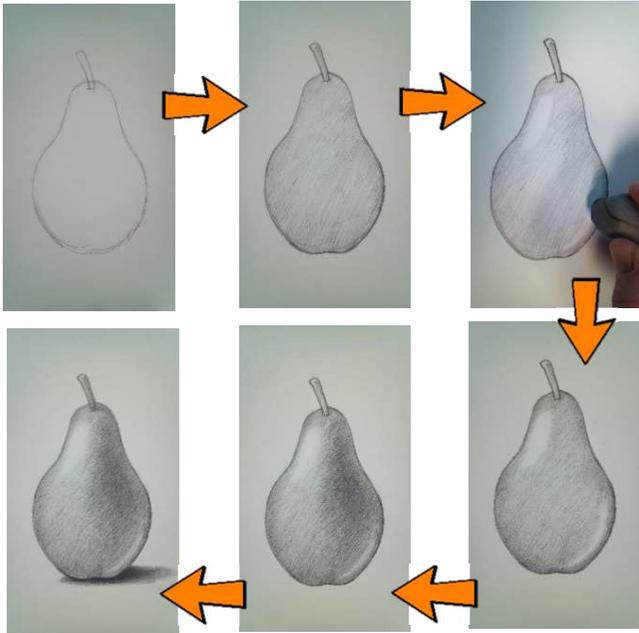
Pencils come in different grades, the softer the pencil, the darker the tone.

H=Hard B=Black

In art the most useful pencils for shading are 2B and 4B. If your pencil has no grade, it is most likely HB(hard black) in the middle of the scale.

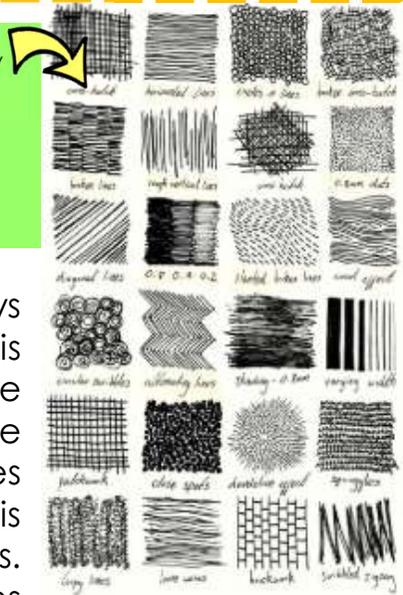


When **applying tone** to a drawing you must remember to apply base shades first to add depth and suggest form. Secondly, add mark making to develop the texture and fine details line work to finish.

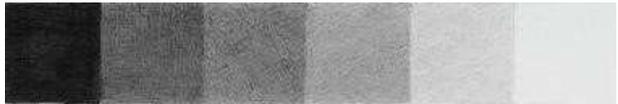


Making things look 3D: To stop drawings looking flat use a range of tone and marks. Pressing harder and light and layering with your pencil creates different tones and adds depth.

Mark Making: To make drawings look more realistic try to use different marks on the surface. You can do this by changing the direction, pressure or length of your marks. Mark making can be used in conjunction with shading or separately.



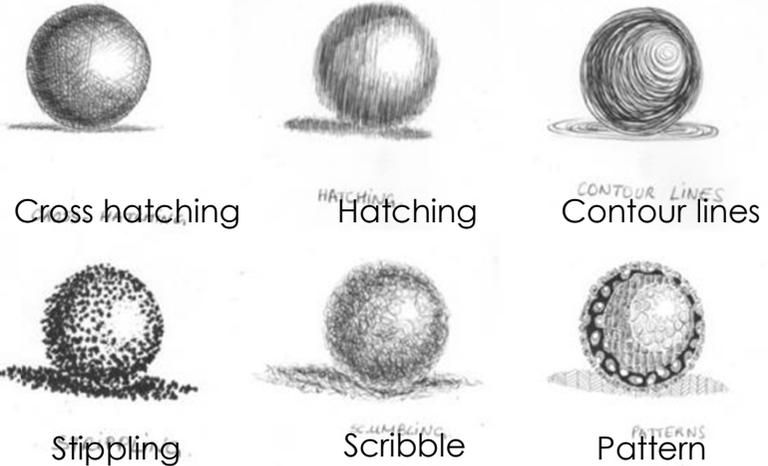
Directional shading is shading that follows the contours of an object. Using this method makes your work appear more realistic. Look at the portrait, see how the shading changes direction and curves with the shape of the figure. This technique should be used on all drawings. See how it has been used on the spheres below.



Tonal shade

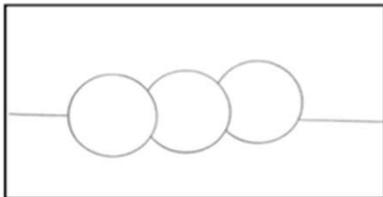
Produce a range of tones by varying the pressure and layering - consider using softer pencils for darker shades

Mark Making - techniques

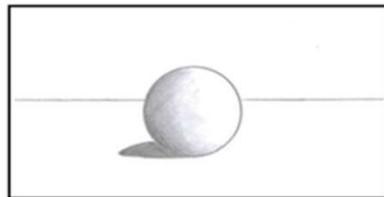


Art - Composition

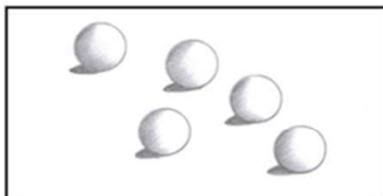
Creating a sense of **space and depth** is important in art work to make it feel sophisticated and well thought out. Knowing how to raise objects over the top of each other is important in communicating space and depth to your viewer.



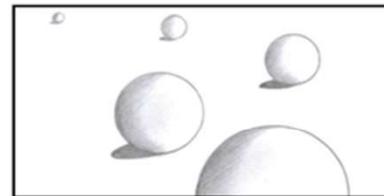
Overlap
One object appears to be behind the other



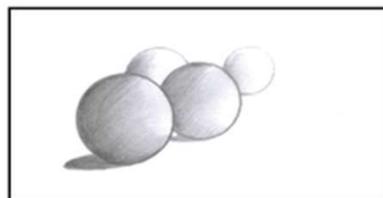
Shading
Light and shadow create the illusion of form and space



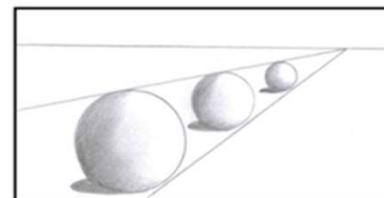
Placement
Objects higher in the picture appear to be in the distance



Size
Small objects look distant, while closer objects should be larger

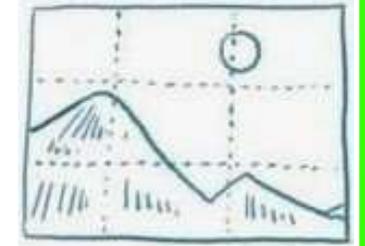


Value and Focus
Lighter values and less details suggest distant objects



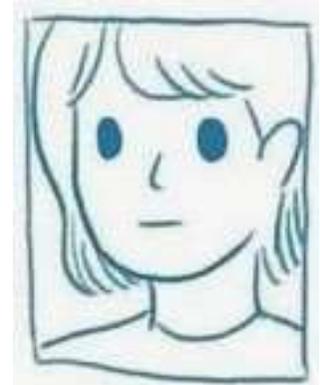
Linear Perspective
Parallel lines and edges seem to go toward one or more vanishing points

Rule of thirds – Place focal elements (objects) at 1/3 or 2/3 of the image horizontally or vertically, not in the middle

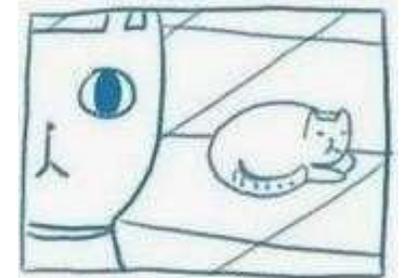


Repetition and grouping
Try grouping objects in odd numbers, this often looks better than an even number of objects.

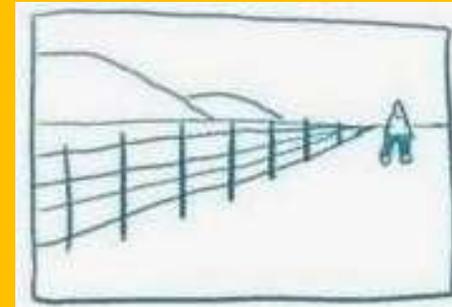
Simplify and fill – Enlarge or crop the image to fill the space and draw your viewers attention to that particular object



Balance elements – If there is an emphasis on one side of the piece balance it out with smaller objects on the other side.



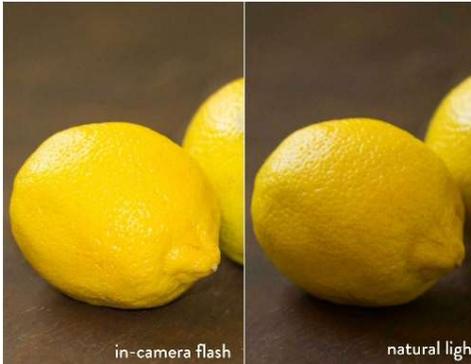
Line – Use lines to draw the viewers eye across the work. The lines don't have to be straight, think about using S or C shaped lines.



Art - Taking a Good Photograph

Light

Use natural light as much as possible. The best times for shooting are sunrise and sunset. As far as possible avoid taking shots in artificial light i.e. bedroom lights or with flash.



Notice that most of the tone is removed with flash on



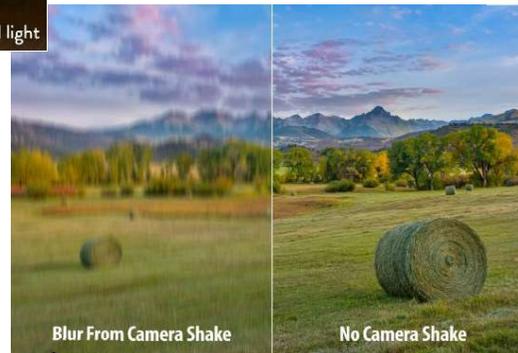
Noise

Avoid digital zoom, it can make images grainy, this is called noise in photography. Try to get physically closer to your subject instead (if you can).



Taking a good photograph will be key to your project. You will be using these images to draw from. Photography is another great way to record (AO3) the work you are carrying out.

If your picture is blurry, it means you are probably too close to your subject. Move back a little bit until your image becomes sharper.

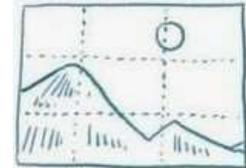


When there is less light your camera finds it harder to focus and often it will create an image with 'camera shake'. If you need to take an image in low light try to rest your camera of a flat surface to help steady it.

Think – don't just point your camera and click. Think about what you want to take a picture of, is it...

- Texture? Get in really close, just make sure your picture is focused and not blurry.
- A portrait? Make sure nothing distracts from your main subject, try to use a plain background,
- Landscape? Then hold your camera steady, stand far back and line up your scene with the rule of thirds.

Grid lines – on most phones/cameras you can go into the settings and add grid lines. Using these grid lines will help you to create a successful composition and therefore photograph. Check out the 'Composition' page and look at the 'rule of thirds'.



To switch the grid on ...

iPhone: Go to "Settings," choose "Photos & Camera," and switch "Grid" on.

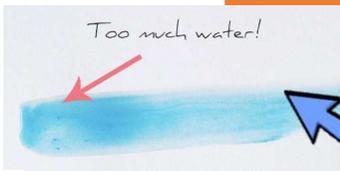
Samsung Galaxy: Launch the camera app, go to "Settings," scroll down and switch the "grid lines" option to "on."

Pro tip: Take lots of pictures from similar angles and only make slight changes with each photograph. Once you have finished capturing you can choose which images are the best.

Art - Painting

Tape Masking

- Tape off sections of your paper with masking tape.
- Paint over the tape and let dry.
- Peel tape off and reveal white paper underneath.



Painting with watercolour – Tips

- If water is pooling at all on the paper, you generally have too much water, it will be harder to control the flow of the paint.
- Use two jars of water, once for cleaning your brushes and one with clean water to mix paints.
- Use thicker 'watercolour paper' normal paper will become wavy as it cannot handle so much water.
- Tape down your paper before, during and after painting until your image is completely dry, this way you will have nice flat paintings.
- Let your watercolour dry between layers,
- Use a layering technique, just remember that you cannot put lighter colours over darker colours when using watercolour, work from light to dark.



Blot

- Use a paper towel to blot up wet paint to reveal white paper underneath.



Salt

- Sprinkle salt into a wet (still shiny) wash of watercolor paint.
- The results will appear when dry.



Consider using some of the watercolour techniques mentioned here to give your work texture and visual interest.

Crayon Resist

- Draw with any color of crayon on dry paper.
- Paint wet watercolor over crayon to reveal drawing underneath.



Wet-in-Wet

- Apply clean water to your paper.
- Before the water dries, load your brush with paint and touch it to the water. The color will spread quickly.



Dry Brush

- Start with a dry brush and almost dry paint.
- Run your brush over your paper to create grass or scratchy lines.

Wash

- Load your brush with plenty of wet paint. Smooth your brush over the paper with swooping strokes.



Painting in layers

Painting, just like drawing (or making a sandwich) needs to be done in layers.

You must start from the base of your image and work forwards. Think about background, midground and foreground

- We can add different materials or techniques individually one over the other,
- waiting until one layer is dry before applying the next.
- Each layer could be the same technique as before, or a different one.
- A layer doesn't have to cover the surface in its entirety.

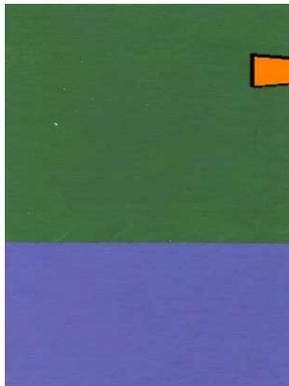
A **layer** can consist merely of one small dab of paint, or can involve thick overlays covering the whole surface. A technique does not have to be applied over the whole surface to qualify as a layer.

Painting with acrylic - In stages

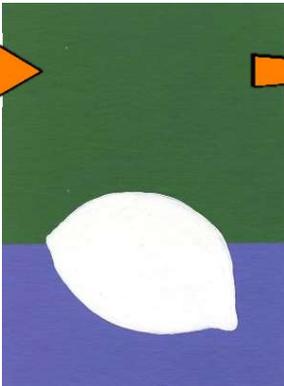
Once you have finished drawing out what you want to paint you should follow these rules when painting with acrylic

Brights: a colour that is lighter than your background

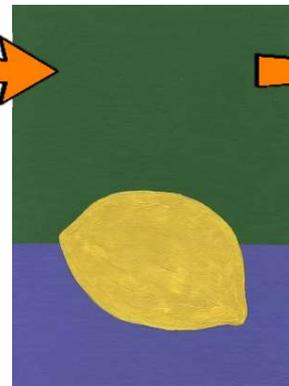
Paint a background



White under brights



Brights over white (block colour)



Apply tonal range, shadows/highlights



Soften edges and blend colours



Art - Colour Theory

Colour Theory

Primary colours are the three main colours, they can't be made, but are used to mix all of the other colours

Secondary colours are made by mixing two primary colours

Tertiary colours are made by mixing a primary and a secondary colour

Tint – when you add white to a colour to make it lighter

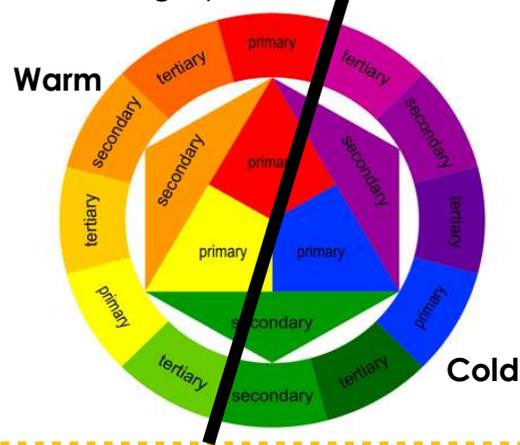


Shade – when you add black to a colour to make it darker



Hue – any colour that appears on the colour wheel, note that neither black nor white appear on there

Tone – used to describe a colour that has had grey added to it.



Colour and emotion

Colour has a powerful influence over human behaviour, to the extent it can manipulate your perception of what is actually there.

- Red: Passion, love, anger and danger
- Orange: Vitality, creativity and activity
- Yellow: Energy, light and hope
- Green: Health, nature and wealth
- Blue: Trust, security and spirituality
- Purple: Creativity, royalty and wealth

We can use these psychological triggers to influence how we want the viewer to perceive the painting. If you want the viewer to have a passionate and aggressive response, then you should be utilizing reds and other warm colours. If you want a calming scene, then greens and blues should be utilized.



Complementary colours are opposite each other on the colour wheel. When placed next to each other, there is an extremely strong contrasting and vibrant effect. If overused, your painting may become jarring and uncomfortable to look at.

You should select a dominant colour and use the other colour as an accent.



Harmonious colours are relaxing colour combinations using colours positioned next to each other on the wheel. Harmonious colour combinations were famously used by impressionist artists such as Claude Monet to create beautiful harmonious paintings. It is often most effective to select one dominant colour, a secondary colour and a third accent colour.

What can I actually see?

We all have preconceived ideas of what colour an object should be, i.e. a tree is green. But that is not always the case. If you are not careful and do not observe the tree for what it actually is, then you may be drawn towards adding more green than is necessary. This is because we forget to observe and we try to paint from a memory or idea. - **Paint what you see, not what you think.**

Constructing the Built Environment Level– Unit 3

Clients Team, (Client, Architect, Engineer, Quantity Surveyor, Project Manager, Designer)

Job role	Activities (AC1.1)	Responsibilities (AC1.2)	Outputs (AC1.3)
Client	<p>The client is the customer of the entire industry.</p> <p>Appoint a team of professionals</p> <p>Delegate administration responsibilities or administer the contract themselves.</p> <p>Ensure the wider team is paid in a timely and consistent manner.</p>	<p>Fulfil their duties under CDM regulations</p> <p>Satisfy themselves that the project is feasible in commercial, practical and beneficial terms.</p> <p>Choose and appoint suitably qualified and experienced construction professionals by following the advice of their project manager.</p> <p>Trust their team to procure, design, construct and ultimately deliver solutions</p>	<p>Successfully manage and deliver a project</p> <p>Controls the risks from health and safety of those that might be affected.</p> <p>Ensure the contractors get paid for the work that they have done.</p>
Architect	<p>Creating design to meet client requirements</p> <p>Creating detailed drawings for the contractor, with exact measurements and building materials needed</p> <p>Assessing client needs, identifying potential risks, overseeing the whole construction process.</p>	<p>Considering budget, safety and community needs for a project.</p> <p>Ensuring building regulations, planning laws and environmental considerations are met.</p>	<p>Overall responsibility for creating designs of buildings for client and ensuring it is compliant with regulations and legislation requirements.</p>
Civil Engineer	<p>Assisting with site investigations</p> <p>Developing detailed designs</p> <p>Communicating and liaising effectively with colleagues and architects, subcontractors, contracting civil engineers, consultants, co-workers and clients</p>	<p>Managing budgets and other project resources.</p> <p>Managing change, as the client may change his or her mind about the design</p> <p>Assessing the potential risks of specific projects.</p>	<p>Ensuring planning conditions are met (e.g. specific improvements or methods of work) using highly specialised sub contractors.</p>

Constructing the Built Environment Level– Unit 3

Clients Team, (Client, Architect, Engineer, Quantity Surveyor, Project Manager, Designer)

Job role	Activities (AC1.1)	Responsibilities (AC1.2)	Outputs (AC1.3)
Structural Engineer	<p>Supervising project teams and giving progress reports to clients and senior managers</p> <p>Using computer simulations to predict how structures will react under different conditions, for example high winds or earth tremors</p>	<p>Making sure projects meet legal guidelines, environmental directives, and health and safety requirements</p> <p>Ensuring accuracy in calculating the loads and stresses on different parts of a structure like the foundations, beams, arches and walls.</p>	<p>Ensuring the structure and layout of buildings is accurate in planning and monitoring of construction process.</p>
Quantity Surveyor	<p>Preparing tender and contract documents</p> <p>Working out the cost of repair and maintenance work</p> <p>Establishing exactly what a client wants</p> <p>Weighing up commercial risks</p>	<p>Allocating work to subcontractors</p> <p>Valuing completed work and arranging payments</p> <p>Making sure a project meets every legal and quality standard</p> <p>Making sure that the client gets value for their money.</p>	<p>Ensure performance of contractors is compliant, safe, timely and satisfactory quality of work and that they are paid on time.</p>
Project Manger	<p>Understanding what the client or company wants to achieve</p> <p>Agreeing the timescales, costs and resources needed to deliver the project</p> <p>Drawing up a detailed plan for how to achieve each stage of the project</p> <p>Selecting and leading a project team.</p>	<p>Negotiating with contractors and suppliers for materials and services</p> <p>Directing a multi-disciplinary team and ensuring that each stage of the project is progressing on time, on budget and to the right quality standards</p> <p>Resolving any issues/ delays which may occur</p>	<p>Ensure project is complete and compliant for the client in a safe and timely manner.</p>
Designer	<p>Overseeing internal and external design teams</p> <p>Making sure that design information is available to those who need it, when they need it</p>	<p>Working with clients to ensure that their requirements are fulfilled.</p> <p>Keeping up to date with changing legislation and codes of practice.</p>	<p>Ensure clients design requirements are met and are compliant with regulations.</p>

Constructing the Built Environment Level– Unit 3

Contractors Team, (Builder/Site Engineer, Site supervisor, Safety Officer, Tradesperson, Specialist Sub-contractor)

Job role	Activities (AC1.1)	Responsibilities (AC1.2)	Outputs (AC1.3)
Builder/site engineer	<ul style="list-style-type: none"> Handling health and safety on a project Setting bench marks of work to be done Setting and agreeing budgets for the work Working with client, contractors, architects 	<ul style="list-style-type: none"> Being directly responsible for the work being carried out and the decision making Working on site—Quality assurance and inspection of work carried out 	<ul style="list-style-type: none"> H&S on site and ensuring compliance of build Ensure the realisation of the project in a safe, timely, efficient and productive and profitable approach
Site supervisor	<ul style="list-style-type: none"> Supervise the labour force Plan work to be done Organise plant and site facilities to meet deadlines Prepare reports Overseeing the selection and requisition of materials and plant (heavy machinery) 	<ul style="list-style-type: none"> Make sure quality of health and safety on site is high Problem solving as issues arise & communicating to all parties Acting as the main technical adviser on a construction site for all 	<ul style="list-style-type: none"> subcontractors, crafts people and operatives Ensuring stick to budgets and requirements of client Ensure programme of work and safety on site is followed
Safety Officer	<ul style="list-style-type: none"> Investigating accidents and writing reports Identifying potential hazards Completing risk assessments and site inspections Suggesting improvements 	<ul style="list-style-type: none"> Ensuring staff understand safety processes Checking equipment is safe Reviewing health and safety policies Ensuring compliance with H&S legislation and regulations 	<ul style="list-style-type: none"> Ensure H&S compliance on site Use data to write reports to help reduce risk on site

Constructing the Built Environment Level– Unit 3

Contractors Team, (Builder/Site Engineer, Site supervisor, Safety Officer, Tradesperson, Specialist Sub-contractor)

Job role	Activities (AC1.1)	Responsibilities (AC1.2)	Outputs (AC1.3)
Trades persons	<p>e.g. bricklayer, steel erector, roofer, plasterer, decorator</p> <p>Bricklayer: Work from plans and specifications</p> <p>Produces high quality brick work</p> <p>Steel erector:</p> <p>Planning the layout of the structure using the drawings of construction engineering professionals prior to assembly</p> <p>Fixing safety netting and edge rails</p> <p>Working out how to fit the steelwork together following engineers instructions.</p>	<p>Bricklayer:</p> <p>Ensures follows and understands the requirements of the plans</p> <p>Works with Builder/site supervisor</p> <p>Follows H&S principles of the site</p> <p>Steel erector:</p> <p>Ensure the steel structure is safe and appropriate and safe for site</p> <p>Ensure working at height platforms meet legislation requirements</p> <p>Working with and liaising with engineers , builders and other contractors</p>	<p>Bricklayer: Produces brickwork</p> <p>Steel erector: produce an appropriate scaffolding structure which meets H&S legislation.</p>
Specialist sub-contractors	<p>Follow instructions from main contractor or client</p> <p>Plan and manage their work around other professionals to ensure H&S, quality production and programmes of work.</p> <p>E.g. Asbestos removal</p> <p>Do a site audit to check for asbestos and plan for removal</p> <p>Remove asbestos safely and securely</p>	<p>Consult about H&S or professional opinions</p> <p>Achieve the highest standards of quality</p> <p>Work safely on site</p> <p>Asbestos removal: Follow H&S legislation requirements and ensure appropriate PPE is worn, safe disposal etc</p> <p>Liaise with site team to advise and keep informed</p>	<p>Ensure specialist work is carried out to the highest quality.</p>

Statuary Personnel Team, (Public Health Inspector, Town Planner, Planning Officer, Planning Consultant, Building Inspector, Building Controller)

Job role	Activities (AC1.1)	Responsibilities (AC1.2)	Outputs (AC1.3)
Public health inspector	Ensure that local and national environmental standards of living, working, resting and leisure are achieved and maintained. Review impact of chemical, biological contamination, noise, air and water pollution.	<p>Protection and wellbeing of those that share community</p> <p>Remain accountable. Research issues in relation to environmental and health governance law. Respect opinions and cultures</p> <p>Enforce the law</p> <p>Educate, support and offer guidance on how to comply with the law</p>	Ensure that local and national environmental standards of living, working, resting and leisure are achieved and maintained. Make recommendations and ensure compliance with these and legislation
Town planner/planning officer/planning consultant	Manages the development of cities, towns and countryside. Reviewing and monitoring existing planning policy documents. Helping to ensure that areas are attractive, safe and pleasant to live. Helping to draft and review planning applications. Conducting appropriate research to inform planning applications.	<p>Assisting with consultations and negotiations with consultants and developers. Helping to enforce planning controls for developments i.e. impose conditions e.g. developer must build a school within the housing development. Helping to prepare policy or guidance documents on how to manage historic environments.</p> <p>Ensuring regulations and laws are complied with on matters of development or re-development.</p>	<p>Validate the suitability of developments</p> <p>Ensure planning conditions are understood and carried out</p> <p>Balance the needs of stakeholders</p> <p>Ensuring regulations and laws are complied with</p>
Building inspector / Building control officer (BCO)	<p>Work on the planning and construction phases of a variety of projects, from small house extensions to major city developments.</p> <p>Working closely with the construction workers on planning proposals, approve drawings and plans.</p>	<p>Keeping records and issue completion certificates.</p> <p>Suggesting ways to improve the energy use of building to people like the construction manager.</p> <p>Starting legal proceedings should work not be in line with regulations.</p> <p>.</p>	<p>Ensure plans and works are carried out to meet building regulations and compliance.</p> <p>Produce a final compliance certificate.</p>

Constructing the Built Environment Level– Unit 3

General Team, (Administrator, Finance Officer, Public Liaison Officer, Purchasing Officer, Caterer, Security)

Job role	Activities (AC1.1)	Responsibilities (AC1.2)	Outputs (AC1.3)
Administrator	<p>Collect paperwork, electronic communications and ensure the relevant people complete the tasks or provide out-standing information</p> <p>Keeps programmes of work up-to-date and emails out to all relevant parties</p>	<p>Ensures day-to-day communications are effective and are kept up-to-date</p> <p>Ensures reports or spreadsheets are passed on to the correct people</p> <p>Remain approachable and work with colleagues</p>	<p>Keep documents up-to-date and distribute to the relevant people</p> <p>Pass on information and ensure all aspects of paperwork have been completed</p>
Finance officer	<p>Collect information e.g. profit margins, turnover and pro-cess them into monthly accounts report</p> <p>Analyses forecasted buying proposals and ensures there is funding to avoid litigation (getting sued)</p> <p>Works closely with site/project manager/quantity surveyors to maximise operational efficiency</p>	<p>Ensure accounts are accurate and transparent</p> <p>Present monthly commercial reports to the board of directors</p> <p>Ensure monthly anticipated and projected cash flow is accurately fore-cast so that funds are available to pay the supply chain (sub-contractors and tradespeople)</p>	<p>Ensure accounts are accurate and transparent</p> <p>Ensure there are funds to pay supply chain</p> <p>Keep Directors informed of accounts</p>
Public liaison officer (PLO)	<p>Inform the general public, clients and wider stakeholders of the development and any impacts of it on a day-to-day basis</p> <p>Liaises with press, Uses social media</p>	<p>Ensures the organisation is proactively public facing and accountable</p> <p>Ensures any press statement is approved by at least 2 board directors</p> <p>Ensures the organisation shows a consistent and positive image in terms of H&S, environment, quality and educational/training matters.</p>	<p>Ensures the organisation communicates a positive message to the public and wider stakeholders</p>

Constructing the Built Environment Level– Unit 3

General Team, (Builder/Site Engineer, Site supervisor, Safety Officer, Tradesperson, Specialist Sub-contractor.

Job role	Activities (AC1.1)	Responsibilities (AC1.2)	Outputs (AC1.3)
Purchasing/procurement officer	<p>Advertise and appoint all opportunities for tradespeople, designers and specialist contractors who may offer goods or services</p> <p>All posts must meet national and European procurement and government guidelines, to ensure fairness and transparency.</p>	<p>Ensure the local supply chain (within 200 miles) is made aware of opportunities, Work with PLO to advertise and promote opportunities.</p> <p>Ensure rules of the UK and European procurement law are followed.</p> <p>Accountable person for all matters relating to purchasing or procurement by keeping records to demonstrate at least 3 quotes have been received and fairly processed. Allows the team to compare the value for money.</p>	<p>Ensure all opportunities for goods and services meet UK and European procurement law</p> <p>Ensure process is fair and transparent</p>
Catering	<p>Provides refreshments, snacks, lunches for the workforce both in the office and on site</p> <p>Provide value for money.</p>	<p>All staff must have food preparation qualifications (e.g. L2 Food Safety) to meet government standards.</p> <p>Ensure provide nutritious and inclusive food (e.g. halal, vegetarian etc) as well as allergies (nut allergy, coeliac)</p>	<p>Provide nutritious food and drink to the work-force at a reasonable price</p> <p>Meet Food safety requirements</p>
Security	<p>Asset protection of the site, vehicles and workforce</p> <p>Monitors exposure to risks of fire, theft and vandalism through use and maintenance of electronic surveillance systems and physical presence on site</p> <p>Can carry out drug and alcohol tests on workforce.</p>	<p>Secure perimeter fencing to stop people from entering the site</p> <p>On all projects values at > £5m provide 24hr, 365 provide CCTV, full time guard for 10 weeks leading up to practical completion</p> <p>On projects valued at < £5m provide an ‘outside of normal hours’ alarm with an attendant reactive visiting guard, who can reach site in 20 mins, provide guard for 10 weeks leading up to practical completion.</p>	<p>Remain the accountable and proactive professional team that protects the interests relating to security of the organisation at all times.</p>



Grown

Where does our food come from?
All our food comes from **plants** and **animals**

Reared

Caught



Food Packaging Date Marks

Date Mark	Description	Food Examples
	A safety date. Used on high risk foods that usually need to be stored in the fridge. If you eat the food after this date you risk food poisoning.	Meat Fish Seafood Cheese Milk Cream
	A quality date. Food can still be eaten after but the quality will be reduced. E.g. cereals or biscuits will not be as crunchy.	Bread Cereals Sugar Flour Pasta

Different Types of Food Production

Keyword	Meaning
Genetically modified	A food which has had its genes altered to give it a useful characteristic such as improving its growth or colour
Intensive farming	Uses chemicals to achieve maximum yields (can also be known as conventional farming

Red Tractor is a food assurance scheme showing the food has been farmed, processed and packed in the **UK**. It is **traceable**, safe to eat and has been produced responsibly.

The **animals** have access to outdoor space and can live naturally. The **welfare** standards are high.

Foods that have this label mean the **animals** have had a good life and have been treated with respect

This means the food has been produced without using any chemicals. Only **natural fertilisers and pesticides** are used to help the crops grow.

The **farmer** gets a **fair price** for his produce and fair working and living conditions.

Using **sustainable methods** of fishing to prevent the decline in number of **fish** in our seas.

Foods:
Milk, cheese, yoghurt, poultry

Foods:
Eggs, meat

Foods:
Eggs, meat & fish

Foods:
Eggs, chicken, fruit and vegetables

Foods:
Sugar, bananas, coffee, tea

Foods:
Fish, seafood

Food miles - The distance food travels from Farm To Fork



Some is local

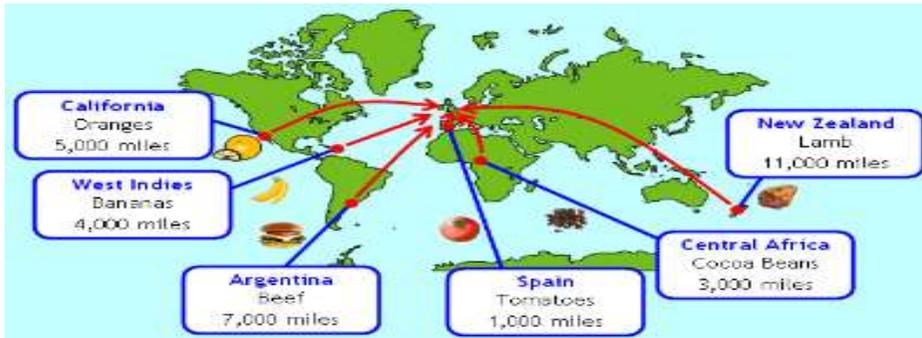


Some comes by lorry from all over the UK or Europe

Food miles

How far does our food travel to get to us?

Some is flown here from all over the world



The higher the food miles the bigger the environmental issues for our planet

Keyword	Meaning
Food miles	The distance a food travels from where its produced to the consumer
Food security	Is where people have access to enough nutritious food to stay healthy and active
Food poverty	Is where a person isn't able to access or afford nutritious food.

Keyword	Meaning
Primary processing	Prepares raw food so that they are ready to be eaten or cooked immediately or used as ingredients to make other food products
Secondary processing	After primary processing, comes secondary processing. Primary processed foods are turned into other food products by altering them in some way or combining them with other ingredients.
Manufactured	Where a product has gone through several stages to reach its final point.
Fortification	Where nutrients are added to a food
Additives	Something that is added to food to improve its properties. Some are natural and some are made artificially

RAW FOODS

PRIMARY PROCESSED FOODS

SECONDARY PROCESSED FOODS

MANUFACTURED PRODUCTS

Foods and Cuisines from Around The World



A **cuisine** is a style of cooking from a particular country or region of the world. Different cuisines have different ingredients, styles and preparation & cooking techniques. **Some examples are shown below.**

Staple foods are crops that grown in particular parts of the world due to their climate and conditions. E.g. wheat in Europe, rice in Asia or maize in South America.



UK

Roast dinner. Fish & Chips. Bakewell Tart.



Japan



Sushi. Ramen. Udon noodles. Jasmine Rice.



Italy

Pizza, Pasta, Lasagne, Risotto, Gelato.



China

Spring Rolls. Stir fry. Sweet & Sour. Chow Mein.



Mexico

Chilli Con Carne, Burritos, Tacos, Salsa, Guacamole



India

Samosas, Curries, Tandoori Chicken, Nan Breads



Environmental Issues With Food Production

Environment

Refers to the air, water and land where people and animals live.

Sustainability

We need to look after our environment by using less energy, reducing the consumption of water, avoiding waste and recycling/reusing as much as possible.

Carbon footprint

A measure of the impact your personal lifestyle has on the environment (**including your food choices**).

Landfill

Nearly a third of all food we produce ends up in landfill sites where it gives off methane gas as it decomposes. This adds to carbon emissions.

Composting - Left over food can be composted for the garden. (vegetable peelings, fruit waste, teabags, eggshells, toilet roll tubes, egg boxes etc). **Meat, fish and dairy products cannot be composted.**



5 ways to reduce your carbon FOOTPRINT

- 1 only buy what you need**
20-30% of everything we buy ends up in landfill
- 2 eat less meat and dairy**
70% of the world's footprint is from animal products
- 3 eat less processed food**
the more processed a food is, the bigger its footprint
- 4 buy local and in season**
these foods have travelled less and stored less
- 5 grow your own food**
the ultimate in local, seasonal, unprocessed food



Reuse left over food to make another dish. E.g. left over chicken in a curry, fruit in a smoothie.

Recycle/reduce as much packaging as you can. Reuse jars/containers, use bags for life, avoid buying over packaged food.



What can impact our food choice?

Food choices for a balanced diet depend on many factors, such as:

- advertising and other point of sale information;
- cost and economic considerations;
- cultural or religious practices;
- environmental and ethical considerations;
- food availability;
- food preferences;
- food provenance;
- health concerns;
- individual energy and nutrient needs;
- portion size;
- social considerations.

Environmental and ethical considerations

Some considerations when buying food might be:

- fair trade;
- local food;
- genetically modified (GM) food;
- organic food;
- free range.

Health concerns

People may choose their food based on their own or their family's health and wellbeing:

- allergy and intolerance, e.g. lactose intolerance, coeliac disease, wheat allergy, dairy allergy;
- body image;
- health issues, e.g. coronary heart disease, type 2 diabetes, inflammatory bowel disease, over or under malnutrition;
- mental health.

Food Choice – KEY WORDS

Keyword	Meaning
Advertising	Advertising is a form of communication for marketing and used to encourage, persuade, or manipulate an audience to continue or take some new action.
Ethical	Relating to personal beliefs about what is morally right and wrong.
Food certification and assurance schemes	Defined standards of food safety, quality or animal welfare.
Marketing	Promoting and selling products or services, including market research and advertising.
Religion	A particular system of faith and worship.
Seasonal food	Food grown at a particular time of year

Cultural or religious practices

People around the world choose to eat or avoid certain food due to their cultural or religious practices.

Religion	Pork	Beef	Lamb	Chicken	Fish
Islam	x	Halal only	Halal only	Halal only	✓
Hinduism	x	x	✓	✓	✓
Judaism	x	Kosher only	Kosher only	Kosher only	✓
Sikhism	x	x	✓	✓	✓
Buddhism (strict)	x	x	x	x	x
Seventh-day Adventist Church	x	x	x	✓	✓
Rastafari movement	x	x	x	x	x

Food prices

Food prices can and do change throughout the year and over time. This may be due to a variety of reasons, including:

- climate and weather patterns;
- crop failure;
- crop disease;
- seasonality;
- consumer demand;
- agricultural costs increase;
- fuel prices go up;
- increased use of bio fuels.

Budgeting

There are many things that we can do to spend money wisely on food. Examples can include:

- eating the seasons;
- stocking up on food with a long shelf-life;
- taking time to plan meals and write a shopping list;
- cooking using one pot;
- making fake-aways rather than buying takeaways;
- using leftovers;
- replacing branded items with cheaper items;
- comparing prices and shop around to find the cheapest items;
- growing your own food.

BTEC MUSIC Unit 4: INTRODUCING COMPOSITION

Vocational Scenario or Context	You have been asked to create some film score examples for a film music publisher. These will be put together to create a portfolio of your work and shown to various film companies so that they may potentially offer you work in the future. You will need to provide the publisher with access to sound clips that could be used for a range of different film types/scene scenarios.
Task 1	<p>You should create four brief musical ideas that try to capture a range of moods or atmospheres suitable for an advert for a range of products. Choose from:</p> <ul style="list-style-type: none"> - Horror Scene - Romantic Scene - Car Chase Scene - End of Battle Scene - Crime Investigation Scene <p>These ideas can be short (under 30 seconds) but should make use of appropriate textures and timbres and have some melodic and rhythmic interest. Your ideas should be varied and have at least two different musical starting points.</p>

	GOOD PRACTICE:	AVOID:
Melody	<ul style="list-style-type: none"> • Include a strong initial melody, from which other ideas can grow • Identify motifs from a longer melody, and work with these to develop the material (or vice-versa) • Melodic balance / phrases • Some repetition of the main idea 	<ul style="list-style-type: none"> • Basic triadic melodic ideas for too long • Disjunct, awkward melodies with notes taken from underlying chords, but show no character or focus on their own • relentless repetition of a motif (without interest) • a melody which doesn't 'fit' with the underlying chords

Using MADTSHIRT in Compositions

Name: _____
Brief No. _____

MELODY

- What type of scale am I using?
- Is there a contrast between conjunct/disjunct?
- Are my phrases balanced?
- Am I using any interesting intervals?
- Have I included any ornaments?
- Have I used these devices appropriately? Imitation/Anacrusis/Sequence



STRUCTURE

- What would be an appropriate structure for my choice of brief?
- AOS1: Classical styles: Binary/Ternary/Rondo/Rounded binary?
 - AOS2: Strophic/Verse-chorus/32 Bar form? Any other ideas?
 - AOS3: Episodic? How can I add contrast?
 - AOS4: If using verse-chorus can I add other sections e.g. Prechorus/instrumental section?
- AM I DEVELOPING MY IDEAS IF REPEATED?**

INSTRUMENTATION

- How can I combine instruments appropriately (families/including voices)?
- Have I written appropriate parts (inc range)?
- Can all the parts be played live? Where would it be performed?

ARTICULATION

- Have I contrasted my piece with the following: Staccato/Legato/Accented notes
- Have I considered the different techniques on the instruments: Slurring/tonguing/tremolo/pizzicato/palm muting etc

DYNAMICS

- Have I added contrast using the following dynamics; e.g. pianissimo/forte/sforzando
- Have I added a Crescendo or Diminuendo?
- Is there any use of silence?

TEXTURE

- Have I contrasted my piece using more than one of the following:
- Monophonic inc Unison/Octaves
 - Homophonic inc Parallel motion/Melody and accompaniment/Chordal
 - Polyphonic inc Countermelody
 - Imitation

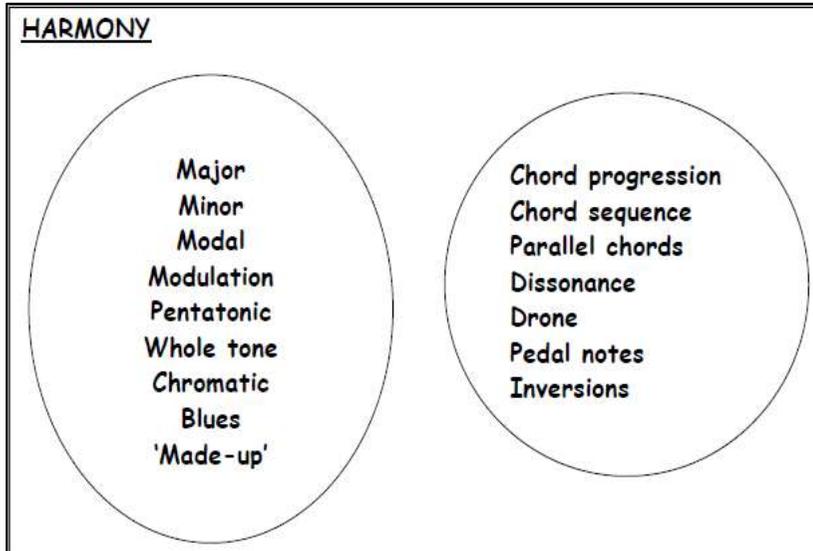
HARMONY (& TONALITY)

- What key am I working in? Major or Minor?
- Have I used any interesting chords; Sus4/Diminished/Augmented/7th?
- Have I added a key change?
- Have I used a Pedal note/Drone?
- How often do the chords change?

RHYTHMS (& TIME SIGNATURE)

- Have I combined long and short notes to different effect?
- What tempo am I working at?
- Have I considered a Dotted rhythm/ Syncopation/Triplets
- How about Hemiola/ Cross rhythm
- Accelerando/Rubato?

BTEC MUSIC Unit 4: INTRODUCING COMPOSITION



Melodic and harmonic ideas

Learners should use compositional techniques such as:

- repetition
- sequence
- decoration
- variation
- modulation
- changing tonality
- transposition
- use of contrast
- transformations, e.g. inversion, retrograde, retrograde inversion
- cut and paste techniques
- processes, e.g. canon, phasing, addition, subtraction, augmentation, diminution, displacement
- instrumentation
- textures, e.g. polyphonic, homophonic, unison, octaves, counterpoint
- chord voicings/inversions.

Building up a bank of chords (Play, Notate, Change, Extend)

EXAMPLE:

Shaping musical ideas

- block structures (binary, ternary, rondo, arch, ground bass)
- style
- introductions
- codas
- song structures (12-bar blues and other templates, verse-chorus constructions)
- effective use of repetition and contrast
- pace, e.g. maintaining momentum
- contrasts
- balancing repetition and change.

MUSIC GCSE: COMPOSITION

Forms you may use:

- BINARY FORM
- TERNARY FORM
- RONDO FORM
- MINUET AND TRIO FORM
- STROPHIC FORM
- THEME AND VARIATIONS FORM
- 32-BAR SONG FORM
- 12-BAR BLUES FORM

Key Minimalism Techniques:

- layers of **ostinati**
- constantly repeated patterns that are subjected to gradual changes
- layered textures
- interlocking repeated phrases and rhythms
- **diatonic** harmony

Layering –	When several layers of sound or musical lines are combined to build up the texture
Leit Motif –	A musical idea associated with a person, place, object, feeling or idea
Imitation –	A contrapuntal device, when a melodic idea (already stated in one part) is copied in another part, while the first tune continues. It may only use the first few notes of the original musical idea.
Chromatic Movement –	When the melodic movement is in semitones, like part of the chromatic scales
Dissonance –	Sounds harsh when notes are played together
Thematic Transformation –	Where the important melody of the music is developed and transformed
TIME SIGNATURE	The number of beats in a bar – you can have simple time (2/4, 3/4, 4/4) or compound time (6/8 – dotted rhythms)
MINIMALISM	A style of music where ideas are very simple and sparse
CHROMATIC HARMONY	A complex harmony system that uses accidentals not belonging to the key
EXTENDED HARMONY	Chords or harmony with added 7ths or more.

MUSIC GCSE: COMPOSITION

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Leit Motif – A musical idea associated with a person, place, object, feeling or idea

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Chromatic Movement – When the melodic movement is in semitones, like part of the chromatic scales

Dissonance – Sounds harsh when notes are played together

Thematic Transformation – Where the important melody of the music is developed and transformed

Developing Chords and Harmony in Composition:

You should have a basic chord progression in place already, but here are the top tips to follow this:

Composer various short progressions of chords – they don't have to stay the same the whole way through, but repetition is also effective

Think about working in a different key

Play pitches together to create chords that you feel would suit the piece – don't feel you have to keep in C major

Build up a chord sequence by starting with one chord of 3 notes, then change one note at a time (you could add or take a note away)

Listen to the ideas. If it doesn't sound right then change it – **YOU ARE NOT GOING TO GET THIS RIGHT FIRST TIME EVERY TIME** – even the world's best composers will keep changing their ideas all the time!!

Establish a HOME KEY

Work out how to move to RELATED keys – think back to our work on Tonic, dominants and relative major/minors – if in doubt, ASK!

Repeat the strongest chord progressions, but include some contrast

Think about phrase endings and cadences (think about balanced phrases when planning these)

Avoid using chords in ROOT position all the time – why not use inversions and 7ths?

Don't be afraid to use DISSONANT harmony, but remember to pull it back into control when needed.

Using MADTSHIRT in Compositions

Name:
Brief No.

MELODY

- What type of scale am I using?
- Is there a contrast between conjunct/disjunct?
- Are my phrases balanced?
- Am I using any interesting intervals?
- Have I included any ornaments?
- Have I used these devices appropriately? Imitation/Anacrusis/Sequence



STRUCTURE

- What would be an appropriate structure for my choice of brief?
- AOS1: Classical styles: Binary/Ternary/Rondo/Rounded binary?
 - AOS2: Strophic/Verse-chorus/32 Bar form? Any other ideas?
 - AOS3: Episodic? How can I add contrast?
 - AOS4: If using verse-chorus can I add other sections e.g. Prechorus/instrumental section?
- AM I DEVELOPING MY IDEAS IF REPEATED?**

INSTRUMENTATION

- How can I combine instruments appropriately (families/including voices)?
- Have I written appropriate parts (inc range)?
- Can all the parts be played live? Where would it be performed?

ARTICULATION

- Have I contrasted my piece with the following: Staccato/Legato/Accented notes
- Have I considered the different techniques on the instruments: Slurring/tonguing/tremolo/pizzicato/palm muting etc

DYNAMICS

- Have I added contrast using the following dynamics; e.g. pianissimo/forte/sforzando
- Have I added a Crescendo or Diminuendo?
- Is there any use of silence?

TEXTURE

- Have I contrasted my piece using more than one of the following:
- Monophonic inc Unison/Octaves
 - Homophonic inc Parallel motion/Melody and accompaniment/Chordal
 - Polyphonic inc Counter melody
 - Imitation

HARMONY (& TONALITY)

- What key am I working in? Major or Minor?
- Have I used any interesting chords; Sus4/Diminished/Augmented/7th?
- Have I added a key change?
- Have I used a Pedal note/Drone?
- How often do the chords change?

RHYTHMS (& TIME SIGNATURE)

- Have I combined long and short notes to different effect?
- What tempo am I working at?
- Have I considered a Dotted rhythm/Syncopation/Triplets
- How about Hemiola/Cross rhythm
- Accelerando/Rubato?

Structure:

Minuet		Trio		Minuet	
Section A (repeated)	Section B (repeated)	Section A (repeated)	Section B (repeated)	Section A (repeated)	Section B (repeated)
G major	G major	D major	D major	G major	G major
Tonic Key		Dominant Key		Tonic Key	

Instrumentation - string quartet:



Dynamic

range:

- pp* very soft
- p* soft
- mp* moderately soft
- mf* slightly loud
- f* loud
- ff* very loud

MINUET AND TRIO
 from *Eine Kleine Nachtmusik*
 By Wolfgang Amadeus **Mozart**
 Composition date: 1787



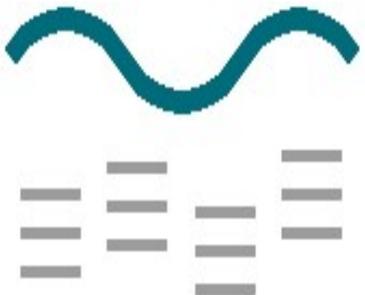
Tempo - Allegretto:
 Quite fast, but not as fast as *Allegro*.

Time signature:

3/4

Texture:

Homophonic : Melody plus accompaniment



Clefs and note positions:

Treble Clef

Alto Clef

Bass Clef

Violin 1 & 2

Viola

Cello

Melody:

Mainly **Conjunct** and within quite a narrow range.

Harmony:

Diatonic, with modulation to the **Dominant** key.

Structure: Verse/Chorus form

Intro	Verse 1	Pre chorus	Chorus	Verse 2	Pre chorus	Chorus	Bridge	Chorus 2
Intro: G D Em C		Verse 1 & 2: G D/F Em D C G/B A D			Pre chorus: Eb F Eb F/A Cm7 D			
Chorus: G D Em C		Bridge: Half tempo feel			Chorus 2 (modulated): A/E E F#m D F			

Instrumentation – Rock band:

Vocals – Male, main melody.

Electric Guitar – Accompaniment and lead in bridge.

Bass guitar – Bass line, supporting the harmony.

Keyboard – Accompaniment, with improvisation in bridge.

Drum kit – Standard kit consisting of snare drum, bass drum, hi hat, tom toms and cymbals.

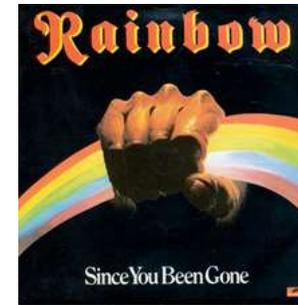
Dynamic range:

Mainly *forte*, although the bridge section is slightly quieter.

Rainbow: *Since You Been Gone*

Recorded: 1979 and featured on the album *Down to Earth*

Written in 1976 by Russ Ballard



Tempo: Moderate

A moderate bright rock beat
BPM: 120

Time signature:



Texture:

Homophonic : Melody plus accompaniment



Moderately bright Rock beat

Words and Music by RUSSELL BALLARD

The song starts with the main **riff** played on **electric guitar**. This riff can also be heard during the chorus.

There is a distinctive rhythmic pattern heard in the **riff**.

Syncopated rhythms are heard throughout the piece.

Melody:

Mainly **conjunct** and **syllabic**, with occasional **melismatic** movement.

Vocal range: G to top D



Harmony:

Diatonic. The piece is in **G major** and modulates to **A major** after the bridge for the final chorus/fade out.

Unit 2 BTEC Sport Level 2

Participation in sport

Participation in sport continues to grow as people become more aware of the benefits of physical activity. Engaging young people through sport is a key political agenda, as current national health statistics show that obesity in young children is rapidly increasing and also because we strive for excellence and success at major sporting events. **Sport** is an activity involving physical exertion and skill in which an individual or team compete against each other and can also compete against each other for entertainment. Physical activity simply means movement of the body that uses energy. Walking, running, climbing the stairs, playing football and dancing are all good examples of physical activity. For health benefits, physical activity should be performed at moderate or vigorous intensity. This means getting the heart and lungs working harder than normal.

Rules (or laws)

Rules (or laws) are regulated by the national or international governing body for the sport. For example, the Fédération Internationale de Football Association (FIFA) laws of football, the International Rugby Board (IRB) laws of rugby, the Badminton World Federation (BWF) rules of badminton and the International Orienteering Federation (IOF) rules of orienteering. Rules keep everyone safe and make sure the game or sport is played fairly.



Rule example :
In Football you can't touch the ball with your hand during play.



Regulations

These relate to players and participants, equipment, playing surface, facilities, health and safety, time and officials (referee, umpire, judge, starter, timekeeper). For example, all Netball players should be wearing the correct kit on court. This kit should be specified before a game so that the opposition has a contrasting kit and they won't clash or get confused. In addition, all players should remove jewellery and play in the correct footwear, this is also the same for football.



Scoring Systems

All sports have a scoring system and often if you can get a better score than your opponent you will win. Scoring is done by officials. E.G referee, umpire, and judges.

1	30	4	7	3
	GAME	SET1	SET2	SET3
2	40	6	6	2

Review performance

- Strengths and areas for improvement: components of fitness, skills and techniques, specific to the sport and non-specific, e.g. fitness.
- Self-analysis: completion of observation checklist, e.g. use of video.
- Strengths and areas for improvement: tactics, the effectiveness of decision making.
- Activities to improve performance (**short-term and long-term goals**): e.g. training programmes, use of technology, attending courses, where to seek help and advice.



Roles of officials

For example, the roles of umpires, referees, referees' assistants, judges, timekeeper, starters, table officials, third umpire, fourth official.



Responsibilities of officials

These include: appearance, equipment, fitness, qualifications, interpretation and application of rules, control of players, accountability to spectators, health and safety (equipment, facilities, players), fair play, use of technology, effective communication (voice, whistle, signals).



Safe and appropriate participation

For a new player this may include practising skills, techniques and tactics within a controlled environment. This may include performing drills and set plays.

Adhere to 'rules', health and safety guidelines, and consider appropriate risk management strategies in physical activity and sport.



Top Tips

1. Wear protective gear such as, helmets, protective pads, and gum shields.
2. Warm up and cool down.
3. Know the rules of the game.
4. Watch out for others.
5. Don't play when you're injured

Relevant Tactics

Tactics are used by players or teams in different situations to try and gain an advantage or outwit an opponent.



Strategies and tactics

Are often pre-arranged and rehearsed, especially in team games. Performers also need to be able to adapt or change them during a performance. This requires good problem-solving and decision-making skills. Good observation and tactical awareness are important while playing and analysing play. For example taking a fast centre pass in Netball or double marking an attacking player.



Unit 2 BTEC Sport Level 2

Key Words Unit 2

Participation:- To take part in sport or activity. You can have high and low levels of participation.

Performance:- Sports performance is the manner in which sport participation is measured. Sport performance is a complex mixture of skills training and techniques.

Fitness:- Is being physically fit and healthy. Adults and children can have different levels of fitness. Fitness is something that you can improve.

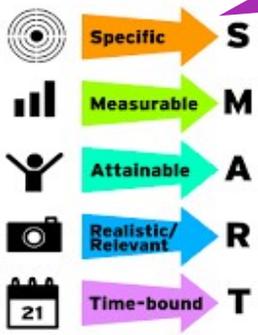
Observation:- An observation is the process of closely observing or monitoring something or someone. For example, watching a specific player in football and making specific notes.

Techniques:- A technique is the method or way in which something is done. An example of technique could be, bending your knees when taking a set shot.

Self –Analysis:- Is where you would review your own performance to understand your performance without the aid of another person.

Governing Body:- A governing body is an organisation that governs and administers a specific sport. For example, the FA or England Hockey or swim England.

NHS:- National Health Service. It refers to the Government-funded medical and health care services that everyone living in the UK can use for FREE!



Observation checklist

To review performance in selected sports using video analysis:

- components of physical fitness
- technical demands of sport (skills and techniques)
- production of a checklist suitable for self-analysis of performance in selected sports
- tactical demands of sport



Observation Checklist	Comments:
Defence	
Speed	
Aerobic Endurance	

Isolated Practices

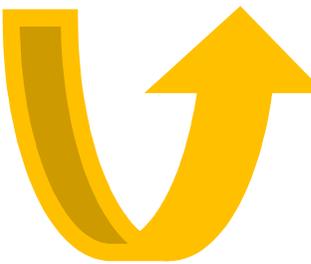
For example, skills and techniques demonstrated independently without any pressure or external forces, completed successfully and without fault.

Conditioned practices

For example, small-sided games, a limited number of touches, a set number of defenders or attackers.

Competitive situations

- Full-sided games.
- Appropriate oppositor
- With match officials.
- Personal performance that contributes to relevant use of skills, techniques and tactics in relation to:
 1. communication
 2. Individual role
 3. responding to team mates and/or opposition.



Effective use of skills and techniques.

For example: rugby conversion, including head position, body position, placement of non-kicking foot, placement of kicking foot, connection with the ball.

Technique is so important for all sports and its important that you break it down into specific parts.



Components of Physical Fitness



Aerobic endurance: the ability of the cardiorespiratory system to work efficiently, supplying nutrients and oxygen to working muscles during sustained physical activity.

Muscular endurance: the ability of the muscular system to work efficiently, where a muscle can continue contracting over a period of time against a light to moderate fixed resistance load.

Flexibility: having an adequate range of motion in all joints of the body; the ability to move a joint fluidly through its complete range of movement.

Speed: distance divided by the time taken. Speed is measured in metres per second (m/s). The faster an athlete runs over a given distance, the greater their speed.

Muscular strength: the maximum force (in kg or N) that can be generated by a muscle or muscle group.

Body composition: the relative ratio of fat mass to fat-free mass (vital organs, muscle, bone) in the body.



The application of the components of fitness to a chosen sport.

Example :- Football requires speed and muscular strength to allow the player to reach the ball before their opponent and hold them off the ball to keep possession. Long distance running requires good aerobic endurance to supply oxygen and nutrients to working muscles during a race.



SCHOOL LOGO

Unit 6 BTEC Sport Level 2



Leading Sports Activities



Leading Sports Activities

There are many roles working in sport that require effective and successful sports leadership, including personal training and coaching. This unit provides you with what could be your first step into sports leadership, as it could be linked to the completion of a sports leader award, for example the Junior Sports Leader Award (JSLA).

Leadership is defined as:-

Leadership is the art of motivating a group of people to act toward achieving a common goal. In a Sport setting, this can mean guiding players and participants towards a common goal, such as winning the league or getting fitter and reducing your BMI.



Attributes of a Sports leader/Coach

Skills :-

- Communication :- Can be in a variety of ways verbal, none verbal and written communication.
- Organisation of equipment :- Making sure that you have the right equipment and that it is stored safely.

Advanced skills:-

- Activity structure :- In the right order/sequence.
- Target setting:- Giving athletes specific targets to help them improve their performance. (SMART)
- Use of language:- Ensure that you use correct terminology and that you don't swear or use slang during session.
- Evaluation:- Make sure you review and reflect on the session. Good and bad points or strengths and weakness.

Qualities:-

- Appearance:-Don't wear jeans or a tight skirts to a coaching session, it doesn't look professional. Dress appropriately for a session. E.g. a tracksuit or official uniform. This should including not coming to training in dirty or smelly clothing.
- Enthusiasm:- Ensure that you are passionate and that you are happy to be coaching. If you lack enthusiasm the players or team most likely will too.

Additional qualities:-

- Leadership style : Leaders have many different styles and some have preferred styles.
- Motivation:-
- Humour:- Its good practice to use humour within a session as it makes it light hearted and fun.
- Personality:- Its important as a coach you show your personality. This is important as you are a role model.



Who are sports leaders?

- Sports Leaders (School)
- Sports coaches (IN/OUT school)
- Fitness instructors,
- School/college –Leaders
- local club (Community)
- Coaches
- National club coaches,
- Amateur coaches unqualified
- Referee
- Umpire
- Official
- Volunteers



Sports activities

Individual sports

- Cycling
- Athletics
- Tennis

Team sports

- Football
- Hockey
- Rugby

Fitness activities

- Yoga
- Zumba
- HITT
- Aqua aerobics



Responsibilities of a Sports leader/Coach



Core responsibilities

- Professional conduct: Professional conduct is really important. As a coach you shouldn't smoke at the side-lines or act in a manner which can be deemed unprofessional.
- Health and safety:- Coaches should adhere to health and safety guidelines, to protect their participants.
- Equality:- All coaches should believe and adhere to equality policy's and ensure that they are fully inclusive.

Wider responsibilities

- Insurance:- All clubs should have insurance. Players and coaches can also get individual insurance to protect against injury.
- Child protection:- All clubs should have a child protection policy. This is so that they can safeguard children and young people. Any incidents should be recorded and reported. All adults involved in the club should have a DBS.
- Legal obligations:- Clubs and coaches have legal obligations for example being qualified and holding a first aid certificate. All coaches should get a minimum of a level 1 but a level 2 is preferred.
- Ethics and Values:- Ethics and values are different at every club and each coach will have their own values. These should be respected.
- Rules and Regulations:- Coaches and clubs should stick to their rules and regulations. These are often decided by the NGB'S (National Governing Body)



Leading Sports Activities

- Demonstration of attributes (skills, advanced skills, attributes, additional qualities).
- Completion of core responsibilities: Loco parentis, coach, first aider, referee, official, developing training programme and undertaking administrative tasks.
- Completion of wider responsibilities : Role model, ambassador, mentor, analyst , friend, nutritionist.



Unit 6 BTEC Sport Level 2

Planning a session

Name of session:

Date and Time:	Team/Group:	Equipment Needed:
Location:	Duration:	Health & Safety:

What equipment will you be using.

Risk Assessment and checking equipment or playing surface.

What will you be working on this session. Plus aims of the session. What specific skill are you working on.

Cool down. This involves bringing the heart rate down and static stretching to help with flexibility.

Main skills and drills section. This should be the main content of the session.

The coach might make notes in this section.

Aim of Session:		
Context and previous content:		
Warm Up Activities:	Main Activity:	Cool-Down
Coaching Points/Questions:	Additional Notes:	

Who is it you are coaching males, females. Children?

Where will the session take place. Astro, field, swimming pool and sports hall.

How long the session will last.

Warming up. This involves bringing the heart rate up. Dynamic and static stretching can be used to mobilise joints.



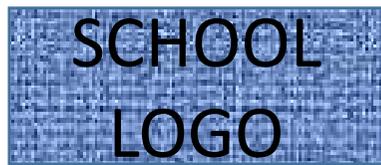
Specific skills/drills/techniques.

Planning definitions

- Participants:- Age, ability, gender, numbers, medical and specific needs.
- Aims and objectives:- Target setting, expected outcomes.
- Resources :- Equipment, time and environment.
- Warm-up: This should get the brain and the body both physically and mentally prepared for exercise.
- Pulse raiser: activities that can be used to gradually increase the pulse rate.
- Mobilise: Activities to mobilise the main joints of the body such as knees and hips, shoulders, ankles and wrists.
- Stretching (different types of stretches for the main muscles used in sports activity sessions – deltoids, triceps, erector spinae, obliques, quadriceps, hamstrings, gastrocnemius).
- Main component/components of activity, e.g. skill introduction, development, conditioned game, final activity.
- Incorporate safe activities to minimise injury.
- Cool down.
- Pulse lowering: activities that gradually decrease in intensity.
- Stretch: carry out maintenance and developmental stretches with the main muscles that were used in the activity session, including deltoids, biceps, triceps, erector spinae, abdominals, obliques, hip flexors, gluteus maximus, quadriceps, hamstrings, gastrocnemius.
- Health and safety considerations: adhere to health and safety guidelines, and consider appropriate risk management strategies.
- Risk assessment: environmental and injury **prevention**.

Targets for development

- SMARTER targets (specific, measurable, achievable, realistic, time-related, exciting, recorded).
- Development plans should include:-
 - Aims and objectives
 - Goals
 - SMARTER targets (specific, measurable, achievable, realistic, time-related, exciting, recorded).
 - Activities and opportunities, e.g. training, courses, qualifications
 - Possible barriers. (Finance, transport, equipment and injury)



Review

- Feedback for review, e.g. from participants, supervisor, observers, self-analysis.
- Methods, e.g. questionnaires, comment cards, observation records, direct verbal feedback.
- Strengths and areas for improvement (demonstration of attributes, completion of responsibilities, e.g. planning, content, organisation, health and safety and achievements).

Child Development

Gross motor development:

- Newborns are born with reflexes – sucking, rooting, startling, grasping – which help them survive. Movements are uncontrolled and uncoordinated:
- at three months able to lift up head and chest when on their stomachs and bring hands together over body
- at six months can roll over from back to front
- at nine months can sit unsupported and is usually mobile by crawling or rolling, may pull up to stand alone and walk by holding on to furniture
- at twelve months pulls up to stand, stands alone, walks holding on to furniture.

Fine motor development:

- No coordinated movement but newborns will grasp things put into their hands as a reflex action
- at three months can watch their hands and hold a rattle for a moment
- at six months can reach for a toy and move a toy from one hand to the other
- at nine months can use a pincer grasp (index finger and thumb) to grasp objects, can deliberately release objects by dropping them
- at twelve months can use pincer grasp to pick up small objects, points using index finger.



Cognitive development:

- at one month 'freezes' if hears a sound played softly
- at three months can recognise familiar routines, alert and follows movement with eyes if objects are close
- at six months can explore objects by putting in mouth, recognises voices
- at eight or nine months can look for dropped objects and objects that they see being hidden
- at twelve months enjoys throwing toys to the ground and watching their descent, learns by trying things out and repeating if successful. This approach to learning is called 'trial and error'

Emotional and social development:

- at one month can focus on human faces with interest
- at six weeks can smile
- at three months enjoys being held and forms indiscriminate attachments
- at six months can recognise and respond to emotions in others
- from seven to eight months can form specific attachments and show wariness of strangers
- from eight months develops specific attachments and imitates actions of others, such as clapping
- from eight months experiences separation anxiety from primary carer(s).

Communication and language development:

- at one month can turn head to adult voice, at six weeks begins to coo
- at three months smiles when hears a familiar voice
- at six months makes short babbling sounds, such as 'da' and 'ba'
- at nine months understands 'no', vocalises in long strings of babbling
- at twelve months knows own name and understands simple instructions

Development: Birth – 12 months

Child Development

Gross motor development:

- at fifteen months can crawl upstairs and may walk hesitantly
- at eighteen months can walk unaided, can walk upstairs with help and can squat to pick up toys
- at two years can run, climb onto furniture and use sit-and-ride toys
- at two and a half years can kick a large ball and can jump with two feet together from a low step
- at three years able to run forwards and backwards, steer and pedal a tricycle, walk upstairs with alternate feet and throw a large ball.

Fine motor development:

- at fifteen months pincer grasp is precise, uses palmar grasp to hold crayons
- at eighteen months can build a tower of three bricks, can feed self with a spoon and scribble using a crayon in palmar grasp
- at two years can draw dots and circles, can put on shoes and fasten with Velcro® but not buckles and laces
- at two and a half years starts to show a hand preference, can pull down items of clothing and starting to develop tripod grasp
- at three years can use tripod grasp, draw a circle, hand preference is established for most tasks.



Development: 12 month – 3 years

Cognitive development:

- at fifteen months explores objects by sight and sound
- at eighteen months very curious to explore environment, remembers where things belong
- at two years recognises self in mirror, can remember past experiences
- at two and a half years recognises self in photographs, with help can complete simple puzzles
- at three years understands the difference between past and present, can complete simple puzzles

Communication and language development:

- at fifteen months communicates by pointing and vocalising, has up to six words
- at eighteen months has around 15 words, able to communicate wishes, understands simple requests
- at two years has up to 50 words, able to join words, enjoys looking at books
- at two and a half years has around 200 words, starting to use simple sentences, asks questions, uses personal pronouns, plurals and negatives
- at three years speech is clear to anyone unfamiliar with child, enjoys books and turns pages.

Emotional and social development:

- at eighteen months emotionally dependent on parents and key persons, plays alone but enjoys being near adults and siblings, insistent on immediate attention to needs and can copy adult actions
- at two years unable to wait for needs to be met, may be distracted from tantrums, plays in parallel with other children but unable to share toys
- at two and a half years plays alongside other children and engages in onlooker play, very dependent on adults and jealous of other children gaining attention, responds well to adult attention and praise and has tantrums when frustrated
- at three years finds it easier to wait, starting to take turns and share, enjoys being with other children and will comfort another child.

Child Development

Gross motor development:

- from three to four years can hop on one foot, walk along a line, aim and throw a ball and kick it with force, ride a tricycle using pedals
- from four to five years can run avoiding obstacles, skip with a rope, throw a large ball to partner and catch it.

Fine motor development:

- from three to four years can button and unbutton clothes, use scissors to cut out simple shapes, draw a person with head, trunk and legs, eat with a knife and fork, thread beads to make a necklace
- from four to five years can form letters, write own name and colour in pictures.

Cognitive development:

- from three to four years can recognise and name primary colours, understands what is meant by 'more', can tell whether an object is heavy or light, arranges objects into categories, makes a connection between people and events
- from four to five years can count accurately up to 10, can add two sets of objects together, can match equal sets, understands the need for rules, names the time of day associated with activities.

Communication and language development:

- from three to four years, speech can be easily understood, although some words may be incorrect, uses questions and by four years language is fluent, with some speech immaturities
- from four to five years can count accurately up to 10, uses complex sentences with words such as 'because', can talk about what has happened and what might happen, uses language to argue and answer back.

Emotional and social development:

- from three to four years can cope with separation from primary carer with someone they know, is beginning to play cooperatively and show clear friendship preferences, and plays with others
- from four to five years can work out what other people may be thinking, which helps them to negotiate with others, able to understand the need for rules, develops close friendships develop, behaviour mostly cooperative and separates more easily from parents.

Development: 3 – 5 years



Child Development

Gross motor development:

- from five to eight years can hop, skip and jump confidently, can swerve and dodge when running, balance on a beam, ride a bicycle and use roller skates
- coordination is more proficient, allowing for tasks that require coordinated movements including improved ball skills, swimming activities, hopscotch.

Fine motor development:

- from five to eight years can tie and untie shoelaces, and accurately cut out shapes
- from six years able to thread a large-eyed needle and sew large stitches, has good control over pencils and paintbrushes, allowing for more detailed drawings and clear handwriting.

Cognitive development:

- from five to eight years can recognise numerals up to 100, do simple calculations, show simple reasoning and be reasoned with
- from seven years can 'conserve' quantities and numbers, complete a simple maze, is starting to tell the time, understands the need for and uses rules.

Communication and language development:

- from five to eight years uses language to reason and explain ideas, understands and enjoys jokes and riddles
- uses more complex sentence structures and asks what, when, who, where, how, why questions
- from seven years has mastered the basics of reading and writing.

Emotional and social development:

- from five to six years starts to compare self with others and becomes more aware of the feelings and needs of others
- confidence in self may be shaken by 'failure'
- from five to seven years has strong friendships, often of the same gender, can understand that others have different viewpoints than them, can read facial expressions of others accurately and recognise what others might be feeling.

Development: 5 years – 8 years



BTEC travel and Tourism – Unit 3, The travel and tourism customer experience.

Customer service is the provision of service to customers before, during and after a purchase/service.

The aims of customer service (which vary depending on the organisation) include:

- o meeting customer needs (general public, young families, individuals with disabilities, large groups etc.)
- o meeting organisational targets, e.g. visitor numbers, bookings, sales
- o increasing profits
- o creating new business
- o encouraging repeat business.

Customer service provision of organisations is related to the type and size of an organisation.

Size of organisation:

- **small** – fewer than 50 employees
- **medium** – fewer than 250 employees
- **large** – more than 250 employees.

Type of organisation:

- **private**, e.g. tour operators, accommodation providers, visitor attractions, airlines
- **public**, e.g. visitor attractions, tourist information centres (TICs), Visit Britain, Visit Scotland, Visit Blackpool, World Tourism Organisation
- **voluntary**, e.g. charities.

Relationships between organisations and their customers can vary depending on customer service aims and size and type of an organisation.



Customer types

Travel and tourism organisations need to meet and respond to the needs of different customer types, including internal and external customers.

Internal customers:

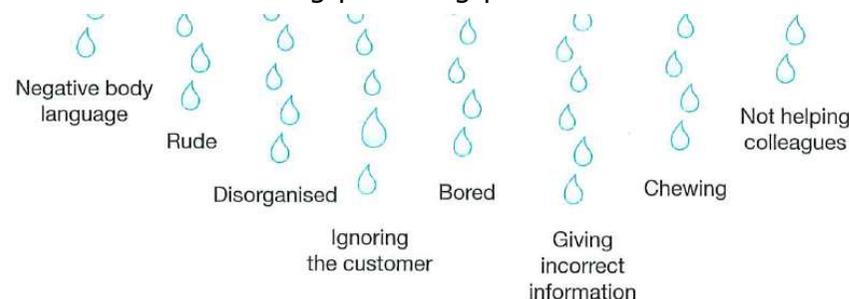
- colleagues and staff with whom you work closely
- supervisors and managers
- directors and owners
- staff at other branches
- suppliers.

External customers:

- individuals and single customers
- groups, which may be organised groups
- those with special interests
- different cultures/ethnicity
- those with additional physical needs.
- existing or new
- families
- Couples

Needs of different types of customer

- Products and services to meet specific needs e.g. accommodation, facilities
- Accurate information, e.g. giving directions, signposting, different language groups, availability, product knowledge.
- Health, safety and security.
- Assistance, e.g. with luggage, with language, for parents with young children or babies, elderly customers.
- Advice may be needed, e.g. the suitability of a tourist attraction, how to obtain a visa, solving problems or issues, matching suitable destinations to customer needs.
- Specific needs, e.g. induction loop, disabled access.
- Unstated needs including providing products and services as booked.



■ Examples of bad customer service behaviours

BTEC travel and Tourism – Unit 3, The travel and tourism customer experience.

Customer types

Travel and tourism organisations need to meet and respond to the needs of different customer types, including internal and external customers;

Internal customers:

- colleagues and staff with whom you work closely
- supervisors and managers
- directors and owners
- staff at other branches
- suppliers.

External customers:

- individuals and single customers
- groups, which may be organised groups
- those with special interests
- different cultures/ethnicity
- those with additional physical needs.
- existing or new
- families
- Couples
- business people
- different age groups



Needs of different types of customer

- Products and services to meet specific needs e.g. accommodation, facilities
- Accurate information, e.g. giving directions, signposting to facilities, price, availability, product knowledge.
- Health, safety and security.
- Assistance, e.g. with luggage, with language, for parents with young children or babies, elderly customers.
- Advice may be needed, e.g. the suitability of a tourist attraction, how to obtain a visa, solving problems or issues, matching suitable destinations to customer needs.
- Specific needs, e.g. induction loop, disabled access.
- Unstated needs including providing products and services as booked.

Responding to customer needs

- ❑ Making suitable recommendations in response to enquiries e.g.
 - destinations with features that appeal to customers and which are appropriate to customer needs, e.g. appropriate visitor attractions, transport links
 - products and services to meet customer needs, e.g. accommodation, facilities, meeting a specific need
- ❑ Written requests in the form of an email for information, a completed booking form or a letter.
- ❑ Verbal requests, either face to face or over the telephone.
- ❑ Recognising unstated needs, e.g. parents with a baby may need priority boarding on a flight if they are travelling with a pushchair; a customer with reduced mobility may need ground-floor accommodation at a hotel and disabled access for a wheelchair.

Exploring expectations of different types of customer in the travel and tourism sector

How do organisations meet and exceed customer expectations.

- Meeting expectations, including level of products, level and efficiency of service.
- Exceeding expectations, including over and above what is expected, pre-empting needs and solving problems for the customer.



BTEC travel and Tourism

Customer service

What are the skills needed to deliver customer service. How do these skills compare when required by different types of travel and tourism organisations.

- Skills and techniques:
 - o skills and techniques needed to provide excellent customer service in different situations, e.g. patience, empathy, active listening when dealing with different situations, showing sensitivity towards different customer types, use of correct language in all situations
 - o teamwork impact on customer service, e.g. working as a team and supporting each other when dealing with customers can boost morale and ensure that customers receive the best service.
- Policies and standards:
 - o key customer service policies and procedures, e.g. complaints policy, mission statement
 - o customer service standards setting and maintenance
- Impacts:
 - o impact of product and service knowledge on customer service delivery, e.g. lack of product and service knowledge may impact on the service provided to customers and complaints may follow if customers do not get the information they require; excellent product and service knowledge will encourage customers to repeat business, i.e. stay loyal as well as recommend products and services to others.
- Technology:
 - o the role of technological developments in improving the customer experience, e.g. self-check-in at airports and online check-in have reduced queuing time for short-haul flights and business travellers, meaning that people are happier with the service they have received; online booking systems mean that commission charges paid to travel agents can be passed on as a discount to customers who book direct with tour operators; helping customers to save money will enhance the customer experience.

Level 2 Pass	Level 2 Merit	Level 2 Distinction
: Learning aim A: Investigate travel and tourism customer service		
2A.P1 Describe the main aims of customer service for three different travel and tourism organisations in relation to their role and functions.	2A.M1 Explain, using relevant examples, how the main aims of customer service for two different travel and tourism organisations help the organisations to carry out their role and functions.	2A. D1 Compare and contrast the how the main customer service aims for two different travel and tourism organisations help the organisations to carry out their role and functions.
1 Learning aim B: Explore the needs and expectations of different types of customer in the travel and tourism sector		
2B.P2 Explain the needs of three customer types and how they are met.	2B.M2 Compare, using relevant examples, how two travel and tourism organisations respond to external customer needs to meet and exceed customer expectations.	2B.D2 Evaluate the success of two different travel and tourism organisations in recognising, meeting and exceeding external customer needs.
2B.P3 Explain how three travel and tourism organisations respond to external customer needs to meet and exceed customer expectations.		
Learning aim C: Understand the importance of customer service to travel and tourism organisations		
2C.P4 Explain customer service skills relevant to two travel and tourism organisations.	2C.M3 Compare customer service skills relevant to two travel and tourism organisations.	2C.D3 Recommend and justify improvements to poor customer service for one travel and tourism organisation.
2C.P5 Assess the impact of excellent and poor customer service on travel and tourism organisations.	2C.M4 Compare, using relevant examples, the impacts of excellent and poor customer service on two travel and tourism organisations.	

GCSE Statistics – Key Definitions

2 Processing and representing data

Recording data

- A **database** is a collection of information.
- A **two-way table** shows information in two categories.
- **Tables** give exact data values for different categories, but do not show trends and patterns as clearly.
- **Bivariate data** has two variables.

Pictograms, bar charts and vertical line graphs

- A **pictogram** uses symbols or pictures to represent a number of items.
- In a **bar chart**, bars are **equal width** with equal spaces between them. The height (or length) of the bar represents the **frequency**.
- A **vertical line graph** is similar to a bar chart, but uses lines instead of bars.
- **Multiple bar charts** have more than one bar for each class. A **key** shows what each bar represents. The frequencies of each category can easily be compared.
- A **composite bar chart** compares data for each category in a single bar, divided into components that show the frequency for each part. A key identifies each component.
 - The **total frequencies** and the frequencies of each component group can be compared.
- **Bar charts** and **vertical line graphs** show trends and patterns in data.

Stem and leaf diagrams

- A **stem and leaf diagram** shows numerical data split into a 'stem' and 'leaves'. The numbers are written in order. A key shows how to combine the stem and leaves to read the numbers.
- A stem and leaf diagram shows the shape of the data distribution in the same way as a bar chart, but retains the original data values.
- A **back-to-back stem and leaf diagram** shows two sets of data with the same stem. The smallest values on each row are always nearest the stem.

Pie charts

- A **pie chart** is a way of displaying data when you want to show how something is shared or divided. Pie charts show proportions but not accurate data values.
- The **area of each sector** of a pie chart is proportional to the frequency it represents. The **area of the whole pie chart** is proportional to the total frequency.
- **Comparative pie charts** are used to compare two sets of data with different total frequencies.
 - The areas of the two circles should be **in the same ratio** as the two total frequencies.
 - To compare the **total frequencies**, compare the **areas**. To compare **proportions**, compare the individual **angles**.

Population pyramids

- **Population pyramids** are similar to stem and leaf diagrams. They show the age groups in a population, usually divided by gender.

Choropleth map

- A **choropleth map** is used to classify regions of a geographical area. Regions are shaded with an increasing depth of colour. A key shows what each shade represents.
- A choropleth map can be a diagram rather than an accurate map.

Histogram

- A **histogram** is similar to a bar chart but, because the data is continuous, there are no gaps between the bars.
- To draw a **histogram for unequal class intervals**, adjust the height of the bars so the **area** of the bar represents the frequency. The height of each bar represents the **frequency density**.
- $$\text{Frequency density} = \frac{\text{frequency}}{\text{class width}}$$
- You can compare data from histograms if they have the same class intervals and the same frequency density scales.

Frequency polygons

- A **frequency polygon** joins the midpoints of the tops of the bars of a histogram with straight lines. A frequency polygon may be drawn with or without a histogram.

Cumulative frequency

- **Cumulative frequency** is the running total of the frequencies from each class interval.
- For discrete data, you can draw a **cumulative frequency step polygon**. Plot the cumulative frequencies against the upper class boundaries. Join the steps with straight lines.
- For grouped continuous data, you can draw a **cumulative frequency diagram**. Plot the cumulative frequencies against the upper class boundaries. Join the points with a smooth curve or straight lines.
- Cumulative frequency diagrams can be used to estimate or predict other values.

Distributions

- The **shape of a distribution** is the shape formed by the bars in a histogram, or by a frequency polygon, or by the rows of a stem and leaf diagram.
- A **distribution** can be **symmetrical**, or have **positive skew** or **negative skew**.

Misleading diagrams

- **Three-dimensional diagrams** make comparisons difficult as data proportions appear distorted.
- Diagrams without clear scales, labels or keys may be misleading.

GCSE Statistics – Key Definitions

4 Scatter diagrams and correlation

Scatter diagrams and correlation

- When you draw a scatter diagram, plot the **explanatory (independent) variable** on the horizontal axis and the **response (dependent) variable** on the vertical axis.
- Two variables are **correlated** if they show an increasing or decreasing trend: as one variable increases, the other variable increases or decreases.
- When a change in one variable directly causes a change in another variable, there is a **causal relationship** between them.
- Correlation does not imply a causal relationship.

H • In most real-life situations, multiple factors interact to cause variables to change.

Lines of best fit and the equation of a straight line

- A **line of best fit** is a straight line drawn so that the plotted points on a scatter diagram are evenly scattered on either side of the line. To get a good fit, draw your line through the mean point (\bar{x}, \bar{y}) .
- Using a line of best fit to estimate data values within the range of the data is **interpolation**. Values estimated by interpolation are usually reliable.
- Using a line of best fit to estimate data values outside the range of the data is **extrapolation**. Values estimated by extrapolation are less reliable the further they are from the known data.
- The equation of the line $y = ax + b$ has **gradient** a and its **intercept** on the y-axis is $(0, b)$.
- For a line of best fit:
 - the gradient is the rate of increase of the response variable in relation to the explanatory variable
 - the y-intercept is the value of the response variable when the explanatory variable is 0.

H ◦ the values of the constants in the equation are calculated using:

$$a = \frac{y_2 - y_1}{x_2 - x_1} \text{ and } b = y_1 - ax_1 \text{ or } b = y_2 - ax_2.$$

Correlation coefficients

- **Spearman's rank correlation coefficient** r_s measures the strength of the correlation between two sets of data.
 - If r_s is close to 1 there is strong positive correlation.
 - If r_s is 0 there is no correlation.
 - If r_s is close to -1 there is strong negative correlation.

H • The formula for Spearman's rank correlation coefficient r_s is:

$$r_s = 1 - \frac{6\sum d^2}{n(n^2 - 1)}$$

where d is the difference in ranks and n is the number of values in each set.

- Spearman's rank correlation coefficient is most suitable for data that shows **non-linear** correlation.

H • **Pearson's product moment correlation coefficient** r measures the strength of **linear correlation** between two sets of data.

- If r is close to 1 there is strong positive linear correlation.
- If r is 0 there is no linear correlation.
- If r is close to -1 there is strong negative linear correlation.

- Pearson's product moment correlation coefficient is most suitable for data that shows linear correlation.

GCSE Statistics – Key Definitions

6 Probability

The meaning of probability

- Probability is a numerical measure of the chance of an event happening.
 - A probability of 0 means it is impossible for the event to happen.
 - A probability of 1 means the event is certain to happen.
- Probabilities can be written as fractions, decimals or percentages.
- If all possible outcomes are equally likely:

$$\text{the probability of an event} = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
- Expected frequency of event A = $P(A) \times \text{number of trials}$

Experimental probability and risk

- Estimated probability = $\frac{\text{number of trials with successful outcome}}{\text{total number of trials}}$
- Risk of event = $\frac{\text{number of trials in which event happens}}{\text{total number of trials}}$
- The **absolute risk** is the probability of an event happening.
- The **relative risk** of an event is how many times more likely it is to happen for one group compared to another group.
- Relative risk for the group = $\frac{\text{risk for those in the group}}{\text{risk for those not in the group}}$

Sample space diagrams and Venn diagrams

- A list of all possible outcomes is called a **sample space**.
- Each region of a **Venn diagram** represents a different set of data.
- Each region of a **probability Venn diagram** represents a different outcome.

6 Probability

Mutually exclusive and exhaustive events

- Events are **mutually exclusive** if they cannot happen at the same time.
- For two mutually exclusive events, A and B:

$$P(A \text{ or } B) = P(A) + P(B)$$
- A set of events is **exhaustive** if the set contains all possible outcomes.
- For a set of mutually exclusive, exhaustive events, the sum of all the probabilities is equal to 1.

$$P(A) + P(\text{not } A) = 1$$

$$P(\text{not } A) = 1 - P(A)$$

The general addition law

The addition law for events that are not mutually exclusive is:

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

Independent events

- Two events are **independent** if the outcome of one event does not affect the outcome of the other event.
- For two independent events, A and B:

$$P(A \text{ and } B) = P(A) \times P(B)$$
- For three independent events, A, B and C:

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

Tree diagrams

- Each branch of a tree diagram represents an outcome. The probability of the outcome is written on the branch.

Conditional probability

- Two events are **conditional** if the outcome of one event affects the outcome of the other event.
- The probability that B will happen if A has happened is the **conditional probability of B given A**. It is written $P(B|A)$.
- The formula for the **conditional probability of B given A** is:

$$P(B|A) = \frac{P(A \text{ and } B)}{P(A)}$$

- $P(A \text{ and } B) = P(B|A) \times P(A)$
- For two independent events A and B, $P(A) = P(A|B)$

GCSE Statistics – The Statistics Enquiry Cycle



Stage	Details
Initial Planning	<ul style="list-style-type: none"> Defining a question or hypothesis (hypotheses) to investigate Deciding what data to collect and how to collect and record it, with reasons Developing a strategy for how to process and represent the data, giving reasons
Data Collection	<p>You must recognise the constraints involved in sourcing data including</p> <ul style="list-style-type: none"> When designing collection methods for primary data When researching sources of secondary data, including from reference publications, the internet and the media Through appreciating the importance of acknowledging sources By recognising where issues of sensitivity may influence data availability
Data Processing and presentation	<p>You must understand the ways that data can be processed and presented including</p> <ul style="list-style-type: none"> Organising and processing data, including an understanding of how technology can be used Generating diagrams and visualisations to represent the data, including an understanding of outputs generated by appropriate technology Generating statistical measures to compare data, understanding the advantages of using technology to automate processing
Interpretation of results	<p>You must understand that results must be interpreted with reference to the context of the problem including:</p> <ul style="list-style-type: none"> Analysing/interpreting the diagrams and calculations/measures Reaching conclusions that relate to the questions and hypotheses addressed Making inferences and/or predictions Discussing the reliability of findings An understanding of your target audience
Evaluation and review	<p>You must understand the importance of evaluating statistical work including</p> <ul style="list-style-type: none"> Identifying weaknesses in approach or representation Suggesting improvements to processes or the presentation Refining the process to elicit further clarification of the initial hypothesis

PUNCTUATION

Full Stop

●
Use full stops at the end of a sentence or abbreviation.

Question Mark

●
Use question marks at the end of a question instead of a full stop.

Use quotation marks for direct quotations or to show spoken words.

“ ”
Quotation Marks

’ Apostrophe

Use apostrophes in contractions and to show possession.

Comma

Use commas to separate clauses in complex sentences and separate items in a list or before a speech mark. ,

● ● ● Ellipsis

An ellipsis can be used to show words that have been missed out of a quotation or informally to show an incomplete sentence.

Exclamation Point

Use exclamation points at the end of an exclamation. !

● ● Colon

A colon can be used to introduce a list and before a final clause that explains something in the sentence.

(Parentheses)

Use parenthesis around an inserted comment, aside, explanation or additional information.

Semicolon

Use a semicolon to join two independent clauses that are not connected with a conjunction. ;



Paragraphs

Remember **PPPTT**

Start a new paragraph for these reasons:

Person
If a new person is talking or a new character being described.

Place
If the story or text has changed location.

Point
If you start to make a new point.

Topic
If you've started writing about something different.

Time
If a significant change in time has happened and it has been mentioned.

Literacy Writing Mat

Sentence Openers

Realities

'Once upon a time...'

'To begin with...'

'I sleepily opened my eyes...'

'I will never forget the time...'

Expository Writing

'My name is _____ and I am writing to argue for...'

'Let me get things straight...'

'First of all...'

'One thing that you need to know about ... is...'

Indication/Exclamation

'It has been reported that...'

'Witnesses were shocked last night as...'

'Recent research has shown...'

Introducing

'Firstly... 'To begin with...'

Analyzing

'I am writing to analyse the...'

'The text that I have been reading is...'

Summarizing

'The good points about ... are'

Vocabulary

Adjectives

- Instead of **Big** - **Huge, Enormous, or Gigantic.**

- Instead of **Small** - **Tiny, Minute, or Miniature.**

- Instead of **Old** - **Ancient, Outdated, or Antiquated.**

- Instead of **Young** - **Youthful, Infantile, immature.**

- Instead of **Good** - **Fantastic, Excellent, Outstanding.**

Adverbs

Use these to add more detail to verbs and adjectives.

'Speedily' 'Thoughtfully'

'Casually' 'Purposefully' 'Slowly'

'Innocently' 'Consequently'

'Incredibly' 'Overwhelmingly'

'Nicely' 'Superbly' 'Flatly'

'Questionably' 'Massively'

'Darkly' 'Nicely' 'Subtly'

'Massively' 'Happily'

Adding Connectives

'And' 'Also' 'As well as'

'Too' 'Additionally' 'Especially'

'Moreover' 'Furthermore'

'Notably' 'Above All' 'Indeed'

'Significantly' 'In addition to'

Contrasting Connectives

'However' 'Whereas' 'But'

'Yet' 'Nevertheless' 'Still'

'Conversely' 'On the other hand'

'Then again' 'In spite of this'

'Though' 'Then' 'Except'

'But' 'Apart from' 'Aside from'

Time Connectives

'Firstly' 'Finally' 'In the end'

'Secondly' 'Primarily' 'After'

'Thirdly' 'Before' 'Meanwhile'

'When' 'Consequently' 'Now'

'Later' 'Since' 'Suddenly'

'After a while' 'Following'

Punctuation

• ()

; - ?

! { }

/ , :

' ' \

Using Speech Marks

'Speech marks should go around every word that was said,' instructed my English teacher.

Speech marks go outside the other punctuation in the sentence.

Using Apostrophes

Use apostrophes only to:

- Show when something belongs to someone, e.g. *'It was Sarah's book.'*

- Show when letters have been left out, e.g. *'format - can't - article not - don't.'*

Common Mistakes

Their, There's, and There

Their - When something belongs to someone, e.g. *'It was their dog.'*

They're - When you are replacing the word 'they are.' e.g. *'I like dogs. They're funny.'*

There - All other situations, e.g. *'The dog was over there.'*

Should, Could, Would of

This mistake happens because people hear the term 'could've' and think that 'could of' is being said. What is actually meant is 'could have.'

Wrong: 'I could of gone today.'

Correct: 'I could have gone today.'

The same applies to 'should' and 'would.'

Two, Two, To

Two - 200 number two, e.g.

'There were two days until Christmas.'

Too - 'Also' or 'As Well', e.g. *'I am excited for Christmas too.'*

To - All other situations, e.g. *'I went into town to buy a Christmas tree today. To see the lights was so lovely.'*

TYPES OF SENTENCES.

SIMPLE SENTENCE

Subject + **verb** = simple sentence.

My **brother** **walked** into the field.

COMPOUND SENTENCE

Sentence CONJUNCTION sentence.

These are called conjunctions

but
so
and
if
when
although
whereas

My **brother** **walked** into the field and he **found** his football.

COMPLEX SENTENCE

Opener, sentence.

Adverbs, connectives and verbs can be used as openers.

slowly
quietly
carefully
smiling
finally
in addition
hoping
screaming

This is an independent clause

Carefully **pushing** the gate open, my **brother** **walked** into the field.

Smiling to himself, my **brother** **walked** into the field.

(When you are confident with this structure, try moving your subordinate clause to the end of the sentence or embedding it into the middle of the independent clause.)

SENTENCES

SENTENCES

SENTENCES



Vocabulary Instruction The Power of Words



Break it down:

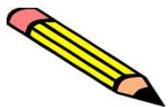
How many syllables?

What does it sound like?

Definition:

Say it in a sentence:

Now write the sentence.



Synonyms:

Words with similar meanings

Antonyms:

This word is opposite to...

Can you draw it?

