Year 8 Knowledge Organiser

Core

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English

English – Year 8 – HT1 – *Sawbones*

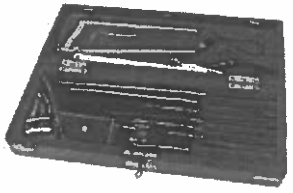
Summary- Position in the Curriculum

In 18th century London, 16-year-old Ezra is working as apprentice to a highly respected surgeon, William McAdam. He knows that his impressive knowledge of anatomy and skill at the dissection table will ensure he has a trade for life. Yet whilst he is grateful to his master, who rescued him from a life of slavery, Ezra is eager for independence and to be his own man. Then a strange series of events changes everything. Now, McAdam is dead, and Ezra is alone - except for the unconventional Miss Loveday Finch, daughter of a magician, who is looking for answers about her father's death. Soon, the pair find themselves tangled in an adventure featuring grave-robbing, body-switching and political intrigue, which takes them a journey across London from the Operating Theatre at St Bart's, to the vaults of Newgate Prison, to the shadowy Ottoman Embassy. The text is studied within its context, a key skill required in English; students relate factors such as the advances in medical science, slavery and racism, prejudice and discrimination, and women's rights. In doing so, students engage with the characteristics of tolerance and respect, building upon work from Year 7, such as the study of 'Noughts and Crosses.' Other contextual links exist between this text and the study of Jekyll and Hyde in KS4 and in addition to this the genre of the detective fiction is also explored and this is good preparation for the study of Sherlock Holmes in HT2.

Terminology	Definitions	Core Knowledge	Preparing for Assessment
Freytag's Pyramid	A five part dramatic structure that goes from the introduction into the rise, to the climax, falling action, and finally the resolution.	Johnson focuses on the experiences of **marginalised people** in Georgian London.	1. *What do we learn about the relationship between Ezra and other characters?*
Protagonist	The main character in a story.	Sawbones is structured using **Freytag's pyramid**. The plot can be clearly linked to each stage of the pyramid.	2. *What do we learn about Ezra's life before and after Mr McAdam dies?*
Antagonist	A character who causes conflict and is typically the 'villain'.	Johnson highlights the **medical advancements** being made in the 18th Century, drawing close parallels with **John Hunter** and the use of **'body snatchers'** for this scientific advancement.	3. *What do the characters of Ezra and Loveday tell us about the experiences of marginalised people in the 18th Century?*
Enlightenment	promoted the idea that people were able to and should think for themselves..	The themes of **racism and power** are explored throughout the novel. She is also keen to highlight the experiences of Black Britons in historical novels.	4. *What does the museum of curiosities tell us about scientific progress in the 18th Century? What were people's opinions of surgeons and medical science in the 18th century?*
Resurrectionist	A person (in the past) who stole the bodies of dead people and sold them to scientists who wanted to perform experiments on them.	Johnson makes frequent references to **the Ottoman Empire and the French Revolution**, both have parallels with the storyline.	5. *What are our initial opinions of both Ezra and Loveday and do they change over time??*

Key Quotations:

"Do not think of vanishing with those rubies, Mr Finch." * "A girl: small, maybe fourteen from her face, with bright – no flaming – red hair piled on top of her head." * "Ezra was sixteen...he had the man's surname, but that was simply because he had none of his own." * " Lashley paused, ..."You would do well to remember that without your master, a boy like you is so much less than nothing" *"We should work together, as a team."

Ezra and Loveday	John Hunter	Catherine Johnson	Sultan/Ottoman Empire	19th Century Surgeon
				

English – Year 8– HT2 – *Sherlock Holmes*

Summary- Position in the Curriculum

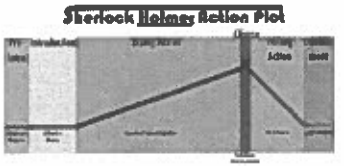
This unit consists of three stories from 'The Adventures of Sherlock Holmes' (1892): The Speckled Band', 'The Red-Headed League' and 'The Blue Carbuncle' by Sir Arthur Conan Doyle. Ever since the first Sherlock Holmes story was published in 1887 the series has remained one of the most iconic in detective fiction, English literature, and even in the world of crime-solving itself. Each story is an entertaining mixture of intrigue, mystery, humour and suspense. Sherlock Holmes' fictional home was 221B Baker Street, which is now a museum of Doyle's life and work.

Terminology	Definitions	Core Knowledge	Preparing for Assessment
Detective fiction	The literary genre that fictionalises crimes and their detection, criminals and their motives.	Detective fiction became immensely popular in the 1800s due to a combination of social, cultural, and technological that aligned perfectly to captivate the public's imagination.	1. *Research crime in Victorian London. Consider why this might have made Sherlock Holmes so popular at the time.*
Narrative voice	The voice or voices used to tell a story, such as 1st or 3rd person.	The narrative voice establishes perspectives, creates mystery and suspense, aids character development, relays complex information and can provide reliability, or in some cases unreliability.	2. *Identify the different types of narrative voice, with a definition. Rewrite a Sherlock Holmes passage, using a different narrative voice.*
Characterisation	The strategies a writer uses to create a character	Detective stories are often told in the first person ('I') so that the reader shares the narrator's viewpoint as they uncover the clues to solve it.	3. *Is there an archetypal detective and if so, what are the most effective characteristics?*
Red herring	False clues that are planted to mislead.	A red herring in detective fiction is a misleading clue or piece of information that diverts the attention of the reader and characters away from the real solution to the mystery. It is a common narrative device used to create suspense and keep readers guessing.	4. *Choose a specific story and identify a red herring used by Doyle. Explain how this red herring diverts attention from the real solution and discuss its impact*
Denouement	The final outcome of the main dramatic complication in a literary work.	The denouement in Sherlock Holmes stories is the final part of the narrative where all the mysteries are unravelled, and the detective explains how he solved the case. This phase is crucial as it provides closure and satisfaction to the reader by tying up loose ends and revealing the logic behind Holmes's deductions.	5. *Choose a specific Sherlock Holmes story and analyse the denouement. How does Arthur Conan Doyle use the denouement to reveal the solution to the mystery and provide closure to the story?*

Key Quotations:

'[Watson admired] the rapid deductions, as swift as intuitions, and yet always founded on a logical basis with which [Sherlock] unravelled the problems which were submitted to him.' ***Speckled Band***

'[Helen's face] all drawn and grey, with restless frightened eyes, like those of some hunted animal.' ***Speckled Band***

Sir Arthur Conan Doyle	Sherlock Holmes	Victorian London	Victorian Police Force	Detective Fiction Story Structure
				

English – Year 8 – HT3 – *Romeo and Juliet*

Summary- Position in the Curriculum

Written by Shakespeare in the 16th century, the play opens with a prologue explaining there is an ongoing conflict between two families: The Montagues and The Capulets. The play follows two characters called Romeo and Juliet who fall in love although their relationship is destined for tragedy due to the rivalry of their families. Students will look at themes such as religion, death, love, violence and fate in order to contextualise the play and explore Shakespeare's intentions in writing this tragedy to be performed on a stage. In Year 7, students were introduced to Shakespeare's plays through the study of Much Ado About Nothing – a comedy that also looks at romantic relationships. In studying this at this particular stage in the curriculum we will strengthen their understanding of key conventions of a tragedy and explore characterisation and themes which will contribute to pupils' study of Macbeth at KS4.

Terminology	Definitions	Core Knowledge	Preparing for Assessment
Dramatic Irony	When an audience knows something the characters on stage do not.	At the time of Shakespeare, the belief in astrology was far more popular than in society today. The reference to "star-cross'd lovers" in the prologue demonstrates the large role of horoscopes and planet positions in being used to predict fate.	1. *What do we learn about the treatment of women in the play?*
Foreshadowing	An indication of what is to come later in the text.	Elizabethan society was extremely religious (Catholicism). The play was set in Verona, **Italy** where the Catholic Church had great influence. There was a strong belief that everything was **predetermined** and part of God's plan.	2. *What is the relationship like between Juliet and her father?*
Unrequited Love	When one person loves another but it is not reciprocal.	Marriage was sacred and divorce was not an option. Suicide was also seen as a mortal sin.	3. *How does Shakespeare explore the theme of Fate in the play?*
Patriarchal Society	A society that is dominated by men and they are in charge. Women are powerless.	A **prologue** is an opening or introduction to a story that establishes the setting and gives background details. Shakespeare explains how there are two members from feuding families that fall in love which ends in **tragedy**.	4. *Romeo may be described as a fickle character.* ***To what extent do you agree with this statement?***
Rhyming Couplets	Two consecutive lines that rhyme with each other, often used for dramatic impact.	There are 3 main genres in theatre: comedy, tragedy and history. **Tragedy** plays usually end in death and destruction.	5. *Is the ending of the play predictable? Is there any way that Romeo and Juliet were destined to be together?*

Key Quotations:

*"My only love sprung from my only hate!" Act 1 Scene 5 * "It is the east, and Juliet is the sun" – Act 2, Scene 1 * "These violent delights have violent ends" – Act 2, Scene 5 * "A plague o'both your houses!" – Act 3, Scene 1 * "O happy dagger" – Act 5, Scene 3*

Astrology	Death	William Shakespeare	Religion	Film: Romeo and Juliet
				

English – Year 8 – HT4 – Gender Representations in Poetry

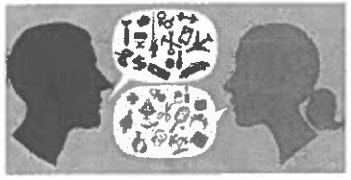
Summary- Position in the Curriculum

This unit uses a range of poems from across time periods and cultures to develop a student's ability to respond to a poem independently. The unit follows on from *Romeo and Juliet* because the themes and stylistic elements of *Romeo and Juliet* continue to inspire modern poets. Contemporary gender and relationship poetry often revisits these themes, adapting them to new contexts and exploring diverse perspectives on love and relationships. Students will utilise their prior knowledge of poetic conventions and their ability to engage critically with how these have been used – but they are taught the skills and strategies to approach and respond to poetry. Students are also taught comparison skills, making links and connections between poems using what/how/why skills.

Terminology	Definitions	Core Knowledge	Preparing for Assessment
Extended metaphor	An extended metaphor is a metaphor that is developed in great detail.	**Patriarchy** is a society or social system that is controlled by men or in which men have power.	1. *What traditional stereotypes of women do you know of? Are female characters oversimplified? Weak? Foolish? Excessively naive?*
Oxymoron	A phrase that contains an apparent contradiction.	**Feminism** supports the feminist goals of defining, establishing, and defending equal civil, political, economic, and social rights for women.	2. *Choose a poet known for their love poetry (e.g., William Shakespeare, John Donne, Elizabeth Barrett Browning). Research their major works and contributions to the genre.*
Personification	Giving human qualities to inanimate objects. This might make them appear alive or as a thinking and acting entity.	A **motif** is a recurring image or theme that appears throughout the work to reinforce a deeper central meaning.	3. *Analyse how love is portrayed differently in poetry from different cultures or traditions. Provide examples to support your analysis.*
Dramatic monologue	A poem that takes the form of a speech by a fictional character.	**Inequality** shows a clear difference between people –e.g. the inequality between genders.	4. *How has modern love poetry evolved from its classical counterparts? What new themes and styles have emerged?*
Colloquial language	Informal language, usually creates a conversational tone or authentic voice.	**Marginalised** means to be relegated to the edge of society and culture.	5. *Reflect on a love poem that resonates with you personally. Discuss why it speaks to you and how it connects to your own experiences or beliefs about love.*

Poets in the unit:

Robert Burns * Carol Ann Duffy * Elizabeth Barrett Browning * John Cooper Clarke * Brian Bilston * Ntozake Shange * William Shakespeare * Maya Angelou * Robert Browning *

Carol Ann Dufy	Stereotype	Semantic field	Structure vs Form	Robert Browning
				

English – Year 8 – HT5 – Rhetoric

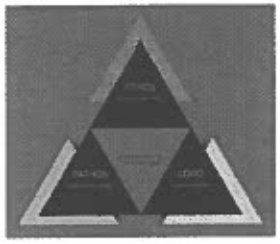
Summary- Position in the Curriculum

The rhetoric unit allows students to study the art of persuasive speaking and writing, exploring the history of rhetoric and the structural and language techniques that have stood the test of time. Students will have studied descriptive and creative writing in Year 7, but this unit looks at writing for an alternative purpose - persuasion. By reading and analysing a range of speeches and letters from history, students will understand the components of effective rhetoric and apply these to their own persuasive writing. This knowledge will help them in their study of 'Animal Farm' in HT6 due to the theme of persuasion and propaganda. This will also support their GCSE studies, specifically the Spoken Language unit and English Language Paper 2.

Terminology	Definitions	Core Knowledge	Preparing for Assessment
Rhetoric	The art of writing or speaking in an effective and persuasive way.	Good rhetoric involves an **opening statement** where you introduce your point of view, **a range of arguments** and a **conclusion** where you summarise and repeat your point of view	1. *Plan your own speech in response to the following statement: Every home should own a pet. Choose one side to argue.*
Ethos	Conveys the author's credibility and knowledge about the topic at hand.	Rhetoric can be structured using **logical connections** (because, however) and **time connectives** (firstly, secondly)	2. *Find an example of a famous speech (there are some suggestions below) and identify the use of logical connections, time connectives and persuasive devices.*
Pathos	Is a means to persuade an audience by appealing to emotion.	Rhetoric can employ a range of **techniques**, including flattery, opinion, hyperbole, personal pronouns, imperative command, triple emphasis, emotive language and rhetorical questions.	3. *Look at Alexander the Greats speech. How does he use ethos effectively?*
Logos	Is a means to persuade an audience by appealing to their sense of logic.	Rhetoric has existed for 2000 years – **Sophists** formed schools that travelled from city to city teaching the art of persuasion. A philosopher called **Aristotle** criticised them for manipulating emotion rather than speaking truth.	4. *Write your own speech where you argue for a four-day school week. Plan it first and use ethos, pathos and logos as well as other persuasive techniques. Annotate it afterwards and identify the techniques used.*
Sophists	A paid teacher of philosophy and rhetoric in Greece in the Classical and Hellenic period.	Aristotle wrote his own book, 'The Art of Persuasion', which was a guide for persuasion and introduced the concepts of **ethos, pathos and logos** (The Aristotelian Triad)	5. *Take one of the speeches studied and write a counter-argument speech to it – even if you agree with the original speech, play devil's advocate.*

Featured speeches:

*Malala * Winston Churchill * Alexander the Great * Donald Trump * Greta Thunberg * Martin Luther King*

Aristotle	Aristotelian Triad	Alexander the Great	Malala	Martin Luther King Jr
				

English – Year 9 – HT6 - Animal Farm

Summary- Position in the Curriculum

Published in 1945, Orwell's allegorical tale is based on the events of the 1917 Russian Revolution which lead to the creation of the Soviet Union. Set within the confines of a farm, with animals playing the main roles, the story critically explores the recurring human themes (adopted by the farm animals) such as Hopes, Dreams, Power, Control and Manipulation. Orwell shows how those in power become corrupt and oppress the people they are meant to help. He also shows how those in power use propaganda to distort the truth in order to maintain power. His Dystopian book also serves as a warning to cynical citizens!

Terminology	Definitions	Core Knowledge	Preparing for Assessment
Propaganda	Dissemination of information—facts/lies—to influence public opinion	Napoleon turns the other animals against Snowball by spreading lies, but using Squealor as his mouthpiece. Thereby, mirroring the Soviet state newspaper, Pravda.	1. *In what ways does the dream of Old Major mirror the visions of Karl Marx and Lenin? To what extent is the idea of a Utopian society an achievable aim?*
Exploitation	Treating someone unfairly in order to benefit from their work	By the end, Old Major's dream to improve the lives of all animals has become a nightmare. The farm becomes even more exploitative and the pigs are just as cruel as the farmer	2. *By withholding the food and starving the other animals in order to maintain control, what does Orwell tell us about the new leadership of Animal Farm and its methods?*
Apathy	Lack of feeling, emotion or concern about life.	Benjamin the Donkey's cynicism is a prime example of how the apathy of individuals can spread across society if left unchallenged.	3. *The building of the windmill is a main part of the story. It is originally Snowball's idea but it is taken by Napoleon. How and why does Napoleon take over what he was opposed to?*
Hierarchy	A system where people are organized into levels according to authority	Napoleon eventually takes complete control over the farm with the aid of attack dogs who chase away his main rival for power, thereby exercising complete control over the other animals.	4. *How were Orwell's ideas for writing Animal Farm influenced by his early life? What did he witness and what impact did these events have upon his writing?*
Idealism	A philosophical view that ideas, rather than physical objects, are more fundamental than physical objects	Orwell satirises the Russian Revolution as Lenin/Old Major dreaming of a farm life free from the exploitation of humans and where all animals can live in equality, harmony and self-rule. They achieve this act by violent rebellion.	5. *Although the story of Animal Farm is based on the events of the1917 Russian Revolution and the subsequent rise of Stalin, have similar events happened in modern times in other countries or is it only Russia?*

Key Quotations:

"All animals are created equal. But some are created more equal than others"

"The creatures outside looked from pig to man, and from man to pig, and from pig to man again; but already it was impossible to say which was which."

"The human beings did not hate Animal Farm any less now that it was prospering; indeed, they hated it more than ever."

Pigs	Worker	George Orwell	Lenin	1917 Russian Revolution
				

Maths

Yr. 8 Maths Knowledge Organiser: Autumn 1 – Proportional Reasoning (Chapter 1)

By the end of this half-term, you should be able to:

1.1 – Ratio & scale	1.2 – Multiplicative change	1.3 – Multiplying and dividing fractions
• Simplify any given ratio • Share an amount in a given ratio • Solve ratio problems given a part	• Solve problems and explain direct proportion • Use conversion graphs to make statements, comparisons and form conclusions • Understand and use scale factors for length	• Carry out any multiplication or division using fractions and integers • Solutions can be modelled, described and reasoned

Keywords

Ratio: a statement of how two numbers compare.

Equal Parts: all parts in the same proportion, or a whole shared equally.

Proportion: a statement that links two ratios.

Order: to place a number in a determined sequence.

Part: a section of a whole.

Equivalent: of equal value.

Factors: integers that multiply together to get the original value.

Scale: the comparison of something drawn to its actual size.

Variable: a part that the value can be changed.

Axes: horizontal and vertical lines that a graph is plotted around.

Approximation: an estimate for a value.

Preparing for Assessment

- Login to **Maths Watch** and complete your independent tasks each week. Attempt all questions and aim to get at least 80% correct. Remember, you can watch the videoclip attached to each question to help you understand the topic better.
- Use **'Read, Cover, Write, Check'** to test your understanding on the key words and core knowledge in this organiser.

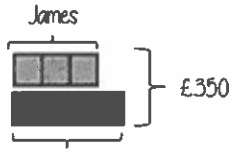
Core Knowledge

Sharing a whole into a given ratio

James and Lucy share £350 in the ratio 3:4. Work out how much each person earns

Model the Question

James : Lucy
3 : 4



Find the value of one part

Whole: £350
7 parts to share between
(3 James, 4 Lucy)

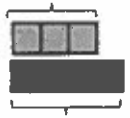
£350 ÷ 7 = £50

□ = one part
= £50

Put back into the question

James : Lucy
(×50) 3 : 4 (×50)
£150 : £200

James = 3 × £50 = £150



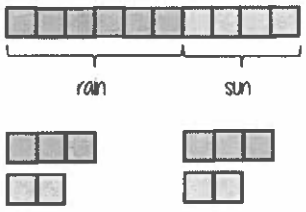
Lucy = 4 × £50 = £200

Simplifying a ratio

Cancel down the ratio to its lowest form

"For every 6 days of rain there are 4 days of sun"

6:4 → ÷ by 2 → 3:2



Find the biggest common factor that goes into all parts of the ratio

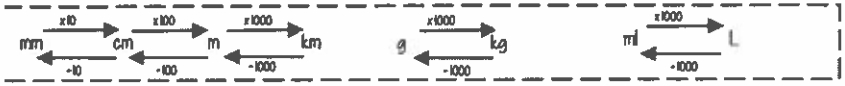
For 6 and 4 the biggest factor (number that multiples into them is 2)

"For every 3 days of rain there are 2 days of sun" – when this happens twice the ratio becomes 6:4

Units are important:

When using a ratio – all parts should be in the same units

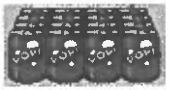
Useful Conversions



Direct Proportion

Os one variable changes the other changes at the same rate.

This is a multiplicative change



4 cans of pop = £240

4 cans of pop = £240 ×

Understand Scale Factor

The two rectangles are similar.

Scale Factor: the multiple that increases/ decreases a shape in size.

Currency: the system of money used in a particular country.

Conversion: the process of changing one variable to another.

Numerator: the number above the line on a fraction which represents how many parts are taken.

Denominator: the number below the line on a fraction which represents the total number of parts.

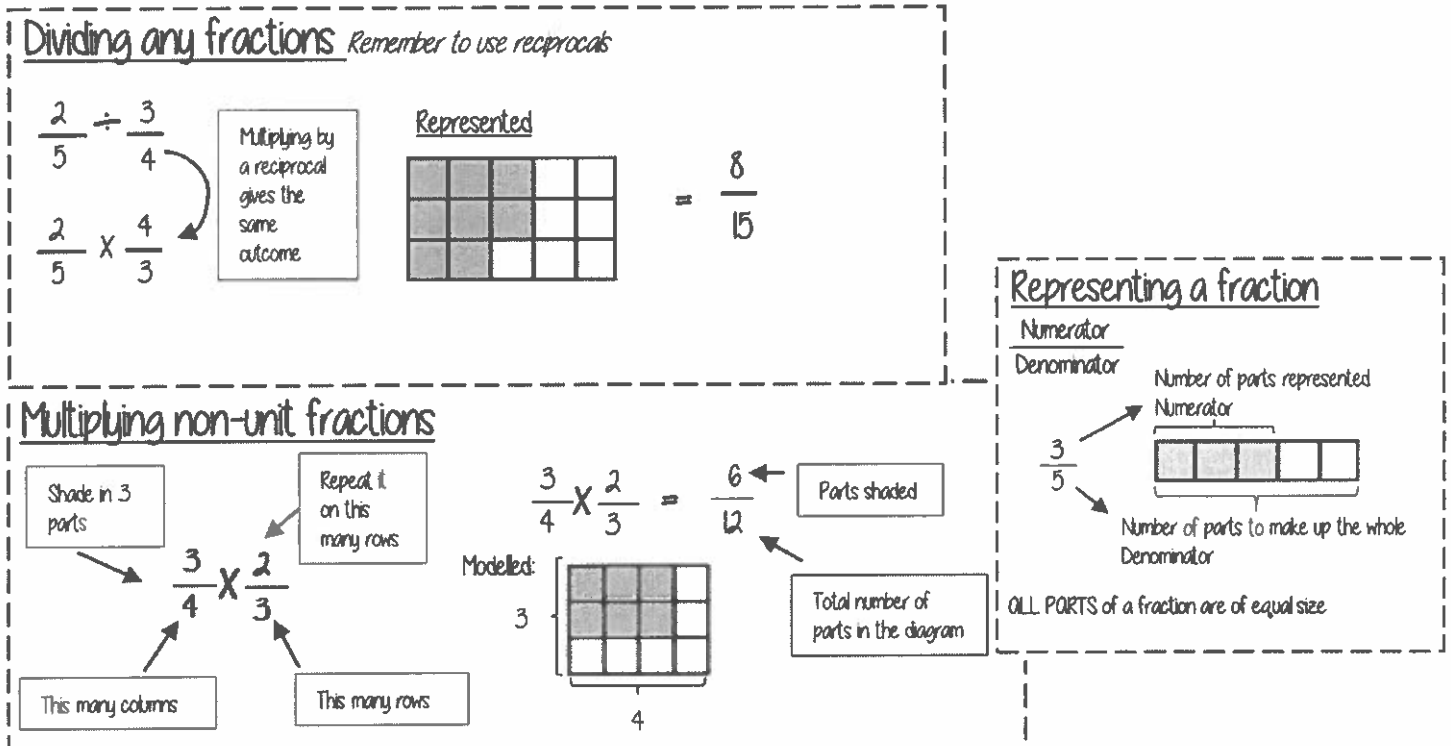
Whole: a positive number including zero without any decimal or fractional parts.

Commutative: an operation is commutative if changing the order does not change the result.

Unit Fraction: a fraction where the numerator is one and the denominator is a positive integer.

Non-unit Fraction: a fraction where the numerator is larger than one.

Reciprocal: a pair of numbers that multiply together to give 1.



Principled **Resilient** **Open** **Understanding** **Disciplined**

Yr. 8 Maths Knowledge Organiser: Autumn 2 – Representations (Chapter 2)

By the end of this half-term, you should be able to:

2.1 – Working in the Cartesian plane	2.2 – Representing data	2.3 – Tables & Probability
• Label and identify lines parallel to the axes • Recognise and use basic straight lines • Identify positive and negative gradients • Link linear graphs to sequences • Plot $y = mx + c$ graphs	• Draw and interpret scatter graphs • Describe correlation and relationships. • Identify different types of non-linear relationships. • Design and complete an ungrouped frequency table. • Read and interpret grouped tables (discrete and continuous data) • Represent data in two-way tables	• Construct a sample space diagram • Systematically list outcomes • Find the probability from two-way tables • Find the probability from Venn diagrams

Keywords

Quadrant: four quarters of the coordinate plane.

Coordinate: a set of values that show an exact position.

Horizontal: a straight line from left to right (parallel to the x axis).

Vertical: a straight line from top to bottom (parallel to the y axis).

Origin: (0,0) on a graph. The point the two axes cross.

Parallel: Lines that never meet.

Gradient: The steepness of a line which can be determined by dividing the change in y by the change in x.

Intercept: Where lines cross.

Preparing for Assessment

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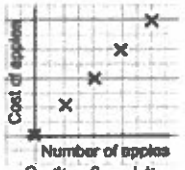
- Use **'Read, Cover, Write, Check'** to test your understanding on the key words and core knowledge in this organiser.

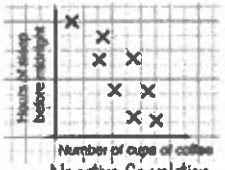
Core Knowledge

Linear Correlation



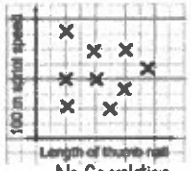
Positive Correlation

As one variable increases so does the other variable



Negative Correlation

As one variable increases the other variable decreases



No Correlation

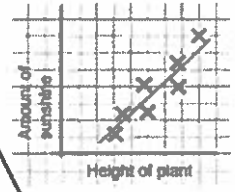
There is no relationship between the two variables

The line of best fit

The Line of best fit is used to make estimates about the information in your scatter graph

Things to know:

- The line of best fit DOES NOT need to go through the origin (The point the axes cross)
- There should be approximately the same number of points above and below the line (it may not go through any points)
- The line extends across the whole graph



It is only an estimate because the line is designed to be an average representation of the data

It is always a straight line.

Plotting y = mx + c graphs

$y = 3x - 1$ → 3 x the x coordinate then – 1

Ungrouped Data

The number of times an event happened

The table shows the number of siblings students have. The answers were
3, 1, 2, 2, 0, 3, 4, 1, 1, 2, 0, 2

Variable: a quantity that may change within the context of the problem.

Relationship: the link between two variables (items). E.g. Between sunny days and ice cream sales.

Correlation: the mathematical definition for the type of relationship.

Origin: where two axes meet on a graph.

Line of best fit: a straight line on a graph that represents the data on a scatter graph.

Outlier: a point that lies outside the trend of graph.

Frequency: the number of times a particular data value occurs.

Outcomes: the result of an event that depends on probability.

Probability: the chance that something will happen.

Set: a collection of objects.

Chance: the likelihood of a particular outcome.

Event: the outcome of a probability – a set of possible outcomes.

Probability from two-way tables

	Car	Bus	Walk	Total
Boys	15	24	14	53
Girls	6	20	21	47
Total	21	44	35	100

P (Girl walk to school) = $\frac{21}{100}$

The event

The total in the set

The total number of items

Grouped Data

If we have a large spread of data it is better to group it. This is so it is easier to look for a trend. Form groups of equal size to make comparison more valid and spread the groups out from the smallest to the largest value.

Discrete Data
The groups do not overlap

Cost of TV (£)	Tally	Frequency
101 - 150	𝍸 II	7
151 - 200	𝍸 𝍸 I	11
201 - 250	𝍸	5
251 - 300	III	3

We do not know the exact value of each item in a group – so an estimate would be used to calculate the overall total (Midpoint)

Continuous Data
To make sure all values are included inequalities represent the subgroups

x Weight(g)	Frequency
$40 < x \leq 50$	1
$50 < x \leq 60$	3
$60 < x \leq 70$	5

e.g this group includes every weight bigger that 60Kg up to and including 70Kg

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Yr. 8

Knowledge Organiser: Spring 1 – Algebraic Techniques (Chapter 3)

By the end of this half-term, you should be able to:

3.1 – Brackets, equations & inequalities

- Form expressions
- Expand and factorise single brackets
- Form and solve equations
- Solve equations with brackets
- Represent inequalities
- Form and solve inequalities

3.2 – Sequences

- Generate a sequence from term to term or position to term rules
- Recognise arithmetic sequences and find the *n*th term
- Recognise geometric sequences and other sequences that arise

3.3 – Indices

- Add/ Subtract expressions with indices
- Multiply expressions with indices
- Divide expressions with indices
- Know the addition law for indices
- Know the subtraction law for indices

Keywords

Simplify: grouping and combining similar terms.

Substitute: replace a variable with a numerical value.

Equivalent: something of equal value.

Coefficient: a number used to multiply a variable.

Product: multiply terms.

Highest Common Factor (HCF): the biggest factor (or number that multiplies to give a term).

Inequality: an inequality compares who values showing if one is greater than, less than or equal to another.

Sequence: items or numbers put in a pre-decided order.

Term: a single number or variable.

Preparing for Assessment

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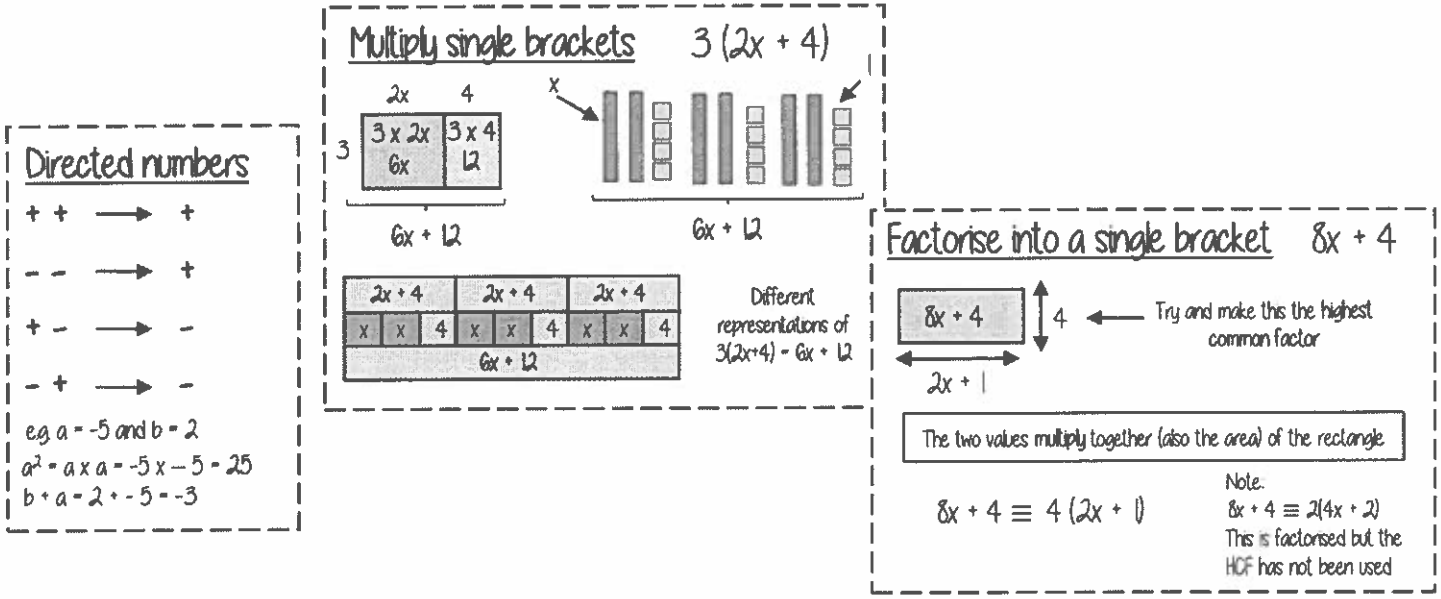
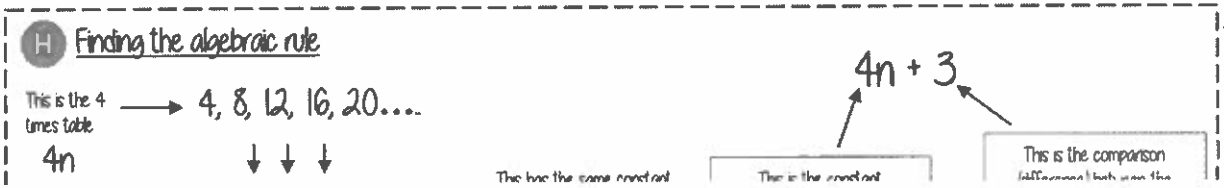
- Use **'Read, Cover, Write, Check'** to test your understanding on the key words and core knowledge in this organiser.

Core Knowledge





Position: the place something is located.

Linear: the difference between terms increases or decreases (+ or -) by a constant value each time.

Non-linear: the difference between terms increases or decreases in different amounts, or by x or ÷.

Difference: the gap between two terms.

Arithmetic: a sequence where the difference between the terms is constant.

Geometric: a sequence where each term is found by multiplying the previous one by a fixed non-zero number.

Base: the number that gets multiplied by a power.

Power: the exponent – or the number that tells you how many times to use the number in multiplication.

Exponent: the power – or the number that tells you how many times to use the number in multiplication.

Indices: the power or the exponent.

Addition/ Subtraction with indices

Coefficient, Power

$5x^2 + 4x^4$

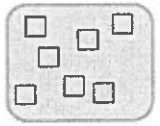
Term, Term

Expression

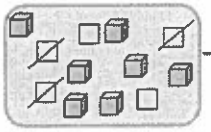
Each square represents x^2 and each cube represents x^4

Only similar terms can be simplified
If they have different powers, they are unlike terms

$5x^2 + 2x^2 \longrightarrow \longrightarrow 7x^2$



$5x^2 + 6x^4 - 3x^2 + x^4 \longrightarrow \longrightarrow 2x^2 + 7x^4$



Addition/ Subtraction laws for indices

$3^5 \times 3^2 \longrightarrow 3^7$

$= (3 \times 3 \times 3 \times 3 \times 3) \times (3 \times 3)$

The base number is all the same so the terms can be simplified

Addition law for indices

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

$3^5 \div 3^2 \longrightarrow 3^3$

$\frac{3 \times 3 \times 3 \times \cancel{3} \times \cancel{3}}{\cancel{3} \times \cancel{3}} \longrightarrow \frac{3^3}{3^0} \longrightarrow \frac{3^3}{1}$

Subtraction law for indices

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

Multiply expressions with indices

$4b \times 3a$
$\equiv 4 \times b \times 3 \times a$
$\equiv 4 \times 3 \times b \times a$
$\equiv 12ab$

$5t \times 9t$
$\equiv 5 \times t \times 9 \times t$
$\equiv 5 \times 9 \times t \times t$
$\equiv 45t^2$

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Yr. 8 Maths Knowledge Organiser: Spring 2 – Developing Number (Chapter 4)

By the end of this half-term, you should be able to:

4.1 – Fractions & percentages	4.2 – Standard index form	4.3 – Number sense
• Convert between FDP less than and more than 100 • Increase or decrease using multipliers • Express an amount as a percentage • Find percentage change	• Write numbers in standard form and as ordinary numbers • Order numbers in standard form • Add/ Subtract with standard from • Multiply/ Divide with standard form • Use a calculator with standard form	• Round numbers to powers of 10 and 1 significant figure • Round numbers to any decimal place • Estimate solutions • Calculate using order of operations • Calculate with money, units of measurement and time

Keywords

Percent: parts per 100 – written using the % symbol.

Decimal: a number in our base 10 number system. Numbers to the right of the decimal place are called decimals.

Fraction: a fraction represents how many parts of a whole value you have.

Equivalent: of equal value.

Reduce: to make smaller in value.

Growth: to increase/ to grow.

Integer: whole number, can be positive, negative or zero.

Invest: use money with the goal of it increasing in value over time (usually in a bank).

Preparing for Assessment

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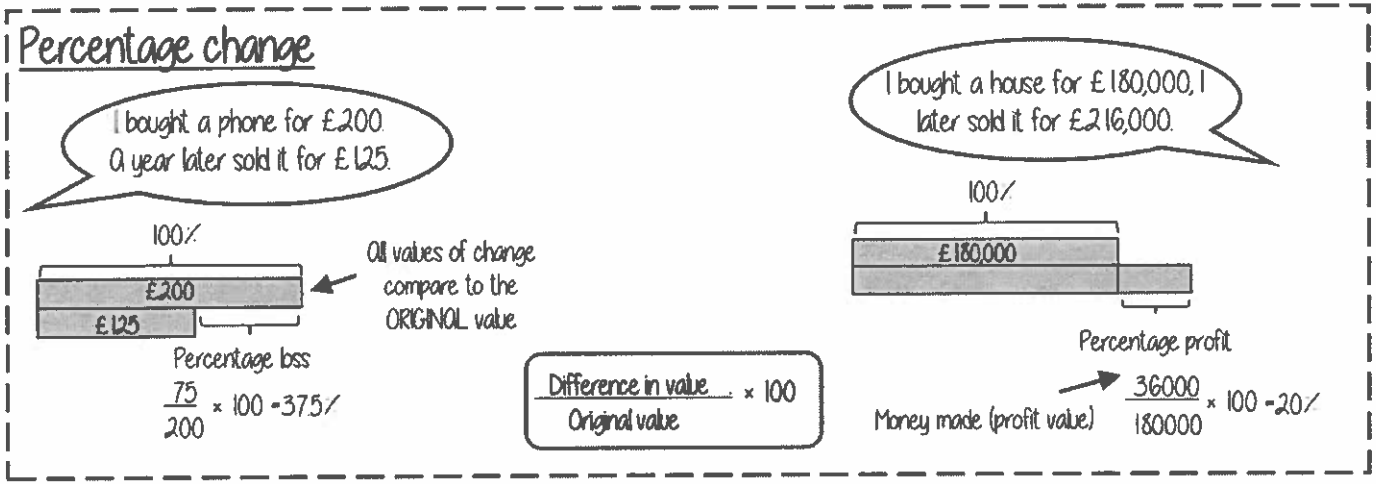
Core Knowledge



Standard (index) Form: A system of writing very big or very small numbers.

Base: The number that gets multiplied by a power.

Power: The exponent – or the number that tells you how many times to use the number in multiplication.

Exponent: The power – or the number that tells you how many times to use the number in multiplication.

Indices: The power or the exponent.

Negative: A value below zero.

Significant: Place value of importance.

Round: Making a number simpler but keeping its value close to what it was.

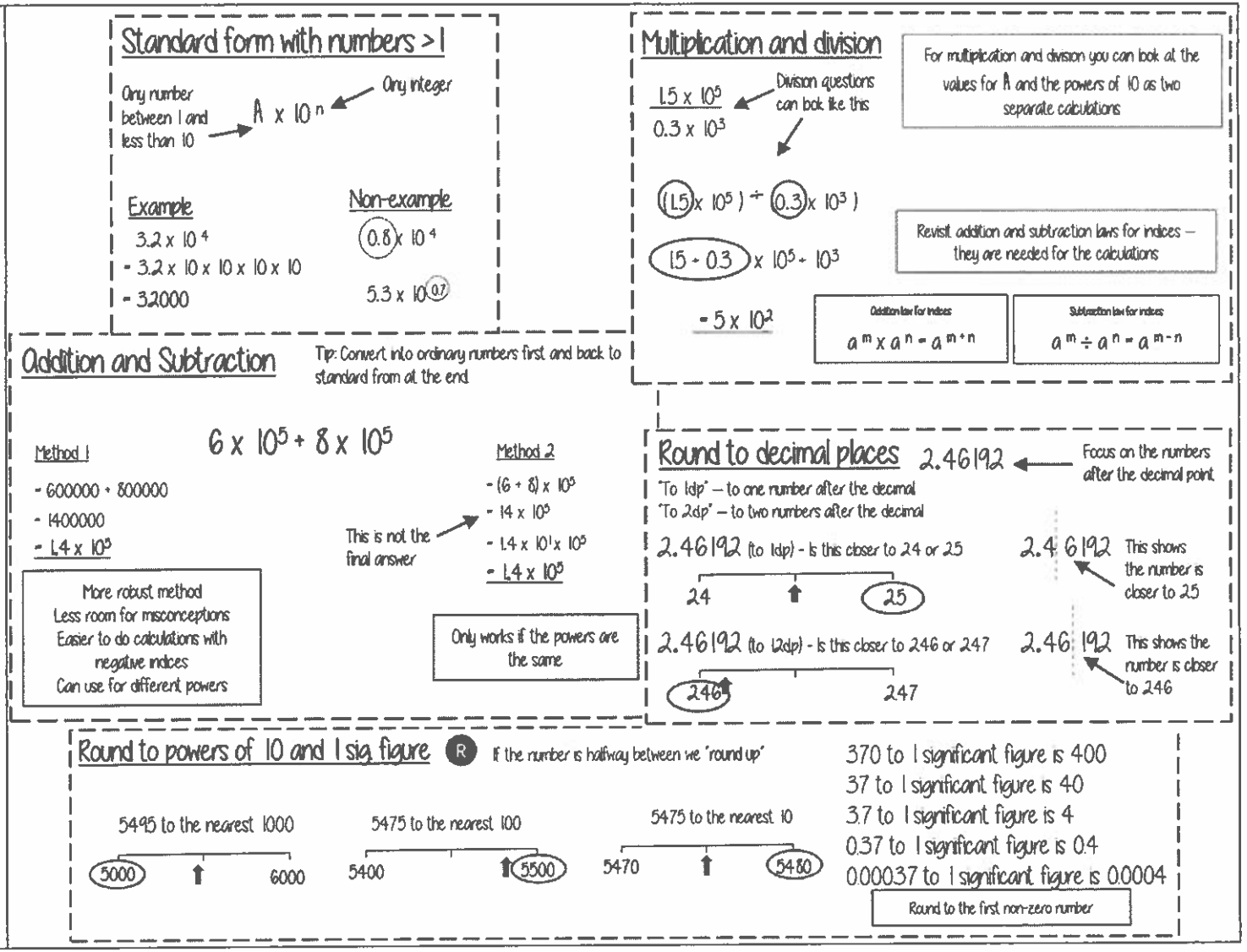
Overestimate: Rounding up – gives a solution higher than the actual value.

Underestimate: Rounding down – gives a solution lower than the actual value.

Metric: A system of measurement.

Balance: The amount of money in a bank account.

Deposit: Putting money into a bank account.



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Yr. 8 Maths Knowledge Organiser: Summer 1 – Developing Geometry (Chapter 5)

By the end of this half-term, you should be able to:

5.1 – Angles in parallel lines & polygons	5.2 – Area of trapezia & circles	5.3 – Line symmetry & reflection
• Identify alternate angles • Identify corresponding angles • Identify co-interior angles • Find the sum of interior angles in polygons • Find the sum of exterior angles in polygons • Find interior angles in regular polygons	• Recall area of basic 2D shapes • Find the area of a trapezium • Find the area of a circle • Find the area of compound shapes • Find the perimeter of compound shapes	• Recognise line symmetry • Reflect in a horizontal line • Reflect in a vertical line • Reflect in a diagonal line

Keywords

Parallel: Straight lines that never meet.

Angle: The figure formed by two straight lines meeting, a measure of a turn (in degrees).

Transversal: A line that cuts across two or more other (normally parallel) lines.

Polygon: A 2D closed shape made with straight lines.

Regular polygon: All the sides have equal length; all the interior and exterior angles have equal size.

Congruent: The same, identical.

Area: Space inside a 2D object.

Perimeter: Length around the outside of a 2D object.

Pi (π): The ratio of a circle's circumference to its diameter.

Preparing for Assessment

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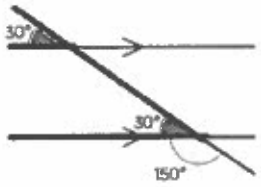
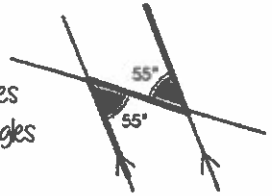
Core Knowledge

Alternate/ Corresponding angles

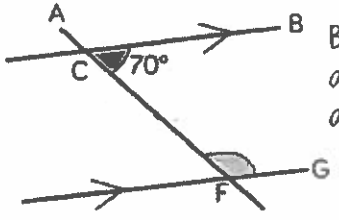


Because alternate angles are equal the highlighted angles are the same size

Because corresponding angles are equal the highlighted angles are the same size



Co-interior angles



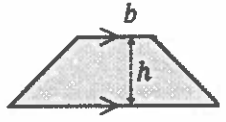
Because co-interior angles have a sum of 180° the highlighted angle is 110°

As angles on a line add up to 180° co-interior angles can also be calculated from applying alternate/ corresponding rules first

Area of a trapezium

Area of a trapezium

$$\frac{(a+b)\times h}{2}$$



Why?

- Two congruent trapeziums make a parallelogram

Lines of symmetry

Mirror line (line of reflection)

Rhombus
two lines of symmetry

Parallelogram
No lines of symmetry

Perpendicular: At an angle of 90° to a given surface.

Formula: A mathematical relationship/ rule given in symbols. E.g. b x h = area of rectangle/ square.

Infinity (∞): A number without a given ending (too great to count to the end of the number) – never ends.

Sector: A part of the circle enclosed by two radii and an arc.

Mirror line: a line that passes through the centre of a shape with a mirror image on either side of the line.

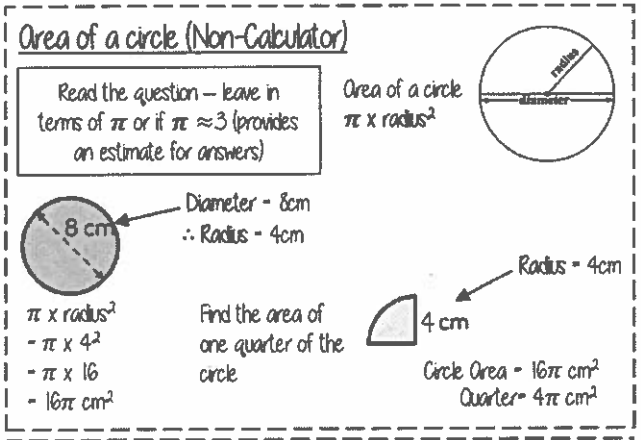
Line of symmetry: same definition as the mirror line.

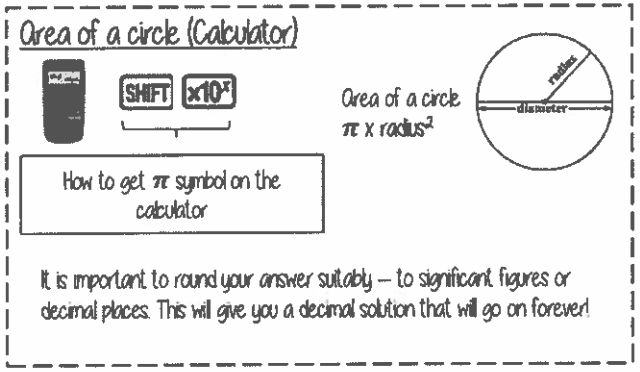
Reflect: mapping of one object from one position to another of equal distance from a given line.

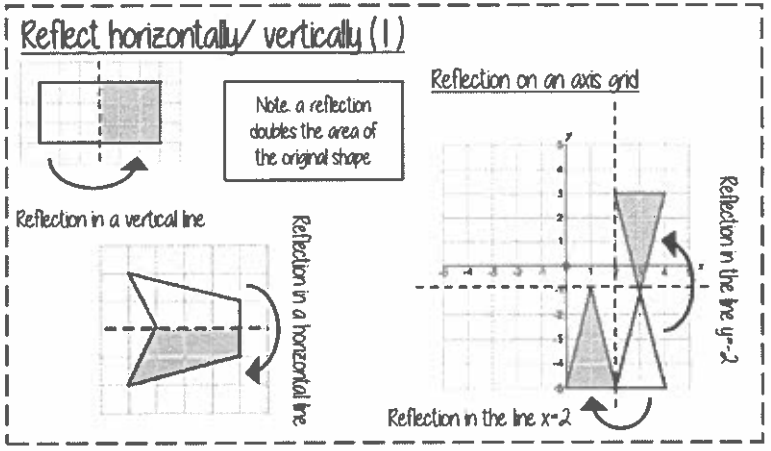
Vertex: a point where two or more-line segments meet.

Horizontal: a straight line from left to right (parallel to the *x* axis).

Vertical: a straight line from top to bottom (parallel to the *y* axis).







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Yr. 8 Maths Knowledge Organiser: Summer 2 – Reasoning with Data (Chapter 6)

By the end of this half-term, you should be able to:

6.1 – The data handling cycle

- Set up a statistical enquiry & design and criticise questionnaires
- Draw and interpret multiple bar charts and line graphs
- Represent and interpret grouped quantitative data
- Find and interpret the range & compare distributions

6.2 – Measures of location

- Understand and use mean, median and mode
- Choose the most appropriate average
- Identify outliers
- Compare distributions using averages and range

Keywords

Hypothesis: an idea or question you want to test.

Sampling: the group of things you want to use to check your hypothesis.

Primary Data: data you collect yourself.

Secondary Data: data you source from elsewhere e.g. the internet/ newspapers/ local statistics.

Discrete Data: numerical data that can only take set values.

Continuous Data: numerical data that has an infinite number of values (often seen with height, distance, time).

Spread: the distance/ how spread out/ variation of data.

Preparing for Assessment

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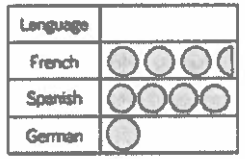
Core Knowledge

Pictograms, bar and line charts (R)

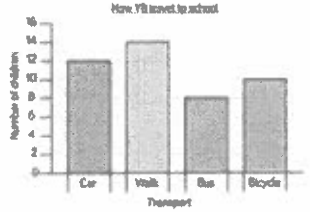
Represents quantitative data

Pictogram



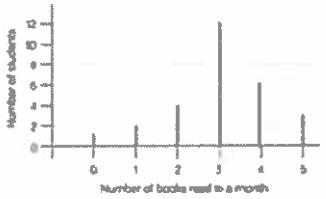
- Need to remember a key
- Visually able to identify mode

Bar Chart



- Gaps between the bars
- Clearly labelled axes
- Scale for the axes
- Title for the bar chart
- Discrete Data

Line Chart



- Gaps between the lines
- Clearly labelled axes
- Scale for the axes
- Discrete Data

Average: a measure of central tendency – or the typical value of all the data together.

Proportion: numerical relationship that compares two things.

Total: all the data added together.

Frequency: the number of times the data values occur.

Represent: something that shows the value of another.

Outlier: a value that stands apart from the data set.

Consistent: a set of data that is similar and doesn't change very much.

Draw and interpret Pie Charts (R)

Remember a circle has 360°

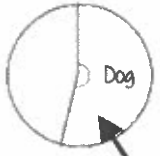
Type of pet	Dog	Cat	Hamster
Frequency	32	25	3

There were 60 people asked in this survey (Total frequency)

$\frac{32}{60}$ "32 out of 60 people had a dog"

This fraction of the 360 degrees represents dogs

$\frac{32}{60} \times 360 = 192°$



Use a protractor to draw This is 192°

Multiple method
Ds 60 goes into 360 – 6 times.
Each frequency can be multiplied by 6 to find the degrees (proportion of 360)

Represents quantitative, discrete data

Mean, Median, Mode

The Mean

A measure of average to find the central tendency... a typical value that represents the data

24, 8, 4, 11, 8,

Find the sum of the data (add the values) 55

Divide the overal total by how many pieces of data you have $55 \div 5$

Mean = 11

The Median

The value in the center (in the middle) of the data

24, 8, 4, 11, 8,

Put the data in order 4, 8, 8, 11, 24

Find the value in the middle 4, 8, 8, 11, 24

Median = 8

NOTE: If there is no single middle value find the mean of the two numbers left

The Mode (The modal value)

This is the number OR the item that occurs the most (it does not have to be numerical)

24, 8, 4, 11, 8,

This can still be easier if it the data is ordered first

4, 8, 8, 11, 24

Mode = 8

Principled **Resilient** **Open** **Understanding** **Disciplined**

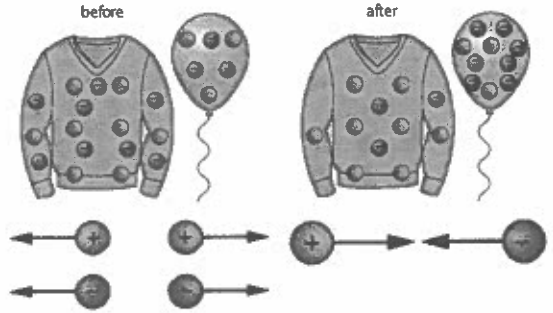
Science

Electricity and magnetism

Knowledge organiser

Charging up

Static electricity: by rubbing **insulators** together **electrons** are transferred, which gives the objects electric charges.



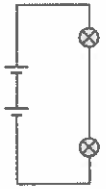
Charged objects have **electric fields** around them.
If you put a charged object in an electric field, a force acts on the object.

Series and parallel circuits

In a series circuit all of the components are connected in one loop. If one component or wire breaks, **current** stops flowing everywhere.

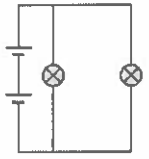
Series circuits

- contain only one loop
- the current is the same everywhere
- the **potential difference** across each component adds up to the potential difference across the battery



Parallel circuits

- contain multiple branches
- currents in all the branches add up to make the total current
- the potential difference across each component is the same as the potential difference across the battery



Potential difference

- Potential difference is the amount of energy transferred by the charges in the circuit.
- It is measured with a **voltmeter** (connected in parallel). The unit is the **volt (V)**.

Circuits and currents

- Current is the amount of charge flowing per second.
- It is measured with an **ammeter** (connected in series).
- The unit for current is the **amp (A)**.

Resistance

The resistance is a measure of how easy it is for current to pass through a component.

conductors – low resistance
insulators – high resistance

Resistance is calculated by measuring the potential difference and the current.

The unit for resistance is the **ohm (Ω)**.

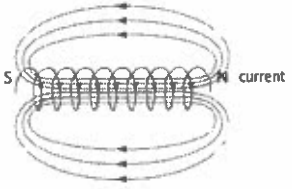
$$\text{resistance } (\Omega) = \frac{\text{potential difference (V)}}{\text{current (A)}}$$

Electromagnets

- Electromagnets are only magnetic when they have a flow of current, so they can be turned off.
- They are made by running a current through a coil of wire.
- They usually have an iron core in the middle of the coil, which makes them stronger.

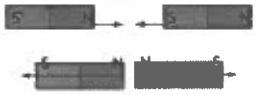
You can make an electromagnet stronger by:

- adding more turns of wire on the coil
- using more current.



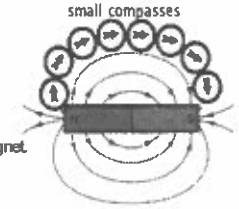
Magnets

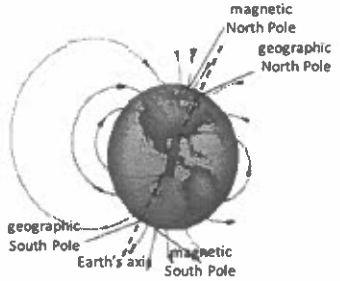
- **Magnets** have north and south poles.
- Opposite poles attract, and the same poles repel:



Magnetic fields

- A magnet has a field around it.
- You can see the field around a bar magnet with a small compass or iron filings.
- If the lines are close together the field is stronger.
- The Earth has a magnetic field, which acts like a big bar magnet.





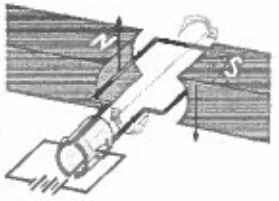
Uses of electromagnets

- moving cars or other metal objects
- sorting iron and steel from aluminium
- making motors and speakers
- making levitating trains, which travel much faster as there is no friction

How motors work

Applying a current to a coil of wire makes it electromagnetic.

This causes a force between the coil of wire and the permanent magnet nearby, which makes the wire spin. This is a motor.



Key words

Make sure you can write definitions for these key terms.

conductor **current** **electron** **electric field** **electromagnet** **insulator** **repel** **magnet** **magnetic field line motor** **north pole** **ohm** **parallel** **potential difference** **resistance** **ammeter** **attract** **series** **static electricity** **south pole** **volt** **voltmeter**

Electricity and magnetism
Homework questions

Q1 Describe 3 different problems caused by static and describe 2 different ways to prevent problems caused by static electricity.

Q2 Explain how a balloon can be statically charged.

Q3 What is the symbol for a bulb, a wire, a switch and a cell?

Q4 Draw a series circuit with two bulbs, one cell and a switch in it.

Q5 Describe what you use to measure the current in a circuit. Draw the circuit in question 3 with an ammeter in it.

Q6 Using circuit diagrams, explain why when one bulb breaks in Xmas tree lights, the other lights do not turn off.

Q7 State the 4 magnetic materials.

Q8 What do the magnetic field lines look like around a bar magnet?

Q9 Describe how to make an electromagnet.

Q10 Draw a circuit with a cell and two bulbs in parallel. Add switches to the circuit so that you can turn each light on and off independently.

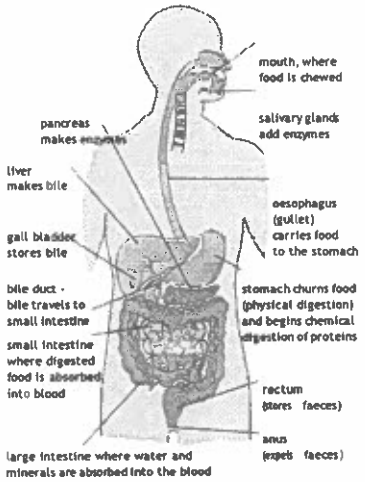
Health and lifestyle

Knowledge organiser

Diet

The digestive system

Digestion is the breaking down of large insoluble food molecules to small soluble ones. These small molecules are absorbed into the blood for your body to use.



Bacteria live on fibre in your diet in the large intestine and make important vitamins (e.g., vitamin K).

Enzymes

Enzymes are special proteins that can break large molecules of nutrients down into small molecules.

Enzymes are known as biological **catalysts** – they speed up **digestion** without being used up.

There are three **main types of enzyme** involved in digestion:

	Type of enzyme		
	carbohydrase	protease	lipase
speeds up digestion of	carbohydrates (e.g., starch)	protein	lipids
	↓	↓	↓
	sugars	amino acids	fatty acids and glycerol

Nutrients

Nutrient	Role in your body
carbohydrates	main source of energy
lipids	fats and oils provide energy
proteins	growth and repair of tissues
vitamins and minerals	essential in small amounts to keep you healthy
water	needed in all cells and body fluids
fibre	provides bulk to food to keep it moving through the gut (not actually a nutrient)

Food tests

Starch

Add a few drops of iodine solution to the food solution.

Result: If the solution turns blue-black, the food contains starch.

Lipids

Add a few drops of ethanol to the food solution, shake it, and leave for one minute. Then pour the ethanol into a test tube of water.

Result: If the solution turns cloudy, the food contains lipids.

Sugar

Add a few drops of Benedict's solution and heat the solution in a water bath.

Result: If the solution turns orange-red, the food contains sugar.

Protein

Add a few drops of copper sulfate solution and sodium hydroxide solution.

Result: If the solution turns purple, the food contains protein.

Effects of an unhealthy diet

A **balanced diet** is when you have the right proportions of the food groups to keep you healthy.

Eating an unbalanced diet can lead you to be:

underweight

Increased risk of:
- poor immune system
- lack of energy
- lack of vitamins and minerals.

overweight

Increased risk of:
- heart disease
- stroke
- diabetes
- some cancers.

vitamin and mineral deficient

Vitamin A deficiency can lead to night blindness.

Vitamin D deficiency can lead to rickets.

Effects of lifestyle on health

Drugs

Drugs are any chemicals that affect the way your brain and body work.

Medicinal drugs	Recreational drugs
• used in medicine • benefit your health if used correctly • used to treat symptoms or cure illness • some have side effects	• taken for enjoyment/to relax/stay awake • normally have no health benefits • many can be harmful • many are illegal
examples include: painkillers, antibiotics, and cough mixture	examples include: alcohol, caffeine, heroine, cocaine, tobacco

Alcohol

Alcohol is a depressant because it slows down your body's reactions.

Drinking large amounts of alcohol over a long time can cause:
- stomach ulcers
- heart disease
- reduced fertility
- brain damage
- liver damage (cirrhosis)

Drinking during pregnancy increases the risk of:
- miscarriage
- stillbirth
- premature birth
- low birth weight babies
- Foetal Alcohol Syndrome (FAS)

Smoking

Cigarette smoke is full of harmful chemicals including:

tar – clogs the lining of the lungs and alveoli, contains cancer-causing chemicals

nicotine – an addictive stimulant

carbon monoxide – stops blood from carrying oxygen.

Smoking can cause many different diseases, including:
- heart disease
- emphysema
- respiratory infections
- strokes
- lung cancer

Smoking during pregnancy increases the risk of miscarriage and low birth weight babies, and can also affect the foetus' development.

Addiction – When your body becomes used to the chemical changes caused by a drug and you need to take the drug to feel normal.

When a person who is addicted to a drug tries to stop taking it, they may suffer from sickness, nausea, stomach cramps, headaches, anxiety, and sweating. These are called **withdrawal symptoms**.

Key words

Make sure you can write definitions for these key terms.

addiction anus balanced diet carbohydrase carbohydrate carbon monoxide catalyst deficiency digestion digestive system drug enzyme fibre food test large intestine lipid lipase mineral nicotine nutrient obese oesophagus protease protein rectum small intestine starvation stimulant stomach tar vitamin withdrawal symptom

Health and Lifestyle
Homework Questions

Q1 In a table list the 7 groups of nutrients. Give an example of a food from each one and describe why we need each nutrient.

Q2 Describe the food tests for starch, simple sugars, fats/lipids and protein

Q3 Explain the difference between a balanced diet, starvation, malnutrition and obesity

Q4 Write a story about a day in the life of a chicken sandwich as it passes through the digestive system.

Q5 Draw a table to show examples of medicinal and recreational drugs (including alcohol and tobacco) and their effects on the body.

Q6 Explain why a fat free diet is not good for the body. *(higher)*

Q7 Explain why explorers in the arctic need a massive amount of food to maintain their body weight. *(higher)*

Q8 Research the importance of enzymes in digestion. *(higher)*

The Periodic Table

Knowledge Organiser

The **Periodic Table** displays the names and symbols of all the **elements** we have discovered which are organised by their **chemical properties** and their **physical properties**. There are about 100 naturally occuring elements.

Physical properties

The **physical properties** of an element describe how a substance behaves generally.

(*E.g., **conductor** of electricity, dense, conductor of heat, shiny, **malleable**, sonorous, high melting and boiling points*)

Chemical properties

The **chemical properties** of an element describe how a substance behaves in chemical reactions.

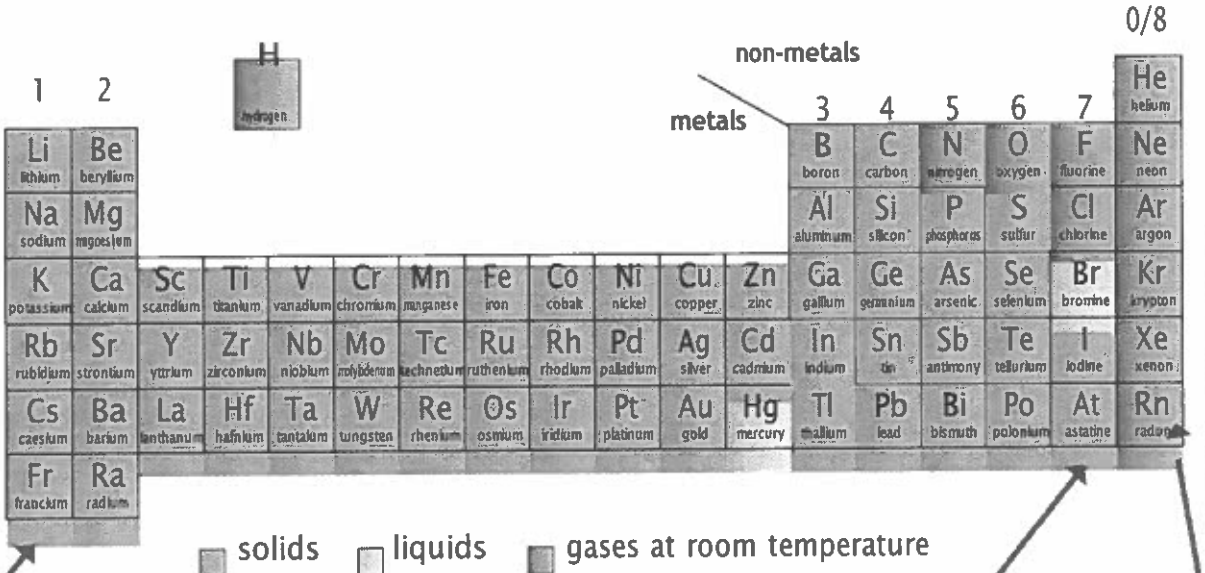
For example, how reactive it is, what other substances it reacts with, and the products it forms in reactions.

Metals

- good conductors of heat and electricity
- shiny
- malleable and ductile
- sonorous when solid
- most have high melting and boiling points
- some metals react with oxygen to form metal oxides

Group 1

- like all other metals but are very **reactive**
- react vigorously (strongly) with water
- get more reactive as you go down the group
- lower melting points than most other metals
- melting points decrease down the group
- always produce a metal hydroxide and hydrogen gas when reacted with water



solids liquids gases at room temperature

This version of the Periodic Table does not include every discovered element.

- columns are called **groups**
- rows are called **periods**

Elements in a group normally have similar properties, meaning chemists can predict properties of elements based on their group.

Non-metals

- often have properties the opposite of metals
- low boiling points, so are often gases at room temperature
- poor conductors of electricity and heat
- dull in appearance
- low density
- **brittle** and not sonorous

Group 7

- generally very reactive
- generally the opposite of Group 1
- melting point increases down the group while reactivity decreases.
- take part in **displacement reactions**, where an element from higher up the group takes the place of one from lower down the group in a compound.

For example: *potassium iodide + chlorine → potassium chloride + iodine*

Group 0

- called the **noble gases**
- very unreactive
- low boiling points, so are gases at room temperature
- like the halogens, their boiling points increase

Key words

Make sure you can write definitions for these key terms.

element **group** **halogen** **malleable** **metal** **noble gas** **non-metal** **alkali metal** **brittle conductor** **chemical property** **dense** **displacement reaction** **periodic table** **physical property** **sonorous** **physical property** **reactive**

The periodic Table
Knowledge organizer

Q1 Where are the non-metals on the periodic table? – draw a diagram

Q2 What are the groups and periods in the periodic table?

Q3 What differences are there between metals and non-metals.

Q4 Make a poster to summarise the reactions and properties of Group 1 elements lithium, sodium, potassium and rubidium

Q5 What are the properties of group 7 elements?

Q6 What is a displacement reaction?

Q7 What is unusual about group 0 elements?

Q8 Evaluate the uses for Helium. Why is using it for balloons potentially a problem for scientists?

P1 Light

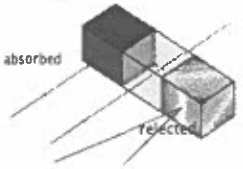
Knowledge organiser

How does light travel?

Luminous objects are sources of light, e.g., the Sun.

Non-luminous objects do not produce their own light, e.g., the Moon.

When light hits an object it can be **absorbed**, **reflected**, or **transmitted**.



If an object is:

transparent – most light is transmitted

translucent – light is scattered

opaque – no light is transmitted so a shadow is produced.

Light can travel through gases, some solids and liquids, and completely empty space (a vacuum).

The speed of light in a **vacuum** is about 300 000 km/s.

Distances in space are measured in **light-time**. Remember that light-time is a distance (not a measure of time).

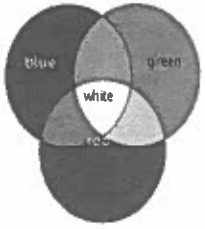
A light-minute is the distance light travels in one minute.

A light-year is the distance light travels in one year.

Colours of light

A **prism** refracts different colours of light by different amounts. This disperses light into a continuous **spectrum** of colours.

The **primary colours** of light are **red**, **green**, and **blue**.



Secondary colours are produced when any two primary colours are mixed.

Filters subtract colours from white light, so that only one colour of light is transmitted.

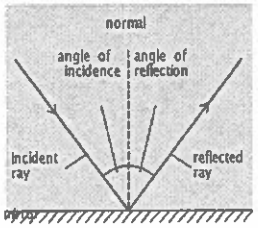
Objects appear to be different colours because they reflect some colours of light and absorb others.

Black objects absorb all colours and white objects reflect all colours.

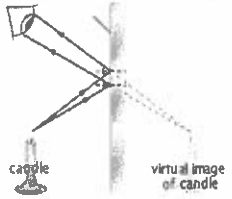
Reflection and Refraction of Light

The **angle of incidence** is equal to the **angle of reflection**.

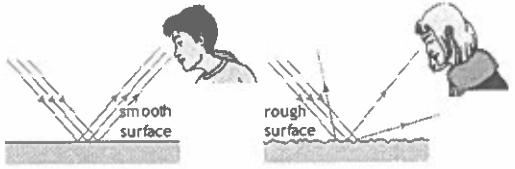
The **normal** is an imaginary line at 90° to the mirror.



Images in mirrors are virtual – they look like they are behind the mirror.



Whether or not you can see a clear reflected image depends on how smooth the surface is:

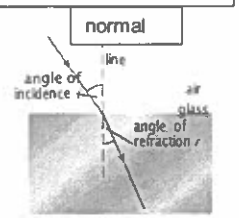


specular reflection **diffuse scattering**

Refraction is when light changes direction when it travels from one **medium** (material, such as air or water) to another. Refraction happens because light travels at different speeds in different materials.

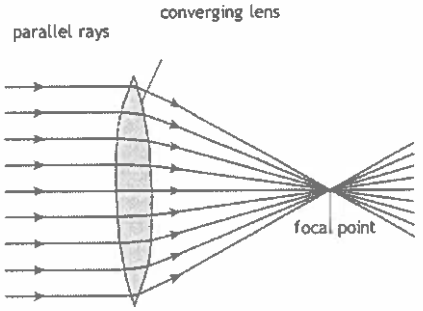
Rays of light will be refracted:

- towards the normal if they slow down, such as going from air to glass
- away from the normal if they speed up, such as going from water to air.



Lenses use refraction to spread out or **focus** light.

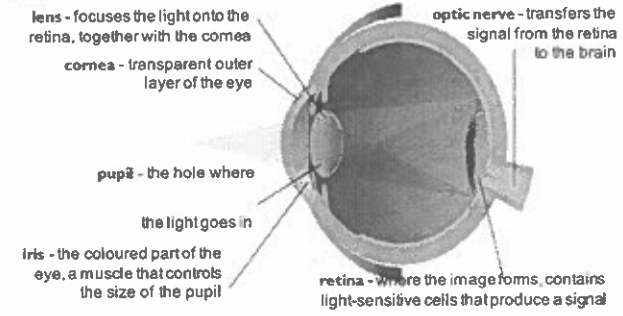
Convex (or **converging**) lenses (like the ones in your eyes) are shaped to focus the light to a point – called the **focal point**.



How do eyes and cameras work?

Light entering your eye is refracted by the **lens**, focusing it on the **retina** and creating an inverted image. **Photoreceptors** detect the light hitting your retina and send an electrical impulse to your brain.

object



Cameras work in the same way as your eye – light passes through an opening and a **real image** is formed on a screen or film.

Digital cameras now have a **charge-coupled device** (**CCD**) instead of film – when light hits a **pixel** it produces an electrical charge.

Key Words

Make sure you can write a definition for these key terms.

absorb angle of incidence angle of reflection aperturecamera charge-coupled device continuous converging convex cornea diffuse scattering dispersion emit eye filter focal point focus image incident ray inverted iris law of reflection lens light-time luminous medium non-luminous normal opaque optic nerve photoreceptors pixel plane primary colour prism pupil ray real image reflect reflected ray refraction retina secondary colour source spectrum specular reflection translucent transmit transparent virtual image

Light
Homework questions

1. Describe what is meant by a luminous object.
2. Describe the difference between opaque, transparent and translucent.
3. Describe what is meant by the law of reflection.
4. Find out what a reflective telescope is. Using diagrams explain how it works.
5. Describe what refraction is and explain why it happens (you may want to use a model to help you)
6. Explain what happens if light travels along the normal to a glass block (*higher)*
7. Describe how your eye works.
8. Describe how we see colours. EG. Why does a red shirt look red?
9. Describe what is meant by a mirage and explain how one is created.
10. Find out what total internal reflection. Use it to explain why diamonds sparkle in light (*higher)*

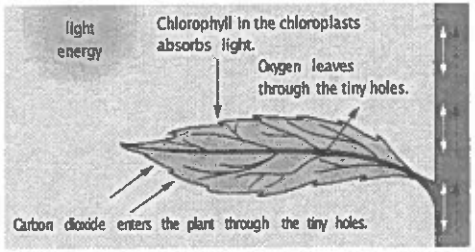
Biological processes

Knowledge organiser

Photosynthesis

Photosynthesis is a chemical reaction that takes place in the **chloroplasts** to produce **glucose**.

carbon dioxide + water → oxygen + glucose

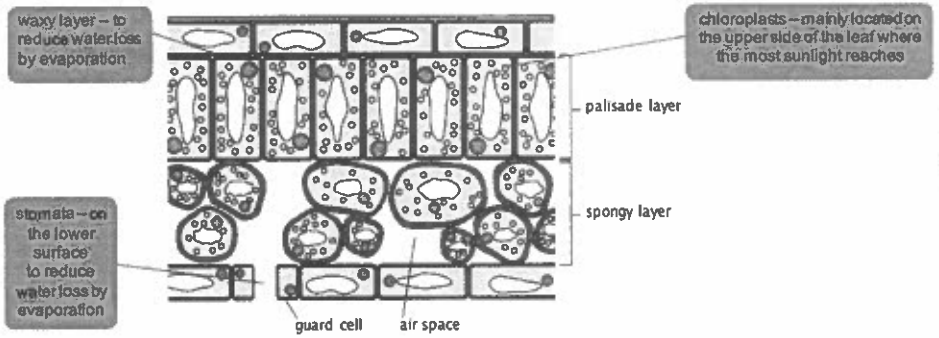


Glucose (white arrows) is transported to all parts of the plant. Water (blue dashed arrows) is transported from the roots to the stem and leaves.

The minerals plants need are:

1 **nitrates** for growth
2 **phosphates** for healthy roots
3 potassium for healthy leaves and flowers
4 magnesium for making chlorophyll

If a plant does not have enough of a mineral, it may suffer from a mineral **deficiency**. Farmers can use **fertilisers** to add missing minerals to the soil.



Leaves are specially adapted for photosynthesis:

- have lots of green **chlorophyll** – absorb sunlight for photosynthesis
- are thin – allow gases to diffuse in and out of the leaf
- have a large surface area – absorb as much light as possible
- have veins – xylem transports water and phloem transports glucose

Respiration

with oxygen

Aerobic respiration

glucose + oxygen → carbon dioxide + water (+ energy)

- Respiration occurs in the **mitochondria** of cells to produce energy.
- Glucose is absorbed from the small intestine into the blood **plasma**. It is transported to the cells where it diffuses in.
- Oxygen is breathed in and diffuses into the bloodstream. Oxygen is then carried by haemoglobin to the cells where it diffuses in.
- Carbon dioxide diffuses out of the cells into the blood plasma. It is transported to the lungs where it diffuses into the air sacs and is exhaled.

without oxygen

Anaerobic respiration (in animals)

glucose → lactic acid (+ energy)

- This occurs when there is not enough oxygen for aerobic respiration, such as during strenuous exercise.
- It transfers less energy than aerobic respiration.
- The lactic acid produced can cause muscle cramps. This causes increased inhalation to break down lactic acid – the oxygen needed is called the **oxygen debt**.

Fermentation (in microorganisms)

glucose → ethanol + carbon dioxide (+ energy)

- Yeast respires anaerobically – this fermentation is important in food production (e.g., bread, beer, and wine).

Key words

Make sure you can write definitions for these key terms.

aerobic **anaerobic** **chlorophyll** **community** **consumer** **deficiency** **fermentation** **fertiliser** **producer** **mitochondria** **nitrate** **oxygen debt** **plasma** **phosphate** **photosynthesis** **stomata**

Biological Processes
Homework questions

Q1 Using the equation for photosynthesis, describe where the reactants come from and what the products are used for by the plant.

Q2 Describe the role of the stomata in photosynthesis.

Q3 Describe what you would expect a plant to look like if it was deficient in a) nitrate, b) magnesium, c) phosphorus, d) potassium

Q4 Compare the equations for aerobic and anaerobic respiration and list the similarities and differences between the processes.

Q5 Write down the meaning of the term interdependence. In a food web describe what could happen to the other organisms if one of the herbivores population decreased.

Q6 Explain how the palisade layer, the spongy layer and stomata in the leaf are adapted for photosynthesis *(higher)*

Q7 Explain why anaerobic respiration in yeast is economically important. *(higher)*

Q8 Explain the importance of chlorophyll, stomata and xylem vessels in photosynthesis. *(higher)*

Metals and acids

Knowledge organiser

Metals and acids

- If a metal reacts with an acid, it produces a salt and hydrogen gas.
- All acid compounds have hydrogen in them.
- When the hydrogen is replaced by a metal, the compound is called a salt.

For example, sulfuric acid has the formula $H2SO4$. .

CuSO4 is a salt because the copper has taken the place of the hydrogen in sulfuric acid.

The three main acids are hydrochloric acid, sulfuric acid, and nitric acid.

Metals can react with all of these acids to produce a salt and hydrogen gas.

copper + hydrochloric acid → copper chloride + hydrogen

iron + sulfuric acid → iron sulfate + hydrogen

magnesium + nitric acid → magnesium nitrate + hydrogen

Metals and water/steam

- Very reactive metals like sodium will react with cold water to produce a metal hydroxide and hydrogen gas.

sodium + water → sodium hydroxide + hydrogen

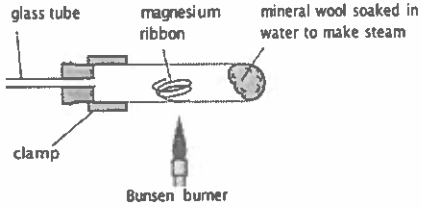
$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

- Other metals like magnesium only react with steam, and produce a metal oxide and hydrogen.

magnesium + steam → magnesium oxide + hydrogen

$Mg(s) + H_2O(g) \rightarrow MgO(s) + H_2(g)$

Magnesium can be reacted with steam using the following experimental set-up.



Testing for hydrogen gas

The gas produced when reacting a metal and a salt can be collected in an upturned test tube, and a test performed to check that the gas is hydrogen.

Insert a lit splint into the upturned test tube – if the gas is hydrogen, there will be a 'pop' sound.

Metals and oxygen

- Many metals will react with oxygen from the air to produce a metal oxide.
- Often, they will need to be heated before they can react.

Metal	Reaction with oxygen
magnesium	burns vigorously
zinc	burns less vigorously
iron	burns
lead	do not burn; when heated, form layer of oxide on surface
copper	
gold	no reaction

Metal displacement reactions

- A **displacement reaction** occurs when a more reactive element takes the place of a less reactive element in a compound. In metals, this means that the more reactive metal will become a compound, and the less reactive one an element.

For example, iron is more reactive than copper so:

copper sulfate + iron → copper + iron sulfate

The iron has displaced the copper from its compound. The solution changes from blue to pale green and the metal changes from grey to rose coloured, indicating that a chemical reaction has happened.

The reactivity series

Increasing reactivity

most reactive
potassium
sodium
lithium
calcium
magnesium
aluminium
zinc
iron
lead
copper
silver
gold
least reactive

State symbols

- Symbol equations have letters in brackets after each substance.
- These tell you the state of matter of each substance, and are called **state symbols**:

(s) = solid, (l) = liquid, (g) = gas, (aq) = dissolved in water

For example, $H_2O(s)$ *is ice,* $H_2O(l)$ *is water,* $H_2O(g)$ *is steam, and* $NaCl(aq)$ *is sodium chloride (table salt) dissolved in water.*

Materials

A **ceramic** is a hard, brittle material that is made by firing a material, such as clay, at a high temperature. Ceramics also have similar chemical properties to each other. They do not react with water, acids, or alkalis.

A **polymer** is a substance with very long molecules. There are many polymers. Different polymers have different properties. Their properties make them suitable for their uses. Natural polymers include wool and rubber. Synthetic polymers include polyester and nylon.

A **composite** is a mixture of materials. Each material has different properties. The composite has properties that are a combination of the properties of the materials that are in it.

Metal extraction

Only very unreactive metals like gold and platinum are found as their metals themselves in nature. Most metals are found in compounds called minerals. Chemical reactions can be used to extract the metal element from its compound. Minerals that have enough metal in them to make it financially worthwhile to extract the metal are called ores.

Key words

Make sure you can write definitions for these key terms.

acid **ceramic** **composite** **displacement reaction** **hydrogen** **material** **metal** **polymer** **reaction** **reactivity** **reactivity series** **salt** **state symbol**

Metal and Acids
Homework Questions

1. What gas is made when a metal reacts with acid?

2. What is formed when a metal reacts with oxygen?

3 Describe the test for hydrogen. Include a diagram.

4 What is the word equation for the reaction of metals with water?

5. What causes a displacement reaction to occur?

6. How are metals extracted from ores?

7. What is the reactivity series? List at least 10 metals in the right order.

8. What properties do ceramics have?

9. What is a polymer? 8. What is a composite material?

10. Why is gold used for jewellery?

11. Why can't you use carbon to extract magnesium? *(higher)*

12. Suggest some reactions that would let you determine the reactivity series of a set of metals. *(higher)*

Energy

Knowledge organiser

Energy adds up

The **law of conservation of energy** states that energy cannot be created or destroyed, only transferred.

total energy before = total energy after

Transferring energy

Light, sound, and electricity are ways of transferring energy between different stores.

Energy and temperature

- **Thermometers** measure temperature in degrees **Celsius (°C)**.
- Temperature measures the *average* energy.
- **Thermal energy** measures the total energy.

A warm bath has more thermal energy than a heated kettle, even though the kettle has a higher temperature.

Heating solids, liquids, and gases

- As we heat things the particles gain more **kinetic energy**, and vibrate more or faster.
- The energy needed to heat an object depends on the mass, material, and temperature rise.

Equilibrium

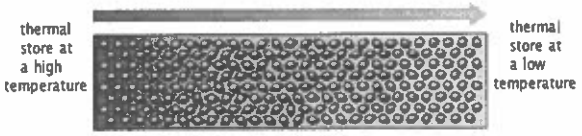
Equilibrium is when objects have the same thermal energy.

Particles

Thermal energy can be **transferred** by **conduction, convection** or **radiation.**

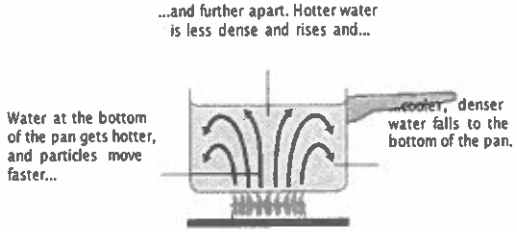
Conduction

- Particles collide into others when they vibrate.
- Occurs in solids.



Convection

- Occurs in liquids or gases.
- The part in contact with the heat source gets hotter. The particles move faster, causing them to become further apart, and a decrease in density.
- The hot part then rises, and cooler, denser parts fall and take its place at the bottom.
- They now heat, so the cycle continues. We call this a **convection current.**



Energy and power

Power is the rate of energy transfer – how much energy is transferred each second.

Energy bills

- Energy use is measured in kilowatt hours (kWh).
  For example, a 2 kW device used for 1 hour uses 2 kWh; if used for 2 hours, it uses 4 kWh.
- An energy bill covers the cost of the fuel used at the power station, the power station, staff, and infrastructure.
- To convert kWh to joules, convert the time to seconds (there are 3600 seconds in an hour).
  For example, 2kWh = 2000 J/s × 3600 s = 7 200 000 J

Reducing bills

- Use fewer appliances or more efficient ones.
- Insulated houses lose less thermal energy so don't need to use as much power.

Work

You can transfer energy by using a force, which is doing **work.**

Work done (J) = force (N) × distance (m)

Simple machines like **levers** and **gears** can make it easier to do work but you still get the energy out that you put in.

Radiation

- **Infrared radiation** transfers energy without particles – it is a wave.
- All objects emit radiation.
- The amount depends on their temperature and the surface (colour and rough/smooth).
- Radiation can be **absorbed** or **reflected.**

[illegible]

Renewable resources produce greenhouse gases when built, not when used, and will not run out.
For example, wind, tidal, wave, hydroelectric, geothermal, biomass, and solar powers.
The power rating tells you how much energy is transferred per second, or the rate of transfer of energy. Measured in **watts (W).**

Energy transferred (J) = power (W or J/s) × time (s)

The current generated is sent to our offices, factories, and homes down long cables.

Fossil fuels are burned to heat water, which produces steam.

Burning fossil fuels produces **greenhouse gases**, such as carbon dioxide.

The steam turns a turbine, which spins a generator.

Non-renewable resources

Non-renewable resources include the **fossil fuels** coal, oil, and gas. These were formed millions of years ago from fossilised remains.
These are non-renewable because you cannot reuse them, and they will eventually run out.
Coal, oil, or gas are used to run **thermal power stations.**

[illegible]

- There is energy in the chemical stores associated with food and fuel.
- Energy is measured in **joules (J).**
- You need different amounts of energy for different activities.

The energy in food varies.
For example:
- *apple – 200 kJ per 100 g*
- *chips – 1000 kJ per 100 g*

The energy used when we do things varies too.
For example:
- sitting – 6 kJ per minute
- running – 60 kJ per minute

Key words

Make sure you can write definitions for these key terms.

absorb **chemical store** **conduction** **convection** **convection current** **energy store** **fossil fuel** **gear** **greenhouse gas** **infrared radiation** **insulator** **joule** **kilowatt** **law of conservation of energy** **lever** **non-renewable** **power station** **radiation** **renewable** **reflect** **thermal energy** **thermometer** **work**

Energy
Homework Questions

Q1. Give 3 different examples of how energy can be stored. List at least 6 stores of energy.

Q2. Give 4 examples of energy transformation.

E.g A light bulb

Electricity ⟶ Light + Heat

Q3. Describe what heat is and what it is measured in.

Q4. Describe what temperature is and what it is measured in.

Q5. Describe how heat is transferred through conduction, convection and radiation 6. Describe how energy is generated using a thermal power station.

Q6. Find out 4 different ways to insulate a house. Explain how one of these methods actually works.

Q7 Describe what is meant by the conservation of energy.

Q8 Calculate the work done by lifting a rock of weight 200N a distance of 0.25m.

Q9 A 8kW cooker takes 45 minutes to cook chicken nuggets.

a) Calculate the energy transferred in kWh
b) Calculate the cost of cooking the nuggets if the electricity company charges 35p per kWh.

Key words

Make sure you can write definitions for these key terms.

absorb **chemical store** **conduction** **convection** **convection current** **energy store** **fossil fuel** **gear** **greenhouse gas** **infrared radiation** **insulator** **joule** **kilowatt** **law of conservation of energy** **lever** **non-renewable** **power station** **radiation** **renewable** **reflect** **thermal energy** **thermometer** **work**

Ecosystems and adaptation

Knowledge organiser

Competition

Animals compete for:

1 food
2 water
3 space – to hunt and for shelter
4 mates – to reproduce.

Plants compete for:

1 light
2 water
3 space
4 minerals – plants do not compete for food, as they produce their own through photosynthesis.

Predators and prey

When a predator feeds on just one type of prey, there is an interdependence between the predator population and the prey population. This means that changes in the population of one animal directly affect the population of the other.

Populations and ecosystems

The number of organisms that live in the same area is called a **population**. Populations of organisms are constantly changing – this affects other populations in a food web.

Interdependence is when living organisms depend on each other to survive, grow, and reproduce.

Ecosystem: all the organisms found in a particular location, and the area they live in.

Community: the organisms in an ecosystem.

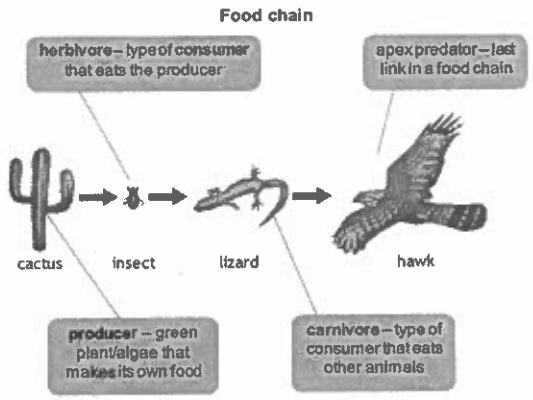
Habitat: the area a community lives in.

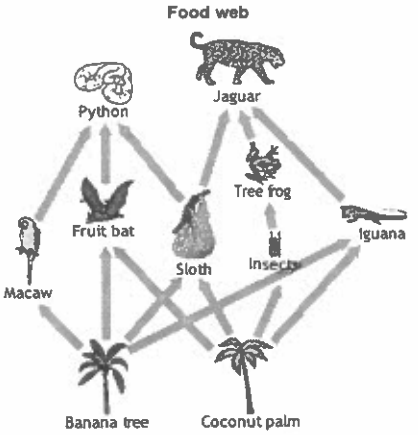
Niche: the particular place or role that an organism has within an ecosystem. This reduces competition for resources.

Food chains and webs

Food chains show the transfer of energy between organisms – the arrows represent the direction of energy transfer.

Food webs show how lots of food chains are connected in an ecosystem.





Prey: an organism eaten by another organism.

Predator: an organism that eats another organism.

Bioaccumulation is the build up of chemicals, like insecticides, passed along a food chain.

Adaption and change

Adaptation

- Adaptations are characteristics that help an organism to survive and reproduce.

For example, the cheetah is the fastest land animal. This speed makes it a very successful predator.

Environmental changes

- Plants and animals adapt to changes in their environments.
- Habitats can change through fire, climate change, or disease causing reduced food supplies.

For example, deciduous trees look different in each season, and bears hibernate somewhere warm in the winter.

Interdependence

- Predator and prey species are **interdependent.**
- This occurs when a change in the population of one animal directly affects the population of the other.

For example, Canadian lynx and the snowshoe hare are interdependent:

- When the prey (hare) population increases, the predators (lynx) have more to eat, the lynx survive longer and reproduce more, so the number of predators increases.
- The increase in predators means that more prey are eaten, so the prey population decreases.
- The predators then do not have enough food, so their numbers decrease, and the prey population increases again.

Key words

Make sure you can write definitions for these key terms.

adaptation **bioaccumlation** **carnivore** **chemosynthesiscompetition** **continuous** **characteristic** **discontinuous**
ecosystem **environmental variation** **evolution** **extinct** **food chain** **food web** **fossil record** **habitat** **herbivore**
inherited variation **interdependence** **interdependent** **natural selection** **niche** **population** **predator** **prey** **species** **variation**

Ecosystems and adaptations
Homework questions

Q1 Choose an animal or a plant and list as many ways it is adapted to its habitat.

Q2 Draw a food web to show the feeding relationships in a pond.

Q3 Explain why most food chains have a maximum of four levels.

Q4 Give an example for the following organisms.

producer carnivore predator prey primary consumer secondary consumer tertiary consumer

Q5 Write down the meaning of the term interdependence. In a food web describe what could happen to the other organisms if one of the herbivores population decreased.

Q6 What is an ecosystem? What is population?

Q7 What do animals and plants compete for?

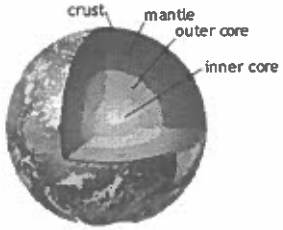
Q8 Describe the terms predator and prey and explain how the changes in the numbers of predator or prey can affect the balance in an ecosystem. *(higher)*

Q9 DDT is an insecticide that was once used to kill insects. It is no longer used, as it killed many fish-eating birds. The fish fed on plankton which absorbed the insecticide from the rivers. Draw a food chain to show this and explain how the insecticide killed the birds but not the fish. *(higher)*

C2 The Earth

Knowledge organiser

The Earth

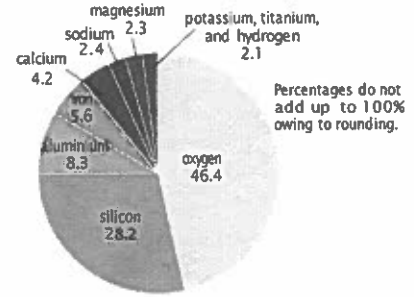


The Earth is made of several layers:

- The **crust** is rocky and solid.
- The **mantle** is solid rock but can flow.
- The **outer core** is liquid metal and the **inner core** is solid metal.

The crust

The Earth's crust contains many naturally-occurring elements in different proportions.

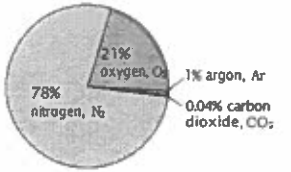


Types of rock

There are three types of rock that make up the Earth's crust. These are formed by different processes in the **rock cycle**, and have different properties.

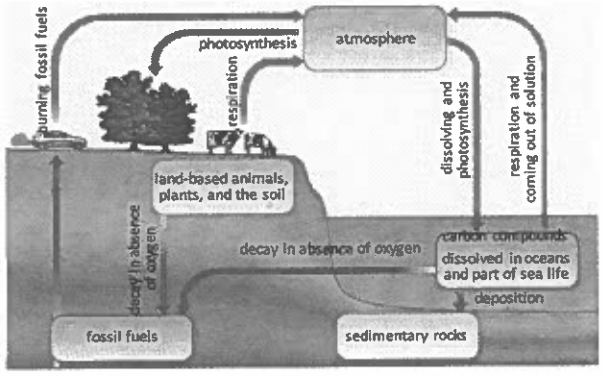
The atmosphere

The **atmosphere** is a layer of gas surrounding the Earth. It is mainly composed of nitrogen and oxygen.



The carbon cycle

The carbon cycle shows how carbon atoms move between carbon dioxide in the atmosphere, and carbon compounds on Earth.



Climate change

Greenhouse gases like carbon dioxide trap energy in the Earth's atmosphere. Humans are adding more of these gases and this is causing global heating. This causes:

- melting of glaciers and polar ice
- changes to local weather patterns.

Long-term changes to weather patterns are called climate change. Climate change has led to the extinction of some plant and animal species. Climate change makes it harder for people to grow food.

Recycling

Earth's resources are limited and come from the ocean, crust or atmosphere. To make sure there are enough resources to live our lives as we wish we can:

- Reuse: you or someone else uses an object again, either for its original purpose or for a different purpose.
- Recycle: collecting and processing used objects so that their materials can be used again.

Type of rock	How it is formed	Properties	Uses
sedimentary rock	• **sediment** piles up in one place and over many years stick together by **compaction** or **cementation** • **compaction**: weight of sediments above squeeze them into rocks • **cementation**: another substance sticks the sediments together	• porous: made of small grains stuck together so there are holes that water can pass through • soft: easy to break apart the sediments	building materials (*e.g., sandstone and limestone*)
igneous rock	• when liquid rock cools it turns into igneous rocks these are made of **crystals** locked tightly together • **Magma**: liquid rock underground – cools slowly and forms large crystals. • **Lava**: liquid rock above the ground – cools quickly and forms small crystals.	• Durable and hard (difficult to damage): the crystals are locked tightly together • Not porous: there is no space between crystals	pavement rail tracks
metamorphic rock	• other rocks under the Earth are heated and put under pressure • overtime, these rocks become metamorphic	• Not porous: there is no space between crystals	marble used for kitchens slate used for roofing tiles

Key words

Make sure you can write definitions for these key terms.

atmosphere **cementation** **climate change** **compaction** **crust** **Earth** **global heating** **global warming**
greenhouse effect **greenhouse gases** **igneous rock** **inner core** **lava** **magma** **mantle** **metamorphic rock**
outer core **porous** **recycle** **resource** **reuse** **rock cycle** **sedimentary rock**

The Earth
Homework questions

Q1 Make a detailed poster to show the structure of the Earth with clear labels

Q2 What are the three main types of rock? Give an example for each and describe their structure.

Q3 What is the rock cycle?

Q4 List 4 stages in making sedimentary rock.

Q5 Draw a diagram of the carbon cycle and label the key stores.

Q6 Why is the level of carbon dioxide in the atmosphere increasing?

Q7 What is recycling? List advantages and disadvantages of recycling.

Q8 Why are scientists worried about climate change?

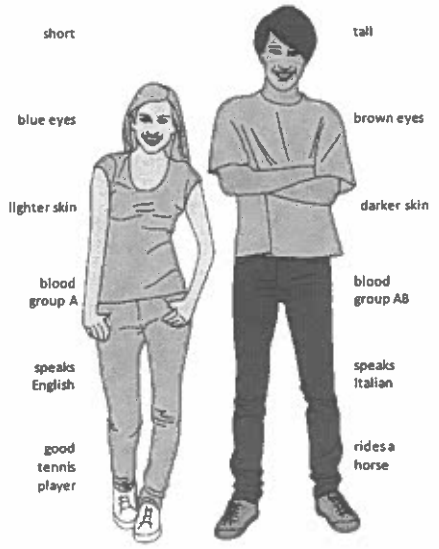
Inheritance

Knowledge organiser

Variation

Variation is the difference in characteristics of individuals of the same species. Variation can be:

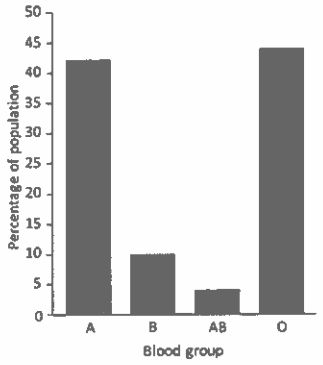
- **Inherited** – passed on from parents to offspring by genes e.g., eye colour.
- **Environmental** – caused by the surroundings and what has happened to you in your life e.g., getting a tattoo.



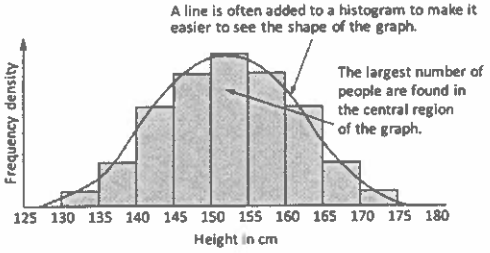
Many characteristics are affected by both inherited and environmental variation. For example, somebody may inherit the characteristic to be tall from a biological parent, but if they eat a poor diet their rate of growth may be reduced.

Displaying data

- **Discontinuous variation** – Fixed number of values e.g., Blood group. Display data in tables, pie charts, and bar charts.



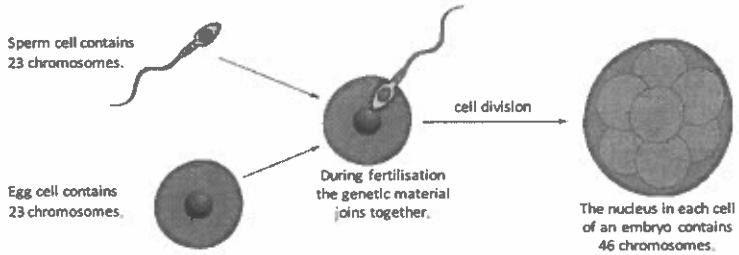
- **Continuous variation** – Any value within a range e.g., height. Display data in tables, scatter graphs, histograms, and bar charts.



How are genes inherited?

DNA (deoxyribonucleic acid) is genetic material stored in the **nucleus** of your cells. The structure of DNA was discovered by Crick, Watson, and Wilkins, who won the Nobel Prize for medicine in 1962. Their discovery was underpinned by the X-ray images from Rosalind Franklin.

The DNA is organised into **chromosomes**; different species have different numbers of chromosomes. Each section of a chromosome is called a gene.



What causes species to change?

Natural selection is when individuals that are best adapted survive and have offspring of their own and pass on the successful genes. This causes a gradual change in a species over millions of years and is called evolution. Fossils give evidence to this theory.

If all the organisms in a species die before reproducing the species will become **extinct**.
This can happen due to:

- changes to the organisms' environment
- destruction of habitat
- outbreak of a new disease
- introduction of new predators and competitors.

Key Words

Make sure you learn the definitions for these key terms.

Adaptation biodiversity chromosome continuous variation discontinuous variation DNA endangered environmental variation extinct fossil

Gene gene bank inherited variation evolution natural selection nucleus species variation

Inheritance

Homework questions

Q1 Define the term species. Describe how one inherited and one environmental variation could change individuals in a species.

Q2 Explain why gender is a discontinuous variation but height is a continuous variation.

Q3 Explain why identical twins look similar but may have some differences.

Q4 Describe how characteristics are inherited in humans.

Q5 Describe how the story of the peppered moth is an example of natural selection.

Q6 What does 'survival of the fittest' mean in terms of natural selection?

Q7 Explain how organisms become extinct.

Q8 Explain how changes to a species' environment can lead to extinction.

Q9 Describe how the structure of DNA was discovered (higher)

Q10 Research the work of Charles Darwin (higher)

Notes

	Monday	Tuesday	Wednesday	Thursday	Friday
Form					
P1					
P2					
P3					
P4					
P5					