Year 9 Knowledge Book 2025-2026 CORE SUBJECTS

Saint Benedict
A Catholic Voluntary Academy

Love, Belief, Integrity, Knowledge

Your Knowledge Book

Our Values

Equipment List and signatures


Study Skills – Yellow


English – Light Pink


Science - Bright Green


Independence Templates - Teal

Knowledge Book for Core Subjects costs just over £8 to make.

If you lose, damage or break your KB, you will need to buy a new one for £8.

Saint Benedict
Catholic Voluntary Academy

MY EQUIPMENT PLEDGE

To succeed you must be prepared. Every night before school, you need to check your school bag to ensure that you have all the correct equipment.

Here is the list of equipment you need for every lesson:

- ❑ Black or blue pens
- ❑ Red pens (one or two)
- ❑ A ruler
- ❑ A pencil
- ❑ A scientific calculator (CASIO)
- ❑ A rubber
- ❑ A protractor
- ❑ Colouring pencils
- ❑ A sharpener
- ❑ Glue stick
- ❑ Your KNOWLEDGE BOOK

I pledge that I will always bring the correct equipment to class so that I can effectively learn.

Your signature: Parent/carer's signature: Form tutor's signature:

....

BE WHO GOD MEANT YOU TO BE
AND YOU WILL SET THE WORLD ON FIRE
ST CATHERINE OF SIENA

Respect

What is Respect?

Showing respect is an important part of life, and how you maintain relationships.

Three types of respect:

1. Respect Yourself
2. Respect Others
3. Respect the Planet

Why is respect important?

Receiving respect from others is important because it helps us to feel safe and to express ourselves. Respecting others helps maintain a peaceful world and encourages others to be better people. Showing respect to our planet allows us to maintain it for future generations.

Key words	Definitions
Respect	Due regard for the feelings, wishes and rights of others
Honour	The quality of knowing and doing what is morally right
Dignity	Sense of pride and self respect
Relationships	The way two or more people or groups connect and behave towards each other
Worthiness	The quality of being good enough

Rules and Sanctions

Build up a loving community

Key word	
Conduct	The way in which a person behaves.
Unacceptable	Something that is not suitable or appropriate.
Boundaries	The limits of something.
Sanction	A penalty or action taken when a rule or law has been broken.
Consistent	Acting in the same way overtime to be fair.

Behaviour

Rules and sanctions are things which guide our behaviour. We follow rules and regulations to be fair and consistent. Sanctions occur if we do not follow rules or deliberately break them.

Preparation for life

All aspects of life require us to follow rules. There are rules in school; rules in your family and home; rules to follow when crossing the road and using the bus and so on. Structure and rules allow us all to know what is acceptable and how to conduct ourselves. Rules reassure us

The law

We are all bound by the rules of the law. If we break the law, we face a raft of different sanctions. Ultimately, having rules in schools is about a lifelong understanding about what is right and what is wrong.

Kindness

Key word	
Empathy	Understand and share feelings of others
Compassion	Concern for misfortune of others
Compliment	Praise or congratulate others
Considerate	Thoughtfulness and sensitivity to others
Generous	Being liberal with things

Treat others how you would want to be treated yourself.

What is Kindness?

The quality of being friendly, generous and considerate

What does it mean to be kind?

To have empathy/sympathy, be compassionate, looking for good in people.

Why is it important to be kind?

Makes you feel happy, feel good about yourself

Builds strong relationships

Inspires others

How can we show kindness?

Smile

Hold the door open for somebody

Say something nice (compliment)

Invite somebody sat on their own to join you

Manners

Listen to somebody

Emotions

Key Words	
Feelings	An emotional state or reaction.
Relationships	The state of being connected with someone else.
Instinct	A fixed pattern of behaviour.
Intuitive	Using what you feel to be true even without conscious reasoning.
Reaction	Something done, felt or thought in response to a situation or event.
Identification	The act or process of identifying someone or something.

Work and play in harmony

What are emotions?

Emotions are biological states associated with the nervous system.

Thoughts, feelings, behavioural responses, and relationships all generate emotions.

An instinct or, intuitive reaction or feeling can create emotions

Identifying feelings

Making sense of what and how you feel is not always easy. To do this, we need to regularly check in with ourselves, making time to think about the feelings we are having and naming them. To do this, we need to think about our daily lives which may help us to see patterns of behaviour.

Not all feelings or emotions are bad or negative!

It is important to recognise when you feel happy; relaxed and good about yourself. Knowing what has led to these feelings can help us identify things we do not like which may cause us negative feelings.

Verbal Communication

Treat each other with dignity and justice

Key Words	
Clarity	Vocal clarity means you do not speak too fast or too slowly. You consider carefully the words you mean and whether your listener can understand you.
Honesty	Honesty is speaking the truth.
Respect	Respect means that you accept somebody for who they are, even when they are different from you or you do not agree with them.
Appropriate	fitting the practical or social requirements of the situation.
Tone	a quality in the voice that expresses your feelings or thou ghts, often towards the person being spoken to or the subject being spoken about
Courtesy	politeness, good manners, or consideration for other people.

What is verbal communication?
Verbal communication is the use of words to share information with other people.

What does it mean to communicate effectively?
Every time you verbally interact with someone you are aiming to develop your understanding of the world; you may be wishing to obtain information, respond to a request or offer support or guidance to another. In every one of these exchanges you are representing your tutor, your family and most importantly yourself.

Why is it important to communicate effectively?
All young people need to develop good speech, language and communication skills to reach their full potential.

Speech, language and communication underpin the basic skills of literacy and numeracy and are essential for you to understand and achieve in all subjects.

How can we communicate effectively?
Make eye contact
Speak honestly
Consider your role within the school
Consider the role of the person you are speaking to
Think carefully why you need to speak to the person you are addressing
Where necessary adapt as your conversation develops

Manners

Key Words	
Manners	A person's words or way of behaving towards others.
Respect	A regard for the feelings, wishes, or rights of others.
Listen	To take in what you hear.
Harmony	A time of behaving in one way to produce a pleasing effect.
Vocabulary	The range of words that we know and use.
Gratitude	The quality of being thankful; readiness to show appreciation for and to return kindness.

Loving...harmony...dignity

Treat your neighbour as yourself
The way in which we behave and speak towards others, reflects in their actions and words towards us.

Show the best side of yourself
When you speak to others, always show respect; be polite and thankful. Use the words 'please, thank you, sorry and pardon' when communicating with others.

Manners are for every situation
Every interaction has space for the use of manners: speech, emails, messages. Often when we get upset or angry we don't use manners.
However it does calm a situation if you do.

Change

Key Words	Definition
Change	Make or become different
Organised	Make arrangements or preparations for an event or activity
Opportunity	A time set of circumstances that make it possible to do something
Coping	To deal effectively with something difficult
Embrace	Accept (a belief, theory or change) willing and enthusiastically
Strategies	A plan of action designed to achieve a long term or overall aim

Develop potential to the full

Find the positive

Don’t allow yourself to become negative about the changes in your life. Change is good, keep repeating it.

Feeling vulnerable

Facing change can be very overwhelming, leaving you feeling very emotional. Make it your mission to be proactive and respond to it positively.

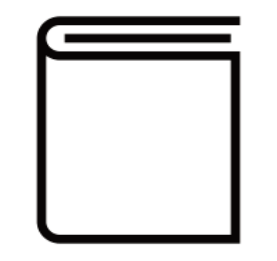
Talk about it

It’s good to talk about change in your life. Focus on problems, solutions and the positives that change will bring. Try to avoid focussing on the negatives and letting emotions take over.

Study Skills – Ways to **learn and remember**

Self quizzing (look, cover, write)

Read through the information in the knowledge book that you want to learn



Cover the information up

Write down as much as you can remember

Use the knowledge book to;

a) Correct any mistakes
b) Add any information that you forgot

Study Skills – Ways to **learn and remember**

Spacing

Complete a self quiz of the information you want to learn

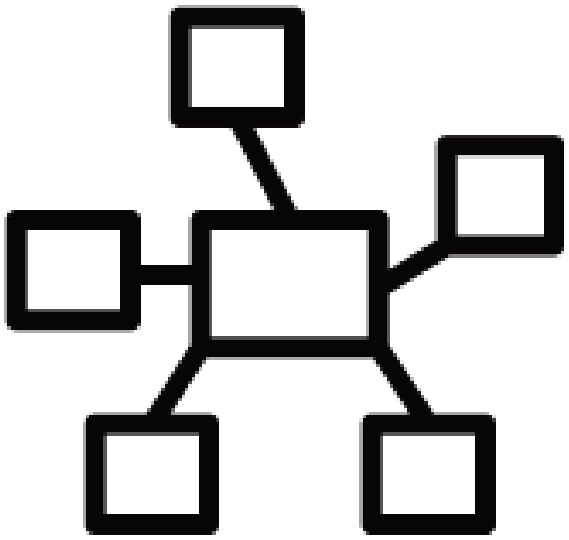
Wait for a day or 2 (depending on the deadline)

Repeat the self quiz.

The more times you can repeat this process, the more you will be able to remember without the book

Study Skills – Ways to **learn and remember**

Elaboration



Think about the topic that you are studying

Ask questions such as who, what , why , where , when how. Try to find the answers

See how these ideas connect - a mind map will be useful for this

Study Skills – Ways to **learn and remember**

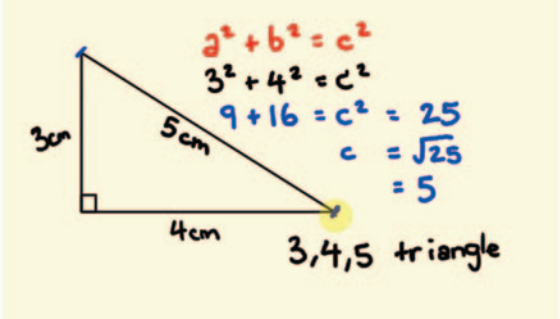
Concrete Examples

A concrete example is an clear example of an abstract idea

Pythagoras theorem example

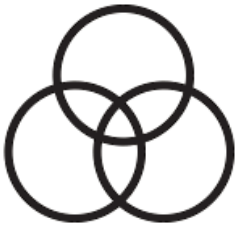
If you tried to explain Pythagoras's theorem to someone verbally, it would be quite hard to understand.

By using a concrete example that shows exactly how to use Pythagoras theorem, it is much easier to remember, understand and use



Study Skills – Ways to **learn and remember**

Interleaving



Research says we will actually learn more effectively if we mix our study skills up rather than using the same techniques all the time

1. Try to use different study skills rather than just one technique.

2. When revising for exams, prepare a revision timetable and try to revise more than one subject during a session

Study Skills – Ways to **learn and remember**

Dual Coding

As well as **writing** information down, **create an icon/ drawing** too for individual facts. This helps your brain to remember the information

Year 9 English Knowledge Organiser

Full academic year

Grammar

Full academic year

CONTENTS

Capitalisation in English means using capital (uppercase) letters in the right places.

Start of a sentence: Always capitalise the first word.	The cat is sleeping.
Names and titles: Capitalise names of people, places, days, months, and specific things.	Sarah, London, Monday, August, the Eiffel Tower.
The word "I": Always capitalise "I" when you talk about yourself.	I went to the park.
Titles of books, films, etc.: Capitalise the main words in titles.	**Harry Potter** and the **Goblet** of **Fire**.
Holidays and events: Capitalise special days.	Christmas, Halloween, World Book Day.

TERM 1

A simple sentence is a complete piece of information. It contains a subject, a verb and sometimes an object.

The pen fell on the floor.

A compound sentence contains two main clauses (like two simple sentences). These are joined with a conjunction: *and, but, so, because*.

Miss Kelly was tired, so she bought a large coffee.

A complex sentence contains a main clause and a subordinate clause.

Whilst it was raining, Mr Thornhill enjoyed a cup of tea in his office.

TERM 2

A comma indicates a pause between parts of a sentence or separates items in a list.

I went to Morrisons and bought linguine, king prawns, garlic and chilli flakes.

A semi-colon can be used between two closely related independent clauses, provided they are not already joined by a coordinating conjunction.

Miss Kureczko was busy; she wouldn't even answer the phone.

A colon is used to precede a list of items, a quotation, or an expansion or explanation.

Monday: the worst day of the week.

TERM 3

ISPACE indicates the various ways you can start a sentence. It stands for –ING verbs, Simile, Preposition, Adverb, Connective, -ED verbs.

–ING verb	-ING verb example: Flying proudly in the wind, the flag reigned over the castle
Simile	Simile example: Like a predator, the child caught the escaping balloon.
Preposition	Preposition example: Turning to my right, I saw the corridor I was meant to walk down.
Adverb	Adverb example: Nervously, the cat padded its way across the room.
Connective	Connective example: Finally, she arrived at her front door.
-ED verb	-ED verb example: Withered, the trees stood like ancient guards.

An apostrophe is used to indicate either possession or the omission of letters.

Apostrophes for possession	Using an apostrophe + s ('s) shows that one person/thing owns or is a member of something.	Recce's ballet class Iqra's bike Jake's pen Jess' room
Apostrophes for contractions	When you combine two words to make a contraction, you will always take out some letters. In their place, use an apostrophe.	they + have = they've are + not = aren't they + will = they'll

TERM 3

A paragraph is a distinct section of a piece of writing, usually dealing with a single theme and indicated by a new line.

New paragraphs should start with a topic sentence, and information within the paragraph should stay focused on that topic.

A helpful way to remember when to start a new paragraph is to learn TiPToP.

Ti - stands for **Time**, so start a new paragraph for a different time period.

P - stands for **Place**, so start a new paragraph for each new place.

To - stands for **Topic**, so start a new paragraph for each new topic, idea or subject.

P - stands for **Person**, so start a new paragraph for each new person or change of speaker in a dialogue.

English skills

Full academic year

CONTENT

TIER THREE VOCABULARY

WORD	DEFINITION
Adjective	A word describing or naming an attribute of a noun e.g ***Tasty*** *cheese*
Adverb	A word that describes how a verb is being done e.g *Walked* ***quickly***
Alliteration	The repetition of the same sound in a sequence of words beginning with the same letter e.g **C**autious **c**at
Allusion	A reference to another literary text, event or person e.g I am the **Juliet** to your **Romeo**!
Foreshadowing	A warning or indication of (a future event).
First person narrative	When a narrator recounts events from their own point of view using the first person such as **"I", "us", "our" and "ourselves"**
Genre	A style or category of art, music, or literature e.g ***Gothic, Comedy***

WORD	DEFINITION
Metaphor	A figure of speech in which a word or phrase is applied to an object or action to which it is not literally applicable e.g ***Love is a battlefield***
Noun	A word used to identify a person, place or thing e.g **Table, love**
Pathetic fallacy	When the weather reflects the mood or tone of a character.
Personification	The attribution of human feelings and responses to inanimate things or animals e.g *The clouds* ***cried***
Simile	A figuring of speech involving the comparison of one thing with another thing of a different kind e.g ***Love is like a battlefield***
Symbolism	The use of symbols to represent ideas or qualities
Third person narrative	When the poet writes about a character who isn't the speaker
Verb	A word describing an action or how something is done e.g ***Walking***

TIER THREE VOCABULARY

WORD	DEFINITION
Ellipsis	Intentionally leaving out a word, sentence, or whole section from a text without altering its original meaning
Emotive language	Words which elicit a powerful emotional response
Exaggeration	Representing something as being larger, better, or worse than it really is
Direct address	Referring to the reader directly using the pronouns **'we' or 'you'**
Facts	Something which can be proven to be true
Knowledge	Knowing the topic/subject you are writing or speaking about
Repetition	The repetition of a word or phrase across the text

WORD	DEFINITION
Onomatopoeia	The process of creating a word that phonetically imitates, resembles, or suggests the sound that it describes e.g **'Zap' 'sizzle' 'Pow'**
Opinion	A belief which cannot be proven to be true
Oxymoron	A figure of speech in which apparently contradictory terms appear in conjunction e.g ***Happy accident***
Pun	• A joke using the different possible meanings of a word or the fact that there are words which sound alike but have different meanings e.g **Denial is a river in Egypt.**
Archaic pronoun	Archaic pronouns are personal pronouns that were commonly used in Shakespeare's writing e.g **Thou, thee, thine, thy**

ORACY - RESPONDING VERBALLY

Practicing oracy means getting better at speaking and listening. It helps you talk clearly, share your ideas, and listen to others. This can make you more confident, help you learn better in all subjects, and prepare you for things like teamwork, debates, and job interviews in the future.

Supporting or agreeing
- I strongly believe that...
- It is my opinion that...

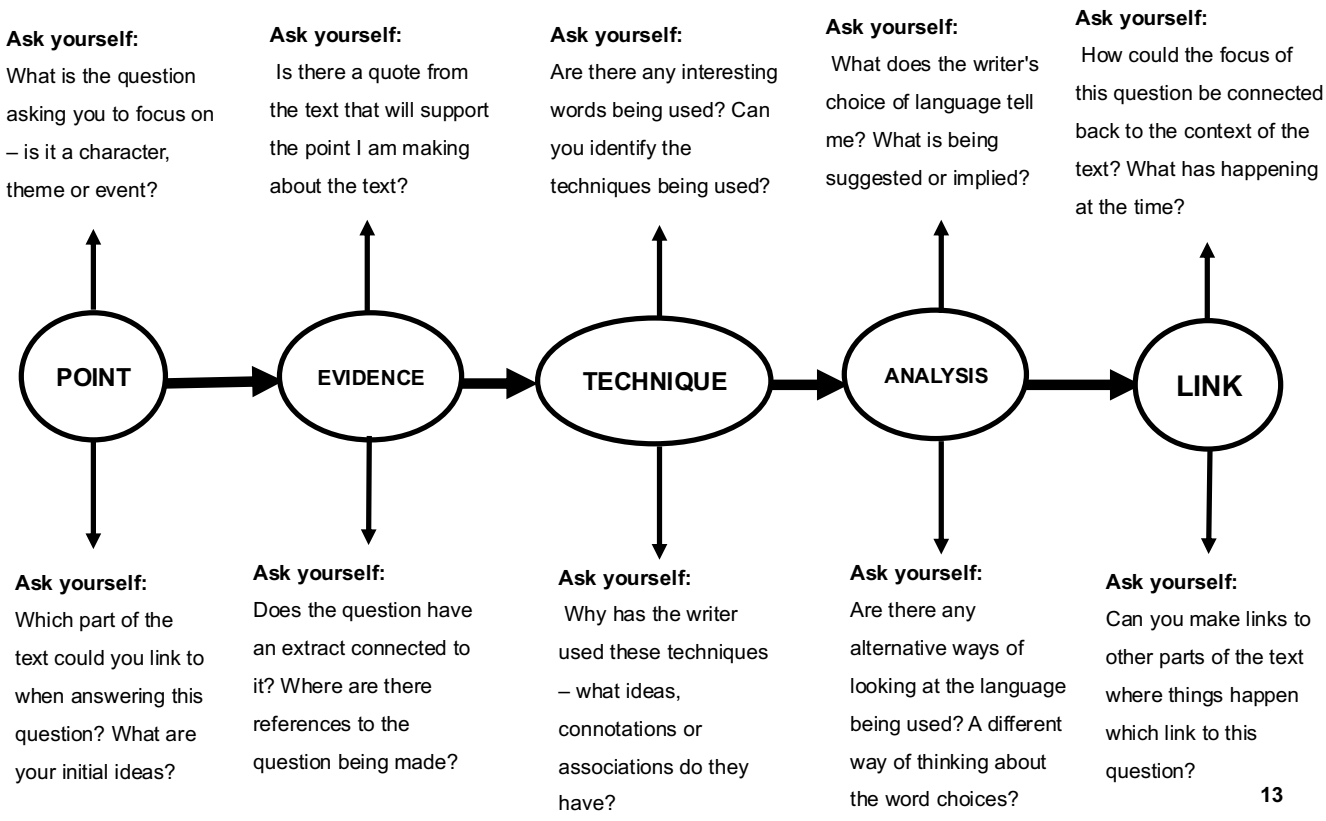
Challenging/ disagreeing
- I have a different idea...
- I disagree...
- I would like to challenge something that X said...
- I would like to respectfully challenge...

Expanding or building on...
- Adding on what X said...
- Building on what X said...
- I have been listening carefully, and I would like to add a new point...

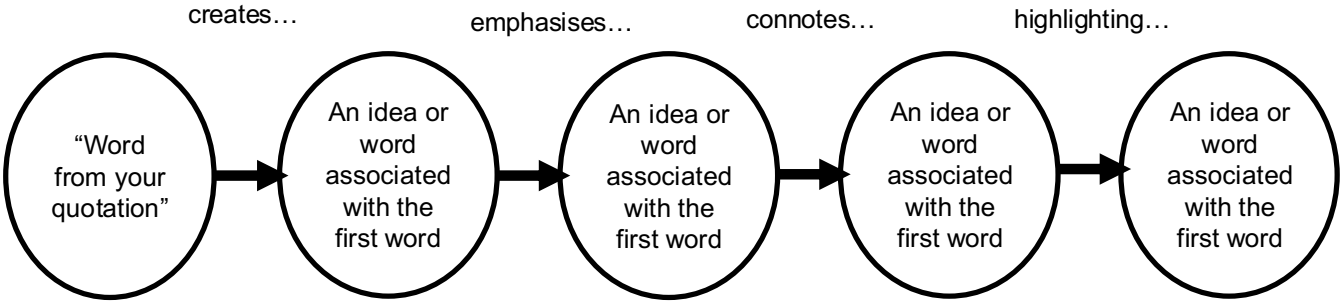
Concluding or end words...
- My final thoughts are...
- There are lots of powerful arguments, but my own opinion is...
- For me, the strongest argument is...

Passing on the dialogue...
- X, what do you think?
- X, what do you think about what I said?
- X, do you agree or disagree?

RESPONDING TO A TEXT



FINDING CONNOTATIONS

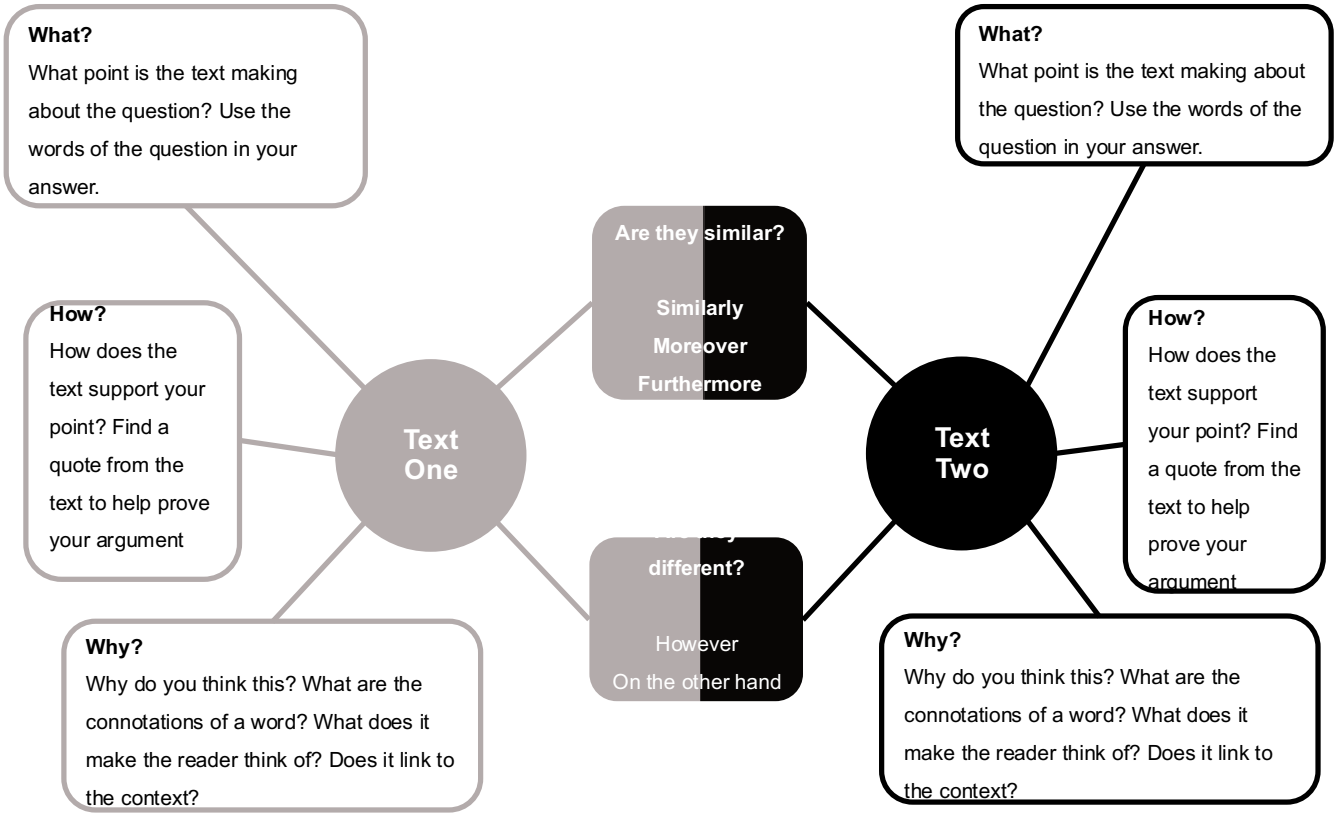


The word "_____" creates an image of _____.

It emphasises _____ because it connotes_____.

This highlights_____ and therefore makes the reader feel _____ about _____.

COMPARING TWO TEXTS



NARRATIVE STRUCTURE

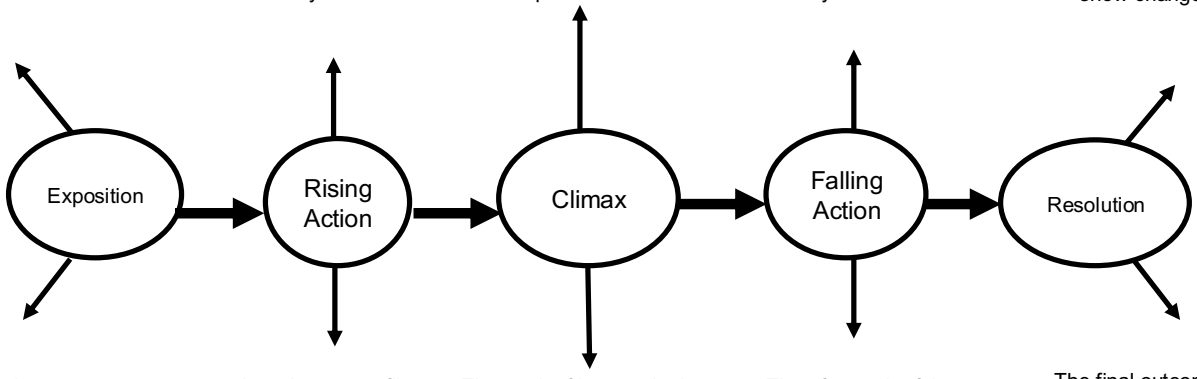
You could use: Pathetic fallacy to build the atmosphere and foreshadow events.

You could use: Reflections here which could be revisited later in the story.

You could use: Short, simple sentences to add to the suspense.

You could use: Flashbacks or flash forwards to show the possible outcomes of the story.

You could use: Repetition from the beginning of the story to show change.



Set the scene, introduce characters and the plot.

Introduce a conflict, a new character, or a dilemma to move the story forward.

The peak of interest in the story, when the tension is at its greatest and the action takes place.

The aftermath of the action, what will happen as a result of the events in the climax of the story.

The final outcome of the story, ether all problems have been solved, or the story ends on a cliff-hanger.

Year 9 Texts

Full academic year

Ghost Boys

Autumn Term 1

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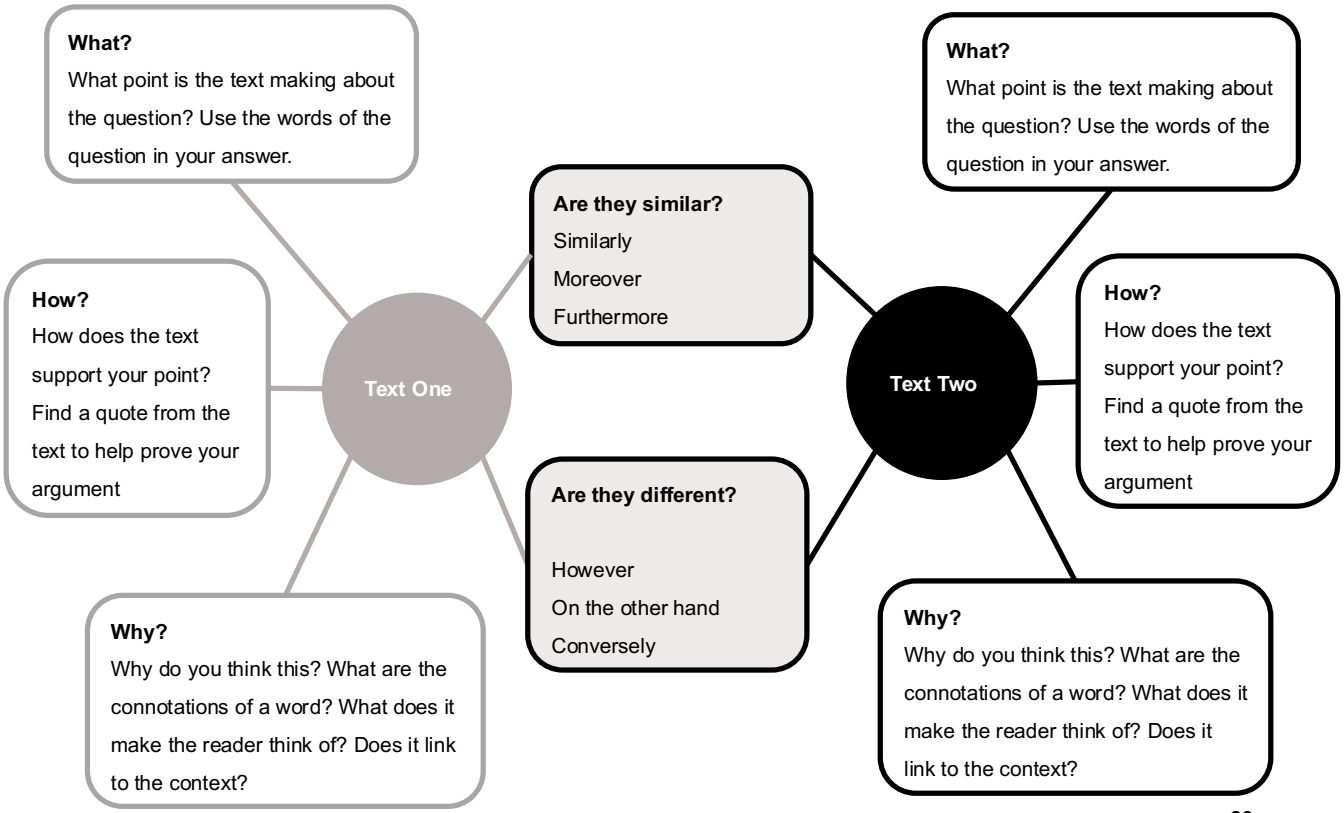
TIER TWO VOCABULARY

WORD	DEFINITION
Aspirational	Having a strong desire to achieve something.
Dependent	Relying on something or someone else.
Destiny	The hidden power believed to control future events; fate.
Ethical	Morally right or acceptable.
Empower	Make (someone) stronger and more confident, especially in controlling their life and claiming their rights.
Idealist	A person who is guided more by ideals than by practical considerations.
Innocent	Not guilty of a crime or offence.
Justice	Just behaviour or treatment.
Loneliness	Having no friends or company; isolation.

WORD	DEFINITION
Marginalised	To make a group feel isolated or unimportant.
Naïve	Showing a lack of experience, wisdom, or judgement.
Ostracised	Exclude from a society or group.
Pragmatic	Dealing with things sensibly and realistically in a way that is based on practical rather than theoretical considerations.
Segregation	The action or state of setting someone or something apart from others.
Racism	Prejudice against a person or people on the basis of their membership of a particular racial or ethnic group, typically one that is a minority or marginalised.
Secluded	Not seen or visited by many people; sheltered and private
Solitary	Done or existing alone.

COMPARING TWO TEXTS



GHOST BOYS CONTEXT

Civil Rights

American civil rights movement, **mass protest movement against racial segregation and discrimination in the southern United States** that came to national prominence during the mid-1950s. This movement had its roots in the centuries-long efforts of African slaves and their descendants to resist racial oppression and abolish the institution of slavery.

Racial Inequality

Racial inequality is **a disparity in opportunity and treatment that occurs as a result of someone's race.** This type of discrimination is clearly the **domination of one race over another**, which frequently results in favoritism and bias towards people from their race or ethnicity.

Equity and Equality

Equity is **what builds an anti-racist future.** The concept of racial equity recognises that not all races are starting from the same place. Some people and groups have different circumstances and need different resources and opportunities to succeed. Equity is about providing those particular resources to the groups who need them.

Black Lives Matter

Black Lives Matter (**BLM**) is a decentralised political and social movement that seeks to highlight racism, Discrimination, and inequality experienced by black people. When its supporters come together, they do so primarily to protest incidents of police brutality and racially motivated violence against black people.

Nonfiction Reading

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COMMON RHETORICAL DEVICES

Direct address

Referring to the reader directly using the pronouns ‘we’ or ‘you’.

Alliteration

The repetition of the same **sound** in a sequence of words beginning with the same letter.

Repetition

Where a word or phrase is used more than once across a text

Knowledge

Knowing the topic/subject you are writing or speaking about.

Facts

Something which can be proven to be true.

Opinion

A belief which cannot be proven to be true.

Rhetorical question

Any question in a piece of writing which does not require an answer.

Emotive language

Words which elicit a powerful emotional response.

Similes and metaphors

A **simile** directly compares one object to another using ‘like’ or ‘as’. A **metaphor** compares two things by stating one is the other.

Triplets

Lists of three things in a sentence.

ADVANCED RHETORICAL DEVICES

Allusion

A reference to an event, place, literary work or person.
Example: "I can't get changed that quickly, I'm not **Superman**!"

Anaphora

The repetition of a word or phrase **at the start** of successive phrases.
Example: "**If you** prick us, **do we not** bleed? **If you** tickle us, **do we not** laugh?"

Anecdote

A short amusing or interesting story about a real incident or person.
Example: “When I was your age, I …"

Epistrophe

The repetition of a word or expression **at the end** of successive phrases, clauses, sentences, or verses especially for rhetorical or poetic effect.
Example: “of the **people**, by the **people**, for the **people**”

Hypophora

A figure of speech in which a writer raises a question, and then immediately answers it.
Example: ““What should young people do with their lives today**?** **Many things, obviously**.”

Hyperbole

An exaggeration.
Example: "I have done this **a thousand times**"

Parallelism

The use of words or phrases with a similar structure.
Example: "Like father, like son"

Oxymoron

A combination of contradictory or unsuitable words.
Example: “It is a cruel kindness”

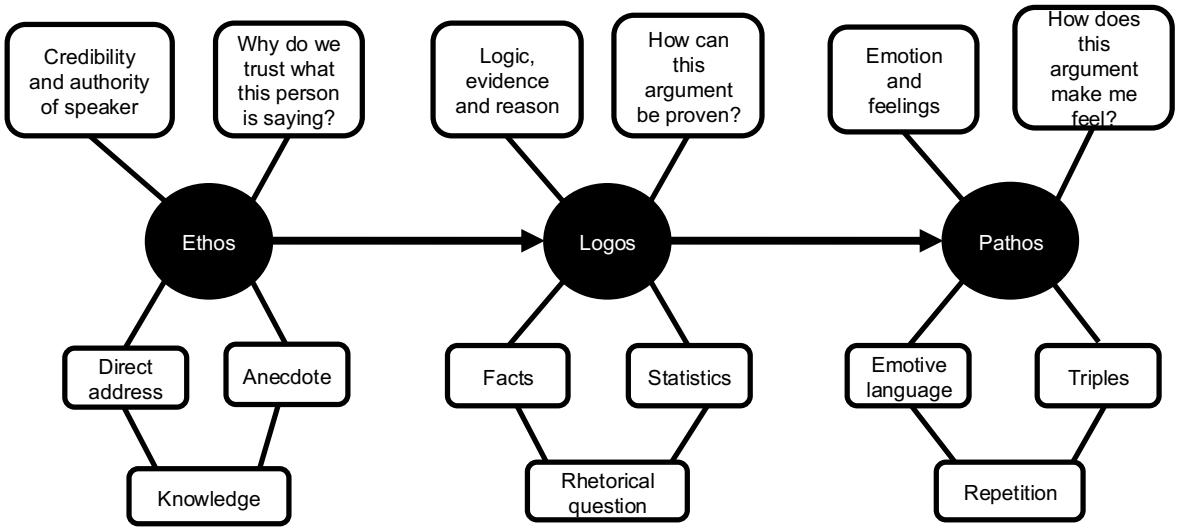
ARISTOTLE'S THREE PILLARS OR PERSUASION

Aristotle

Born in Greece, Aristotle lived from 384 BC to 322 BC.

Instructed on how to best persuade people.

Aristotle was a student of Plato (another Greek philosopher).



HOW AN ARGUMENT IS STRUCTURED

Make your position clear. What is your point of view on how?

Introduce the topic you are writing about. Still make your opinion clear.

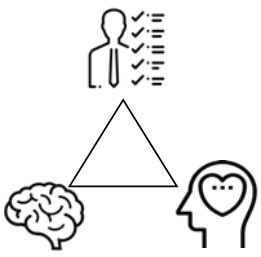
Offer your first point through a topic sentence and identify one issue. Explain your point.

Offer your second point through a topic sentence and identify one issue. Explain your point.

Acknowledge the opposing point of view but then challenge it. Why are those critics wrong and you're right?

Offer solutions for the points you raised: How can we avoid these issues? What are the benefits? Create a sense of urgency.

Repeat your position. This is the last message you want your reader/listener to leave with.



Othello

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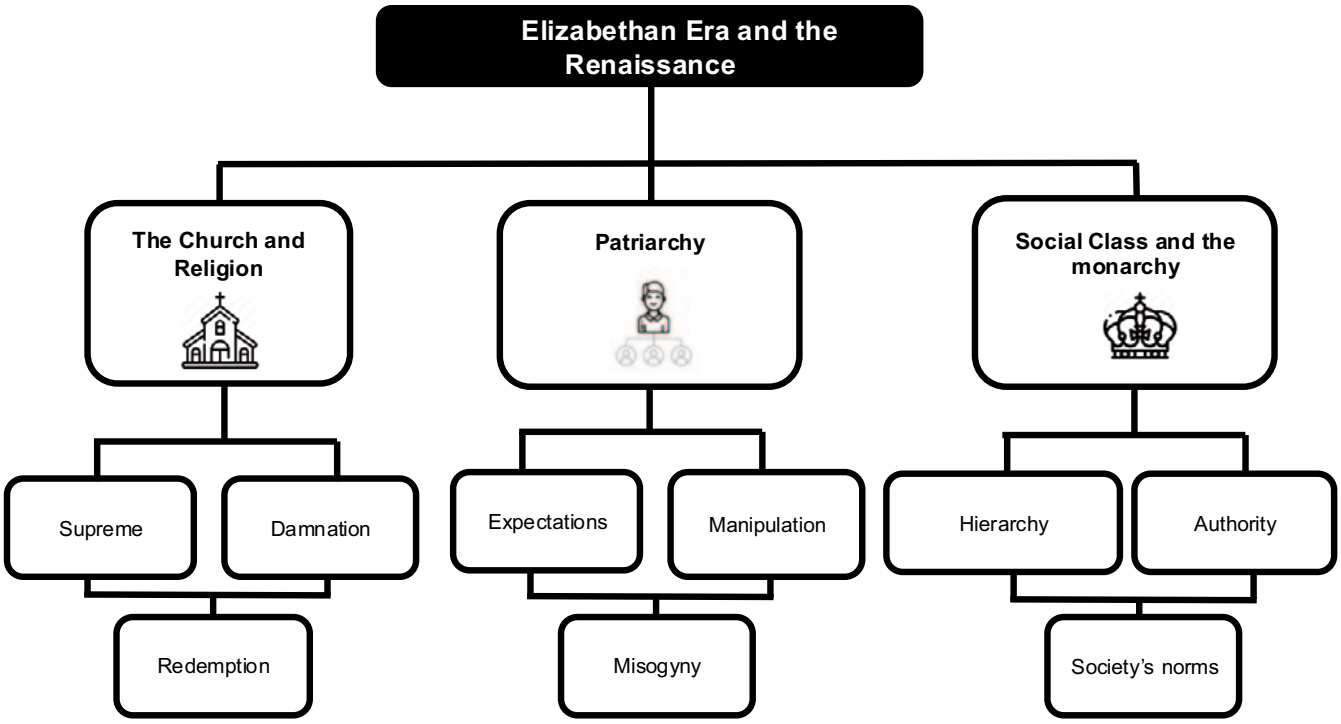
TIER TWO VOCABULARY

WORD	DEFINITION
Artifice	Clever or cunning devices to trick or deceive others.
Bigotry	Extreme prejudice against a particular person or group often based on their race or religion.
Bellicose	Demonstrating aggression and willingness to fight.
Chaos	Complete disorder and confusion.
Confidante	A person with whom one shares a secret or private matter, trusting them not to repeat it to others.
Culpable	Deserving of blame.
Exploitative	Making use of a situation or treating others unfairly in order to gain an advantage or benefit.
Fiendish	Extremely cruel or unpleasant.
Guileful	Having or showing cunning and sly intelligence.
Gullible	Easily persuaded to believe something.

WORD	DEFINITION
Incandescent	Full of passionate emotion, usually extreme anger.
Infidelity	The action or state of being unfaithful to a spouse or other sexual partner.
Machiavellian	Cunning, scheming, and unscrupulous, especially in politics.
Manipulation	Having control or clever techniques to make someone do what you want them to.
Motivation	A reason for acting or behaving in a certain way.
Noble	Having fine personal qualities, high moral principles.
Resentment	Feeling extremely bitter at being treated unfairly.
Self-effacing	Not wanting attention for achievements, modest.
Submissive	Willing to be obedient without question.
Turmoil	A state of great disturbance, confusion, or uncertainty.

SHAKESPEAREAN CONTEXT



OTHELLO CONTEXT

The Patriarchal Society

Elizabethan society was patriarchal, meaning that men were considered the leaders and women their inferiors. Women were regarded as "the weaker sex", not just in terms of physical strength, but emotionally too. Women were expected to be ruled by men. Men saw women as possessions and fathers expected to choose husbands for their daughters. They were believed to be intellectually inferior to men, incapable of rational thought and rarely received an education.

Assertive and argumentative women were seen as a threat to social order and were often punished. Shakespeare included a large number of parts for strong women in his plays.

Race in Othello

Racism was widespread in Elizabethan England. Black people were an unusual sight and were viewed with suspicion. Elizabeth 1 issued an order that they be removed from England in 1601. Many believed that they were only fit to be slaves. Elizabethans were against mixed race marriage.

Throughout the play Othello is called 'Moor' and there are also many references to the colour of his skin. The term 'Moor' was derived from the name of the North African country Mauritania or possibly the Greek word 'Mauros' meaning dark. The word Moor not only had connotations of race and ethnicity but also an otherness in terms of religion. Prejudice focussed on this perceived sense of otherness. Despite being honoured for his services to the State, Othello experiences this racism when he marries Desdemona who is white.

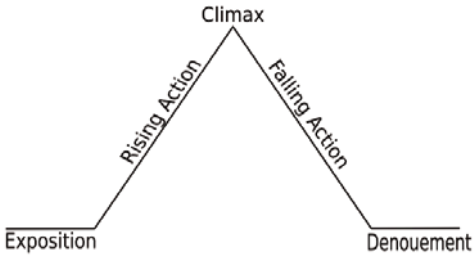
Venice and historical conflicts

Venice was an important trading city. It was a cultural meeting point and was considered multicultural as traders from across the world met there. It was a popular setting for plays about intrigue, love affairs and revenge. It had a reputation for sophistication and wealth but was also seen as a city of loose morals.

Othello is set during the wars that happened between Venice and Turkey in the latter part of the sixteenth century. Much of the action takes place in Cyprus which was an important outpost for the Turkish Navy at this time.

OTHELLO STRUCTURE AND THEMES

Othello follows a traditional 5 act structure. The story line follows Freytag's Pyramid.



Exposition: The effects of Othello and Desdemona's marriage are felt.
Rising Action: Iago puts his plan to convince Othello that Desdemona is having an affair into action.
Climax: Othello decides he must kill Desdemona.
Falling Action: The aftermath of Othello's murder of Desdemona.
Denouement: Othello kills himself.

THEMES

Prejudice

The main form of prejudice is **racism**, as several characters treat Othello as an outsider or animalistic as he is black. We also see **misogyny** within the play as women are judged.

Jealously

Jealously is a driving motive- Iago and Roderigo's jealously cause their actions. Othello's jealously causes him to act out of character, lose all reason and murder the woman he loves.

Deception

Deception drives the plot- Desdemona deceives her father to marry Othello, Iago deceives Othello to gain revenge and Othello is deceived by his own emotions.

Gender

Masculinity is focused strongly on honour- Othello feels emasculated when he believes Desdemona was unfaithful. Women are initially presented as either a Madonna or a whore. We see later in the play that women are more complicated and these are male enforced stereotypes.

OTHELLO ACT 1

PLOT

Othello and Desdemona have secretly married. Iago, resentful that he didn't get a promotion, encourages Roderigo to tell Desdemona's father, Brabanzio, about the marriage and cause trouble. Brananzio is furious and seeks out Othello.

Iago arrives at Othello's house and warns him about Brabanzio. A group of men approach, but it is a summons from the Duke. Brabanzio then arrives and Othello agrees to put the case before the Duke,

Brabanzio makes his complaint against Othello and accuses him of enchantment. Othello explains Desdemona fell in love with him due to his stories.

Desdemona enters and confirms she loves him. The Duke sends Othello to fight the Turks. Desdemona insists on going with him

Roderigo is manipulated by Iago to raise money and follow the army. Iago plans to use him to get his revenge on Othello. He promises Roderigo to help him win Desdemona.

KEY QUOTES

"I follow him to serve my turn upon him"
Iago
Act 1 i

" Damn'd as thou art, thou hast enchanted her"
Brabanzio Act 1 ii

“She loved me for the dangers I had pass'd,
And I loved her that she did pity them."
Othello Act1 iii

“That I did love the Moor to live with him"
Desdemona Act 1 iii

“Hell and night
Must bring this monstrous birth to the world's light."
Iago Act 1 iii

OTHELLO ACT 2





PLOT

A storm delays arrival in Cyprus. Desdemonda, Iago and Emilia arrive first. Iago criticises all women as deceptive. Cassio takes Desdemona aside to speak to her about Othello

Iago sees this conversation and plots to frame Cassio and Desdemona as having an affair. He resents Cassio as he got the promotion Iago wanted. Othello arrives and he announces a celebration .

Iago persuades Roderigo that Desdemona will choose Cassio after she is bored of Othello. He convinces him to start a fight with Cassio that evening, hoping this will make Cassio lose Othello's favour.

Iago gets Cassio drunk while on guard duty. Roderigo comes and starts a fight. Cassio stabs Montano

Othello breaks up the fight and dismisses Cassio from his service. Iago persuades Cassio to petition Desdemona to get his job back.

KEY QUOTES

"You rise to play and go to bed to work" **Iago Act 2 i**

"with as little a web as this will I ensnare as great a fly as Cassio" **Iago Act 2 i**

"I'll have our Michael Cassio on the hip, Abuse him to the Moor in the rank garb" **Iago Act 2 i**

"Zounds, I bleed still; I am hurt to the death." **Montano Act 2 iii**

"I will beseech the virtuous Desdemona to undertake for me" **Cassio Act 2 iii**

OTHELLO ACT 3





PLOT

Desdemona promises Cassio to help him get his position back. Othello enters so Cassio leaves. Iago remarks he looks guilty. Desdemona asks Othello to forgive Cassio.

Iago implies Desdemona and Cassio are having an affair. Othello fears she no longer loves him. Desdemona drops a handkerchief Othello gave her and Emilia gives it to Iago. He plants it in Cassio's room.

Othello is enraged about the possibility of an affair. Iago lies that he saw Cassio use the handkerchief. Othello swears revenge and promotes Iago .

Othello speaks to Desdemona and demands to see the handkerchief. She cannot produce it which angers Othello. Emilia speculates that Othello is jealous.

Cassio asks about his case; Desdemona goes to speak to Othello. Bianca, Cassio's lover appears. He asks her to copy the embroidery from a handkerchief he found in his room. She gets angry and thinks he has another lover.

KEY QUOTES

"I will have my lord and you again As friendly as you were." **Desdemona Act 3 iii**

"She's gone. I am abused; and my relief Must be to loathe her" **Othello Act 3 iii**

"Arise, black vengeance, from thy hollow cell!" **Othello Act 3 iii**

"Is not this man jealous?" **Emilia Act 3 iv**

"My lord is not my lord; nor should I know him" **Desdemona Act 3 iv**

OTHELLO ACT 4





PLOT

Othello falls into a fit from anger. Iago arranges for Othello to overhear Cassio talk about sleeping with Desdemona. However, he tricks them and talks to Cassio about Bianca instead.	Bianca enters with the handkerchief. Othello is even more enraged and vows to kill Desdemonda. Iago promises to arrange Cassio's death,	Desdemona enters with Lodovico, with orders for Othello to leave Cyprus. Desdemona appears happy so Othello hits her and calls her a whore. This shocks Lodovico; he wonders if Othello is mad.	Othello confronts Emilia and Desdemona; both protest innocence. Iago convinces Roderigo the only way to win Desdemona is to kill Cassio.	Desdemona fears her fate and asks Emilia to bury her in her wedding sheets. They discuss adultery and Emilia blames women's disloyalty on the ill treatment of men. Desdemona goes to bed.

KEY QUOTES

"For I will make him tell the tale anew...when He hath, and is again to cope your wife" **Iago Act 4 i**	"Ay, let her rot, and perish, and be damned to-night; for she shall not live" **Othello Act 4 i**	"Is this the noble Moor whom our full senate Call all in all sufficient?" **Lodovico Act 4 i**	"I took you for that cunning whore of Venice That married with Othello." **Othello Act 4 ii**	"But I do think it is their husbands' faults If wives do fall" **Emilia Act 4 iii**

OTHELLO ACT 5



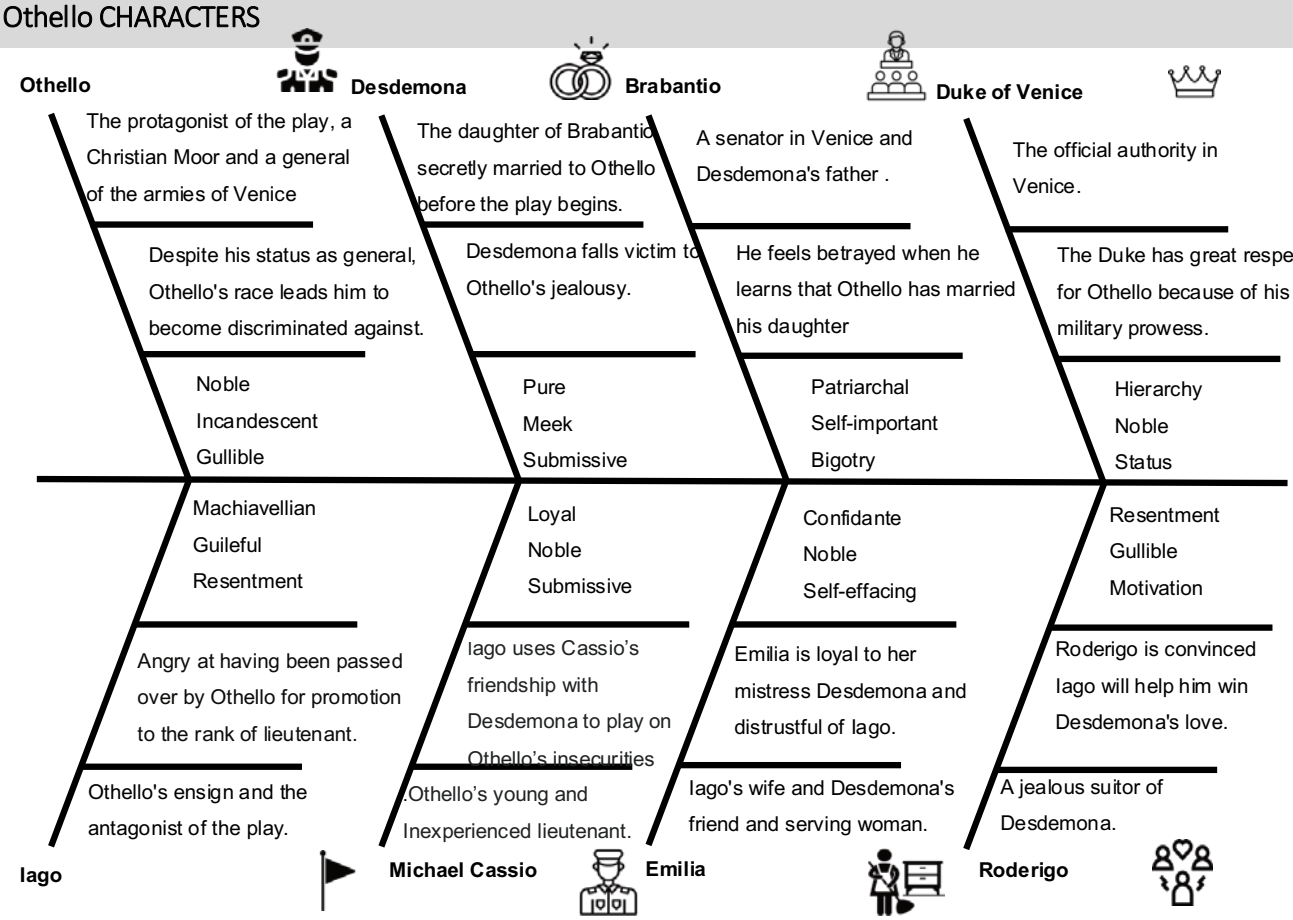

PLOT

Roderigo and Iago ambush Cassio. He is only wounded. Iago then kills Roderigo. He blames the events on Bianca and has her arrested. He sends Emilia to tell Othello what has happened.	Othello prepares to kill Desdemona. She wakes and denies his charges of infidelity He tells her Cassio is dead and then smothers her. Emilia enters and informs them Cassio is alive Desdemona wakes for long enough to absolve Othello then dies.	Emilia calls for help. Montano, Graziano and Iago arrive. Emilia reveals the full story and Iago's role in manipulating Othello. Iago stabs her and she dies.	Othello lunges at Iago and stabs him. Iago refuses to talk or to confess his crimes. A letter is found on Roderigo that proves his guilt though. Othello reconciles with Cassio.	Othello, faced with arrest, asks that he be remembered as he was. He then kills himself with a dagger. Iago is sentenced to execution.

KEY QUOTES

"Iago? O, I am spoil'd, undone by villains! Give me some help" **Cassio Act 5 i**	"A guiltless death I die." **Desdemona Act 5 ii**	"For thou hast kill'd the sweetest innocent That e'er did lift up eye." **Emilia Act 5 ii**	"Demand me nothing: what you know, you know: From this time forth I never will speak word." **Iago Act 5 ii**	"Speak of me as I am" **Othello Act 5 ii**

Othello CHARACTERS



'Be who God meant you to be'

CONTENTS

TIER TWO VOCABULARY

WORD	DEFINITION
Adolescence	The period during which a young person develops from a child into an adult:
Discrimination	The unjust or prejudicial treatment of different categories of people.
Egalitarian	Believing in the principle that all people are equal and deserve equal rights and opportunities.
Equality	The state of being equal, especially in status, rights, or opportunities:
Feminism	The advocacy of women's rights on the basis of the equality of the sexes:

WORD	DEFINITION
Legislation	The process of making or enacting laws.
Masculinity	Qualities or attributes regarded as characteristic of men or boys:
Misogyny	Ingrained prejudice against women:
Prejudice	A preconceived opinion that is not based on reason or actual experience:
Social stratification	A system by which a society ranks categories of people in a hierarchy.
Sexuality	a person's identity in relation to the gender or genders to which they are typically attracted;

TIER TWO VOCABULARY

WORD	DEFINITION
Social stratification	A system by which a society ranks categories of people in a hierarchy.
Sexuality	A person's identity in relation to the gender or genders to which they are typically attracted;
Subordinate	To be lower in rank or position:

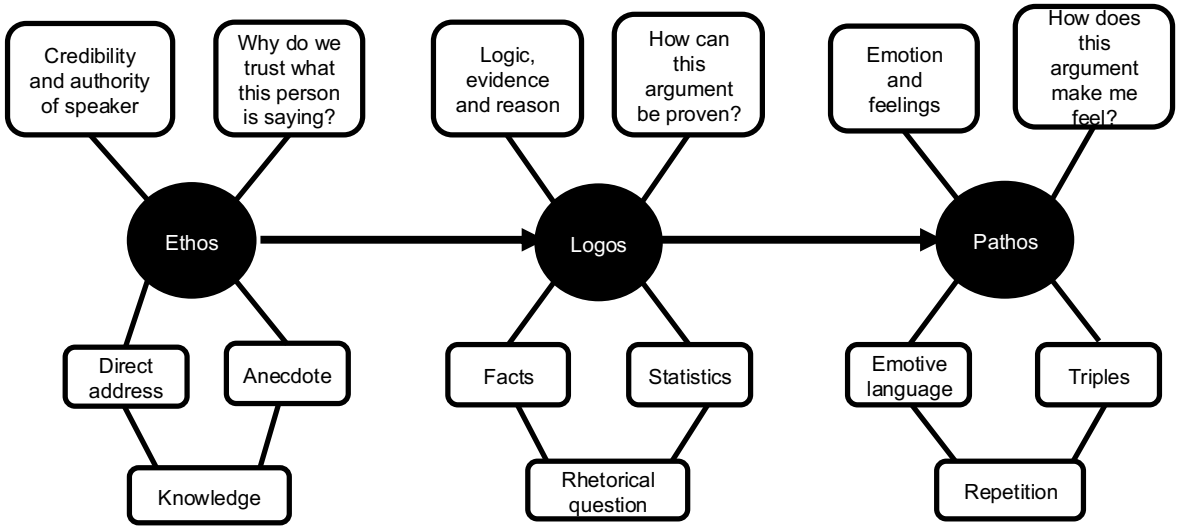
ARISTOTLE'S THREE PILLARS OR PERSUASION

Aristotle

Born in Greece, Aristotle lived from 384 BC to 322 BC.

Instructed on how to best persuade people.

Aristotle was a student of Plato (another Greek philosopher).



Women's Voices

THEMES IN THE TEXTS

Stereotypes: Both men and women have faced stereotypes regarding how they are to present themselves in society since the beginning of time. Stereotypes are limiting beliefs about individuals and groups of people.

Patriarchy: We exist in a society that is built upon patriarchal ideals. Ingrained in social ideas are that men hold greater power than women. Women continue to fight against these perceptions.

Feminism: Over the past 400 years women have fought tirelessly to make a place for women in society. Gaining greater equality, suffrage and access to positions of power.

Misogyny: Women face being disliked, judged and physically or emotionally harmed due to their gender. Attitudes to women, especially in positions of power or who defy society's expectations are particularly negative.

SOJOURNER TRUTH, AIN'T I A WOMAN

A speech by African-American and women's rights activist Sojourner Truth about the plight of women seeking equality in the 19th century.

QUEEN ELIZABETH I, TILBURY SPEECH

A speech by the final Tudor, Queen Elizabeth I. She calls her troops to fight for their country, queen and God in the Spanish Armada.

JULIA GILLARD, AUSTRALIAN PARLIAMENT

A speech by the former Australian Prime Minister, Julia Gillard. She speaks out against her party opponent for his misogynistic and sexist comments and double standards.

Men's Voices

THEMES IN THE TEXTS

Stereotypes: Both men and women have faced stereotypes regarding how they are to present themselves in society since the beginning of time. Stereotypes are limiting beliefs about individuals and groups of people.

Machismo: There is an in ingrained ideology facing men that they have to appear overtly masculine, show strength and bravado in their behaviour and actions to fit social expectations.

Masculinity: Masculinity is a spectrum, there is no right or wrong way to appear masculine or manly. However, each society has its own ideals and norms regarding what it inherently means to be masculine.

Mental Health: Mental health is an area that impacts everyone, however for men it is often overlooked, laughed off or suppressed. Men too need to be able to speak about their feelings and the difficulties and challenges they face.

GARETH SOUTHGATE, YOUNG MEN'S CHALLENGES

A speech by the former England Men's football manager where he discusses the current social challenges and influences on young men.

LZ GRANDERSON, THE GAY AGENDA

A speech by LZ Granderson where he discusses his sexuality and how he feels about his place in society as a gay man.

Minority Voices

THEMES IN THE TEXTS

Race: Race is an inherent part of our identity. It refers to the colour of our skin, our cultural affiliation and how we identify ourselves. It could be related to where we are from and what nationality we have.

Racism: The belief that different races possess distinct characteristics, abilities, or qualities, especially in viewing them as inferior or superior to one another. There are different forms of racism: casual, institutional, unconscious.

Violence: Linking to racism and prejudice, violence is inherently tied to social groups, affiliations and bias. Police brutality is an area we will explore, as well as violence among peer groups.

Prejudice: Prejudice is a negative assumption or opinion about someone based on their group membership. This can be based on any form of difference, inequality or separation within society or social groups.

DAVE, BLACK

A song by British rapper Dave about the experience of being black. It covers the societal stereotypes, personal perceptions and prejudices facing marginalised individuals.

CALEB FEMI, THIRTEEN

A poem that explores the experience of young black men in society and their relationship with law enforcement. Key theme of institutional racism.

Voices of the Youth

THEMES IN THE TEXTS

Adolescence: The transitory phase between childhood and adulthood is fraught and can bring with it challenges around identity, fitting in, taking risks and deciding upon your future.

Subcultures: Subcultures often have beliefs or interests that are different with those of the larger culture. In the past, teens have identified with subcultures as a means to form their own sense of self.

Disillusion: Considering the future can be daunting or disappointing; trying to distinguish your place in society at such a pivotal age can be overwhelming, and young people don't always feel they have all the answers.

SAM FENDER, HYPERSONIC MISSILES

A song by British singer/songwriter Sam Fender that looks at 21st century society and how young people have become voiceless and are losing their individuality.

GRETA THUNBERG,CLIMATE ACTION

A speech given by the teenage environment activist and campaigner, Greta Thunberg to the UN at the Climate Action summit in 2019.

COMMON RHETORICAL DEVICES

	**Direct address**	Referring to the reader directly using the pronouns ‘we’ or ‘you’.
	**Alliteration**	The repetition of the same **sound** in a sequence of words beginning with the same letter.
	**Repetition**	Where a word or phrase is used more than once across a text
	**Knowledge**	Knowing the topic/subject you are writing or speaking about.
	**Facts**	Something which can be proven to be true.
	**Opinion**	A belief which cannot be proven to be true.
	**Rhetorical question**	Any question in a piece of writing which does not require an answer.
	**Emotive language**	Words which elicit a powerful emotional response.
	**Similes and metaphors**	A **simile** directly compares one object to another using ‘like’ or ‘as’. A **metaphor** compares two things by stating one is the other.
	**Triplets**	Lists of three things in a sentence.

ADVANCED RHETORICAL DEVICES

Allusion

A reference to an event, place, literary work or person.
Example: "I can't get changed that quickly, I'm not **Superman**!"

Anaphora

The repetition of a word or phrase **at the start** of successive phrases.
Example: "**If you** prick us, **do we not** bleed? **If you** tickle us, **do we not** laugh?"

Anecdote

A short amusing or interesting story about a real incident or person.
Example: "When I was your age, I …"

Epistrophe

The repetition of a word or expression **at the end** of successive phrases, clauses, sentences, or verses especially for rhetorical or poetic effect.
Example: "of the **people**, by the **people**, for the **people**"

Hypophora

A figure of speech in which a writer raises a question, and then immediately answers it.
Example: ""What should young people do with their lives today**?** **Many things, obviously**."

Hyperbole

An exaggeration.
Example: "I have done this **a thousand times**"

Parallelism

The use of words or phrases with a similar structure.
Example: "Like father, like son"

Oxymoron

A combination of contradictory or unsuitable words.
Example: "It is a cruel kindness"

HOW TO STRUCTURE AN ARGUMENT

Make your position clear. What is your point of view on how?

Introduce the topic you are writing about. Still make your opinion clear.

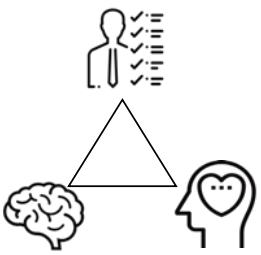
Offer your first point through a topic sentence and identify one issue. Explain your point.

Offer your second point through a topic sentence and identify one issue. Explain your point.

Acknowledge the opposing point of view but then challenge it. Why are those critics wrong and you're right?

Offer solutions for the points you raised: How can we avoid these issues? What are the benefits? Create a sense of urgency.

Repeat your position. This is the last message you want your reader/listener to leave with.



Animal Farm

CONTENT

TIER TWO VOCABULARY

WORD	DEFINITION
Autocracy	A political system governed by a single individual.
Brave	Ready to face danger or pain.
Calculating	Acting in a scheming way.
Callous	Being cruel and unfeeling towards others.
Compassionate	Showing sympathy and concern for others.
Corruption	A dishonest action that destroys people's trust.
Cynical	Believing that people are motivated purely by self-interest; distrustful.
Devious	Using successfully dishonest methods to get your own way.
Devoted	Very loving and loyal.

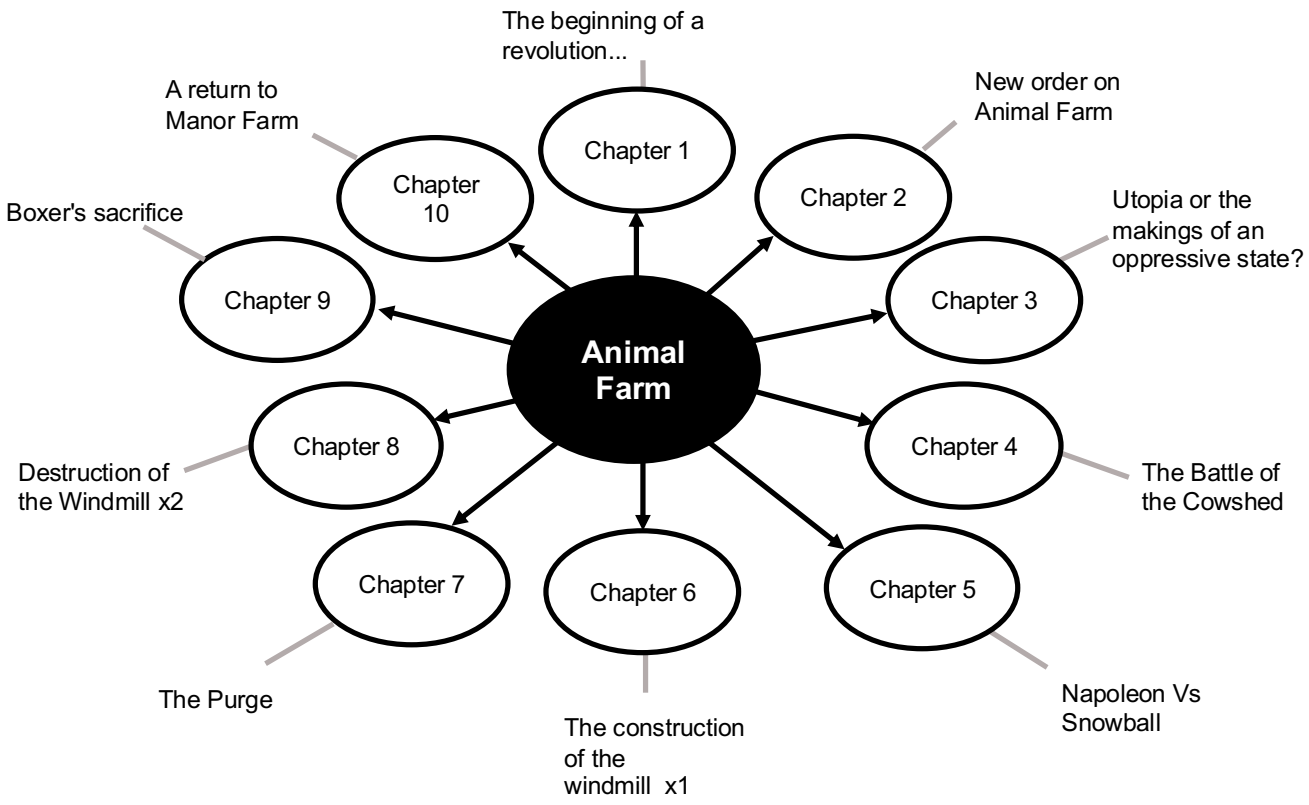
WORD	DEFINITION
Dictatorship	A dictatorship is a government or a social situation where one person makes all the rules and decisions without input from anyone else.
Egocentric	Thinking only of oneself, without regard for the feelings or desires of others.
Eloquent	having or exercising the power of fluent, forceful, and appropriate speech.
Hedonistic	Engaging in the pursuit of pleasure.
Inadequate	Unable to deal with a situation or with life.
Incompetent	Not having the necessary skills to do something successfully.
Inconsiderate	Thoughtlessly causing pain or inconvenience to others.

TIER TWO VOCABULARY

WORD	DEFINITION
Idealism	The unrealistic belief in or pursuit of perfection.
Indifferent	Unconcerned or uninterested.
Ingenuous	Innocent, naïve and unworldly.
Loyal	Giving or showing firm and constant support or allegiance to a person.
Manipulative	Influencing others through deceptive or underhanded tactics.
Naïve	Showing a lack of experience or judgement (Snowball is politically naïve).
Opportunistic	Exploiting immediate opportunities.
Pessimistic	Tending to see the worst aspect of things.

WORD	DEFINITION
Shrewd	To judge a situation accurately and turn it to your own advantage.
Socialist	The idea of collective effort and ownership benefiting all and removing inequality.
Spoilt	Harmed in character by being treated too indulgently.
Steadfast	Dutifully firm and committed to a cause.
Tactical	Relating to actions carefully planned to gain a specific military end.
Tyrannical	Using power in a cruel way or for your own personal gain.
Unscrupulous	Having or showing no moral principles.
Usurp	Seize and take control without authority and possibly with force; take as one's right or possession.

ANIMAL FARM KEY EVENTS



ANIMAL FARM CONTEXT AND EVENTS

Chapter One
The animals are unhappy living at Manor Farm and Old Major gives a speech to inspire the animals to rebel.

Chapter Two
The animals learn Beasts of England and the principles of Animalism.

Chapter Two and Three
Old Major dies and the animals lead a rebellion against Mr Jones. Snowball and Napoleon take charge of the farm.

Chapter Four and Five
Divisions start to form between Snowball and Napoleon during the Battle of the Cowshed. They debate the windmill.




Tzar Nicholas II was the ruler. He was part of the Russian autocracy.

The February and October Revolutions forced Nicholas II to abdicate. Lenin (a Bolshevik) was placed as provisional government.

Lenin ruled for seven years before dying.

The two primary competitors were Stalin and Trotsky. Stalin takes power and becomes a dictator.

Chapter 1

The beginning of a revolution!





PLOT	Famer Jones is introduced as an inadequate leader. He fails to protect the animals and forgets to feed them. The animals hold a secret meeting showing that they are scared of him.	The animals enter in a specific order and Old Major waits to speak to them on a raised platform. The pigs sit at the front. Old Major tells the animals that he has had a dream.	In his speech, Old Major first encourages the animals to question their existence and blames man for all their suffering.	In his speech, Old Major also addresses different animals and comments on how Jones exploits them. He warns Boxer that he will be sold to the butchers.	The meeting ends with the singing of 'Beasts of England'. Farmer Jones is awoken by the uproar and shoots at the barn to quieten the animals.
KEY QUOTES	"Mr Jones, of Manor Farm, […] was too drunk to remember to shut the pop-holes"	"then the pigs, who settled down in the straw immediately in front of the platform"	"Man is the only real enemy we have."	"Boxer, the very day that those great muscles of yours lose their power, Jones will sell you to the knackers"	"The pellets buried themselves in the wall of the barn and the meeting broke up hurriedly."

Chapter 2

Overthrowing the status quo





PLOT	After the death of Old Major, the animals spend their days secretly planning the rebellion and the pigs are placed in charge of educating the animals about Animalism.	Among the pigs, Snowball and Napoleon are the most important to the revolution. Mollie is concerned about her ribbons and Moses speaks about a place called 'Sugarcandy Mountain'.	The rebellion occurs when Jones again falls into a drunken sleep and neglects to feed the animals. The triumphant animals then destroy all traces of Jones.	Snowball changes the sign reading "Manor Farm" to "Animal Farm" and paints the Seven Commandments of Animalism on the wall of the barn.	The cows need milking. The cows then give five buckets of milk, which disappears.
KEY QUOTES	"The work teaching and organising the others fell naturally upon the pigs"	"Comrade," said Snowball, 'those ribbons that you are so devoted to are the badge of slavery."	"Almost before they knew what was happening, the Rebellion had been successfully carried through"	'All animals are equal"	"When they came back in the evening it was noticed that the milk had disappeared."

Chapter 3

Utopia?





PLOT	The animals cooperate to finish the harvest. Boxer distinguishes himself as a strong, tireless worker, admired by all the animals.	The pigs become the supervisors and directors of the animal workers. On Sundays, the animals meet in the big barn to listen to Snowball and Napoleon debate a number of topics.	To help the animals understand the general precepts of Animalism, Snowball reduces the Seven Commandments to a single maxim: "Four legs good, two legs bad."	The animals learn that the cows' milk and windfall apples are mixed every day into the pigs' mash.	When the animals object, Squealer explains that the pigs need the milk and apples to sustain themselves as they work for the benefit of all the other animals.
KEY QUOTES	"How they toiled and sweated to get the hay in!"	"The pigs did not actually work, but directed and supervised others."	"The birds did not understand Snowball's long words, but they accepted his explanations"	"these would be shared out equally:[…] all the windfalls were to be collected […] for the use of the pigs."	"Milk and apples (this has been proven by Science, comrades) contain substances absolutely necessary to the well-being of a pig."

Chapter 4

The Battle of the Cowshed





PLOT

As summer ends, news of the rebellion spreads to other farms. Farmer Jones has spent most of his time at the Red Lion in Willingdon.

Farmer Frederick and Pilkington reluctantly, but out of fear of rebellion in their own farms, decide to help Farmer Jones and his men.

The animals are ready for Farmer Jones to attack. Snowball had studied an old book on Julius Caesar's campaigns. Snowball turns out to be an extraordinary tactician.

During the battle, Napoleon is not mentioned, and Mollie is hiding. Snowball and Boxer are very active in the battle. Snowball is hurt by a bullet and Boxer thinks that he has killed someone.

A sheep dies and is given the honour of 'Animal Hero, Second Class'. The animals then celebrate their victory in what they call "The Battle of the Cowshed." The animals sing 'Beasts of England'.

KEY QUOTES

"[Farmer Jones was] complaining to anyone who would listen of the monstrous injustice he had suffered"

"both [Pilkinton and Frederick] were frightened by the rebellion on Animal Farm"

"Snowball at the head of them"

"I had no intention of doing that. I forgot that I was wearing iron shoes." [Boxer]

"It was decided to set the gun up at the foot of the flagstaff , […] and to fire it twice a year"

Chapter 5

Napoleon seizes power!





PLOT

Winter comes, and Mollie works less and less, and eventually disappears. The pigeons report seeing her standing outside a pub, sporting one of the ribbons that she always coveted.

The pigs increase their influence on the farm, deciding all questions of policy and then offering their decisions to the animals, who must ratify them by a majority vote.

Snowball and Napoleon continue their debates, the greatest of which occurs over the building of a windmill on a knoll. On the Sunday, the plan for the windmill is to be put to a vote.

Napoleon calls out nine ferocious dogs, who chase Snowball off the farm. The animals are terrified.

Napoleon then announces that all debates will stop and institutes a number of other new rules for the farm, but surprises everybody by announcing that the windmill will be built.

KEY QUOTES

"None of the animals ever mentioned Mollie again."

"the pigs occupied themselves with the planning out the work of the coming season."

"they [the animals] always found themselves in agreement with the one who was speaking at the moment"

"Silent and terrified, the animals crept back into the barn. […] They were huge dogs, fierce-looking as wolves."

"but there would be no more debates"

ANIMAL FARM CONTEXT AND EVENTS

Chapter Five and Six
Snowball is chased off the farm by Napoleon's dogs. The animals start to build the windmill according to Napoleon's plans.

Chapter Seven
The pigs announce that the hens will have to sell their eggs which causes the hens to destroy their eggs in protest.
Napoleon forces animals to confess to crimes and has them murdered by the dogs.

Chapter Eight
Napoleon attempts to sell timber to Frederick but learns from Whymper that Frederick's banknotes are fraudulent. Frederick and 14 other men blow up the windmill which leads to The Battle of the Windmill.

Chapter Ten
The sheep learn to chant 'Four legs good, two legs better.' The pigs become indistinguishable from men whilst the other animals live in suffering.

Trotsky is banished from the Soviet Union and Stalin adopts Trotsky's Soviet Five-Year Plan.

Peasants burned crops and slaughtered livestock rather than giving it to the state. NKVD helped Stalin carry out purges.

Molotov-Ribbentrop Pact between Russia and Germany. German invasion of Russia.

Stalin replaces "The Internationale" with the "National Anthem of the Soviet Union".

Chapter 6

The Windmill

PLOT	During the following year, the animals work harder than ever before completing farm work and building the windmill.	Napoleon announces that Animal Farm will begin trading with neighbouring farms and hires Mr. Whymper.	The pigs move into the farmhouse and begin sleeping in beds, which Squealer excuses on the grounds that the pigs need their rest after the daily strain of running the farm.	Boxer works the hardest at ensuring the windmill is built and even works at night time. That November, a storm topples the half-finished windmill.	Napoleon tells the animals that Snowball is responsible for its ruin and then declares that they will begin rebuilding the windmill that very morning.
KEY QUOTES	"All that year the animals worked like slaves."	"He [Mr Whymper] was a sly-looking little man […] The animals watched his coming and going with a kind of dread"	"It was absolutely necessary, he said, that the pigs, who were the brains of the farm, should have a quiet place to work in."	"A terrible sight had met their eyes. The windmill was in ruins."	"Forward, comrades! Long live the windmill! Long live Animal Farm!"

Chapter 7

The Purge





PLOT

The weather gets worse. The animals are led to believe that Snowball is visiting the farm at night and spitefully subverting their labour. He becomes a constant (and imagined) threat to the animals' security.	The animals are facing starvation and Squealer announces that the chickens' eggs will have to be sold. The chickens rebel but their rebellion is swiftly supressed.	Napoleon calls a meeting of all the animals, during which he forces confessions from all those who had questioned him and then has them murdered by the dogs.	The terrible bloodshed leaves the animals deeply shaken and confused. Boxer says that he would never have believed that such a thing could happen on Animal Farm. He blames himself.	Eventually, the singing of "Beasts of England" is outlawed and a new song by Minimus, Napoleon's pig-poet, is instituted. It is a nationalist anthem for Animal Farm.

KEY QUOTES

"It was a bitter winter. The stormy weather was followed by sleet and snow."	"When the hens heard this they raised a terrible outcry."	"Immediately the dogs bounded forward, seized four pigs by the ear and dragged them, squealing with pain and terror"	"These scenes of terror and slaughter were not what they had looked forwards to on that night when Old Major first stirred them to rebellion"	"So 'Beasts of England' was heard no more."

Chapter 8

The Windmill is destroyed (again)





PLOT

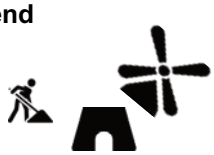
The animals have to work harder than in previous years. Squealer shares with them false figures about the increased production of food on the farm.	Napoleon schemes to sell a pile of timber to Frederick, who tries to pay with a cheque. Napoleon, however, demands cash, which he receives. Whymper then learns that Frederick's banknotes are forgeries.	Frederick and 14 men arrive at Animal Farm and attempt to take it by force. The humans are initially successful, after they blow up the windmill. The animals are completely enraged and drive the men from the farm.	Squealer explains to the bleeding animals that they were actually victorious in what will hereafter be called "The Battle of the Windmill." Boxer is severely injured during the battle.	The pigs find a case of whiskey in Jones' cellar. Napoleon gets ill from it and it is thought he had been poisoned. Napoleon gets better. The pigs change the commandment about drinking.

KEY QUOTES

"Throughout that year the animals worked in the previous year."	"The bank-notes were forgeries! Frederick had got the timber for nothing."	"they did not heed the cruel pellets that swept over them like hail. It was a savage battle."	"In the general rejoicing the unfortunate affair of the bank-notes was forgotten."	"'No animal shall drink alcohol', but there were two words that they had forgotten […] 'to excess'"

Chapter 9

Boxer's end





PLOT

The animals begin building a new windmill. Their efforts are again led by Boxer who, despite his split hoof, insists on working harder and getting the windmill started before he retires.

One day, however, he collapses because of a lung ailment. After he is helped back to his stall, Squealer informs them that Napoleon has sent for the veterinarian at Willingdon to treat him.

The van arrives to take Boxer to the hospital; however, Benjamin reads its side and learns that Boxer is actually being taken to a knacker, or butcher.

Clover screams to Boxer to escape, but he is too weak. Boxer is never seen again. Squealer speaks of Boxer's honourable service and devotion to 'Animal Farm' and Napoleon.

The chapter ends with a grocer's van delivering a crate of whisky to the pigs, who drink it all and do not arise until after noon the following day.

KEY QUOTES

"For a horse, it was said, the pension would be five pounds of corn a day […] possibly an apple on public holiday."

"His eyes were glazed, his sides matted with sweat."

"'Fools! Fools!' shouted Benjamin […] 'Do you not see what is written on the side of the van?'"

"'I was ate his beside at the very last.[…] He whispered […] that his sole sorrow was to have passed on before the windmill was finished.'"

"the pigs had acquired the money to buy themselves another case of whisky."

Chapter 10

The ultimate betrayal





PLOT

Years pass. Many animals age and die, and few recall the days before the Rebellion. The farm seems to have grown richer, but only the many pigs and dogs live comfortable lives.

Squealer takes the sheep off to a remote spot to teach them a new chant. Squealer walks toward the animals on his hind legs.

Napoleon soon appears walking upright; he carries a whip. Before the other animals have a chance to react to the change, the sheep begin to chant: "Four legs good, two legs better!"

Only the last commandment remains: "all animals are equal." However, it now carries an addition: "but some animals are more equal than others."

The farmers praise the pigs and express their regret for past "misunderstandings." Napoleon announces the change of the farm's name back to 'Manor Farm'. The pigs and men fall out. The animals look confused.

KEY QUOTES

"They [the animals] were generally hungry, they slept on straw […] in winter they were troubled by the cold, and in summer by the flies."

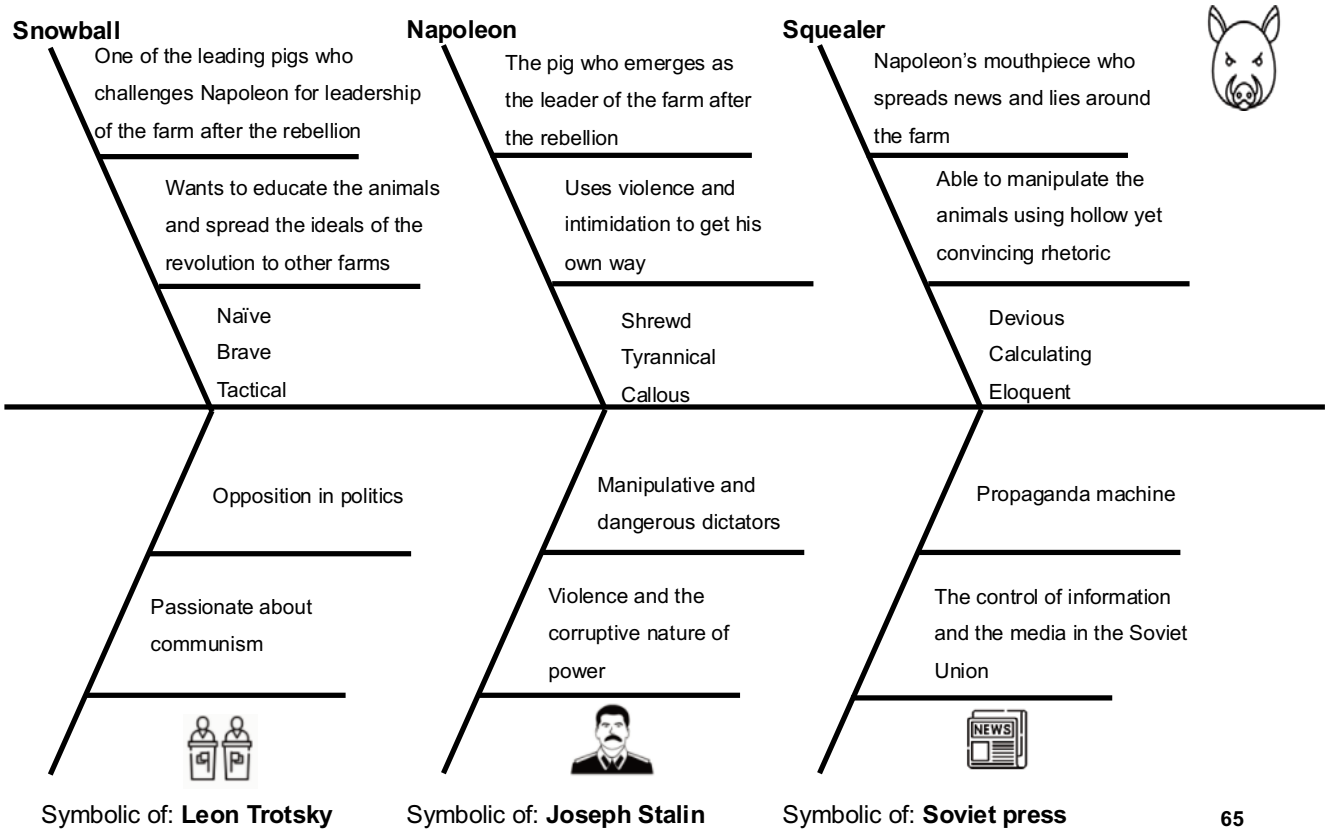
"He [Squealer] was teaching them [the sheep] to sing a new song"

"Napoleon himself, majestically upright […] He carried a whip in his trotter."

"All animals are equal but some animals are more equal than others."

"The creatures outside looked from pig to man […] but already it was impossible to say which was which."

ANIMAL FARM CHARACTERS- THE PIGS

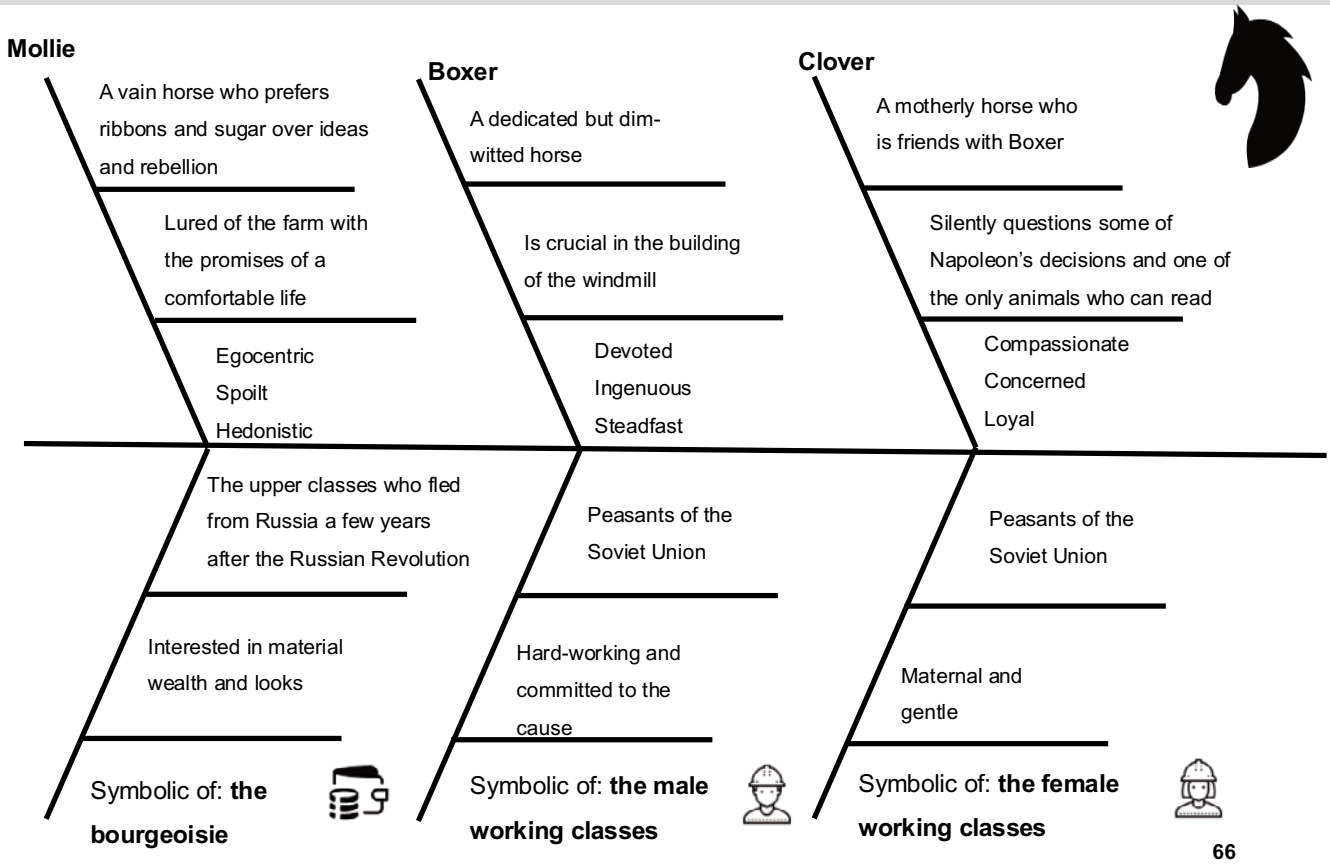


Symbolic of: **Leon Trotsky**

Symbolic of: **Joseph Stalin**

Symbolic of: **Soviet press**

ANIMAL FARM CHARACTERS- THE HORSES

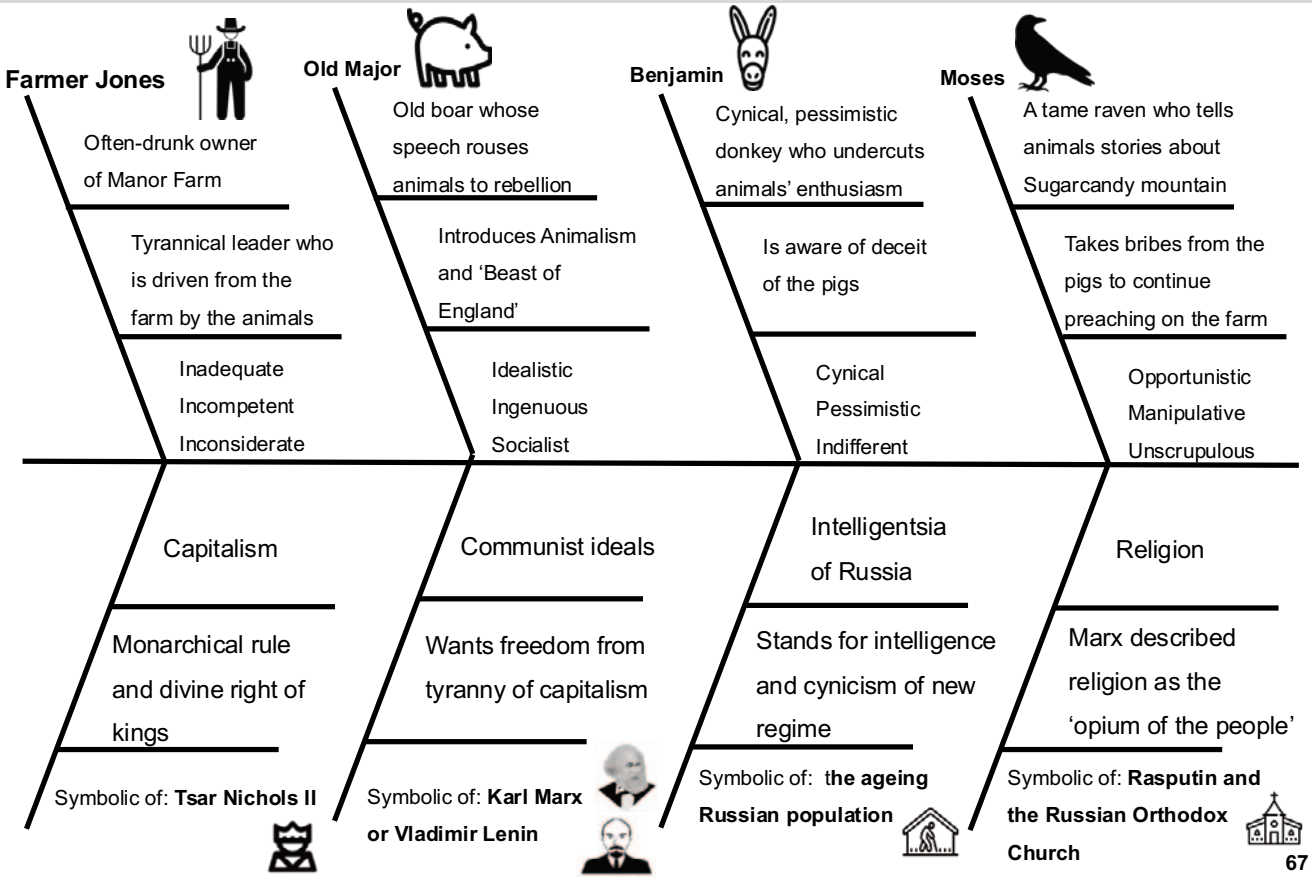


Symbolic of: **the bourgeoisie**

Symbolic of: **the male working classes**

Symbolic of: **the female working classes**

ANIMAL FARM CHARACTERS- OTHER ANIMALS



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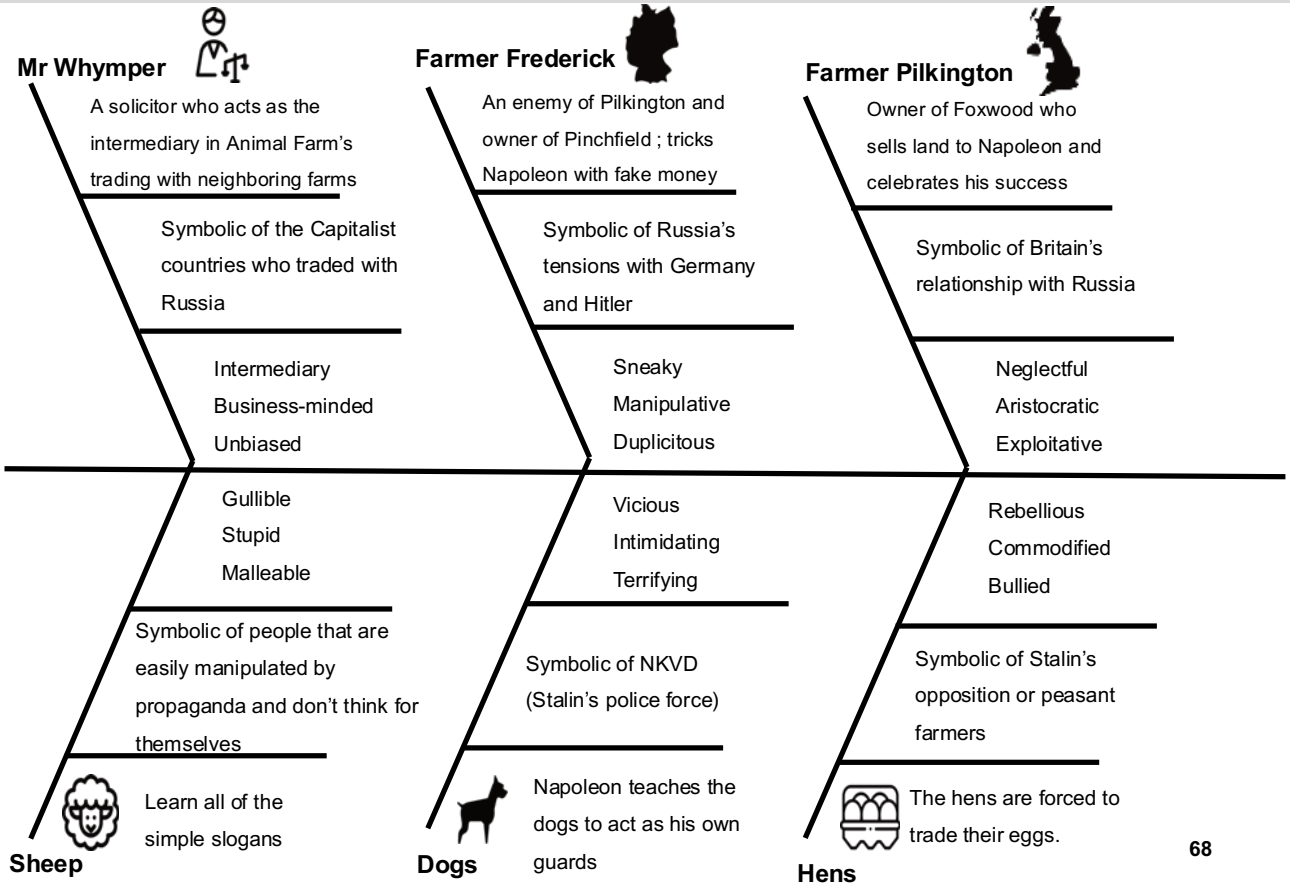
ANIMAL FARM CHARACTERS- MINOR CHARACTERS



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Vocabulary Bank

Full academic year

CONTENTS

YEAR 7 TIER TWO VOCABULARY RECALL

William Blake

WORD	DEFINITION
Inequality	A lack of equality.
Revolution	A forcible overthrow of a government or social order, in favour of a new system.
Childhood	The state of being a child.
Industrial	Relating to or characterized by industry.
Morality	Principles concerning the distinction between right and wrong or good and bad behaviour.
Poverty	The state of being extremely poor.
Vengeance	Getting revenge on someone who has wronged you
Romanticism	An artistic and philosophical movement that redefined the ways people think about themselves and the world.
Misogyny	A hatred towards women.

Women's Literature

WORD	DEFINITION
Empowerment	The process of becoming stronger and more confident, especially in controlling one's life and claiming one's rights.
Prejudice	A preconceived opinion that is not based on reason or actual experience.
Society's norms	The informal rules that govern behaviour in groups and societies.
Suffrage	The right to vote.
Feminism	The belief in women's rights on the ground of the equality of the sexes
Discrimination	The unjust or prejudicial treatment of different categories of people, especially on the grounds of race, age, sex, or disability
Equality	The state of being equal, especially in status, rights, or opportunities
Patriarchy	A society where men have more power than women

YEAR 7 TIER TWO VOCABULARY RECALL

Private Peaceful

WORD	DEFINITION
Justice	Fair behaviour or treatment.
Society	People living together in a more or less ordered community.
Alliance	A union or association formed for mutual benefit, especially between countries
Nationalism	A person who strongly identifies with their own nation and supports its interests to the exclusion of other nations
Patriotism	A person who has or expresses devotion to and support of their country
Conflict	A serious disagreement or argument.
Cowardice	A lack of bravery.
Nostalgia	A sentimental longing or wistful affection for a period in the past.

Shakespearian Comedy

WORD	DEFINITION
Gender	Gender is the range of characteristics relating to, and differentiating between, femininity and masculinity.
Patriarchy	A society in which men hold more power than women.
Expectation	A strong belief that something will happen or be the case.
Hierarchy	A system in which members of an organization or society are ranked according to relative status or authority.
Stereotype	A widely held but fixed and oversimplified image or idea of a particular type of person or thing.
Renaissance	The revival of European art and literature under the influence of classical models in the 14th–16th centuries.

YEAR 8 TIER TWO VOCABULARY RECAP

Life, Labour and Loss

WORD	DEFINITION
Capitalism	An economic or political system where a country's trade and industry is controlled by private owners for profit not the state.
Capital Punishment	The legally authorised killing of someone as punishment for a crime.
Charity	The voluntary giving of help, typically in the form of money, to those in need.
Child Labour	The employment of children in an industry or business.
Control	The power to influence or direct people's behaviour or the course of events.
Corporal Punishment	Physical punishment, such as caning or flogging.
Despair	The complete loss or absence of hope.

WORD	DEFINITION
Desperation	A state of despair, typically one which results in rash or extreme behaviour.
Despondent	In low spirits from a loss of hope or courage.
Destitution	Extremely poor and lacking the means to provide for oneself.
Dilapidated	In a state of disrepair or ruin as a result of age or neglect.
Exploration	The action or fact of treating someone unfairly in order to benefit from their work.
Industrial	Economic activity concerned with the processing of raw materials and manufacture of goods in factories.
Inequality	Lack of equality.

Life, Labour and Loss

WORD	DEFINITION
Labour	Employment in an industry or business.
Malnutrition	Lacking proper nutrition.
Neglect	The failure to provide care for property.
Oppression	The prolonged cruel or unjust treatment or exercise of authority.
Pauper	A recipient of relief under the provisions of the Poor Law or public charity.
Poverty	The state of being extremely poor.

WORD	DEFINITION
Redemption	The action of saving or being saved from sin, error or evil.
Reform	Make changes in (something, especially an institution or practice) in order to improve it.
Superiority	Higher ranking in status or quality.
Voracious	Wanting great quantities of food.
Welfare	The statuary procedure and social effort designed to promote the basic physical and material well-being of people in need.

Pride Not Prejudice

WORD	DEFINITION
Bilingual	The ability to speak two languages fluently.
Culture	The ideas, customs, and social behaviour of a particular people or society.
Discrimination	The unfair or prejudicial treatment of people and groups based on characteristics such as race, gender, age or sexual orientation.
Empowerment	The process of becoming stronger and more confident.
Ethnicity	The state of belonging to a social group that has a common national or cultural tradition.
Expectations	A strong belief that something will happen or be the case.

	DEFINITION
Family	A group of people related by blood or marriage.
Gender	The range of characteristics pertaining to, and differentiating between, masculinity and femininity.
Hierarchy	A system in which members of an organization or society are ranked according to relative status or authority.
History	The whole series of past events connected with a particular person or thing.
Justice	Fair behaviour or treatment.
Language	The method of human communication, either spoken or written, consisting of the use of words in a structured and conventional way.

YEAR 8 TIER TWO VOCABULARY RECAP

Pride Not Prejudice

WORD	DEFINITION
Memory	Something remembered from the past.
Morality	The difference between right and wrong.
Mother tongue	The language which a person has grown up speaking from early childhood.
Nationality	The status of belonging to a particular nation.
Region	An area, especially part of a country or the world having definable characteristics, but not always fixed boundaries.
Revolution	A forcible overthrow of a government or social order, in favour of a new system.

WORD	DEFINITION
Patriarchy	A society where men hold more power than women.
Sexuality	A person's sexual orientation or preference.
Society's norms	The informal rules which govern people's behaviour in groups.
Stereotypes	A widely held but fixed and oversimplified image or idea of a particular type of person or thing.
Tradition	The transmission of customs or beliefs from generation to generation, or the fact of being passed on in this way.

TIER TWO VOCABULARY The Lie Tree

WORD	DEFINITION
Curiosity	A strong desire to know or learn something.
Femme Fatale	An attractive and seductive woman, especially one who is likely to cause distress or disaster for a man who becomes involved with her.
Gothic	A genre of literature and film that combines fiction and horror, death and, at times, romance.
Grotesque	Comically or repulsively ugly or distorted.
Injustice	Lack of fairness or justice.
Isolation	Being on your own away from others.

WORD	DEFINITION
Monstrous	Having the ugly or frightening appearance of a monster.
Neglect	Failure to care for property or people.
Paranormal	Denoting to events or phenomena which are beyond the scope or normal scientific understanding.
Resurrection	The action or fact of rising from the dead.
Supernatural	Manifestations or events considered to be of supernatural origin, such as ghosts.
Telepathic	Able to read the minds of other people.

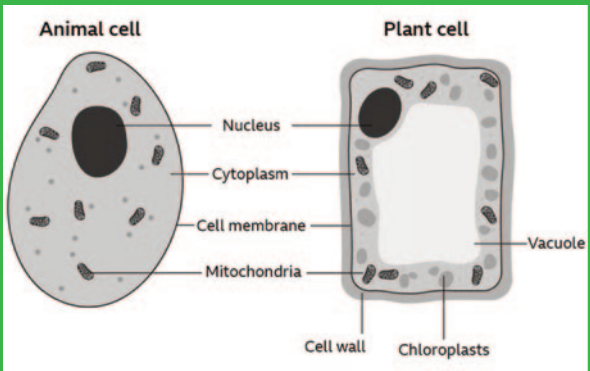
WORD	DEFINITION
Misdirection	the action or process of directing someone to the wrong place or in the wrong direction:
Motive	a reason for doing something: a driving force or desire.
Obsequious	obedient or attentive to an excessive or servile degree:
Paranoia	unjustified suspicion and mistrust of other people or their actions:
Portent	a sign or warning that a momentous or calamitous event is likely to happen:
Remorse	deep regret or guilt for a wrong committed:
Sanctuary	refuge or safety from pursuit, persecution, or other danger:
Sycophant	a person who acts obsequiously towards someone important to gain advantage.
Sovereign	a supreme ruler, especially a monarch:
Treachery	betrayal of trust or the quality of being deceptive.
Unscrupulous	Having no friends or company; isolation
Machiavellian	Cunning and scheming

TIER TWO VOCABULARY Richard III

WORD	DEFINITION
Artifice	Clever or cunning devices to trick or deceive others
Betrayal	Violation of a person's trust or moral standard
Conscience	a person's moral sense of right and wrong, viewed as acting as a guide to one's behaviour:
Corrupt	having or showing a willingness to act dishonestly in return for money or personal gain.
Cunning	having or showing skill in achieving one's ends by deceit or evasion.
Despotism	the exercise of absolute power, especially in a cruel and oppressive way.
Ego-centric	thinking only of oneself, without regard for the feelings or desires of others; self-centred.
Emancipator	someone who frees others from bondage
Favour	approval, support, or liking for someone or something:
Hamartia	A fatal flaw leading to the downfall of a tragic hero
Hubris	Excessive pride or self- confidence
Hypocrisy	the practice of claiming to have higher standards or more noble beliefs than is the case.

Year 9 Biology

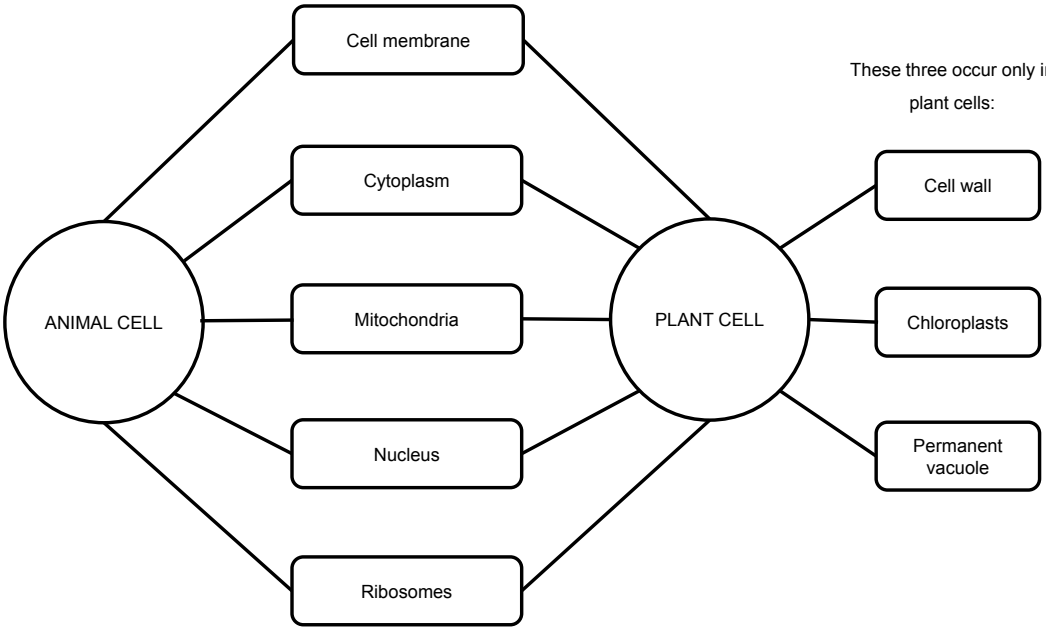
1. Cells



Both animal and plant cells contain a nucleus, cytoplasm, cell membrane, mitochondria and ribosomes. Plant cells also contain a cell wall, chloroplasts, and a permanent vacuole.

Cell organelle	Description
Cell membrane	Controls what enters and leaves the cell.
Cell wall	Made of cellulose, to strengthen the cell.
Chloroplast	The site of photosynthesis.
Cytoplasm	The site of chemical reactions.
Mitochondria	To release energy during respiration.
Nucleus	Contains **chromosomes** made of DNA molecules. Each chromosome carries a large number of genes.
Permanent vacuole	Filled with cell sap (a weak solution of sugars and salts).
Ribosomes	The site of protein synthesis (where proteins are made).

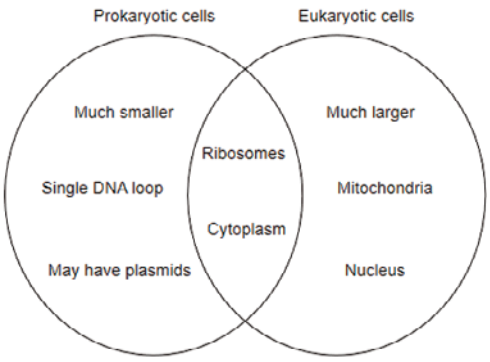
2. Organisation of Cells

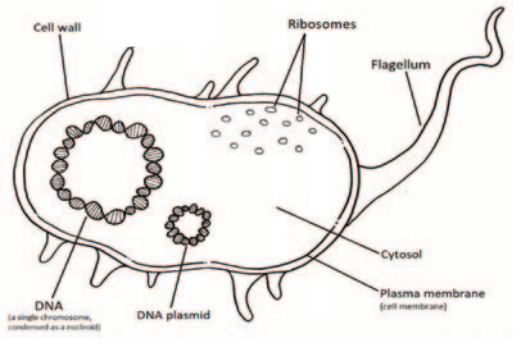


3. Eukaryotic and prokaryotic cells

Eukaryotic cells contain a nucleus.
Plant cells and animal cells are eukaryotic.

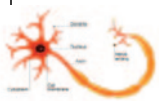
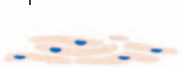
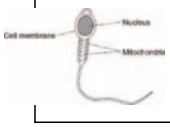
Prokaryotic cells (bacteria) are much smaller than eukaryotic cells.
They do not have a nucleus.
They do not have mitochondria but do have ribosomes.
They have a single DNA loop and may also have small rings of DNA called plasmids.



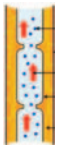


1000nm (nanometres) = 1μm
1000μm (micrometres) = 1mm
1000mm (millimetre) = 1m
10mm = 1cm (centimetre)

4. Animal Specialised Cells

Type of specialised cell	Function	Adaptations
Nerve cell 	Carry electrical impulses around the body	Lots of dendrites to make connections to other cells A very long axon that carries the electrical impulse from one place to another Contain lots of mitochondria to provide the energy needed to make special transmitter molecules, to carry impulses across gaps (synapses) between one nerve cell and the next
Muscle cells 	Contract and relax to allow movement	Contain special fibres that can slide over one another to allow the muscle to contract and relax Contain lots of mitochondria to provide energy for contraction Store glycogen which can be converted into glucose for respiration
Sperm cells 	Fertilise an egg cell	A tail for movement Middle section full of mitochondria to provide energy for tail to move Digestive enzymes in acrosome to digest a pathway into the egg A large nucleus containing half the genetic information needed to make an organism

5. Plant Specialised Cells

Specialised cell	Function	Adaptations
Root hair cell 	Absorb water and mineral ions	Large surface area available for water to move into cell by osmosis Large permanent vacuole that speeds up osmosis Lots of mitochondria that carry out respiration to provide the energy needed for active transport of mineral ions
Xylem cells 	Transport water and mineral ions from the roots to the highest leaves and shoots - always upwards.	When first formed xylem cells are alive but due to build-up of lignin the cells die and form long hollow tubes (vessels). The lignin makes the xylem vessels very strong and helps them withstand the pressure of water moving up the plant.
Phloem cells 	Transport sugars up and down the plant	End walls between cells break down to form sieve plates that allow water carrying dissolved sugars to move up and down the phloem. Neighbouring companion cells are packed with mitochondria to provide their energy needs.

6. Nucleus

Nucleus is found in animal and plant cells. → Chromosomes in the **nucleus** are made of DNA molecules. → **Chromosomes** are long strands of DNA that have been tightly wound together. → A **gene** is a section of DNA that codes for a protein. Proteins make up all parts of our cells

The nucleus contains **chromosomes** made of DNA molecules.
Each chromosome carries a large number of genes.

Gametes (sperm and egg cells) only have 1 set of chromosomes, so they have 23 chromosomes.

When human gametes come together in fertilisation, they form a zygote (fertilised egg cell) with 23 pairs of chromosomes (46 chromosomes).
Human body cells contain 23 pairs of chromosomes.

Biological structures in size order

Smallest	Gene
↓	Chromosome
↓	Nucleus
↓	Cell
↓	Tissue
Largest	Organ

7. Stem Cells and Microscopes

Use the EVERY model to complete calculations:
E = equation
V = values
E = enter results
R = result
Y = units

Magnification = size of image / size of real object

Magnification increases the size of the image.
Resolution increases the detail of the image.

Electron microscopes have higher magnification and higher resolution than **light microscopes.**

They have allowed scientists to study cells in much finer detail.

They have increased our understanding of sub-cellular structures such as mitochondria.

Type	Description
Adult stem cells	Adult cells which can form many types of cells, including blood cells.
Embryonic stem cells	Stem cells from embryos which divide and differentiate into specialised cells.
Differentiation	Specialisation of cells
Stem cells	Undifferentiated cells, capable of dividing to make lots of cells, and of differentiating to form specialised cells.
Meristem tissue	Tissue made up of stem cells in plants. It can differentiate into any type of plant cell, throughout the plant's life. Can be used to produce plant clones quickly and economically. Can be used to clone rare species. Can be used to clone plants with useful features, e.g. disease resistance.
Therapeutic cloning	Scientists can use embryo stem cells to make different types of human cells. The cells are not rejected by the patient's body, but some people have ethical or religious concerns.

8. Transport in and out of cells - diffusion

Diffusion: The overall movement of particles from high concentration to low concentration – they spread out.

Examples

Oxygen and carbon dioxide diffuse in and out of cells in **gas exchange.**

Urea moves out of cells into the blood plasma. It is a waste product. It goes to the kidney to be excreted.

Factors that affect the rate of diffusion

- The bigger the difference in concentrations, the faster diffusion is.
- The higher the temperature, the faster diffusion is.
- The bigger the surface area of the membrane, the faster diffusion is.

Diffusion and single celled organisms

Single celled organisms have a large surface area compared with their volume.

Diffusion is enough to get them all the molecules that they need.

Diffusion and larger organisms

Larger organisms have a small surface area compared to their volume.

They need exchange surfaces and transport systems to allow them to absorb enough oxygen and move it around the body.

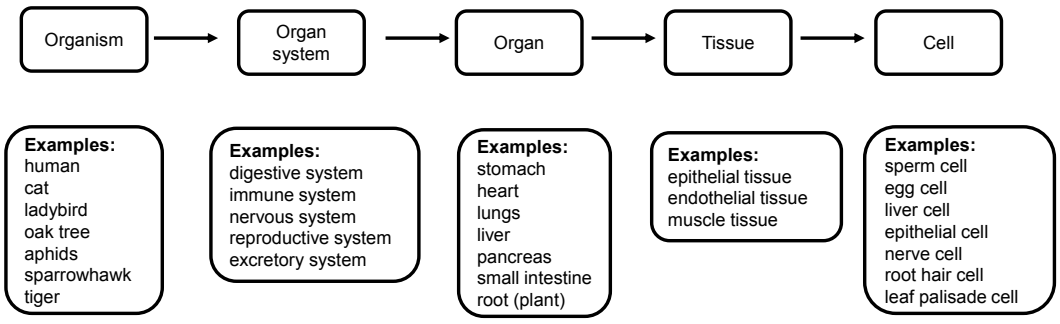
Exchange surfaces in plants have:

1. a large surface area.
2. thin membranes, to provide a short diffusion path.

Exchange surfaces in animals have:

1. a large surface area
2. thin membranes, to provide a short diffusion path.
3. a good blood supply
4. good ventilation (they breathe)

9. Levels of organisation



Basics of organisation

Cells are the building blocks of all organisms.

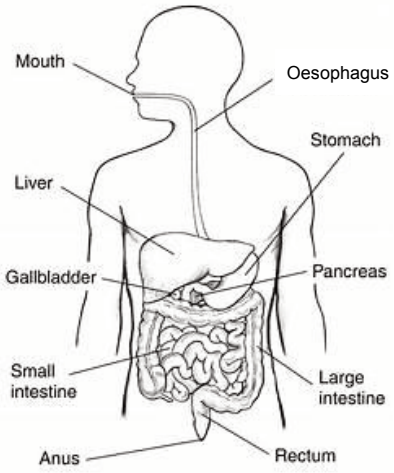
A tissue is a group of cells with a similar structure and function.

An organ is a group of tissues performing similar functions.

An organ system is a group of organs, which work together to perform a particular function.

10. Organisation of cells in the digestive system

The **human digestive system** is an example of an organ system in which several organs work together to digest and absorb food.



Organ	Function
Mouth	First stage of digestion, teeth break up food with mechanical digestion and salivary amylase breaks down food in chemical digestion.
Oesophagus	Transports food from the mouth to the stomach.
Stomach	Churns food and adds acid.
Small intestine	Adds digestive enzymes (amylase, lipase, and protease) and absorbs nutrients from the food.
Large intestine	Absorbs water, producing waste.
Rectum	Stores waste.
Anus	Waste passes out of the anus.
Liver	Produces bile. Bile neutralises stomach acid and emulsifies fats. Food does not pass through here.
Gall bladder	Stores bile which has been produced in the liver. Food does not pass through here.
Pancreas	Produces digestive enzymes: amylase, lipase, and protease. Food does not pass through here.

11. Enzymes in the digestive system

Digestive enzymes break down food into small soluble molecules that can be absorbed into the blood stream.

Digestive Enzyme	Produced by	Converts…	Into…
Amylase (carbohydrase)	Mouth, small intestine, pancreas	Starch (carbohydrates)	Sugar
Lipase	Small intestine, pancreas	Lipid (fat)	Glycerol + fatty acid
Protease	Stomach, small intestine, pancreas	Protein	Amino acids

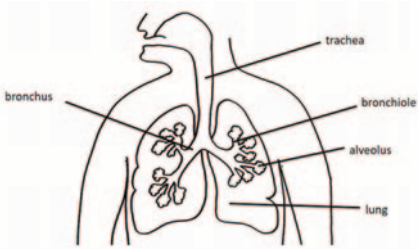
Enzymes are **specific.**
They have a specific shape (**the active site**) which works on a specific substrate – like a lock and key.

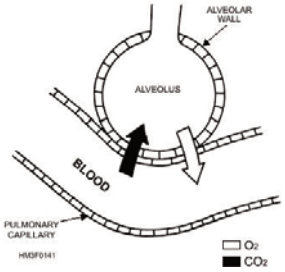
If the active site changes shape, it no longer works.
Changes in pH and temperature can **denature** – change the shape of the active site - so that it no longer works.

The products of digestion are used to build new carbohydrates, lipids and proteins.
Glucose can also be respired.

Bile is made in the liver and is stored in the gall bladder.
It is alkaline and neutralises the hydrochloric acid from the stomach.
It emulsifies fat to form small droplets, increasing the surface area. This makes fat digestion quicker.

12. The breathing system





Air enters the body through the **mouth** and **nose**.

↓

Air enters the **trachea**.

↓

The trachea divides into two **bronchi**. One **bronchus** enters each lung.

↓

Each bronchus branches out into smaller tubes called **bronchioles**. Air travels through these bronchioles.

↓

At the end of the bronchioles, the air enters one of the many millions of **alveoli** where gaseous exchange takes place

The lungs provide a good exchange surface for oxygen:

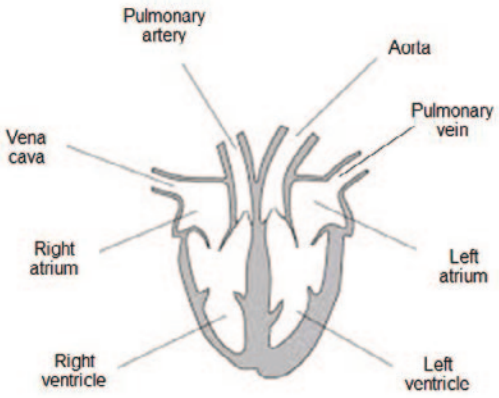
1. **Large surface area** provided by alveoli.
2. **Thin walls** of alveoli (one cell thick) and blood supply (capillary), providing a short diffusion distance.
3. **Good blood supply** to transport the oxygen away from the lungs.
4. **Well ventilated** to supply more oxygen.

13. Organisation of cells in the circulatory system 1

The heart is an **organ**.

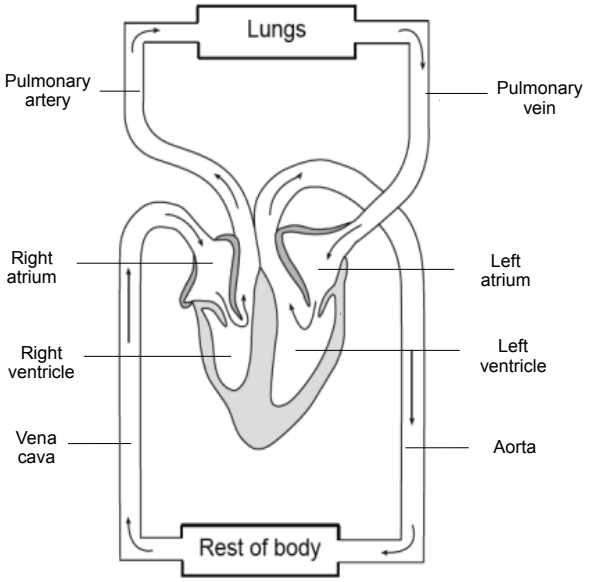
The function of the heart is to pump blood around the body.

Humans have a **double circulatory system**, which means that blood must pass through the heart **twice** to complete a full circuit of the body.



Organ	Function
Heart	Organ that pumps blood around the body in a double circulatory system.
Vena cava	Vein which brings blood from the body to the right atrium of the heart.
Right ventricle	Chamber which pumps blood to the lungs where gas exchange takes place.
Pulmonary artery	Artery takes blood from the right ventricle to the lungs.
Left ventricle	Chamber which pumps blood around the rest of the body
Pulmonary vein	Vein which brings blood from the lungs to the left atrium of the heart.
Aorta	The aorta takes blood from the left ventricle to the body.
Pacemaker	In the wall of the right atrium, controls heart rate.

14. Organisation of cells in the circulatory system 2

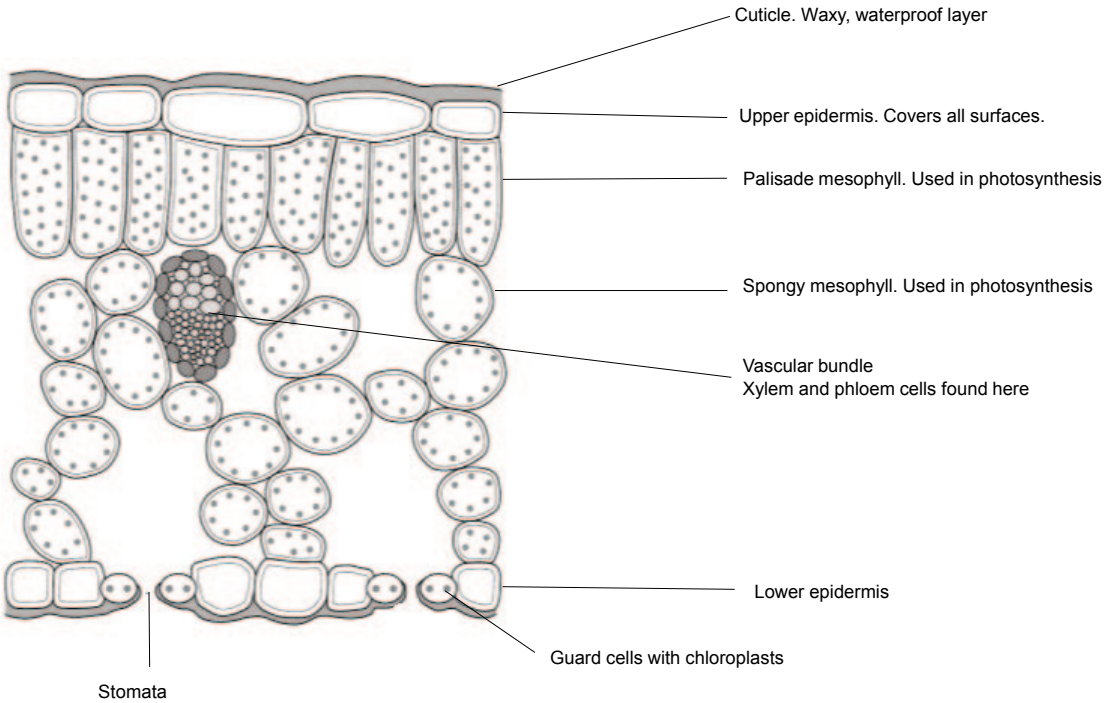


The blood is a tissue.

Blood component	Role
Plasma	Solution in which cells are suspended; carries dissolved food and hormones around the body
Red blood cells	Carry oxygen
White blood cells	Involved in immune response to fight pathogens
Platelets	Involved in blood clotting

Blood vessel	Role	Description
Artery	Carry blood away from heart	Walls contain lots of strong elastic tissue to withstand pressure
Capillary	Allow substances to diffuse into and out of the blood	Walls are one cell thick and include small holes to allow substances to move in and out easily
Vein	Carry blood to the heart	Have valves to keep blood flowing in one direction only

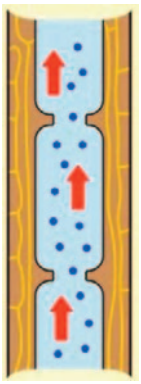
15. Cross section of a leaf



16. Organisation of cells in plants

Water is absorbed (by osmosis) by **root hair cells** that have a large surface area.
The root hair cells also absorb mineral ions (by active transport).

Xylem Cells



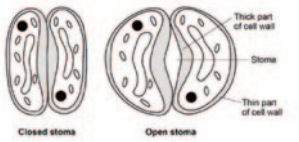
Transports **water and mineral ions** from the roots to the stems and leaves.
Made of hollow tubes, strengthened by lignin.

Transpiration is the transport of water and minerals up the xylem of a plant, and the evaporation of water through the stomata.
Transpiration is increased by
•Increased temperature
•Increased air movement
•Increased light intensity
•Decreased humidity

Phloem Cells

Translocation is the transport of sugars in the phloem, to all parts of the plant.
The leaves make sugars through photosynthesis.
The **phloem** transports dissolved sugars from the leaves to the rest of the plant for respiration or for storage of starch.
Phloem is made of tubes of elongated cells.
Cell sap (dissolved sugars) moves from one phloem cell to the next through pores in the end walls.

Stomata and Guard Cells



The **stomata** (small holes in the underside of the leaf) are needed for gas exchange in the leaf.
Water is also lost to the surroundings through the stomata.
To reduce water loss, **guard cells** can change the size of the stomata.

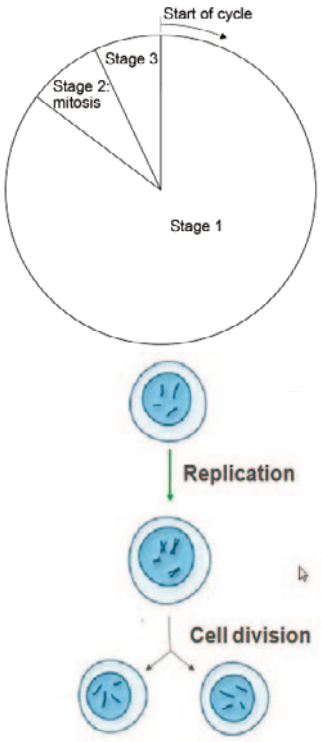
17. Coronary Heart Disease

Term	Definition
Disease	dis-ease (not at ease; something in our body or mind is not working correctly)
Coronary Heart Disease	a non-communicable disease (you can't catch it)
Coronary arteries	supply the heart muscle with oxygen and glucose
Coronary heart disease	The coronary arteries have layers of fatty material building up in them. They get narrower. Less blood can flow through the coronary arteries, so the heart muscle lacks oxygen.

Treatment	Description
Statins	Tablets used to reduce blood cholesterol. They slow down the rate of fatty material build up.
Stents	Used to keep the coronary arteries open.
Heart valve replacement	Valves keep blood flowing through the heart in the right direction. Sometimes the valves don't open fully or become leaky. This prevents blood flowing through the heart properly. The patient becomes out of breath and lacks energy. Faulty heart valves can be replaced with new biological valves (from a donor) or mechanical valves.
Heart failure	Can be treated with a new heart and lungs. The heart would come from a donor. Mechanical hearts can be used to keep the patient alive whilst waiting for a heart transplant.

18. Cell Cycle: Mitosis

Stage of the cell cycle	Events
1	The cell grows. The DNA replicates to form two copies of each chromosome. New mitochondria and ribosomes are made.
2	**Mitosis**: one set of chromosomes is pulled to each end of the cell. The nucleus divides.
3	The cytoplasm and cell membranes divide. There are now two identical cells.



Uses of cell division by mitosis

1. Growth
2. Repair of tissues
3. Asexual reproduction

19. Cell Cycle: Mitosis and Cancer

Stage of the cell cycle	Events
1	The cell grows. The DNA replicates to form two copies of each chromosome. New mitochondria and ribosomes are made.
2	Mitosis: one set of chromosomes is pulled to each end of the cell. The nucleus divides.
3	The cytoplasm and cell membranes divide. There are now two identical cells.

Uses of cell division by mitosis

1. Growth
2. Repair of tissues
3. Asexual reproduction

Cancer is the result of uncontrolled growth and division of cells. This is caused by a change in the genetic material of the cell.

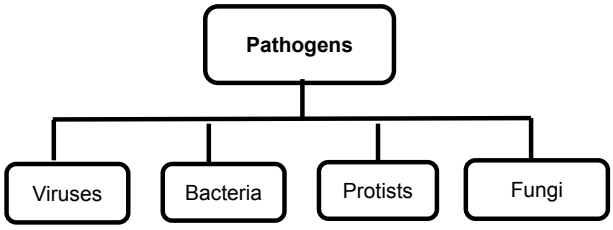
Benign tumours are growths of abnormal cells.
They are contained in one area, usually within a membrane. They do not invade other parts of the body.

Malignant tumour cells are cancers.
They invade neighbouring tissues and spread around the body in the blood, where they form secondary tumours.
Lifestyle factors and genetic factors can be risk factors for cancers.

20. Communicable diseases: pathogens

Communicable diseases are diseases caused by pathogens – they can spread from one organism to another.

Pathogens are organisms that cause infectious disease.
They can be viruses, bacteria, protists or fungi.
Pathogens may infect plants or animals.
Pathogens can spread by direct contact, water or by air.



Bacteria reproduce rapidly inside the body.
Bacteria produce poisons/toxins that damage tissues and make us feel ill.

Viruses reproduce rapidly inside the body.
Viruses live and reproduce inside cells, causing cell damage.

21. Communicable diseases: viruses

Pathogen	Disease	Transmission	Symptoms	Treatment or prevention
Virus	Measles	Sneezing and coughing produces droplets containing the virus; these droplets can be inhaled by others.	Fever and red skin rash. It can be fatal if there are complications.	Most young children are vaccinated against measles.
Virus	HIV/AIDs	Sexual contact or exchange of body fluids such as blood.	Flu-like illness, which then attacks the body's immune cells. Late stage HIV, known as AIDS, happens when the immune system is so damaged that it cannot deal with infections or cancers	treated with antiretroviral drugs.
Virus	Tobacco mosaic virus (TMV)	By direct contact	A distinctive mosaic pattern of discoloration on the leaves. The leaves can't photosynthesise as well, which affects the growth of the plant.	Remove infected plants; wash hands when handling plants to prevent transfer from one to another

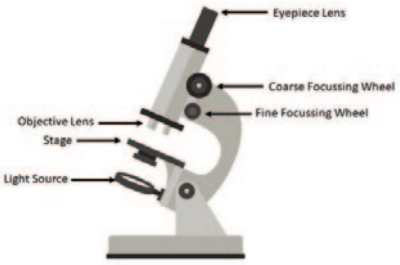
22. Communicable diseases: bacteria, fungi and protists

Pathogen	Disease	Transmission	Symptoms	Treatment or prevention
Bacterium	Salmonella (food poisoning)	Undercooked chicken, or contamination of surfaces from raw chicken	Fever, abdominal cramps, vomiting and diarrhoea, caused by the bacteria and the toxins from the bacteria.	Poultry (chicken, turkey and ducks) are vaccinated against salmonella to control the spread
Bacterium	Gonorrhoea	sexually transmitted disease	Thick yellow or green discharge from the vagina or penis; as well as pain when urinating.	Antibiotics, although there are many resistant strains. Barrier methods of contraception can reduce the spread.
Fungus	Rose black spot	by wind or water	Purple or black spots develop on leaves. The leaves turn yellow and drop off. The leaves don't photosynthesise well, which affects the growth of the plant.	Fungicides and removing and destroying the affected leaves.
Protist	Malaria	Spread by mosquito bites.	Recurrent (repeating) episodes of fever. It can be fatal.	Prevented by stopping mosquitos from breeding, and by avoiding being bitten e.g. with a mosquito net.

23. Required Practicals 1 – Microscopy and Food Tests

Using a Microscope

1. Light on
2. Platform (stage) high
3. Lowest magnification objective lens first
4. Coarse focus first, then fine focus



Rules for Biological Drawings

- Sharp pencil
- Smooth lines
- Ruler for label lines
- No arrowheads
- Add magnification (multiply eyepiece lens by objective lens)

Food tests

Food	Test	Positive result
Starch	add iodine solution	turns black
Sugars	add Benedict's solution → heat	makes (orange) precipitate
Protein	add Biuret solution	turns purple
Fats (lipids)	add ethanol → shake → add water → shake	cloudy white emulsion

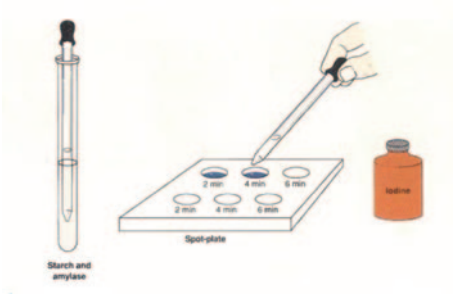
24. Required Practical 2 - Enzymes

Investigate the effect of pH on the reaction of amylase enzyme

IV: pH (change using at least 5 different buffer solutions)

DV: time taken to digest starch (measured as the time it takes for a sample of the mixture **not** to turn black when mixed with iodine solution)

CV: volume and concentration of amylase solution; volume and concentration of starch solution; temperature; time for samples



Method:

1. Place known volume of starch solution into a boiling tube.
2. Place known volume of amylase solution into the boiling tube.
3. Stir using a glass rod.
4. Take a sample of mixture and place onto a spot tile.
5. Add a drop of iodine solution to the spot tile; repeat every 30s; record the time taken for the mixture not to turn black.
6. Repeat steps 1 – 5 for at least 5 different pHs.

Y9 Chemistry

CONTENTS

25. Atoms, Elements, Compounds and Mixtures

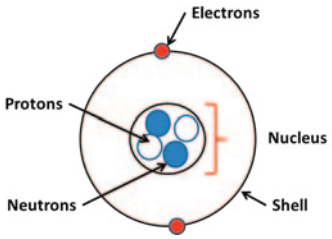
Keyword	Definition
Atom	smallest part of an element
Element	made up of only one type of atom
Compound	made from at least two elements, chemically combined
Mixture	made of two or more elements or compounds not chemically combined together

Radius of an atom = 0.1nm (1×10^{-10}m).

Radius of a nucleus is less than 1/10 000 of that of an atom.
This is 1×10^{-14}m.

Atoms are **neutral** (no electrical charge) because: -The number of protons and electrons are the same. -The charges cancel out
Atomic number = Proton number
Mass number = Number of protons and neutrons
Number of electrons = Number of protons

Structure of the atom (Nuclear model)



Subatomic particle	Relative charge	Relative mass
Proton	+1	1
Neutron	0	1
Electron	-1	1/1840

26. Structure of the Atom

7 Li 3

Top number

Bottom number

Proton = bottom number

Electron = bottom number

Neutron = top number – bottom number

Electronic Configuration

Electrons are arranged in shells.

1st shell – maximum of 2 electrons

2nd shell – maximum of 8 electrons

3rd shell – maximum of 8 electrons

Isotopes:

Atoms of the same element that have different numbers of neutrons but the same number of protons and electrons.

They have the same chemical properties but different physical properties.

39 Ar 18	38 Ar 18
18 protons 18 electrons 21 neutrons	18 protons 18 electrons 20 neutrons

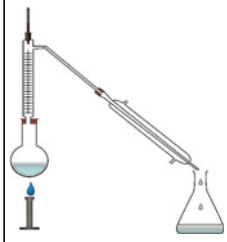
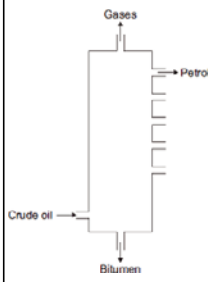
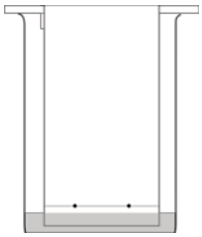
Calculating Relative Isotopic Abundance

Mass number	Abundance (%)
39	93.1
41	6.9

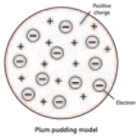
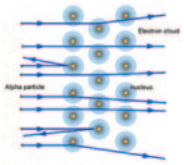
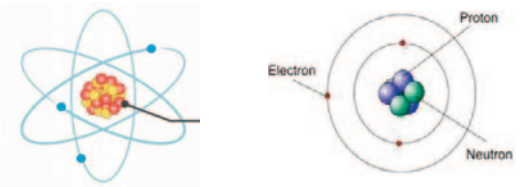
$$= \frac{(39 \times 93.1) + (41 \times 6.9)}{93.1 + 6.9}$$

$$= 39.1$$

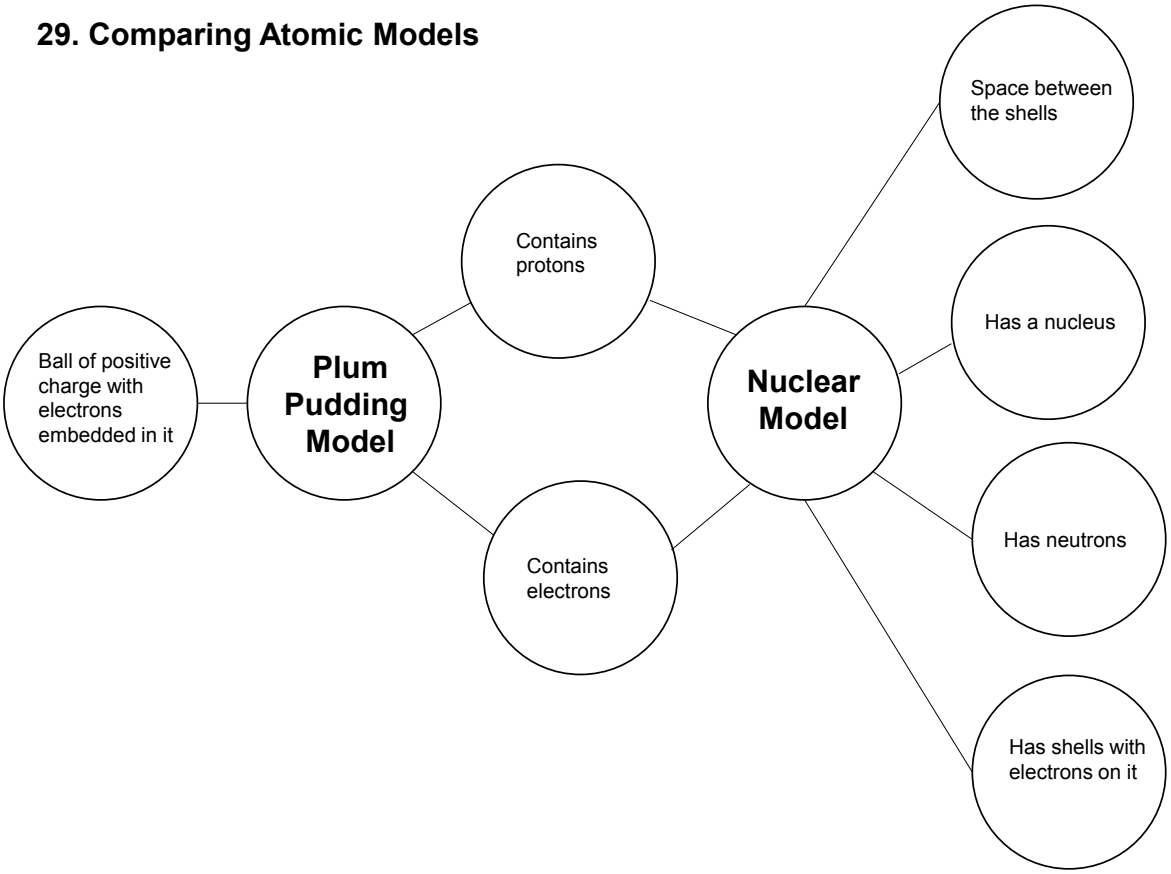
27. Separating Mixtures

Process	Filtration	Distillation	Fractional distillation	Chromatography
Diagram				
Physical property	Difference in solubility	Difference in boiling points	Difference in boiling points	Difference in solubility
Example	Sand and salt	Ink and water	Ink, water and oil	Different colours in dyes

28. History of the Atom

Atomic model	Plum pudding model		Nuclear model		
Diagram					
Discovery	Electron	Positive nucleus in the centre of the atom	Electrons occupy shells Electrons are at specific distances from the nucleus	Neutrons	• Atomic radius: 1×10^{-10} m • Radius of a nucleus is less than 1/10 000 of the radius of an atom. • Most of the mass of an atom is concentrated in the nucleus. • The electrons are arranged at different distances from the nucleus.
Description	The atom is a ball of positive charge with negative electrons embedded in it.	Positively charged alpha particles were fired at thin gold foil. Most alpha particles went straight through the foil. A few were scattered in different directions by the atoms in the foil. It showed that the mass of an atom was in the centre (the nucleus) and the nucleus was positively charged.		Proved the existence of isotopes	
Discovered by	Thompson	Rutherford	Bohr	Chadwick	

29. Comparing Atomic Models



30. Ionic and Covalent Bonding

Ionic Bonding (metal & non-metal)

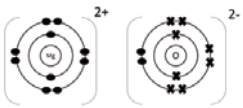
Structure: Giant ionic lattice

Electrons are lost or gained to achieve a full outer shell.

Ionic bond: Electrostatic attraction between oppositely charged ions.

Ions held in a fixed lattice.

Charge of ion: +2 (loses 2 electrons) and -2 (gains 2 electrons)



Describing the formation of an ionic compound

Example 1: NaF

Na atom loses 1 electron to form Na^{1+} ion.

F atom gains 1 electron to form F^{1-} ion

Example 2: Na_2O

Two Na atoms each lose 1 electron to form two Na^{1+} ions.

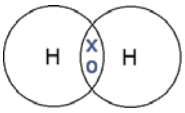
One O atom gains 2 electrons to form O^{2-} ion.

Covalent Bonding (2 x non-metals)

Covalent bond: Pairs of electrons are shared between the atoms.

Sharing one pair of electrons = single bond

Sharing two pairs of electrons = double bond



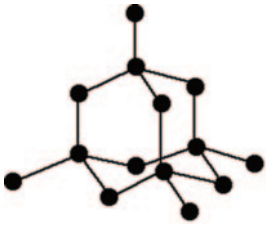
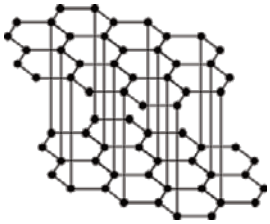
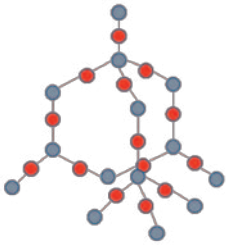
Simple Molecules

(2 x non-metals, covalent bonding)

Simple molecules (small molecules)

e.g. H_2, Cl_2, O_2, N_2, HCl, H_2O

31. Giant Covalent Bonding

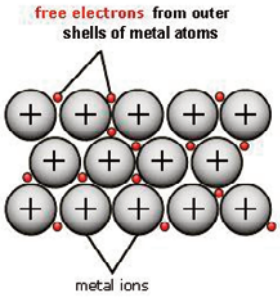
	Diamond	**Graphite**	**Silicon dioxide**
Bonding	Giant covalent	Giant covalent	Giant covalent
Made of	Carbon	Carbon	Silicon and oxygen
Structure	Each carbon atom forms four C-C covalent bonds.	Each carbon atom forms three covalent bonds with three other carbon atoms, forming layers of hexagonal rings . The 4th electron is delocalised	Each silicon atom forms four covalent bonds with oxygen atoms
Diagram			

32. Metallic Bonding and Alloys

Metallic Bonding

Metallic bond: Attraction between the positive metal ion and delocalised electrons.

Structure: Layers of metal positive ions surrounded by delocalised electrons

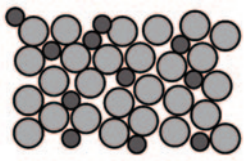


Alloy

Mixtures of metals with metals or a non-metal

e.g. stainless steel is a mixture of iron and carbon

Structure: Irregular layers



33. Quantitative Chemistry

Relative formula mass (RFM or M_r)

This is the mass in grams of 1 mole of the substance.

To calculate M_r (top number) you need to add up the atomic mass (Ar) of all of the atoms in the molecule.

Example1. NaCl = Na + Cl = 23 + 35.5 = 58.5

Example 2. MgF_2 = Mg + (2 x F) = 24 + (2 x 19) = 62

% Mass of an Element in a compound

$$\% \text{ mass of an element} = \frac{\text{Atomic mass of element x number of atoms}}{\text{Relative formula mass of compound}} \times 100$$

Remember: $\frac{\text{part}}{\text{whole}} \times 100$

Conservation of Mass

During a chemical reaction, no atoms are made, no atoms are destroyed.

Decrease in mass:

$CaCO_3$ (s) ⟶ CaO (s) + CO_2 (g)

Carbon dioxide is a gas which is a product

Carbon dioxide escapes into the air.

Increase in mass:

2Mg(s) + O_2 (g) ⟶ 2MgO (s)

Mg reacts with oxygen in the air

Oxygen has added to the magnesium

Concentration of a solution

dm^3 ⟷ cm^3 (X 1000 / ÷ 1000)

Concentration (g/dm^3) = mass (g) ÷ volume (dm^3)

34. Acids and Alkalis

Acid	Chemical formula
Sulfuric acid	H_2SO_4
Nitric acid	HNO_3
Hydrochloric acid	HCl

Alkali	Chemical formula
Sodium hydroxide	NaOH
Potassium hydroxide	KOH

Acid	Salt name ending
Hydrochloric	-chloride
Nitric acid	-nitrate
Sulfuric	-sulfate

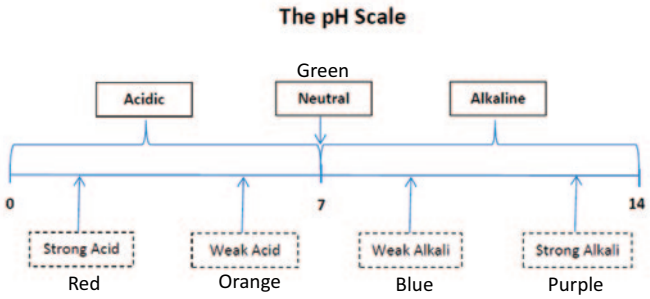
The pH Scale

It can be measured with a pH probe, or universal indicator.

Acid: pH 0-6

Neutral: pH 7

Alkali: pH 8-14



Neutralisation

Acids contain hydrogen ions (H^+)

Alkalis contain hydroxide ions (OH^-)

acid + alkali → water

Ionic equation: H^+ (aq) + OH^- (aq) → H_2O (l)

35. Reactions of Acids to Make a Salt (Neutralisation)

Reaction 1	**Reactions of Acids with Metals (Neutralisation)**
Rule	acid + metal → salt + hydrogen
Example	hydrochloric acid + magnesium → magnesium chloride + hydrogen

Reaction 2	**Reactions of Acids with Metal Oxide (Neutralisation)**
Rule	acid + metal oxide → salt + water
Example	sulfuric acid + magnesium oxide → magnesium sulfate + water

Reaction 3	**Reactions of Acids with Metal Hydroxide (Neutralisation)**
Rule	acid + metal hydroxide → salt + water
Example	nitric acid + magnesium hydroxide → magnesium nitrate + water

Reaction 4	**Reactions of Acids with Metal Carbonate (Neutralisation)**
Rule	acid + metal carbonate → salt + water + carbon dioxide
Example	nitric acid + magnesium carbonate → magnesium nitrate + water + carbon dioxide

36. Strong and Weak Acids

Strong acid

Completely ionised (breaks down) in aqueous solution.

$HCl \rightarrow H^+ + Cl^-$

Examples*:* Hydrochloric acid (HCl), nitric acid (HNO_3) and sulfuric acid (H_2SO_4).

Lower pH numbers (pH 1-3)

The stronger the acid, the more it ionises in solution, and the more hydrogen ions there are in the solution.

Concentrated acid

More hydrogen ions (H^+) per volume

Weak acid

Partially ionised (breaks down) in aqueous solution.

$CH_3COOH \rightarrow CH_3COO^- + H^+$

Examples: Ethanoic acid, citric acid and carbonic acid.

Higher pH numbers (pH 4-6)

pH

If the hydrogen ion concentration in a solution increases by a factor of 10, the pH of the solution decreases by 1.

Volume of acid (cm^3)	**pH**
10	3
1000	5

37. Energy Changes

Exothermic Reaction. Energy is transferred from particles to the surroundings. Temperature increases.
Examples: Combustion, many oxidation reactions, neutralisation.
Every day uses: self-heating cans and hand warmers.

Endothermic reaction. Energy is transferred from the surroundings to the particles. Temperature decreases.
Example: Thermal decomposition and the reaction between citric acid and sodium hydrogencarbonate.
Every day uses: sports injury packs.

Activation energy: minimum amount of energy required for the reaction to start.

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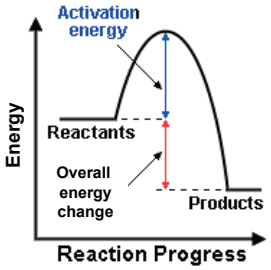

Exothermic reaction

Exothermic energy profile:
Reactants are **higher** in energy than the products.
Energy is released to the surroundings.

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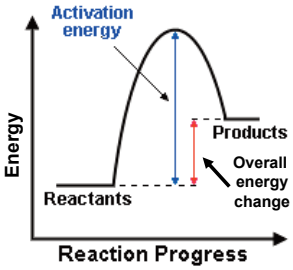


Endothermic reaction

Endothermic energy profile:
Reactants are **lower** in energy than the products.
Energy is absorbed by the surroundings.

.

38. Types of Chemical Reactions

Chemical Reactions

Thermal decomposition
The breakdown of a compound using heat

potassium carbonate → potassium oxide + carbon dioxide

Reactants: Potassium carbonate
Products: Potassium oxide and carbon dioxide

Test for carbon dioxide
Test: Bubble through limewater
Result: Limewater turns cloudy

Examples of fuels: propane and butane

Oxidation
A chemical reaction where oxygen is added.

iron + oxygen → iron oxide

Reactants: iron and oxygen
Products: iron oxide

Combustion (burning) – FO COW
A reaction where oxygen is burned with a fuel to make heat and light.
Combustion must have fuel, heat and oxygen.

FUEL + **O**XYGEN → **C**ARBON DIOXIDE + **W**ATER
methane + oxygen → carbon dioxide + water

Reactants: methane and oxygen
Products: carbon dioxide and water

Incomplete Combustion
Burning with not enough oxygen
Products: carbon monoxide, soot, carbon dioxide and water.

Complete Combustion
Burning with plenty of oxygen
Products: carbon dioxide and water.

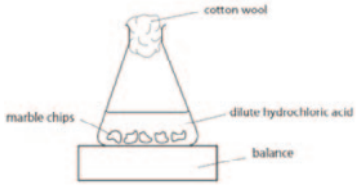
39. Conservation of mass

In a reaction, the atoms you start with are the same as those that you make.

mass of the reactants = mass of the products.

$H_2 + Cl_2 \rightarrow 2HCl$

Reactant side has 2 H and 2 Cl atoms.
The product side has 2 H and 2 Cl atoms.
If one side has a mass of 25g, the other side will have a mass of 25g

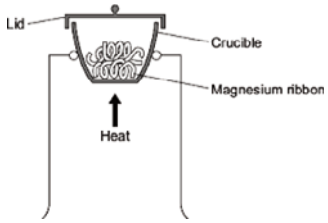


Loss in mass

calcium carbonate → calcium oxide + carbon dioxide

Explanation:

- Carbon dioxide is a gas
- It escapes into the atmosphere



Gain in mass

magnesium + oxygen → magnesium oxide

Explanation:

- Oxygen gas is added
- Oxygen comes from the air

40. Calculating Bond Enthalpy

Energy IN
Total energy needed to break the bonds in the reactants

—

Energy OUT
Total energy needed to form the bonds in the products

=

Energy CHANGE
Overall energy change

Exothermic reaction.

Negative value

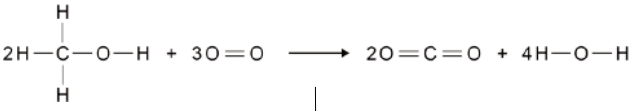
Total energy needed to break the bonds in the reactants 《 Total energy needed to form the bonds in the products

Endothermic reaction.

Positive value.

Total energy needed to break the bonds in the reactants 》 Total energy needed to form the bonds in the products

	C–H	C–O	O–H	O=O	C=O
Bond energy in kJ / mol	412	360	464	498	805



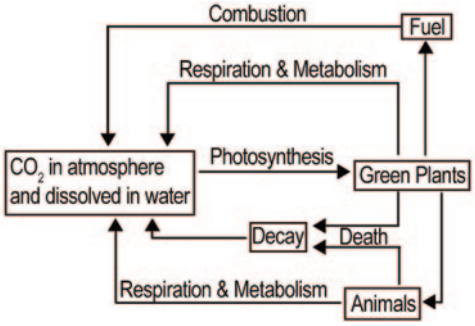
6 x (C-H) = 6 x 412 = 2472
2 x (C-O) = 2 x 360 = 720
2 x (O-H) = 2 x 464 = 928
3 x (O=O) = 3 x 498 = 1494
TOTAL = 5614

4 x (C=O) = 4 x 805 = 3220
8 x (O-H) = 8 x 464 = 3712
TOTAL = 6932

5614 – 6932= -1318

41. The Carbon Cycle

The carbon cycle shows how carbon moves through organisms and as carbon dioxide (CO_2) in the atmosphere.



Earth's atmosphere: 78 % nitrogen, 21 % oxygen, <1 % carbon dioxide, plus small amounts of other gases.

How carbon is recycled: By photosynthesis (COW GO) and respiration (GO COW).

Reasons why CO_2 levels have increased:

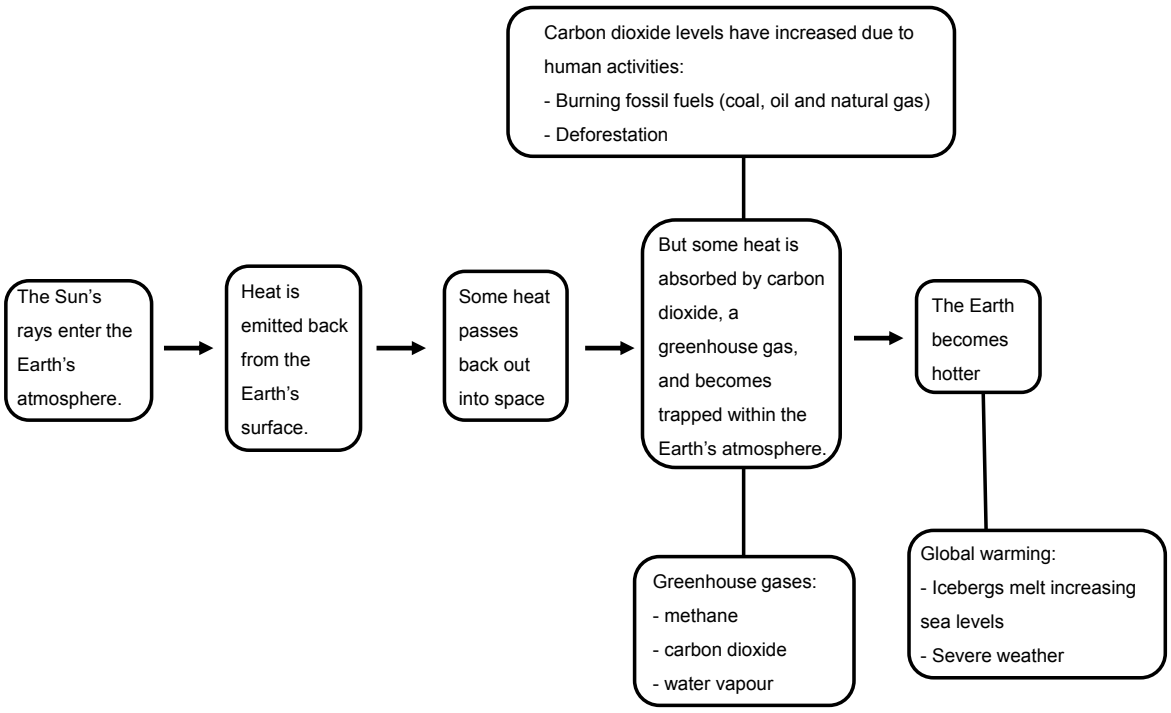
Human activities such burning fossil fuels (FO COW) and deforestation.

Greenhouse effect:

Greenhouse gases are carbon dioxide, methane, water vapour and ozone.

Scientists have evidence that global warming caused by human activity is causing changes in the climate.

42. The Greenhouse Effect



43. Required Practical 1: Making a salt

Making a soluble salt

1. Add excess copper oxide to sulfuric acid in a beaker
2. Stir using a stirring rod
3. Filter using a funnel and filter paper into a conical flask.
4. Evaporate the water from the copper sulfate solution in an evaporating dish using gentle heat until half the volume is left.
5. Leave on windowsill to form crystals.
6. Pat dry crystals.

Reasoning for the steps

Step 1: Excess metal oxide used so that all the acid reacts.
Step 2: Reaction stirred so all the chemicals react.
Step 3: Removal of excess copper oxide. Excess copper oxide used as it is easier to remove than excess acid
Step 4: Slow this step down by using a water bath

Observations:

Black solid (copper oxide) is left in the filter paper
Colour change

44. Required Practical 2 – Energy Changes

Reacting two solutions, e.g. acid and alkali

1.Place the polystyrene cup inside the glass beaker
2.Using a measuring cylinder, measure 25 cm^3 of acid
3. Add to polystyrene cup.
4.Record the temperature of the acid using a thermometer.
5.Add 5cm^3 of alkali to the polystyrene cup and record the temperature obtained.
6.Repeat with 5cm^3 of alkali until 40 cm3 of alkali has been added

IV: Volume of alkali
DV: Temperature of reaction mixture
CV: Type of acid and alkali, volume of acid

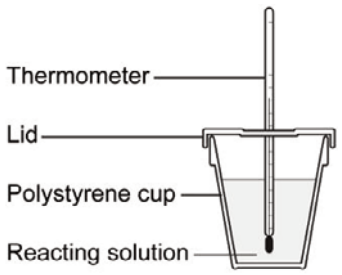
To improve the accuracy

Use polystyrene cup
Add a lid
Repeat the experiment and calculate the mean ignoring anomalous results
Valid results: Repeat 3 times, identify the anomalous results, calculate the mean

Reacting a solid with a solution, e.g. metal and solution

1.Place the polystyrene cup inside the glass beaker to make it more stable.
2.Using a measuring cylinder, measure 25 cm^3 of copper sulfate solution
3.Place the solution in a polystyrene cup.
4.Record the temperature of the solution using a thermometer.
5.Using a balance, weigh out 1g zinc powder
6.Add the zinc powder and record the temperature.
7.Repeat steps 1-6 with different masses of zinc powder

IV: Mass of metal
DV: Temperature of reaction mixture
CV: Concentration and volume of copper sulfate solution



Y9 Physics

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46. Kinetic energy and elastic potential energy
47. Work done
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45. Energy stores and systems

Energy System

System:
An object or group of objects.
When a system changes there are changes in the way energy is stored within it.

Closed system:
Where neither matter nor energy enters or leaves.

Conservation of energy:
Energy is not created or destroyed but may be transferred between different energy stores.

The energy in a system can be transferred between different stores when work is done by:
- Heating
- Current flowing
- Mechanical by waves

Energy Store	Example
Thermal	Cup of hot tea
Kinetic	Moving car
Gravitational Potential	Water in a reservoir at the top of a mountain
Elastic Potential	Stretched bungee cord
Chemical	Battery, food
Magnetic	Two opposing north poles on bar magnet
Electrostatic	Two electrons repelling each other
Nuclear	The energy available to be released by fission when splitting an atom

46. Kinetic Energy and Elastic Potential Energy

Kinetic Energy

Kinetic energy of an object depends on the:
- mass
- speed

Kinetic energy (J) = 0.5 x mass (kg) x velocity^2 (m/s)

$E_k = 0.5mv^2$

Unit conversions:
kJ to J: x 1000
g to kg: ÷ 1000

Elastic Potential Energy

A force acting on an object may cause the shape of an object to change.

Elastic objects can store elastic potential energy if they are stretched or squashed. For example, this happens when a catapult is used or a spring is stretched.

Objects can also store elastic potential energy when they are squashed.

Elastic potential energy (J) = 0.5 x spring constant (N/m) x extension^2 (m)

Unit conversions:
kJ to J: x 1000
cm to m: ÷ 100

47. Work Done

A car braking to slow down
The friction force from the brakes does work. Energy is transferred from the car's kinetic store to the thermal store of its brakes, the brakes then transfer heat to the surroundings.

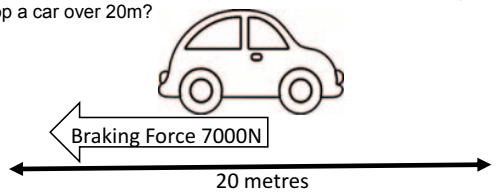
Energy transferred = work done

work done (J) = force (N) x distance (m)

W = Fs

Unit conversions:
kJ to J: x 1000
cm to m: ÷ 100
km to m: x 1000

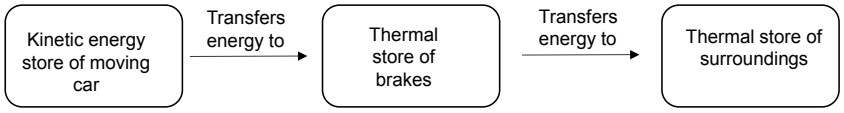
Example: How much work is done by the brakes if a 7000N braking force is used to stop a car over 20m?



Use the EVERY model to complete calculations:
E = equation
V = values
E = enter results
R = result
Y = units

E	W = F x s
V	F = 7000 N and s = 20 m
E	W = 7000 x 20
R	W = 140 000
Y	J

W = 140000J or 140 kJ



48. Gravitational Potential Store (E_p)

Raising an object off the ground increases its gravitational potential energy store.

The amount of energy depends on the mass and height of the object and strength of the gravitational field it is in.

Gravitational potential energy store (J)	**= mass (kg) x**	**gravitational field strength (N/kg)**	**x change in height (m)**

$E_p = mgh$

Unit conversions:
kJ to J: x 1000
cm to m: ÷ 100
km to m: x 1000
g to kg: ÷ 1000

Note: weight = mass x gravitational field strength

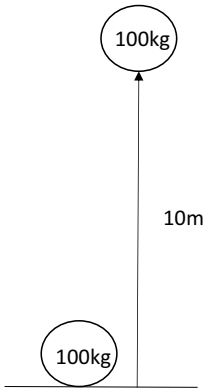
W = m x g

Therefore, we have a second formula for E_p

E_p = Weight x change in height

$E_p = W \times \Delta h$

Example: What is the gravitational energy required to lift a 100 kg mass up by 100 m?
Gravitational field strength = 9.81N/kg



Use the EVERY model to complete calculations:
E = equation
V = values
E = enter results
R = result
Y = units

E $E_p = m \times g \times h$
V m = 100 kg; g = 9.81; h = 100 m
E $E_p = 100 \times 9.81 \times 100$
R $E_p = 98100$
Y J

E_p = 98100 J

49. Specific Heat Capacity (c) and Power

The amount of energy needed to raise the temperature of 1 kg of a substance by 1 °C.

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

$\Delta E = mc\Delta T$

Unit conversions:
kJ to J: x 1000
g to kg: ÷ 1000

Example: How much energy is released into the surroundings when a cup of tea holding 250g of fluid cools from 90°C to 20°C? c = 4200 J/kg°C

Use the EVERY model to complete calculations:
E = equation
V = values
E = enter results
R = result
Y = units

E $\Delta E = m \times c \times \Delta\theta$
V m = 250 g = 0.25 kg; c = 4200; $\Delta\theta$ = 90-20 = 70
E $\Delta E = 0.25 \times 4200 \times 70$
R 73 500
Y J

ΔE = 73500J or 73.5 kJ

Power

Power is the rate at which energy is transferred and is measured in watts.

1 watt = 1 joule of energy transferred per second.

Power (W) = energy transferred (J) ÷ time (s)

Power (W) = work done (J) ÷ time (s)

P = E ÷ t

Unit conversions:
kJ to J: x 1000
minutes to seconds: x 60
hours to seconds: x 3600
W to kW: ÷ 1000

Example. Calculate the power of a motor that uses 60,000 J of energy to lift an object in 20 seconds. Give your answer in kW.

E $P = E \div t$
V E = 60 000J; t = 20 s
E $P = 60\,000 \div 20$
R 3000
Y W

P = 3000W or 3kW

A more powerful device can transfer more energy in a given time or will transfer the same amount of energy in a faster time.

50. Conservation of Energy

Dissipation of energy	Wasting energy. More energy needs to be put into appliance to account for dissipated energy. Useful dissipation of energy example: back of a fridge Example of dissipation of energy is bad: light bulbs, engines and TV's as heat
Conservation of energy	Energy can be transferred usefully, stored or dissipated, but it cannot be created or destroyed
Heat	When an object is heated, thermal energy is being transferred to it
Temperature	A measure of hot or cold something is

Reducing Wasted Energy (dissipated energy)	
Friction	Between two moving objects causes thermal energy to be dissipated. It can be reduced by lubrication.
Lubrication	• Friction between two moving objects causes energy to be dissipated as sound and to the thermal store.
Insulation	Reduces energy transfer by heating
Cavity wall insulation	Fills the air gap between the inner and outer wall reducing heat loss by convection.
Loft insulation	Reduces heat loss by convection.
Double glazing	• Creates an air gap between the two panes of glass to reduce energy loss by conduction. • Gases are good insulators
Draught excluders	Reduce energy loss by convection when placed around windows and doors.
Reflective material behind radiators	To keep infrared radiation in the room

51. Efficiency

Appliance	Useful Energy	Dissipated (wasted) Energy
Light bulb	Light	• Heating the bulb and surroundings
Hair Dryer	• Kinetic energy of the fan to push air • Heating of the air	• Sound of the motor. • Heating of the dryer and surroundings
Electric Motor	• Kinetic energy of objects driven by motor. • Gravitational potential energy of objects lifted by motor	• Heating of the motor and surroundings. • Sound of the motor turning

Efficiency

An efficient device wastes less energy than a less efficient device. It can be calculated as a decimal or multiplied by 100 to give a percentage.

Efficiency = $\frac{\text{useful energy output}}{\text{total energy output}}$ **Efficiency = $\frac{\text{useful power output}}{\text{total power input}}$**

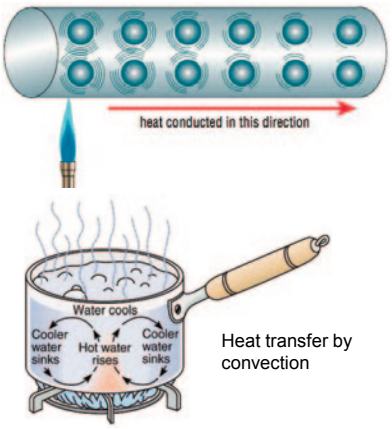
Example:. Calculate the wasted power and efficiency of a motor that has a rated power of 500W and transfers 300W usefully.

Wasted power = input power - output power = 500 – 300 = 200W

$$\text{Efficiency} = \frac{300}{500} = 0.6 \text{ 0r } 60\ \%$$

52. Methods of Heat Transfer

Heat Transfer Method	Description
Conduction (Occurs in solids)	When heated particles vibrate more with an increase in their kinetic energy. They collide more with surrounding particles transferring the heat
Convection (Occurs in liquids and gases)	Particles are free to move (in a liquid and gas). Increase in their kinetic store. Particles move faster. The space between the particles increases, so the density decreases. The warmer less dense region rises and the cooler, denser regions sink.
Infrared Radiation (Occurs in all objects)	The hotter an object the more infrared radiation it emits in a given time. An object at constant temperature emits and absorbs infrared radiation at the same rate A perfect black body absorbs all the infrared radiation that falls upon it and then emits it back at the same rate as it absorbs it.



Heat transfer by convection

Conductivity

How well a material transfers electricity or thermal energy.

Metals have a higher conductivity than non-metals as they have delocalised electrons which can move through the structure transferring energy

The best insulator has **low** conductivity

53. Non-Renewable Energy Resources

Renewable energy resources will never run out. It is an energy resource that can be replenished quickly.

Non-renewable resources will one day run out (fossil fuels). Fossil fuels are coal, oil and natural gas.

Energy Resource	Uses	Advantages	Disadvantages
Coal	Electricity generation, heating, steam trains in some countries	• Reliable energy resource • Low extraction costs • High energy per kg	All fossil fuels are running out. Burning fossil fuels releases carbon dioxide a greenhouse gas which causes global warming. SO_2 found in coal leads to acid rain when burned.
Oil	Electricity generation, heating, basis for petrol and diesel	• Reliable energy resource • Low extraction costs • High energy per kg	Burning fossil fuels releases carbon dioxide a greenhouse gas which causes global warming.
Gas	Electricity generation, heating, cooking	• Reliable energy resource • Gas fired power stations can be started quickly to meet changing energy demands	Burning fossil fuels releases carbon dioxide a greenhouse gas which causes global warming.
Nuclear	Electricity generation Fuel: Uranium or plutonium	• Reliable energy resource • It has the highest energy density per kg of any fuel. • Does not require combustion and therefore does not release carbon dioxide into the atmosphere	The waste products from nuclear plants is dangerous radioactive waste which needs to be stored safely for hundreds of years.

54. Renewable Energy Resources 1

Energy Resource	Uses	Advantages	Disadvantages
Solar Energy	• Heating domestic hot water. • Photovoltaic cells in solar cells can create electricity to charge batteries. • Electricity generation in large scale solar power plants	• No atmospheric pollution due to burning of fossil fuels • In sunny countries it is more reliable (during the day) • Useful for remote places not supplied by the national grid. • No fuel costs and minimal running costs	• Cannot increase supply to match demand • High initial costs • Unreliable due to weather • Does not work at night
Wind Power	Electricity generation	• No atmospheric pollution due to burning of fossil fuels • No fuel costs and minimal running costs No permanent damage to the landscape when removed. • Fast start-up	• Visual and noise pollution • Cannot increase supply to match demand • High initial costs • Cannot generate electricity if there is too little wind • Unreliable
Geothermal	• Electricity generation • Heating	• Reliable • No atmospheric pollution due to burning of fossil fuels	• Few suitable locations (only possible in volcanic areas) • High cost to build power station
Bio-fuels	• Electricity generation • Heating • Fuel for transport	• Carbon neutral (plants absorb carbon dioxide that is released when the fuel is burnt). • Reliable as crops grow quickly	• High costs to refine the fuel • Space for growing food taken up • Forests cleared to make space – decay and burned vegetation release CO_2 and methane.

55. Renewable Energy Resources 2

Energy Resource	Uses	Advantages	Disadvantages
Hydro-Electric	Electricity generation	• Can respond immediately to increased demand, fast start-up. • Reliable (except if there is a drought) • No fuel costs and minimal running costs • Potential to be used as part of **pumped storage** scheme	• Requires land to be flooded to create a dammed reservoir • Loss of animal habitats • Relies on rainfall to keep reservoir full unless part of pumped storage system
Tidal barrage	Electricity generation	• No atmospheric pollution due to burning of fossil fuels • No fuel costs and minimal running costs	• Visual pollution • Difficulty providing access for boats / wildlife • Initial costs are high • Environmental impact during building phase due to multiple vehicles and large amounts of concrete being used
Wave power	Electricity generation	• No atmospheric pollution due to burning of fossil fuels • Smaller solution for limited populations	• Unreliable • Few suitable locations

56. Wave properties

Mechanical Waves travel through a medium (substance).
The particles oscillate (vibrate) and transfer energy.
The particles do not travel along in the wave.

Frequency (f) - the number of complete waves that pass a point every second.
1 wave per second has a frequency of 1Hz (hertz).

Time period (T) - the time for a complete cycle of a single wave.

Frequency (Hz) = 1 ÷ time period (s)

F = 1 ÷ T

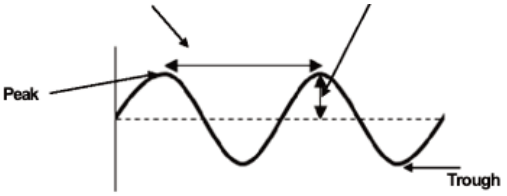
Example: What is the frequency for a wave with a time period of 0.2s

E f = 1 ÷ T
V T = 0.2 s
E f = 1 ÷ 0.2
R 5
Y Hz

f = 5Hz

Wavelength - the distance between adjacent waves (i.e. from peak to peak or trough to trough)

Amplitude - the maximum displacement from the horizontal mid-line.



Wave speed (m/s) = frequency (Hz) x wavelength (m)

V = f λ

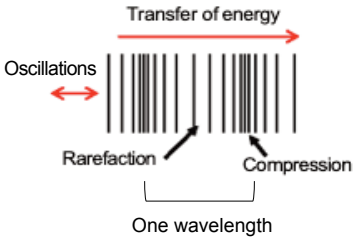
Example: How fast is a wave travelling which has a 3m wavelength and a frequency of 20Hz?

E V = f x λ
V f = 20 Hz; λ = 3 m
E V = 20 x 3
R V = 60
Y m/s

57. Transverse and Longitudinal waves

Longitudinal Waves

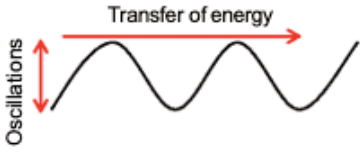
The **oscillations** (vibrations causing the wave are **parallel** to the direction of **energy transfer**.



Compression: particles bunch up
Rarefaction: particles spread out
Example: Sound waves

Transverse Waves

The **oscillations** (vibrations causing the wave) are **perpendicular** (90°) to the direction of **energy transfer**.



Example: Light waves, X-rays and water waves (ripples)
All electromagnetic waves

58. Sound Waves and Speed of Sound experiment

Sound waves are **mechanical longitudinal waves**.
They need a medium to travel through.

The speed of sound can be calculated using:

Speed (m/s) = distance (m) ÷ time (s)

Unit conversions:

km to m:	x 1000
cm to m:	÷ 100
minutes to seconds:	x 60
hours to seconds:	x 3600

Speed of sound experiment

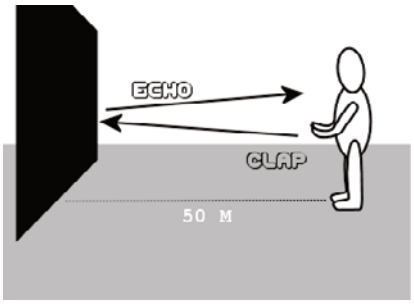
1. Measure the distance between the person and the wall using a metre ruler.
2. Double this distance.
3. Using a stop clock, measure the time taken from the clap being made to hearings it's echo.
4. Use the equation,

   speed = distance ÷ time.

Sound waves

Bigger the amplitude – taller the wave – louder the sound

Higher the frequency – more waves per second – higher pitch



59. Sound and Seismic waves

Human hearing can detect sound in the frequency range of 20Hz to 20,000Hz.

Ultrasound > 20kHz
Infrasound < 20Hz

Ultrasound is used to detect the depth of the sea bed, where inclusions or other defects are found in solid metal and to image soft tissue in humans.

When ultrasound is used to measure the depth of an object, or the distance below a surface to a defect, the signal travels from the transducer to the object and is bounced back to the transducer. The total distance travelled by the sound is twice the depth of the object.

Depth of object (m) = 0.5 x speed of ultrasound (m/s) x time (s)

Seismic Wave type	Description
Primary (P-waves)	• Causes the initial Earth tremor • Longitudinal waves which push or pull on material. • Bend as they travel through the earth's mantle • Refract at boundary between mantle and core • Travels through solids and liquids
Secondary (S-waves)	• Transverse waves that travel more slowly than P-waves • Shake material from side-to-side. • Bend as they travel through the Earth's mantle • Cannot travel through liquid outer core • Travels through solids only
Long (L-waves)	• Arrive last and and cause violent movements on the surface • Only happen in the Earth's crust.

60. Reflection, transmission and absorption of waves

Reflection

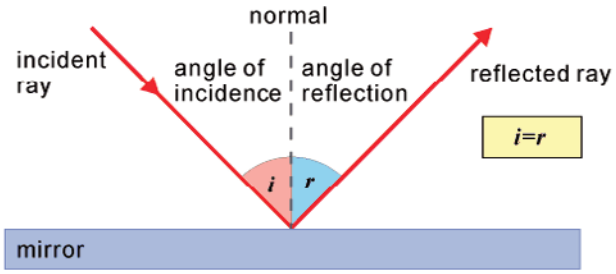
Angles are measured between the wave direction (ray) and a line at 90° to the mirror (boundary)

Normal = an imaginary line drawn at 90° to the surface

The angle of the wave approaching the boundary is called the angle of incidence (i)

The angle of the wave leaving the boundary is called the angle of reflection (r)

Angle of incidence (i) = Angle of reflection (r)



Absorption

Occurs when energy is transferred from the wave into the particles of a substance

Sound waves are absorbed by brick or concrete in houses

Light will be absorbed if the frequency of light matches the energy levels of the electrons

If an object appears red, only red light has been reflected. All the other frequencies of visible light have been absorbed

Transmission

Transmission occurs when a wave passes through a substance

The more transparent the material, the more light will pass through

For the process to count as transmission, the wave must pass through the material and emerge from the other side

When passing through a material, waves are usually partially absorbed

The transmitted wave may have a lower amplitude because of some absorption

For example, sound waves are quieter after they pass through a wall

61. Refraction of waves

Refraction

Waves change speed when they cross a **boundary** between two materials of different density or a boundary of different depths.

If the wave enters a medium of higher **density** at an **angle** the ray bends towards the normal (see diagram).

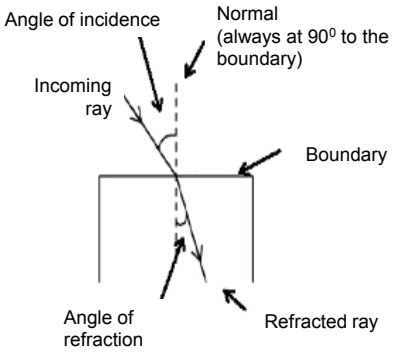
If it enters a medium **along the normal** then the wave does not change direction but the **wavelength** and **speed decrease**.

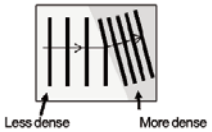
(waves closer together on diagram below but have not changed direction)

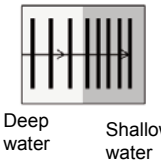
Wave Front Diagrams

The part of the wave front that enters the more dense medium first, slows down as the rest of the wave front continues at the same speed but has to travel further. The difference in distance and speed causes the wave to refract. A wave travelling from deep to shallow water also refracts.

Refraction of Light ray







Change in speed but no change in direction as wave entered **along the normal**

62. Space

Keyword	Description
Asteroid	A lump of rock (may or may not be orbiting anything)
Comet	A ball of ice, dust and gas orbiting a star in an elliptical orbit
Galaxy	A group of billions of stars. Earth is in the Milky Way galaxy
Meteor	A small piece of rocky matter entering Earth's atmosphere from space
Moon	A sphere of rock orbiting a planet
Planet	A sphere of rock or gas orbiting a star
Red Shift	Objects which are moving away from us are said to be red shifted because the wavelengths of light from these objects is shifted towards the red end of the spectrum. Hubble determined that the most distant galaxies are those most red shifted, meaning they are accelerating away from us. This supports the big bang theory.
Satellite	An object which orbits another. Natural (moon) or man-made (space station). They travel at a constant speed. Their orbit is determined by their speed.
Star	A sphere of (mainly) hydrogen carrying out nuclear fusion, producing heat and light
Universe	Everything that exists. Contains billions of galaxies

63. Star formation

Process of star formation: nuclear fusion

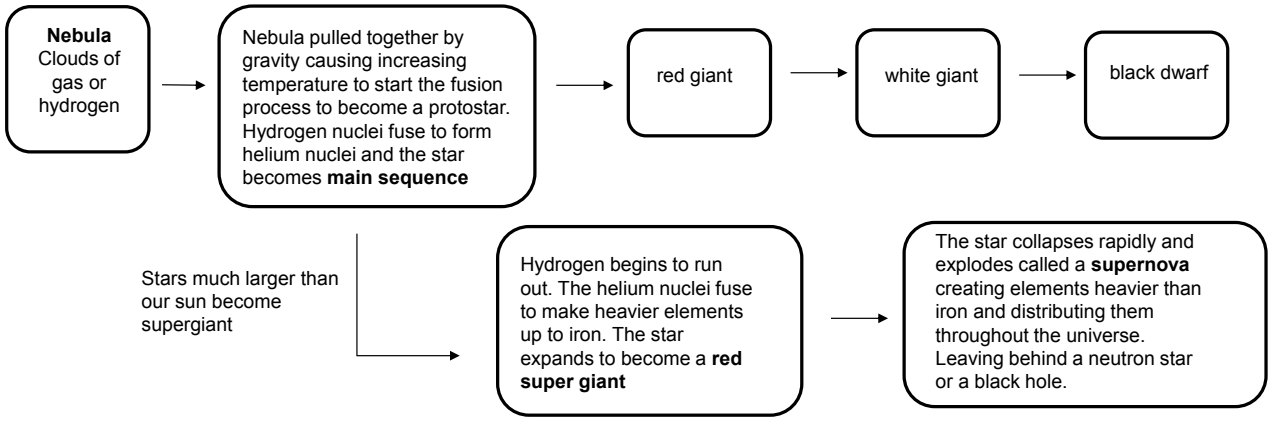
Main fuel source: Hydrogen

The Sun is a stable star. This is because the forces pulling inwards caused by gravity are in equilibrium with the forces pushing outwards caused by the energy released by nuclear fusion.

Range of wavelengths of a star depend on the temperature of the star.

A light year is the distance that light travels in a year

The life cycle of a star



64. Creation of the Universe

Much is still unknown about the universe and galaxies spin faster than they should based on the amount of mass in them. Scientist think that the missing mass is made up of something they have named **dark matter**.

The universe is not only expanding but accelerating in its expansion. Scientists think that **dark energy** is responsible for this acceleration but like **dark matter** they have no idea what **dark energy** is.

The universe could either end in a **big crunch** where the rapid expansion stops and a rapid contraction occurs or it could expand for ever in what is called the **big yawn**.

Mid 20th Century theories for the creation of the universe	**Key points**
Stay State Theory	Universe expands with a constant density, white holes leak matter into the universe to maintain the density as volume increases. Dropped after the discovery of cosmic microwave background radiation (CMBR)
Big Bang Theory	Universe expanded from an extremely small, hot, dense region creating space, time and matter

65. Required practical 1: Specific Heat Capacity

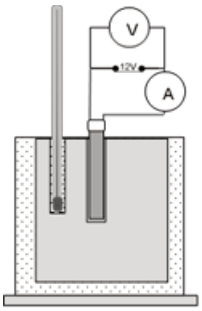
Method

1. Take a 1 kg block of copper.
2. Place an immersion heater in the larger hole in the block.
3. Connect the power supply to the joule meter (reset to read 0 Joules).
4. Connect the joule meter to the 12V immersion heater.
5. Place the thermometer into the other hole in the block.
6. Switch the power pack to 12 V. Turn it on.
7. After 1-minute record the temperature of the block and the reading from the joule meter.
8. Continue taking readings every minute until 10 minutes have passed.

IV - Work done – (energy transferred to block measured by joulemeter)
DV - temperature
CV – Copper block of 1kg mass

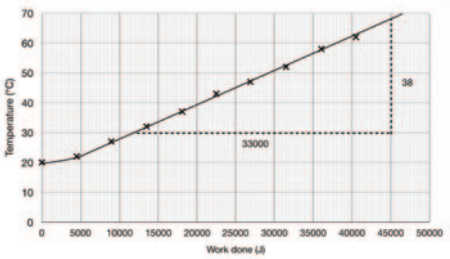
Sources of Error

Heat is lost to the surroundings due to lack of insulation
The immersion heater is not fully immersed into the block
The graph may be curved at the start because it takes time for the heater and block to transfer the energy



Processing data

Plot graph work done against temperature
Specific heat capacity = 1 ÷ gradient

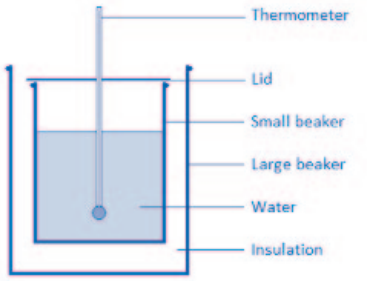


66. Required Practical 2: Thermal Insulation

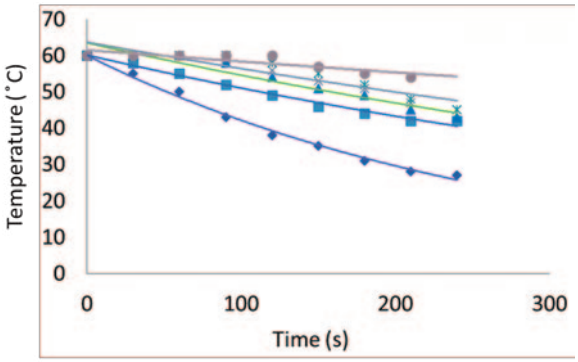
Method

1. Pour 200 cm^3 of hot water into a 250 ml beaker with a single layer of insulating material around it.
2. Use a piece of cardboard as a lid for the beaker.
3. Insert the thermometer through the hole in the cardboard lid
4. Record the temperature of the water and start the stopwatch.
5. Record the temperature of the water every 30 seconds for 5 minutes.
6. Repeat steps **1–5** increasing the number of layers of insulating material wrapped around the beaker until you reach 4 layers.
7. Repeat the experiment with no insulation around the beaker.
7. Plot a graph of temperature versus time.

IV – Time (s)
DV – Temperature change
CV – Volume of water, material of insulation, starting temperature.

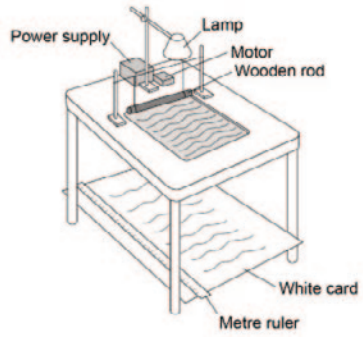


The more layers of insulation the longer it takes for the temperature to drop, indicating a better insulator.



67. Required practical 3: Speed of water waves

1. Set up the ripple tank as shown in the diagram.
2. Make sure that there is a large sheet of white card or paper on the floor under the tank.
3. Pour water to a depth of about 5 mm into the tank.
4. Adjust the height of the wooden rod so that it just touches the surface of the water.
5. Switch on the overhead lamp and the electric motor.
6. Adjust the speed of the motor to produce low frequency water waves.
7. Adjust the height of the lamp so that the pattern of the waves can be clearly seen on the white card.



How to find the frequency of a wave using a ripple tank: count the number of ripples that pass a point in 10 seconds. Divide the number of waves by 10.

How to measure the wavelength: measure the distance across 10 gaps between the shadow lines. Divide this distance by 10.

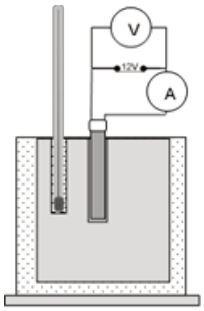
How to calculate the speed of the wave
Wave speed (m/s) = frequency (Hz) x wavelength (m)

How to improve the method of calculating the wavelength:
Take a photo of the shadows and the ruler.
Benefit is that the waves are not being disturbed.

Reasons for using a:
Lamp: create shadows of the ripples
Metre ruler: measure the distance between 10 waves.
Signal generator**:** The vibration generator can have a built in signal generator so that you can directly set the frequency of paddle oscillation i.e. frequency of the ripple waves.

Deeper water means longer wavelength because velocity increases and frequency is constant

65. Required practical 1: Specific Heat Capacity



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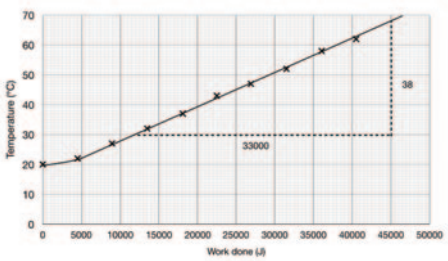

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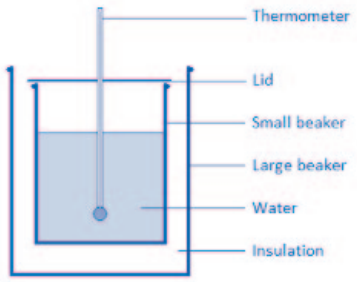

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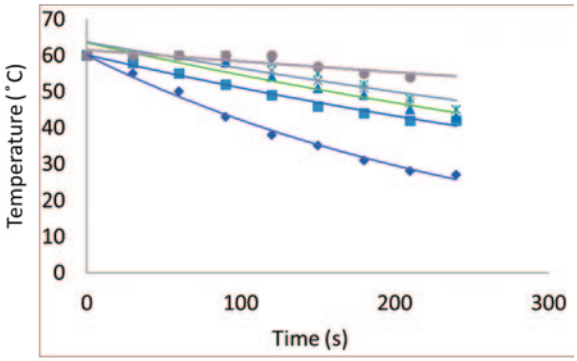

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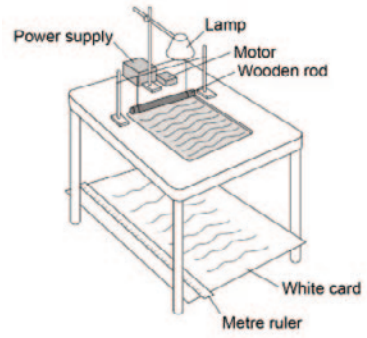

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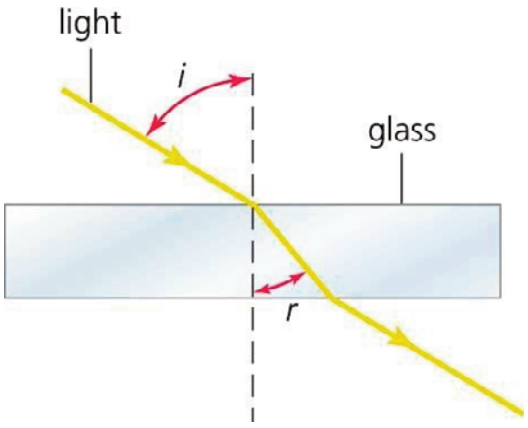
Deeper water means longer wavelength because velocity increases and frequency is constant

68. Required practical 4: Refraction of light

1. Place a glass block on a piece of paper
2. Draw around the glass block and then remove from the paper
3. Draw a line at 90° to one side of the block (the normal)
4. Use a protractor to measure and then draw a line at an angle of 20° to the normal
5. Replace the glass block
6. Using a ray box and slit point the ray of light down the drawn line
7. Mark the ray of light emerging from the block
8. Remove the block and draw in the refracted ray
9. Measure the angle of refraction with a protractor
10. Repeat the procedure for a range of values of the angle of incidence

Source of inaccuracy: The width of the light ray
Reason for inaccuracy: Makes it difficult to judge where the centre of the ray causes a large uncertainty



Normal (90º to the surface)

69. Maths in Science 1

Anomalous result	A number that does not fit the pattern
Mean	Adding up a list of numbers and dividing by how many numbers are in the list. Exclude the anomalous result.
Median	The middle value when a list of numbers is put in order from smallest to largest
Mode	The most common value in a list of numbers. If two values are tied then there are two modes. If more than two values are tied then there is no mode.
Range	The largest number take away the smallest value in a set of data or written as X-Y.
Uncertainty	range ÷ 2
Surface area of a cube	(area of 1 side) x 6 sides
Volume of a cube	Width x height x depth
Area of a circle	∏ x (radius)^2

Prefixes

1 kJ = 1 x 10^3 J = 1000 J

1 pm = 1 x 10^{-12} m

1 mm = 1 x 10^{-3} m= 0.001 m

tera	10^{12}	T
giga	10^{9}	G
mega	10^{6}	M
kilo	10^{3}	k
centi	10^{-2}	c
milli	10^{-3}	m
micro	10^{-6}	μ
nano	10^{-9}	n
pico	10^{-12}	p

0.03581

Standard form: 3.581 x 10^{-2}

2 decimal places: 0.04

3 significant figures: 0.0358

5607.376

Standard form: 5.607 x 10^3

2 decimal places: 5607.38

3 significant figures: 5610

70. Maths in Science 2

Calculating percentage: (part ÷ whole) x 100

e.g. Out of 90 insects, 40 of them were ladybirds. What is the % of ladybirds?

(40 ÷ 90) x 100 = 44 %

Calculating percentage change:

(difference ÷ starting value) x 100

(0.59 ÷ 2.22) x 100 = 26.6 %

Conc of Sucrose (M)	Mass of potato at start (g)	Mass of potato at end (g)	Change in mass (g)
0	2.22	2.81	0.59

Graphs

Proportional (α)

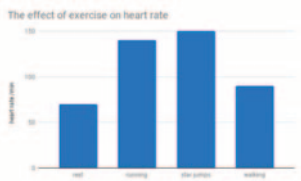
When the line passes through the origin

x axis = independent variable = left hand column of results table

y axis = dependent variable = right hand column of results table

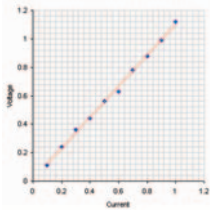
Categoric data: data put into groups e.g. colour of eyes

Draw a bar chart



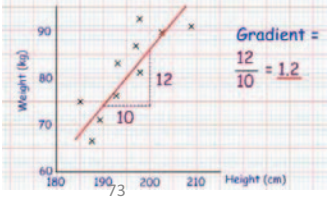
Continuous data: data that can take any value e.g. current

Draw a line graph



Gradient and Graphs

Gradient = $\frac{\text{Change in y}}{\text{Change in x}}$



kinetic energy = 0.5 × mass × (speed)²	$E_k = \frac{1}{2} m v^2$
elastic potential energy = 0.5 × spring constant × (extension)²	$E_e = \frac{1}{2} k e^2$
gravitational potential energy = mass × gravitational field strength × height	$E_p = m g h$
change in thermal energy = mass × specific heat capacity × temperature change	$\Delta E = m c \Delta\theta$
power = $\frac{\text{energy transferred}}{\text{time}}$	$P = \frac{E}{t}$
power = $\frac{\text{work done}}{\text{time}}$	$P = \frac{W}{t}$
efficiency = $\frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$	
efficiency = $\frac{\text{useful power output}}{\text{total power input}}$	
charge flow = current × time	$Q = I t$
potential difference = current × resistance	$V = I R$
power = potential difference × current	$P = V I$
power = (current)² × resistance	$P = I^2 R$

energy transferred = power × time	$E = P t$
energy transferred = charge flow × potential difference	$E = Q V$
density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$
thermal energy for a change of state = mass × specific latent heat	$E = m L$
For gases: pressure × volume = constant	$p V = \text{constant}$
weight = mass × gravitational field strength	$W = m g$
work done = force × distance (along the line of action of the force)	$W = F s$
force = spring constant × extension	$F = k e$
moment of a force = force × distance (normal to direction of force)	$M = F d$
pressure = $\frac{\text{force normal to a surface}}{\text{area of that surface}}$	$p = \frac{F}{A}$
HT **pressure due to a column of liquid = height of column × density of liquid × gravitational field strength**	$p = h \rho g$

	distance travelled = speed × time	$s = v\,t$
	acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$	$a = \frac{\Delta v}{t}$
	(final velocity)² – (initial velocity)² = 2 × acceleration × distance	$v^2 - u^2 = 2\,a\,s$
	resultant force = mass × acceleration	$F = m\,a$
HT	momentum = mass × velocity	$p = m\,v$
HT	force = $\frac{\text{change in momentum}}{\text{time taken}}$	$F = \frac{m\,\Delta v}{\Delta t}$
	period = $\frac{1}{\text{frequency}}$	$T = \frac{1}{f}$
	wave speed = frequency × wavelength	$v = f\,\lambda$
	magnification = $\frac{\text{image height}}{\text{object height}}$	
HT	force on a conductor (at right angles to a magnetic field) carrying a current = magnetic flux density × current × length	$F = B\,I\,l$
HT	$\frac{\text{potential difference across primary coil}}{\text{potential difference across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$	$\frac{V_p}{V_s} = \frac{n_p}{n_s}$
HT	potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil	$V_p I_p = V_s I_s$

1	2											3	4	5	6	7	0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4		Key: relative atomic mass; atomic symbol; name; atomic (proton) number									11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	[285] Cn copernicium 112	[286] Uut ununtrium 113	[289] Fl flerovium 114	[289] Uup ununpentium 115	[293] Lv livermorium 116	[294] Uus ununseptium 117	[294] Uuo ununoctium 118

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.

INDEPENDENCE: DIAGNOSIS – THERAPY - TEST

NAME: CLASS:

TOPIC:

DIAGNOSIS: The thing I don't understand

THERAPY: Where am I going to learn about this?

Which of the templates will I use to transform the information?

TEST: 5 questions someone can ask me about my new understanding.

You can download this template from the school website: www.saintben.sch.uk/content/independence

INDEPENDENCE: DIAGNOSE

NAME: CLASS:

SUBJECT:

Be clear about what you know and what you don't know before you begin.

First, use a contents page or a topic list for the subject you are going to revise.

Then, fill in the following table – the topics, and how well you know them.

Next, prioritise. Which topics will you revise first? Spend time studying the topics which will make the biggest difference to your results.

Topic	Knowledge	Priority
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	

Finally, use the **diagnosis – therapy – test** worksheet to plan your independent study.

You can download this template from the school website: www.saintben.sch.uk/content/independence

INDEPENDENCE: PRIORITISE, REDUCE, CATEGORISE, EXTEND

NAME: CLASS:

TOPIC:

Take a section of text and do the following:

Prioritise: write out the three most important sentences. Rank 1-3 in terms of importance. Justify your decision.
Reduce: reduce the key information to 20 words.
Categorise: sort out the information into three categories. Give each category a title which sums up the information.
Extend: write down three questions you would like to ask an expert in this subject.

INDEPENDENCE: RANKING TRIANGLE

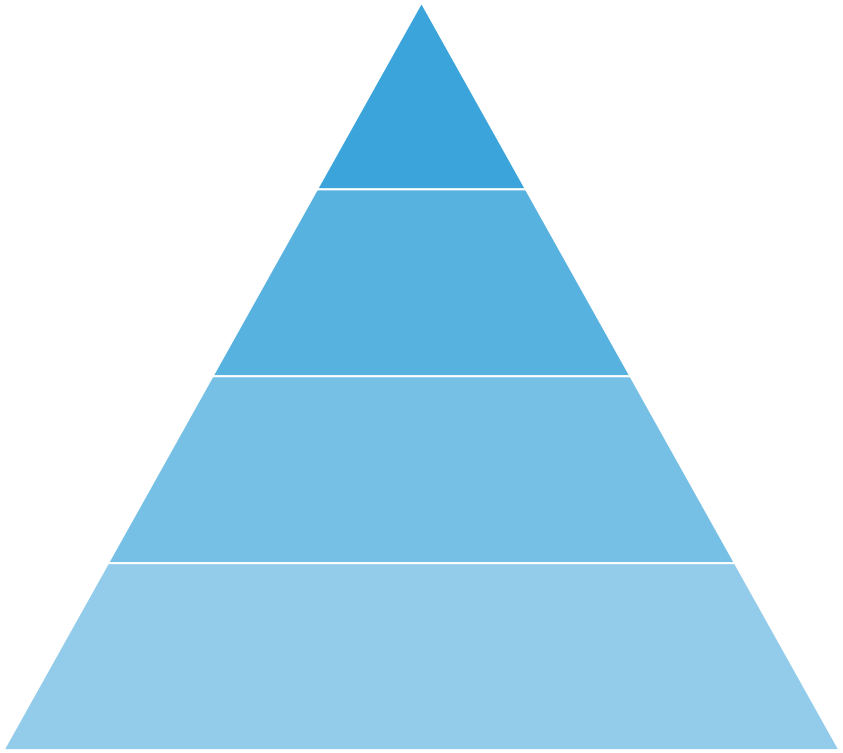
NAME: CLASS:

TOPIC:

The most important information goes at the top.

The least important information goes at the bottom.

Justify WHY. Why is it the most important? Why is it the least important?



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You can download this template from the school website: www.saintben.sch.uk/content/independence

INDEPENDENCE: QUIZZING

NAME: CLASS:

TOPIC:

Read the text and transform it into 10 questions to ask someone.

	Question	Answer
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Question stems:

State… Explain… Suggest…

Describe… Evaluate… Compare…

INDEPENDENCE: BOXING UP

NAME: CLASS:

TOPIC:

Take a section of text. Read it and put your thoughts about the text into different boxes.

Needs a boost: 3 things I did not know:
Almost there: 3 things I understand better now:
I've got these: 3 things I already knew:

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INDEPENDENCE: OTHER IDEAS

Steps → flow chart Transform a sequence of steps into a flow chart or a diagram.

Flow chart → steps Transform a flow chart or a diagram into a sequence of steps.

Look, cover, write, check Cover a list of key words. Write them down. Check which ones you have got right. Repeat until you get them all right.

Link key words Take three words from a topic. Link them together in a sentence or a diagram. Repeat until all the key words have been linked.

INDEPENDENCE: PICTIONARY

NAME: CLASS:

TOPIC:

Transform the material into 6 pictures – one per paragraph or one per key piece of information. The pictures should represent the information so that they can act as a reminder of what the text said. Underneath each picture, explain your thinking.

1.	2.	3.

4.	5.	6.

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