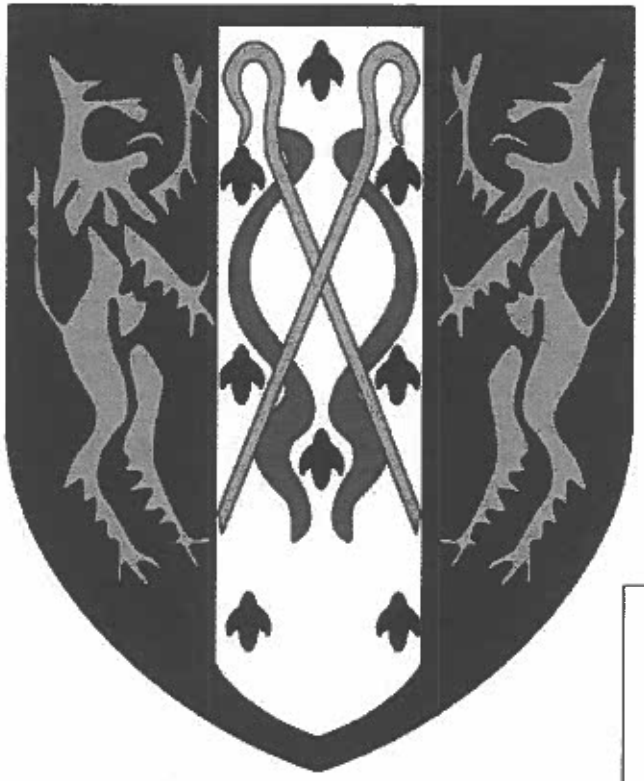
Year 7 Knowledge Organiser

Core



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English

English – Year 7 – HT1 – Homer's *The Odyssey*

Summary- Position in the Curriculum

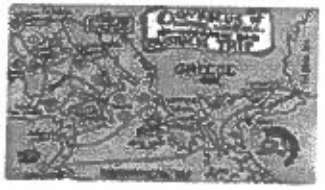
'The Odyssey' is as adapted version for the modern day written by Geraldine McCaughrean. It is an epic poem by Homer, an Ancient Greek poet, which was originally written in poetic form around 750-650 BCE. The adapted story 'The Odyssey' is set in the world of the Ancient Greeks where the lives of gods, men and magical monsters intertwine. The story follows a hero, Odysseus, the king of Ithaca, who is trying to return home to his family after fighting in the Trojan war. Odysseus leads him and his men on an odyssey, which is a long, complicated journey full of adventures where Odysseus uses his strength and cunning to defeat all the challenges and obstacles they face on their journey home. The text is studied to introduce students to Greek mythology and fantasy story, a key skill of being able to write creatively, which is required for English Language.

Terminology	Definitions	Core Knowledge	Preparing for Assessment
Archetypal	Someone or something that has all the most important characteristics of a particular kind of person or thing and is a **perfect** example of it.	Homer is the name that ancient Greeks gave to the author of *The Iliad* and *The Odyssey*: two of the most famous stories of all time. These stories were initially told as really long poems almost 3000 years ago called 'Epic Poems,' focusing on big heroic adventures.	1. *What do we learn about the character of Odysseus and his family?*
Allegory	A story, poem, or picture that can be interpreted to reveal a hidden meaning, typically a moral or political one.	The Greeks called several non-narcotics plants lotus. The phrase to 'eat lotuses or 'lotus-eaters' denotes "a person who spends their time indulging in pleasure and luxury rather than dealing with practical concerns".	2. *The character of Odysseus and Polyphemus are the complete opposite? Why do you think Homer presented them this way?*
Deity	A god or goddess.	The judgement of Paris – Paris has to choose between multiple goddesses and the goddesses' jealousy led to a war among mortals.	3. *What are the main events of Chapter Three: The Brass Island and the Bag of Winds and how do they link to previous events? Any predictions?*
Intertextuality	Intertextuality is the way that one text influences another. This can be directly borrowing quotations from another text or can be more indirect such as using names or places.	The theme of **loyalty** and **honour** is explored throughout the story Glory is attained mainly by victory in battle and by feats of strength and cunning while honour is attained by just, lawful behaviour.	4. *One of the major themes in The Odyssey is the importance of perseverance in the face of challenges. Where and how does Odysseus show perseverance?*
Hamartia	A term used to describe a protagonist's error or flaw.	The poem itself, a story of love, adventure, war, and gods, is a classic that paved the way for all adventure writing to come.	5. *What does the word 'fantasy' mean and what are the key features of a fantasy genre? Write an opening. How does Homer use fantasy?*

Key Quotations:

- 'The gods alone know if I am destined to return.'
- Odysseus obliged: 'my name is Nobody. Nobody, my father, mother, and friends call me.'

'Man is the vainest of all creatures that have their being upon earth.'

	Lotus Flowers	The Judgement of Paris	Odysseus Journey	The Iliad
				

English – Year 7 – HT2 – Lord of the Flies

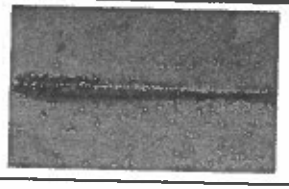
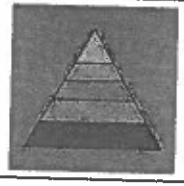
Summary- Position in the Curriculum

Written in 1954, *Lord of the Flies* is about a group of British schoolboys who are stranded on an uninhabited island after their plane crashes. At first, they attempt to establish order and rules, but their society gradually descends into chaos and violence. Students will begin to analyse the language and themes used in a novel and explore the effect of linguistic devices. This will be the first time this skill is introduced at KS3 and will better prepare them for their further studies in Year 8 and into Year 9. This scheme will encourage students to debate societal issues such as good vs evil and look at the different reactions' individuals have when they are left with full autonomy.

Terminology	Definitions	Core Knowledge	Preparing for Assessment
Symbolism	A literary device in which an image is used to represent something else. In some cases, symbolism can represent abstract things or be used to communicate themes and ideas.	In the novel, the conch symbolises **power** in its representation of civilisation, order, and authority. The sound unifies the boys by bringing them together for meetings. It instils order.	1. *What are your initial impressions of Piggy in the opening chapters? How do the other characters treat Piggy?*
Hierarchy	A system in which members of an organisation or society are ranked according to status.	The central concern of Lord of the Flies is the conflict between **two impulses** that exist within all humans: the instinct to live by rules, act peacefully and follow moral commands against the instinct to act violently to obtain supremacy over others, and enforce one's authority over others.	2. *How far does Golding present Jack as responsible for what happens to the boys on the island?*
Civilisation	A large group of people who share certain advanced ways of living and working.	The characters' experience a **loss of innocence** in *Lord of the Flies*. One way this is shown is when Jack killed a pig for the first time.	3. *How does Golding present Piggy as a character that is civilised?*
Savagery	The quality of being cruel, evil and violent.	Piggy represents **intelligence and logic**. His glasses are a symbol of this intelligence and hope. As readers we partake in his bullying, only ever calling him 'Piggy'.	4. *How does the conch represent civilisation in Lord of the Flies?*
Allegory	A story, poem, or picture that can be interpreted to reveal a hidden message, typically a moral or political one.	Golding was horrified by what war revealed about the **savagery** that exists within humans. He was appalled by what happened in the concentration camps.	5. *How does Golding present Ralph as a leader?*

Key Quotations:

'a mildness about his eyes that proclaimed no devil'
"What's grown-ups going to think?"
"'Conch! Conch!" Jack shouted. "We don't need the conch anymore"
"Piggy was an outsider, not only by accent, but by fat, and ass-mar, and specs"
"What are we? Humans? Or Animals? Or savages?"
"The tribe of painted savages giggled and Ralph's mind faltered."

Conch	William Golding	Violence	Leadership	Hierarchy
				

English – Year 7 – HT3 -Much Ado About Nothing

Summary- Position in the Curriculum

The comedy Much Ado About Nothing is one of Shakespeare's later works, first performed in 1612. It is a typical Shakespearean Comedy involving witty innuendo, intersecting love stories, foolish villains and mistaken identities. Like much of Shakespeare's work it was inspired by Roman comedic traditions and continues to inform comedic script writing to this day. Students are introduced to Shakespeare early in our curriculum to challenge their literacy, energise them with performance prepare them for later studies of Macbeth, a key component of their KS4 curriculum. Having studied Ancient Greece via the Odyssey in HT1, students understand the world of classical theatre and how Shakespeare built on this tradition. It also ensures a breadth of curriculum; students have read epic poetry in HT1, a contemporary novel; William Golding's Lord of the Flies in HT2, and now, a renaissance play.

Terminology	Definitions
The Globe	The theatre built by London Bridge on the South Bank for Shakespeare.
Innuendo	Hidden comments containing funny but rude messages or jokes.
Repartee	Conversation with quick, witty, sometimes insulting, remarks or jokes.
To Woo	To flirt with someone, so that they fall for you.
Satire	A mockery of an issue, for instance a play that makes fun of the rich.

Quotes

'There is a skirmish of wit betwist them' Leonato Act 1 Scene 1'

'When I said I would die a bachelor, I did not think I should live till I were married.' Benedick, Act 2 Scene 3

'He that hath a beard is more than a youth, and he that hath no beard is less than a man: and he that is more than a youth is not for me, and he that is less than a man, I am not for him.' Beatrice, Act 2 Scene 1

'For there was never yet philosopher, That could endure the toothache patiently'. Leonato, Act 5 Scene 1

Core Knowledge

Shakespeare wrote three types of plays; comedies, tragedies and histories.

Shakespeare's plays were famous and popular entertainment for Londoners in the 16th Century Elizabethan era.

Shakespearean comedies had certain repeated features (see the summary)

In Much Ado About Nothing we hear the story of:

Claudio falling in love with Hero and Benedick falling in love with Beatrice

Benedick and Beatrice do not initially like each other but the other characters work to bring them together.

Don John the villain of the story organises a plot to drive Hero and Claudio apart.

Hero's father Leonato and the constable, realise Don John's plan, and undo it, also teaching Claudio a lesson in trusting Hero.

The play ends with both sets of lovers happily marrying.

Preparing for Assessment

Revision and self-study questions are below.

Answer 1 per week for Self-Study, you can draw on your notes, this organiser, your memory and your own research.

1. *What were the key features of Classical Greek theatre?*
2. *Where and when was Shakespeare first performed?*
3. *What are the key features of a Shakespearean Comedy?*
4. *Who are the main characters in Much Ado, what are the relationships between them?*
5. *Can you define the words in the terminology section from memory and remember the quotes in the quotes section?*

Shakespeare

The Globe Theatre

Greek Theatre Masks

Claudio and Hero (Film Adaptation)

English – Year 7 – HT4 – Descriptive Writing

Summary- Position in the Curriculum

Students have been studying 'Much Ado About Nothing' and exploring Shakespeare's craft as a writer. Their assessment for HT4 allows students to display their own craft as writers. They will develop the ability to select and use judiciously vocabulary, grammar, form, and structural and organisational features to reflect audience, purpose and context. They will use Standard English where appropriate. They will not only take inspiration from their concurrent study of Shakespeare in terms of plot, setting, characterisation and style, but also from other writers who they have studied previously at Eastbrook, including Homer and Golding. They will write imaginatively and creatively to engage their readers.

Terminology	Definitions	Core Knowledge	Preparing for Assessment
Exposition	The opening of the story, usually used to establish character and setting.	Clear communication: make sure everything you write is clear and makes sense.	1. *Write the opening of a story based on one of the pictures below.*
Show not tell	The reader to experience the story through actions, words, thoughts, sense and feelings.	Quality of ideas: engage your reader with interesting ideas. Spend time planning how you will use setting, character or events to make your response engaging.	2. *Turn this telling sentence in to a showing paragraph:* ***The shop keeper was angry.***
Narrator	The perspective from which a story is told, either from a character or a narrative voice.	Quality of expression: show that you can phrase your response in interesting ways. Take time to craft what you are writing. Use interesting words.	3. *Imagine there is a fight outside Morrisons. Write two descriptions – one using a 3rd person omniscient narrator and one using the 1st person (a character in the story)*
Camera-eye	Describing 'scenes' within an image using camera techniques e.g. zooming in for close ups	Structure and sequence: plan the sequence of your response – what will happen in what order. Show that you can 'shape' a response by giving it an interesting structure.	4. *Describe one of the pictures below using an aerial shot, close up and extreme close up, slowly zooming in on your description.*
Symbolism	The use of a simple image to represent something more than its literal meaning.	Technical accuracy: make sure that spelling, punctuation and expression are as accurate as possible.	5. *Write a story set in a dangerous place.*

Descriptive Devices:

*Simile * Metaphor * Senses * Triple emphasis * Adjectives * Pathetic fallacy * Symbolism * Personification * Contrast * Mood * Tone * Hyperbole*

Stormy Seas	Yurts and Mountains	Busy City	Cowboy	Abandoned House
				

English – Year 7 – HT5 – The Romantics

Summary- Position in the Curriculum

The Romantics are a group of poets who lived in the 18th/19th century (1700's-1800's). They wrote poetry which is not about love, but about appreciating nature, expressing a strong sense of emotion and imagination, and rebelling against oppressive institutions like the government or church. Studying Roman tic poetry prepares students to approach unseen poetry in year 9, and also for their GCSE examinations where they will have to study poems by Romantics such as Percy Shelley and William Wordsworth. This unit gives students an appreciation for poetry and a foundational knowledge of its core components. They will learn about how poetry has evolved ove r time and has been a vessel for change.

Terminology	Definitions	Core Knowledge	Preparing for Assessment
Romanticism	An artistic and intellectual movement that originated in the late 18th century, and stressed strong emotion, imagination, freedom from classical correctness in art forms.	Poetry can be used to speak out against injustices and **express** one's **feelings**. Romantic poets used their writing to demand **social change** in the late 1700's.	1. How has poetry developed over time from Epic poetry to the Harlem Renaissance? What are the key ingredients (conventions) of a poem? What is the Romantic movement?
Industrial Revolution	A period of rapid development, industrialisation and invention during the late 1700's and early 1800's.	Romantic poets were influenced by all that was around them. They rejected the strict and orderly nature of **Classicalism** and were concerned by the **poverty and pollution** caused by the **Industrial Revolution**. They were inspired by the **Age of Enlightenment.**	2. How does Romanticism differ from Classicalism? How was Romanticism influenced by the Industrial Revolution and the Age of Enlightenment?
Age of Enlightenment	Intellectual movement of the 16-1700's promoting the freedom of speech and a breakaway from church, government and monarchical control.	**Chimney sweeps** were young poor boys who suffered as they cleaned the chimneys of the rich and rid them of soot. Blake **rebels** against social conventions by writing about their **experiences.**	3. What did Chimney Sweeps do, and how were they treated? How are the experiences of Chimney sweeps portrayed differently in William Blakes 'Songs of Innocence' and 'Songs of Experience'?
Metaphor	A figure of speech that compares two things by saying one is the other.	Poems are identifiable by their use of **metaphors**. William Blake successfully uses metaphors in his poetry to express strong emotions.	4. How is imagery used to express strong emotion in 'A Poison Tree'? How is the city portrayed as beautiful in "Composed Upon Westminster Bridge"?
Sonnet	A poem with 14 lines which is written in iambic pentameter. Sonnets have a consistent rhyme scheme, and usually focus on the topic of love	Romantic Poems usually explore the beauty which is found in **nature**. 'Composed Upon Westminster Bridge' takes an interesting approach to finding beauty in the **city**.	5. What is a Sonnet? Why might Keats have chosen to use the sonnet form to write about his love of nature in Sonnet X?

Key Quotations:

"All bright and glittering in the smokeless air." * "To one who has been long in city pent' "Weep weep." * "Locked up in coffins of black" * "I was angry with my foe: / I told it not, my wrath did grow."

William Blake	Industrial Revolution	Chimney Sweeps	Songs of Innocence & Experience	Westminster Bridge
				

English – Year 7 – HT6 – Noughts and Crosses

Summary- Position in the Curriculum

Malorie Blackman's *Noughts and Crosses* was published in 2001 and inspires this unit of work. Students will read Dominic Cooke's dramatic adaptation of the novel. This unit acts in preparation for the study of Shakespeare's *Romeo and Juliet* in year 8 which shares a similar tragic love story. The focus is on reading and understanding issues of racial segregation and oppression, which are prevalent in today's society. Students will also deepen their understanding of the conventions of a piece of drama while also developing their oracy skills.

Key words	Definitions	Core Knowledge	Preparing for Assessment
Segregation	The action or state of setting someone or something apart.	**Jim Crow Laws**, USA 1877 – 1950s.– a set of laws introduced in the late 19th century that claimed to give African Americans "separate but equal" status and treatment.	1. *What were the Jim Crow Laws, USA? What happened for the law to come into place?*
Prejudice	Preconceived opinion that is not based on reason or actual experience	**Black Lives Matter** is a political and social movement that seeks to highlight racism, discrimination and racial inequality experienced by black people and to promote anti-racism.	2. *What do we learn about the relationship between the Noughts and Crosses?*
Discrimination	Different or unfair treatment of people because of their race, gender or religion.	**Elizabeth Eckford** – The Little Rock Nine were a group of nine African American students enrolled in Little Rock Central High School in 1957. Their enrolment was followed by the Little Rock Crisis in which students were prevented from entering racially segregated school.	3. *What are the main events of Act One? What predictions can you make for the rest of the novel? What did Malorie Blackman and Dominic Cooke want the audience to THINK, FEEL and UNDERSTAND in parts of Act 1?*
Morality	A code of conduct that would be accepted by society; being able to define what is right and wrong.	The theme of **racism, division and tragedy** is at the heart of the novel. The story takes place in an alternate universe where, instead of Europe colonizing other parts of the world, people from Africa colonized Europe.	4. *What do we learn about Callum's life? How does this reflect the experience of a Nought? What do we learn about the Liberal Militia and what does this suggest?*
Oppression	Governing or treating people cruelly or unjustly.	In the foreword (book), Blackman says that she wrote *Noughts and Crosses* to: 'tackle the subject of racism head on.' She drew inspirations from her own experiences of racisms a Black British woman.	5. *Write a speech from Callum's perspective about his feeling when his father is arrested for his involvement in the mall bombing?*

Key Quotations:

- *What if a virus wiped out every single Cross and not a single Nought?'*
- I'm a Nought who dared to fall in love with a Cross.'
- 'No more prejudice, a fair police force, an equal justice system, equality of education, equality of lives, a level playing field...'
- 'Look at my skin. Such a beautiful colour. So dark and rich and wonderful. I'm so lucky. I'm a Cross - closer to God'
- 'Love doesn't exist. Friendship doesn't exist – not between a nought and a Cross. There's no such thing.'

Little Rock Nine

Death Penalty

Malorie Blackman

Noughts and Crosses Book Cover

TV Series: Noughts and Crosses

Maths

Year 7 Maths Knowledge Organiser: Autumn 1 – Algebraic Thinking (Chapter 1)

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

1.1 – Sequences

- Describe and continue both linear and
- non-linear sequences
- Explain term to term rules for linear sequence
- Find missing terms in a linear sequence

1.2 – Understand & use algebraic notation

- Be able to use inverse operations and "operation families".
- Be able to substitute into single and two step function machines.
- Find functions from expressions.
- Form sequences from expressions
- Represent functions graphically

1.3 – Equality and equivalence

- Form and solve linear equations
- Understand like and unlike terms
- Simplify algebraic expressions

Keywords

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

Term: a single number or variable.

Position: the place something is located.

Rule: instructions that relate two variables.

Linear: the difference between terms increases or decreases by the same value each time.

Non-linear: the difference between terms increases or decreases in different amounts.

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.

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

Continue Linear Sequences

7, 11, 15, 19...

How do I know this is a linear sequence?
It increases by adding 4 to each term

How many terms do I need to make this conclusion?
At least 4 terms – two terms only shows one difference not if this difference is constant (a common difference)

How do I continue the sequence?
You continue to repeat the same difference through the next positions in the sequence.

Continue non-linear Sequences

1, 2, 4, 8, 16 ...

How do I know this is a non-linear sequence?
It increases by multiplying the previous term by 2 – this is a geometric sequence because the constant is multiply by 2

How many terms do I need to make this conclusion?
At least 4 terms – two terms only shows one difference not if this difference is constant (a common difference)

How do I continue the sequence?
You continue to repeat the same difference through the next positions in the sequence.

Explain term-to-term rule

How you get from term to term

Try to explain this in full sentences not just with mathematical notation
Use key maths language – doubles, halves, multiply by two, add four to the previous term etc

To explain a whole sequence you need to include a term to begin at...

The next term is found by tripling the previous term. The sequence begins at 4

4, 12, 36, 108...
x3 x3 x3
First term

Function: a relationship that instructs how to get from an input to an output.

Input: the number/ symbol put into a function.

Output: the number/ expression that comes out of a function.

Operation: a mathematical process.

Inverse: the operation that undoes what was done by the previous operation. (The opposite operation).

Substitute: replace one variable with a number or new variable.

Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign).

Evaluate: work out.

Equality: two expressions that have the same value.

Equation: a mathematical statement that two things are equal.

Equals: represented by '=' symbol – means the same.

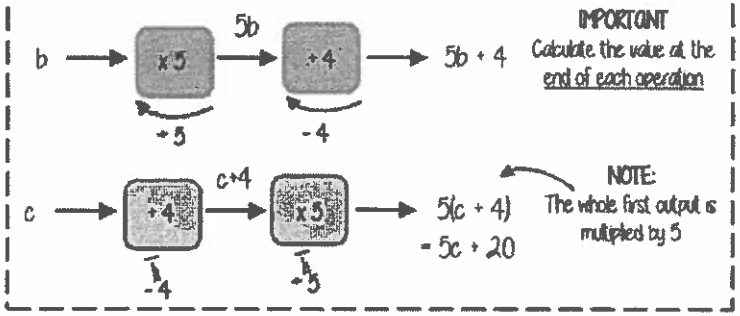
Solution: the set or value that satisfies the equation.

Solve: to find the solution.

Like: variables that are the same are 'like'.

Coefficient: a multiplicative factor in front of a variable e.g., $5x$ (5 is the coefficient, x is the variable).

Two step function machines (algebra)



Solve one step equations (+/-)

There is more to this than just spotting the answer

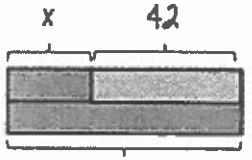
$x + 42 = 59$

$x + 42 = 59$

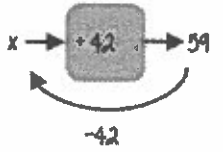
$42 + x = 59$

$59 - x = 42$

$59 - 42 = x$

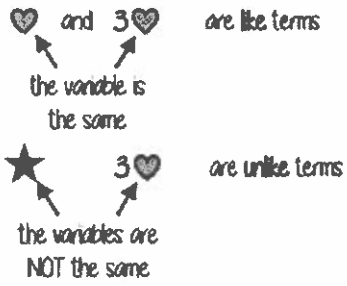


Don't forget you know how to use function machines

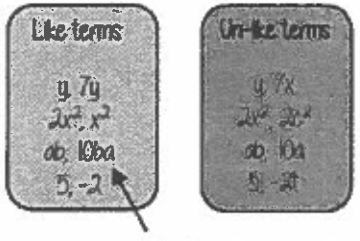


Like and unlike terms

Like terms are those whose variables are he same



Examples and non-examples



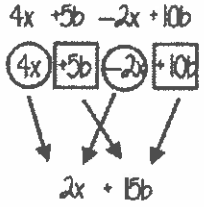
Collecting like terms ≡ symbol

The ≡ symbol means equivalent to

It is used to identify equivalent expressions

Collecting like terms

Only like terms can be combined



Common misconceptions

$2x + 3x^2 + 4x \equiv 6x + 3x^2$

Although they both have the x variable, x2 and x terms are un-like terms so can not be collected

Substitution into expressions

4y ← 4 lots of 'y'

If y = 7 this means the expression is asking for 4 'lots of' 7

4 × 7 OR 7 + 7 + 7 + 7 OR 7 × 4 = 28

eg: $y - 2$

$= 7 - 2 = 5$

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

Year 7 Maths Knowledge Organiser: Autumn 2 – Place Value & Proportion (Chapter 2)

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

2.1 – Place value & ordering integers & decimals

- Understand place value and the number system including decimals
- Understand and use place value for decimals, integers and measures of any size
- Order number and use a number line for positive and negative integers, fractions and decimals
- Use the symbols $=, \neq, \leq, \geq$
- Work with terminating decimals and their corresponding fractions
- Round numbers to an appropriate accuracy
- Describe, interpret and compare data distributions using the median and range

2.2 – Fraction, decimal & percentage equivalence

- Convert fluently between fractions, decimals & percentages

Keywords

Approximate: To estimate a number, amount or total often using rounding of numbers to make them easier to calculate with.

Integer: a whole number that is positive or negative.

Interval: between two points or values.

Median: A measure of central tendency (middle, average) found by putting all the data values in order and finding the middle value of the list.

Negative: Any number less than zero; written with a minus sign.

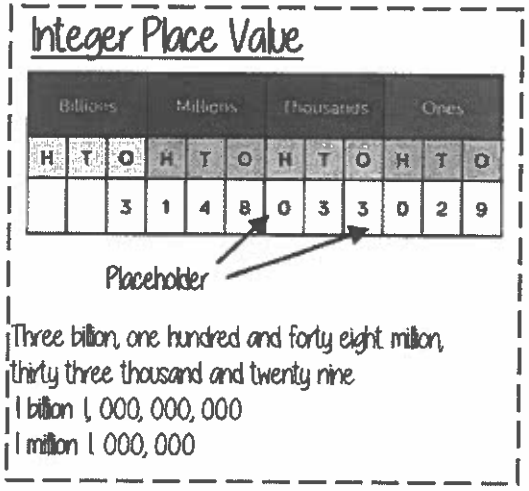
Place holder: We use 0 as a place holder to show that there are none of a particular place in a number.

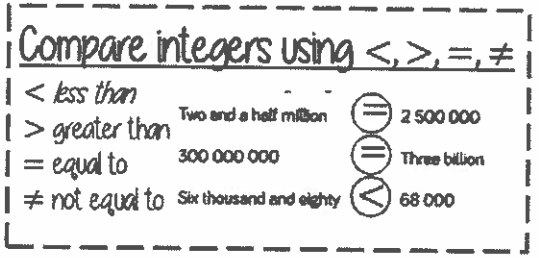
Place value: The value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right.

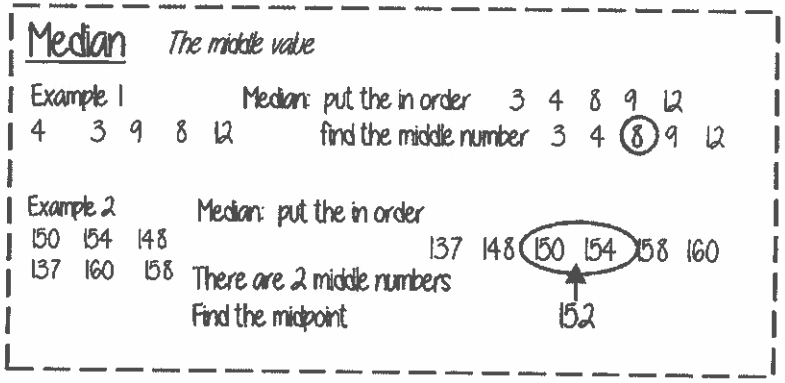
Preparing for Assessment

- 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







Range: The difference between the largest and smallest numbers in a set.

Significant figure: A digit that gives meaning to a number. The most significant digit (figure) in an integer is the number on the left. The most significant digit in a decimal fraction is the first non-zero number after the decimal point.

Fraction: how many parts of a whole we have.

Decimal: a number with a decimal point used to separate ones, tenths, hundredths etc.

Percentage: a proportion of a whole represented as a number between 0 and 100.

Place value: the numerical value that a digit has decided by its position in the number.

Placeholder: a number that occupies a position to give value.

Interval: a range between two numbers.

Tenth: one whole split into 10 equal parts.

Hundredth: one whole split into 100 equal parts.

Sector: a part of a circle between two radii (often referred to as looking like a piece of pie).

Recurring: a decimal that repeats in a given pattern.

Range

Spread of the values

Difference between the biggest and smallest

3 9 8 12

Range: Biggest value – Smallest value

12 – 3 = 9

Range = 9

Round to 1 significant figure

370 to 1 significant figure is 400

37 to 1 significant figure is 40

3.7 to 1 significant figure is 4

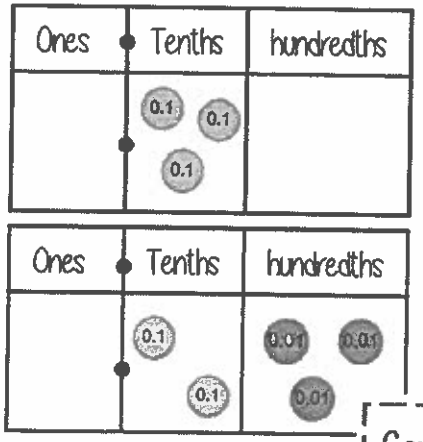
0.37 to 1 significant figure is 0.4

0.00000037 to 1 significant figure is 0.0000004

Round to the first non zero number

Comparing decimals

Which the largest of 0.3 and 0.23?



0.3 > 0.23

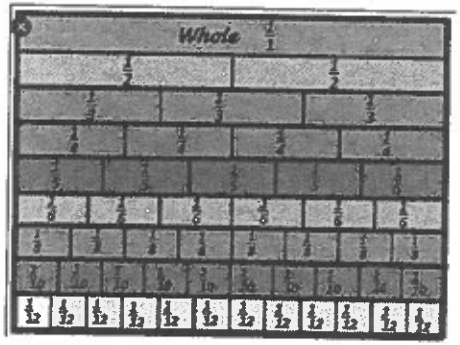
"There are more counters in the furthest column to the left"

0.30
0.23

Comparing the values both with the same number of decimal places is another way to compare the number of tenths and hundredths

Equivalent fractions

Represent equivalence with fraction walls



Convert FDP

$\frac{70}{100}$ → This also means 70 ÷ 100 → 70 out of 100 squares → 70 "hundredths" = 7 "tenths" = 0.7 →  → 70 hundredths = 70%

Using a calculator

$\frac{\blacksquare}{\square}$ → S⇔D Convert to a decimal

This will give you the answer in the simplest form

× 100 converts to a percentage

Be careful of recurring decimals

e.g. $\frac{1}{3}$ = 0.3333333 = $0.\dot{3}$

The dot above the 3

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

Year 7 Maths Knowledge Organiser: Spring 1 – Applications of Number (Chapter 3)

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

3.1 – Solving problems with addition & subtraction

- Understand properties of addition/ subtraction
- Use mental strategies for addition/subtraction
- Use formal methods of addition/subtraction for integers
- Use formal methods of addition/subtraction for decimals
- Solve problems in context of perimeter
- Solve problems with finance, tables and timetables
- Solve problems with frequency trees
- Solve problems with bar charts and line charts

3.2 – Solving problems with multiplication & division

- Understand and use factors
- Understand and use multiples
- Multiply/ Divide integers and decimals by powers of 10
- Use formal methods to multiply
- Use formal methods to divide
- Understand and use order of operations
- Solve area problems
- Solve problems using the mean

3.3 – Fractions & percentages of amounts

- Find a fraction of a given amount
- Use a given fraction to find the whole or other fractions
- Find the percentage of an amount using mental methods
- Find the percentage of a given amount using a calculator

Keywords

Commutative: changing the order of the operations does not change the result.

Associative: when you add or multiply you can do so regardless of how the numbers are grouped.

Inverse: the operation that undoes what was done by the previous operation. (The opposite operation).

Placeholder: a number that occupies a position to give value.

Perimeter: the distance/ length around a 2D object.

Polygon: a 2D shape made with straight lines.

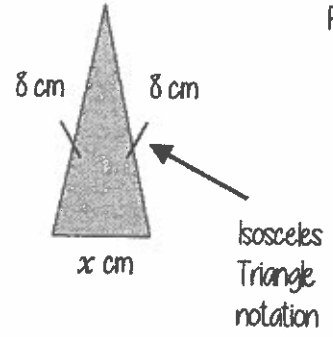
Preparing for Assessment

- 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

Solve problems with perimeter

Perimeter is the length around the outside of a polygon



The triangle has a perimeter of 25cm
Find the length of x

$8cm + 8cm + xcm = 25cm$

$16cm + xcm = 25cm$

$xcm = 9cm$

Balance: in financial questions – the amount of money in a bank account.

Credit: money that goes into a bank account.

Debit: money that leaves a bank account.

Multiples: found by multiplying any number by positive integers.

Factor: integers that multiply together to get another number.

Kilo: prefix meaning multiply by 1000.

Fraction: how many parts of a whole we have.

Equivalent: of equal value.

Whole: a number with no fractional or decimal part.

Percentage: parts per 100 (uses the % symbol).

Place Value: the value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right.

Convert: change into an equivalent representation, often fraction to decimal to a percentage cycle.

Factors

●●●●● Arrays can help represent factors ●●●●●●●●●●
●●●●●

5 x 2 or 2 x 5

Factors of 10
1, 2, 5, 10

10 x 1 or 1 x 10

The number itself is always a factor

Square numbers have an ODD number of factors

Factors of 4
1, 2, 4

Factors of 36
1, 2, 3, 4, 6, 9, 12, 18, 36

Be strategic
- Lay factors out in pairs can help you not to miss any

Multiples

Bar models can represent by something is a multiple. E.g. 20 is a multiple of 4

Lowest Common Multiples

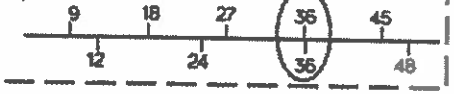
LCM of 9 and 12

The first time their multiples match

LCM = 36

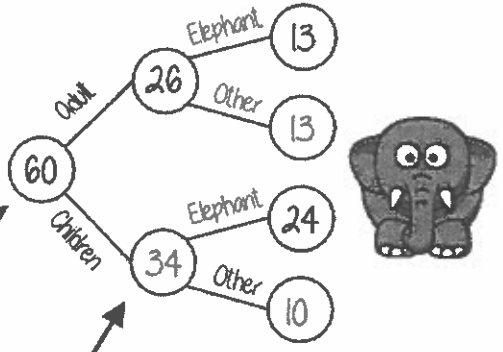
9: 9, 18, 27, 36, 45, 54

12: 12, 24, 36, 48, 60



Frequency trees

60 people visited the zoo one Saturday morning.
26 of them were adults. 13 of the adult's favourite animal was an elephant. 24 of the children's favourite animal was an elephant.



The overall total "60 people"

A frequency tree is made up from part-whole models. One piece of information leads to another

Probabilities or statements can be taken from the completed trees
e.g. 34 children visited the zoo

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

Year 7 Maths Knowledge Organiser: Spring 2 – Directed Number & Fractional Thinking (Chapters 4 & 5)

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

4.0 – Operations & equations with directed number

- Perform calculations that cross zero
- Add/ Subtract directed numbers
- Multiply/ Divide directed numbers
- Evaluate algebraic expressions
- Solve two-step equations
- Use order of operations with directed number

5.0 – Addition & subtraction of fractions

- Convert between mixed numbers and fractions
- Add/Subtract fractions including unit fractions (same denominator)
- Add/Subtract fractions from integers as well as any fractions
- Use equivalent fractions
- Add/Subtract improper fractions and mixed numbers
- Use fractions in algebraic contexts

Keywords

Subtract: taking away one number from another.

Negative: a value less than zero.

Commutative: changing the order of the operations does not change the result.

Product: multiply terms.

Inverse: the opposite function.

Square root: a square root of a number is a number when multiplied by itself gives the value (symbol √).

Square: a term multiplied by itself.

Preparing for Assessment

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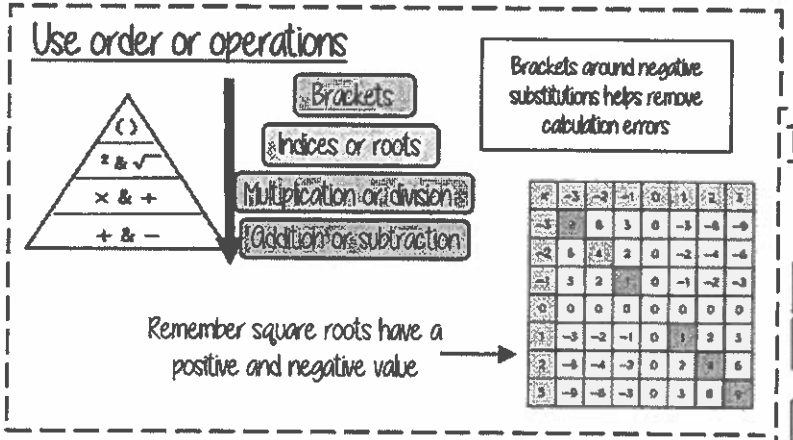
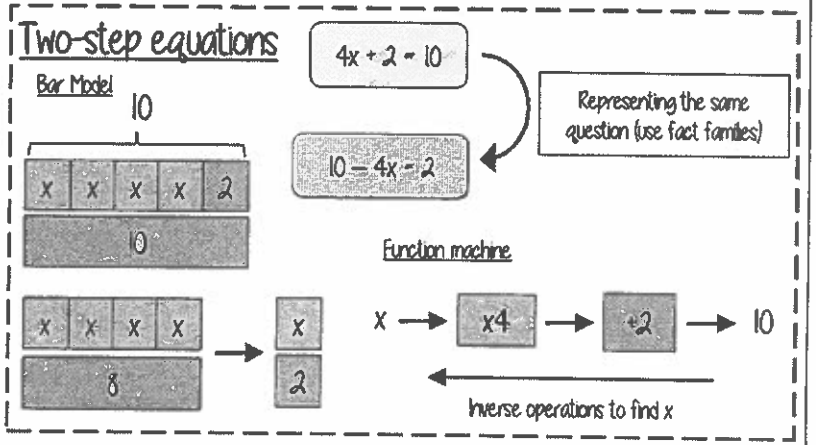
Core Knowledge





Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign).

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

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

Equivalent: of equal value.

Mixed numbers: a number with an integer and a proper fraction.

Improper fractions: a fraction with a bigger numerator than denominator.

Substitute: replace a variable with a numerical value.

Place value: the value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right.

Evaluate algebraic expressions

$a = 5$ $\quad$ $b = -4$

$a^2 = 5^2$ $\quad$ $b^2 = (-4)^2$

$a^2 = 25$ $\quad$ $b^2 = 16$

With negative numbers the brackets are important so that it performs -4×-4

Brackets around negative substitutions helps remove calculation errors

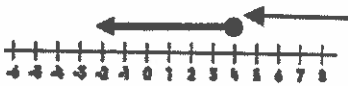
$2a - b = 2 \times 5 - (-4) = 10 + 4 = \underline{14}$

$3b - 2a = 3(-4) - 2(5) = -12 - 10 = \underline{-22}$

Perform calculations that cross zero

Number lines are useful to help you visualise the calculation crossing 0

$4 - 6 = -2$



Use the number line to guide subtraction of 6

Start at 4

Find the difference between 6 and -4:

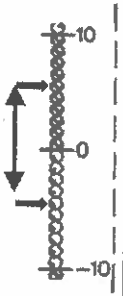
From 6 to 0

6

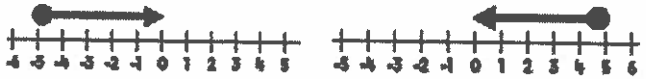
From 0 to -4

4

10 beads between them



$-5 + 5 = 0$ $\quad$ Rearrangements of the same equation $\quad$ $5 - 5 = 0$

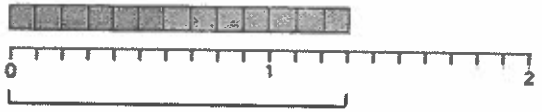


Add/Subtraction fractions (common multiples)

$\frac{3}{5} + \frac{7}{10}$

$\frac{6}{10} + \frac{7}{10}$

Addition/Subtraction needs a common denominator

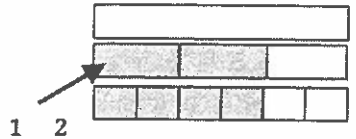


$\frac{13}{10}$

Equivalent fractions

Numerator and denominator have the same multiplier

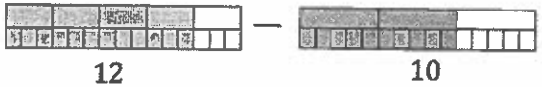
$\frac{2}{3} = \frac{4}{6}$



$\frac{1}{3} = \frac{2}{6}$

Add/Subtraction any fractions

$\frac{4}{5} - \frac{2}{3}$



$= \frac{2}{15}$

$\frac{12}{15} - \frac{10}{15}$

Use equivalent fractions to find a common multiple for both denominators

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

Year 7 Maths Knowledge Organiser: Summer 1 – Lines & Angles (Chapter 6)

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

6.1 – Constructing, measuring & using geometric notation

- Use letter and labelling conventions
- Draw and measure line segments and angles
- Identify parallel and perpendicular lines
- Recognise types of triangles, quadrilaterals & identify polygons
- Construct triangles (SAS, SSS, ASA)
- Draw pie charts

6.2 – Developing geometric reasoning

- Understand/use the sum of angles at a point
- Understand/use the sum of angles on a straight line
- Understand/use equality of vertically opposite angles
- Know and apply the sum of angles in a triangle
- Know and apply the sum of angles in a quadrilateral

Keywords

Polygon: A closed 2D shape made with at least 3 straight lines.

Scalene triangle: a triangle with all different sides and angles.

Isosceles triangle: a triangle with two angles the same size and two angles the same size.

Right-angled triangle: a triangle with a right angle.

Frequency: the number of times a data value occurs.

Sector: part of a circle made by two radii touching the centre.

Rotation: turn in a given direction.

Preparing for Assessment

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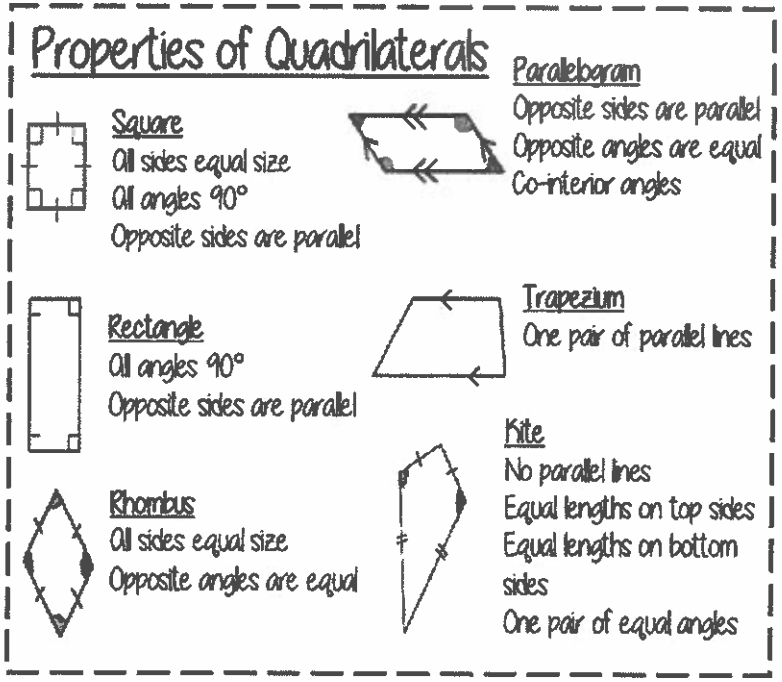
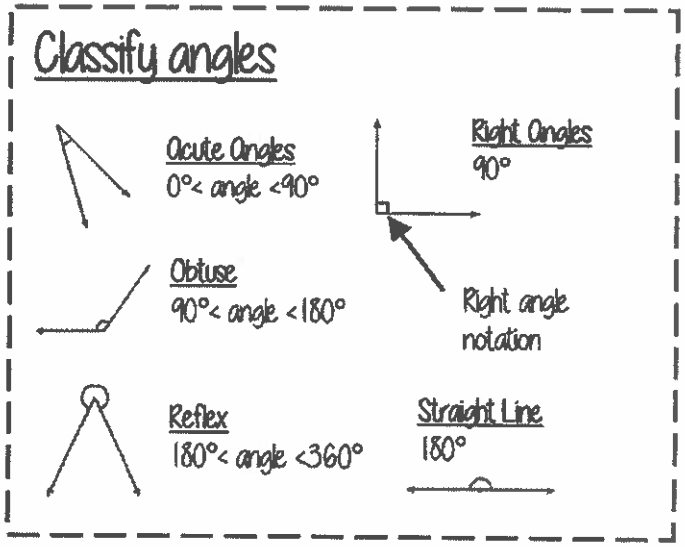
Core Knowledge





Protractor: equipment used to measure angles.

Compass: equipment used to draw arcs and circles.

Vertically opposite: angles formed when two or more straight lines cross at a point.

Interior angles: angles inside the shape.

Sum: total, add all the interior angles together.

Quadrilateral: a four-sided polygon where all the interior angles sum to 360° (degrees).

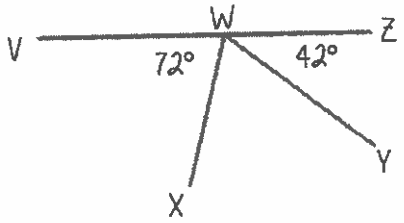
Scalene triangle: a triangle with all different sides and angles.

Isosceles triangle: a triangle with two sides the same size and two angles the same size.

Right-angled triangle: a triangle with a right angle 90° (degrees).

Sum of angles on a straight line

Adjacent angles that share a common point on a line add up to 180°

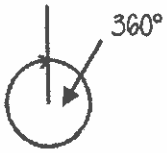


Find angle XWY

72° + 42° = 114°
180° - 114° = 66°

Sum of angles at a point

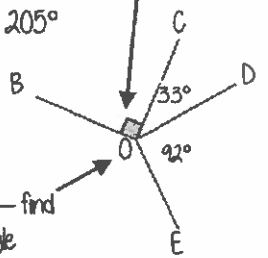
The sum of angles around a point is 360°

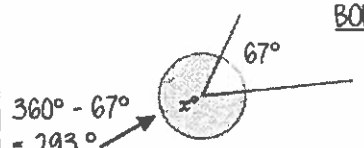


Find angle BOE

90° + 33° + 92° = 205°
360° - 205°
BOE = 155°

Angle notation – 90°



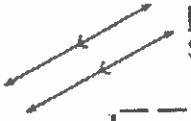


360° - 67°
= 293°

Angle notation – find this missing angle

Parallel and Perpendicular lines

Parallel lines
Straight lines that never meet
(Have the same gradient)



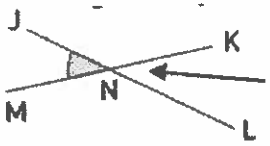
Perpendicular lines
Straight lines that meet at 90°

Polygons

3	- Triangle	5	- Pentagon	8	- Octagon
4	- Quadrilateral	6	- Hexagon	9	- Nonagon
		7	- Heptagon	10	- Decagon

If all the sides and angles are the same, it is a regular polygon

Vertically opposite angles



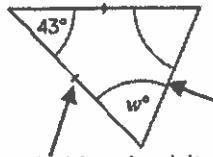
Angle JNM is vertically opposite to angle KNL

JNM = KNL

Vertically opposite angles are the same

Sum of angles in triangles

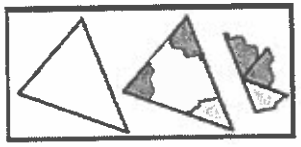
Sum of interior angles in a triangle = 180°



The two base angles will be the same size

Look at triangle notation
This indicates an isosceles triangle
∴ 180 - 43 = 137
137 ÷ 2 = 68.5°

A triangle can only have ONE right angle



Have a go!
Tearing the corners from triangles forms a straight line which is therefore 180°

Year 7 Maths Knowledge Organiser: Summer 2 - Reasoning with Number (Chapter 7)

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

7.1 – Developing number sense

- Know and use mental addition/ subtraction
- Know and use mental multiplication/ division
- Know and use mental arithmetic for decimals
- Know and use mental arithmetic for fractions
- Use factors to simplify calculations
- Use estimation to check mental calculations
- Use number and algebraic facts

7.2 – Sets & probability

- Identify and represent sets
- Interpret and create Venn diagrams
- Understand and use the intersection of sets
- Understand and use the union of sets
- Generate sample spaces for single events
- Calculate the probability of a single event
- Understand and use the probability scale

7.3 – Prime numbers & proof

- Find and use multiples
- Identify factors of numbers and expressions
- Recognise and identify prime numbers
- Recognise square and triangular numbers
- Find common factors including HCF
- Find common multiples including LCM

Keywords

Commutative: changing the order of the operations does not change the result.

Associative: when you add or multiply you can do so regardless of how the numbers are grouped.

Dividend: the number being divided.

Divisor: the number we divide by.

Equation: a mathematical statement that two things are equal.

Quotient: the result of a division.

Set: collection of things.

Element: each item in a set is called an element.

Intersection: the overlapping part of a Venn diagram (AND ∩).

Preparing for Assessment

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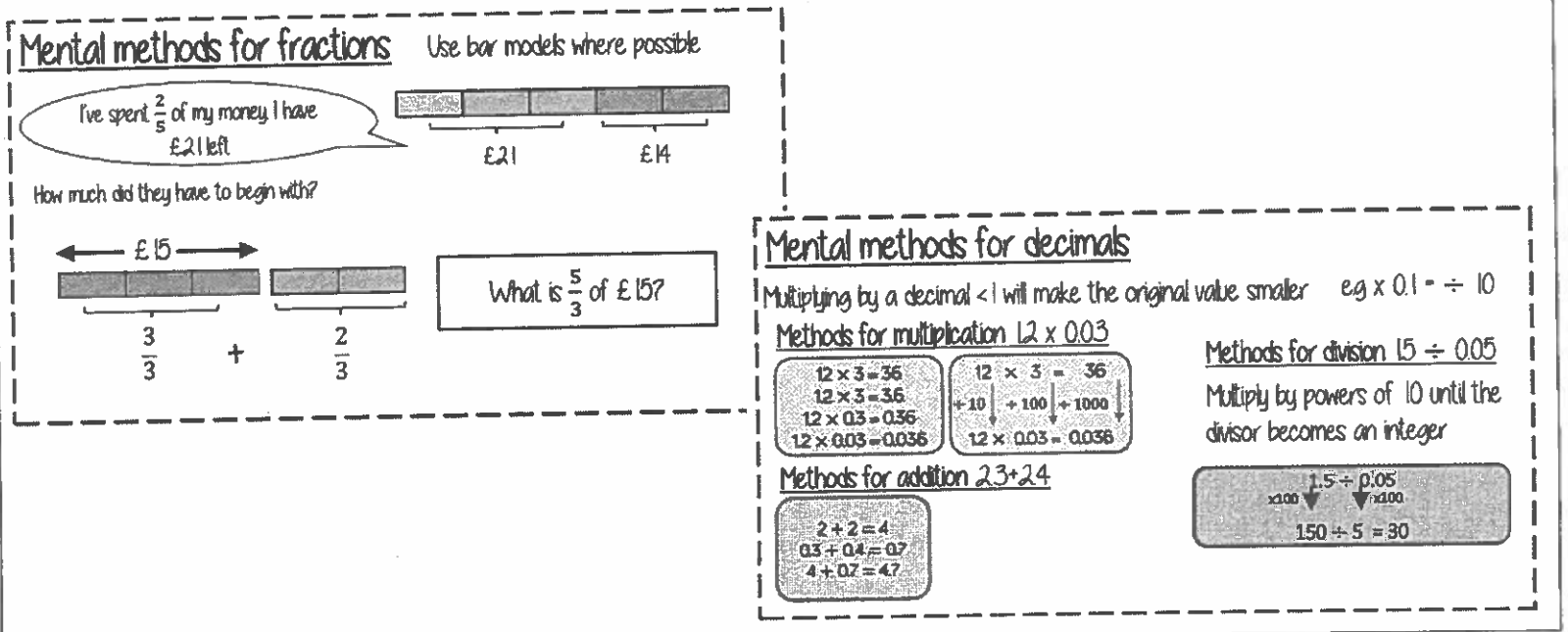
Core Knowledge



Union: two ellipses that join (OR ∪).

Mutually Exclusive: events that do not occur at the same time.

Probability: likelihood of an event happening.

Bias: a built-in error that makes all values wrong (unequal) by a certain amount, e.g. a weighted dice.

Fair: there is zero bias, and all outcomes have an equal likelihood.

Random: something happens by chance and is unable to be predicted.

Multiples: found by multiplying any number by positive integers.

Factor: integers that multiply together to get another number.

Prime: an integer with only 2 factors.

Counterexample: a special type of example that disproves a statement.

HCF: highest common factor (biggest factor two or more numbers share).

LCM: lowest common multiple (the first time the times table of two or more numbers match).

Probability of a single event

Probability = number of times event happens / total number of possible outcomes

P(Blue) = 4/10 ← There are 4 blue sectors; There are 10 sectors overall

Probability notation P(event) = 2/5

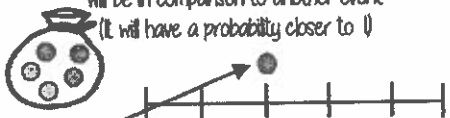
Probability can be a fraction, decimal or percentage value

4/10 = 40/100 = 0.40 = 40%

Probability is always a value between 0 and 1

The probability scale

The more likely an event the further up the probability it will be in comparison to another event (it will have a probability closer to 1)



There are 2 pink and 2 yellow balls, so they have the same probability

There are 5 possible outcomes
So 5 intervals on this scale, each interval value is 1/5

Sum of probabilities

Probability is always a value between 0 and 1

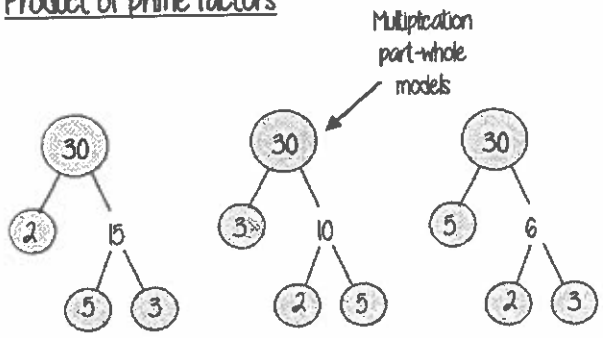
The probability of getting a blue ball is 1/5
∴ The probability of NOT getting a blue ball is 4/5
The sum of the probabilities is 1

The table shows the probability of selecting a type of chocolate

Dark	Milk	White
0.15	0.35	

P(White chocolate) = 1 − 0.15 − 0.35
= 0.5

Product of prime factors



All three prime factor trees represent the same decomposition

Multiplication is commutative

30 = 2 × 3 × 5 ← Multiplication of prime factors

Using prime factors for predictions

e.g. 60 = 30 × 2 = 2 × 3 × 5 × 2

150 = 30 × 5 = 2 × 3 × 5 × 5

Common factors and HCF

1 is a common factor of all numbers

Common factors are factors two or more numbers share

HCF – Highest common factor

HCF of 18 and 30

18: 1, 2, 3, 6, 9, 18

30: 1, 2, 3, 5, 6, 10, 15, 30

Common factors (factors of both numbers)
1, 2, 3, 6

HCF = 6

6 is the biggest factor they share

Common multiples and LCM

Common multiples are multiples two or more numbers share

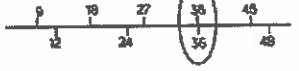
LCM – Lowest common multiple

LCM of 9 and 12

9: 9, 18, 27, 36, 45, 54

12: 12, 24, 36, 48, 60

LCM = 36 ← The first time their multiples match



Comparing fractions

Compare fractions using a LCM denominator

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

Science

Introduction to Science

Knowledge organiser

A science laboratory is used for carrying out practical investigations. This can involve using hazardous chemicals and equipment such as Bunsen burners. Some practical equipment, such as test tubes, are easily breakable so care must be taken. Thinking about the students' and teacher's health and safety is very important so that no one gets hurt

Hazard symbols

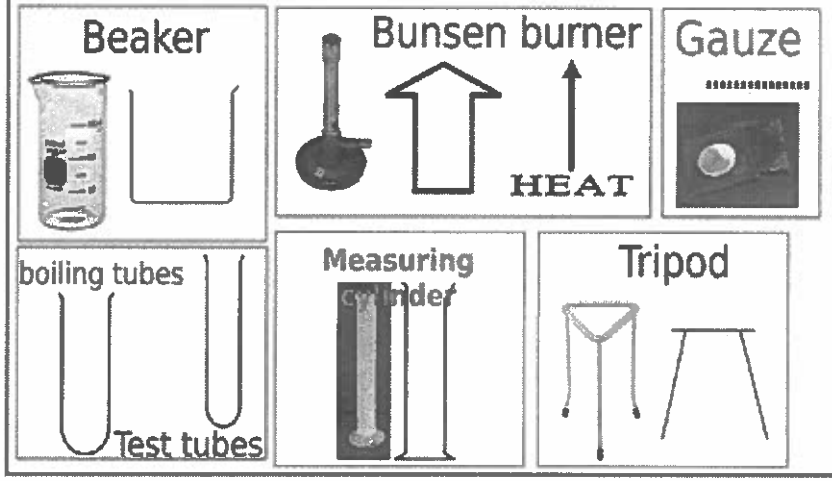
Hazard symbols show people how dangerous a chemical is, and what care should be taken when handling them. Symbols can be used all over the world and are immediately recognisable, so it does not matter which language is used.

Laboratory Safety Rules

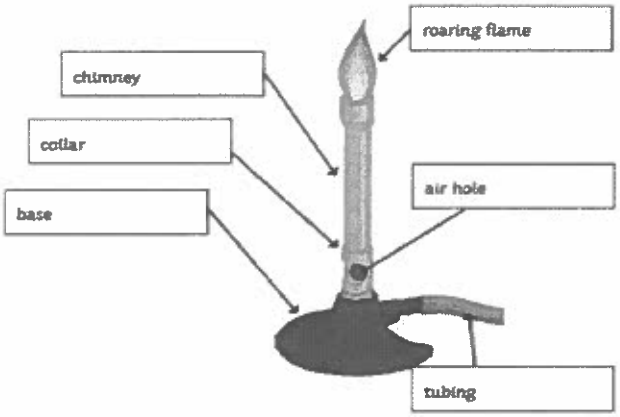
Below are some important safety rules, which should always be followed, but there may be others which you need to consider in addition to these.

- Always wear eye protection during a practical.
- Carry out a practical while standing up.
- Do not eat or drink in the laboratory.
- Tie long hair back and tuck loose clothing in during practicals.
- If something is spilled or broken, tell the teacher.
- Ensure that the floor and work space is clear of obstacles.

How do scientists display this apparatus?



Bunsen Burner



The safety flame is used when the Bunsen burner is not in use. The flame is easier to see when it is the yellow flame. To produce this flame, the air hole is fully shut. Less oxygen will get into the Bunsen burner, hence the yellow flame.

The roaring flame is used to heat things quickly. To produce this flame, the air hole must be fully open. More oxygen will get into the Bunsen burner, hence the blue flame.

Investigative Skills

Independent variable: The variable that you change or select the values for.

Dependent variable: The variable that is measured for each change of the independent variable.

Control variable: A variable that may, in addition to the independent variable, affect the outcome of the investigation and therefore must be kept constant.

Prediction: What you think will happen and why.

Risk assessment: Identify hazards, the harms they can do and how you will minimise any risks in a practical investigation.

Method: Step-by-step instructions for how to carry out a practical investigation.

Results table: As the practical is carried out, write the results in a table.

Conclusion: An explanation of what you found out in your investigation.

Evaluation: Where you consider the quality of your method and the data you collected.

Homework Questions

Q1 Write few sensible precautions you must take during a practical lesson.

Q2 Explain how you would change the temperature of the flame on a Bunsen burner.

Q3 What word describe the chance that a hazard will cause harm?

Q4 Learn all the hazard symbols

Q5 Which hazard symbol is represented by a skull and crossbones?

Q6 Describe the hazard symbol for corrosive

Q7 Which variable changes during an experiment and which variable is measured during an experiment?

Q8 When dropping a ball from different heights to see how high it bounces, which is the independent variable?

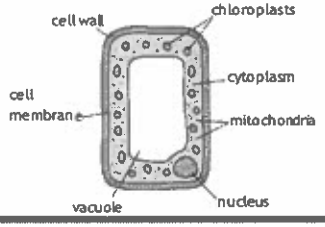
Cells

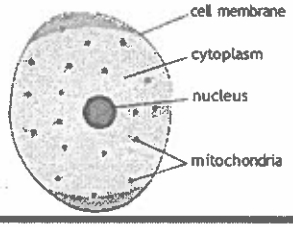
Knowledge organiser

All living things (organisms), are made of **cells**. Some are only made of a single cell, for example, bacteria. A person is made up of millions of cells joined together.

Plant and animal cells

Cells have smaller structures inside them, called components, that each have an important function.





Specialised cells

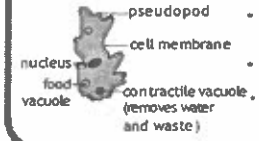
Specialised cells have special features that allow them to do a specific job or function:

	Cell type	Function	Special features	Diagram
plant cells	root hair cell	absorb water and nutrients from soil	• root hair creates a large surface area • no chloroplasts as no light underground	
	leaf cell (palisade cell)	carry out photosynthesis	• found at the top surface of leaves • packed with chloroplasts • thin with a large surface area to absorb more light	
animal cells	red blood cell	transport oxygen around the body	• contain haemoglobin which joins to oxygen • no nucleus • disc shaped to increase surface area	
	nerve cell (neurone)	carry electrical impulses around the body	• long and thin with connections at each end	
	sperm cell	carry male genetic material	• streamlined head and a long tail • lots of mitochondria to transfer energy	

Unicellular organisms

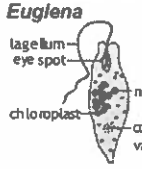
A **unicellular** organism only consists of one cell. They have no fixed shape and are adapted to carry out many different functions.

Amoeba



- nucleus controls growth and reproduction
- move by moving part of their body and the rest follows slowly in the same direction
- eat bacteria, algae, and plant cells by engulfing them
- reproduce by splitting in half (binary fission)

Euglena



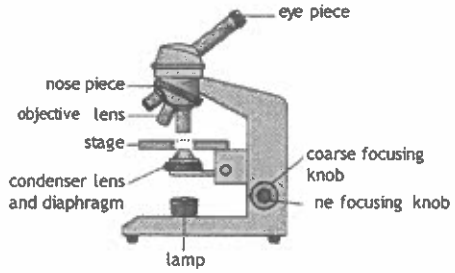
- microscopic organism found in fresh water
- contain chloroplasts and make their own food by photosynthesis
- eye spot that detects light
- flagellum allows the *Euglena* to move towards the light to make more food

Microscopes

Cells can only be seen under a microscope. A microscope magnifies an object using lenses.

Remember that:

- the specimen needs to be thin so light can pass through
- a dye can be added to make the object easier to see.



Using a microscope

1. Move the stage to its lowest position.
2. Place the slide/object on the stage.
3. Choose the objective lens with the lowest magnification.
4. Look through the eyepiece and turn the coarse-focus knob slowly until you see the object.
5. Turn the fine focus knob until it comes into focus.
6. Repeat steps 1–5 using a higher magnification lens.

Movement in and out of cells

Particles move in and out of cells by **diffusion**.

During diffusion, particles spread out from where they are in *high* **concentration** to where they are in *low* concentration.

Glucose and oxygen move from the blood into cells by diffusion.

Carbon dioxide moves out of cells to the blood by diffusion.

Key words

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

amoeba **binary fission** **cell** **cell membrane** **cell wall** **chloroplast** **concentration** **cytoplasm** **diffusion** **Euglena** **flagellum** **leaf cell** **microscope** **mitochondria** **nerve cell** **nucleus** **red blood** **root hair** **specialised cell** **sperm cell** **unicellular** **vacuole**

Cells
Homework Questions

Q1 Learn all the correct spellings of the keywords for a spelling test.

Q2 Draw and label all the structures in a plant and animal cells and describe the functions.

Q3 a) Draw a picture of a microscope. Label the eyepiece, objective lens, stage, light and focus.

Extended writing

b) Give a step by step instruction to a year 7 student on how to use the microscope to see a slide

Q4 Research a muscle cell. Draw a diagram of the cell, describe its function, describe where it is found and explain how it is adapted to its function.

Q5 Research a ciliated cell. Draw a diagram of the cell, describe its function, describe where it is found and explain how it is adapted to its function. *(higher)*

Q6 Explain how substances get in and out of cells. *(higher level)*

Q7 Describe the similarities and differences between plant and animal cells.

Q8 A student suggested that a euglena could be classified as a plant cell. *(higher level)*

a) Describe one piece of evidence to support the student's suggestion.

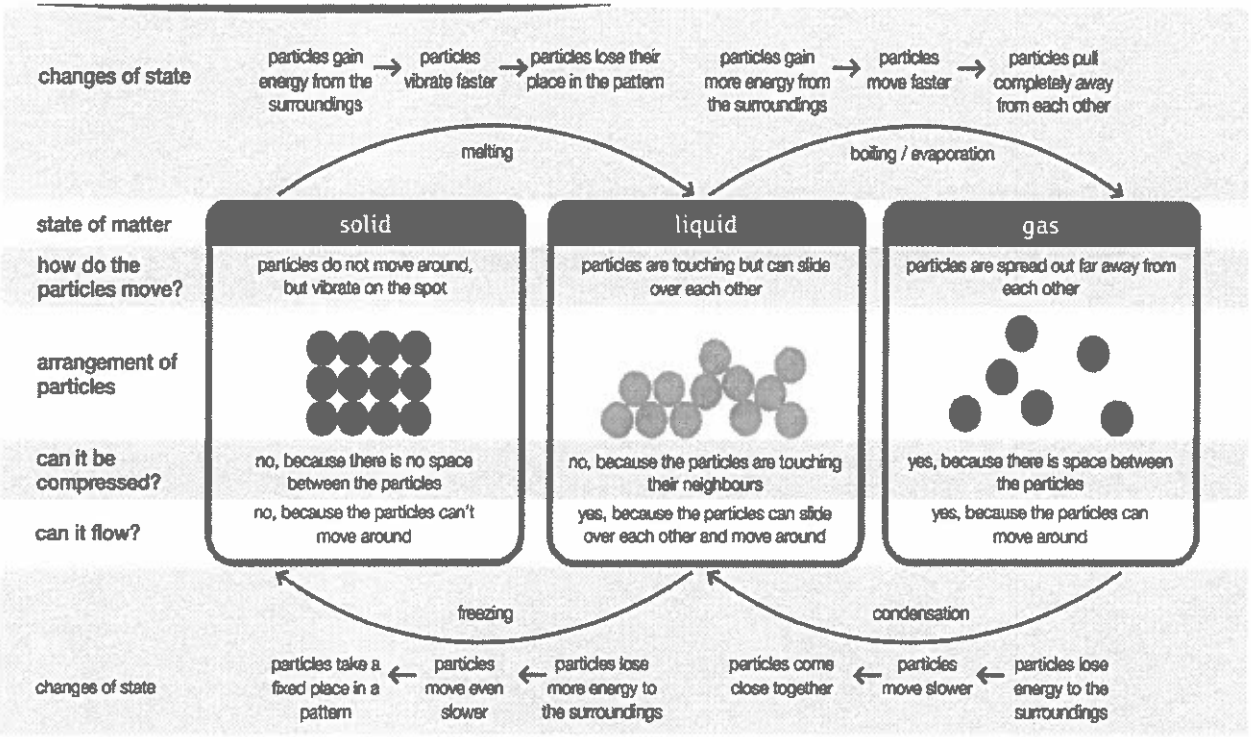
b) Give one structural reason why euglena would not be classified as a plant cell.

Q9 Write down the formula to calculate the total magnification

If you have an eyepiece lens of ×10 and an objective lens of ×60, what will be the total magnification?

Particles and their Behaviour

Knowledge organiser



Sublimation

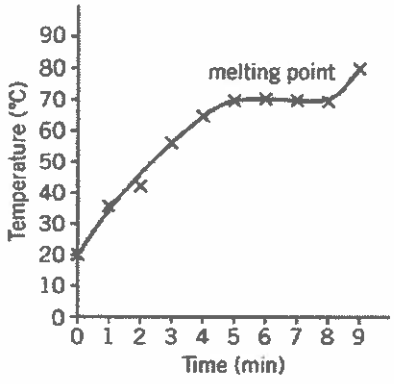
Some substances do not exist as liquids, but instead directly change state from solid to gas in a process called sublimation.

Melting and boiling points

Melting point — the temperature at which a **substance** melts

Boiling point — the temperature at which a substance boils

If you heat a **solid** and plot a graph of temperature against time the melting point will appear as a flat line if the substance is **pure** (has only one type of particle).



Diffusion

Particles move about randomly in liquids and gases and spread out through **mixtures**. This process is called diffusion. How quickly diffusion happens depends upon three variables:

Variable	Effect on diffusion
temperature	diffusion is faster at higher temperatures *because* particles move faster when hotter
particle size	diffusion is slower with larger, heavier particles
state of matter	diffusion is: • fast in gases • slow in liquids • doesn't happen in solids

Gas pressure

Density

Density tells us how heavy something is for its size. You can calculate density using the formula: density = mass / volume

Mass is the amount of 'stuff' an object is made of, measured in grams or kilograms.

Volume is the amount of space an object takes up, measured in cm^3.

Density of a substance depends on:

- the mass of the particles
- how closely together the particles are arranged.

A substance is most dense as a solid, as the particles are closely packed together, and least dense as a gas, as the particles are spread far apart.

Particle model and properties

The properties of a substance depend on:

1 the shape and size of its particles
2 the arrangement of its particles
3 how its particles move
4 how strong the forces between its particles are.

Key words

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

boiling boiling point change of state condensation

diffusion evaporation freezing gas liquid

Melting mixture particle solid state of matter

Sublimation substance

Homework Questions

Q1 Draw a picture of particles in solids, liquids and gases. Describe the arrangement of particles.

Q2 Explain the different diffusion speeds through substances in solid, liquid and gas.

Q3 Draw on graph paper the cooling curve of steric acid when it freezes. Label on the diagram when a change of stare occurs.

Q4 Research the terms sublimation, condensation and diffusion. Explain what they mean

Q5 Explain why a balloon would get bigger as it gains altitude.

Q6 . Explain why a balloon would get bigger as it gets hotter.

Q7 . Neon has a boiling point of -249 degrees Celsius. Explain what would happen to the particles as it is slowly heated from -255 degrees Celsius to -245 degrees Celsius. *(higher)*

Forces

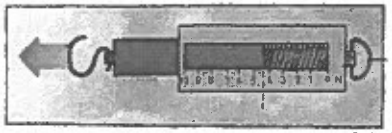
Knowledge organiser

What are forces?

A **force** can be a *push* or a *pull*.

Forces can be measured using a **newtonmeter**.

Forces are measured in **newtons** (N).



Contact forces occur when objects are touching, for example:

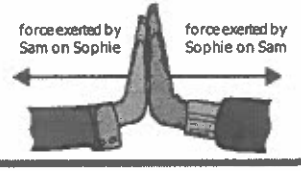
- **friction**
- **drag forces (air resistance** and **water resistance)**
- support forces (e.g., **reaction forces)**

Non-contact forces work at a distance, for example:

- **gravity** • **magnetic force** • **electrostatic force**

Forces always occur in pairs.

The pairs are called **interaction pairs.**



Balanced and unbalanced forces

When the forces acting on an object are the same size, but act in opposite directions, we say that they are **balanced.**

The balanced forces cancel out, and the object is in **equilibrium**.

If the forces are not the same size, and do not cancel each other out, we say they are **unbalanced.**

The larger the difference between unbalanced forces, the quicker the object will change speed.

Drag forces and friction

Friction is a contact force that occurs when two objects move against each other. It happens because all surfaces have some roughness – even ones that look smooth.

Friction can be reduced by adding **lubrication** (e.g., oil or grease).

Friction is often useful, for example:

- you need friction to walk across surfaces
- the brakes on a bike need friction to work.

A solid moving through a liquid or a gas has to push the liquid or gas particles out of the way. This produces a drag force on the solid object.

Water resistance and air resistance are drag forces.

Drag forces can be useful if we need to slow something down, for example, by using parachutes.

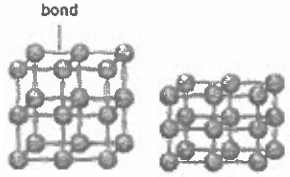
Making an object more **streamlined** will reduce the drag forces on it.

Reaction forces

When you stand on the floor:

- your weight pushes the particles in the floor together
- the bonds between the particles are **compressed**
- the compressed particles push back and support you.

A support force that balances the weight of an object is called the reaction force or the normal force. **Upthrust** is another example of a support force.



Fields and non-contact forces

In physics, a **field** is a special region where certain objects experience a non-contact force. For example, when

- a mass experiences a force in a gravitational field
- a magnetic material (like iron) experiences a force in a magnetic field
- a charged object experiences a force in an electrostatic field.

As you get further away from a mass, a magnet, or a charged object, the field gets weaker.

Weight and mass

Mass is the amount of 'stuff' something is made of – it is measured in kilograms (kg).

Weight is a force so it is measured in newtons.

$$\text{weight (N)} = \text{mass (kg)} \times \text{gravitational field strength (N/kg)}$$

The **gravitational field strength** on Earth is about 10 N/kg.

Your weight depends on the gravitational field strength but your mass is the same everywhere.

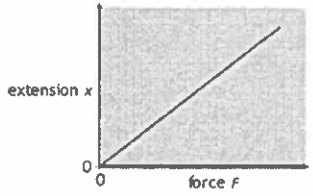
Hooke's law

Some objects – like springs – can be **stretched** when pulled.

The amount they stretch by is called the **extension.**

A force called **tension** makes a spring return to its original length (unless it has gone beyond its **elastic limit**).

Hooke's law states that the extension of a spring doubles when you double the force. This means there is a **linear** relationship between force and extension.



Key words

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

air resistance balanced compress contact force drag force elastic limit electrostatic force extension field friction gravity newton newton meter non-contact force gravitational field strength Hooke's law interaction pair lubrication magnetic force unbalanced linear reaction force stretch streamlined tension water resistance weight mass upthrust equilibrium

Forces
Homework questions

Q1 What can forces do?

Q2 What is an interaction pair, give an example.

Q3 Describe the difference between a contact and a non-contact force. Give examples of each.

Q4 Describe what happens if you double the force applied to stretch a spring.

Q5 Describe what is meant by an object's elastic limit.

Q6 Describe what friction is. Describe a situation where friction is and is not useful.

Q7 Describe what happens to an object when the forces acting on it are balanced.

Q8 Describe what you can do to decrease the air resistance acting on something.

Q9 Describe the difference between mass and weight. If your mass on Earth is 60 Kg, what will be your weight?

Q10 Describe the different ways that cars and other vehicles use to increase their top speed. Explain how this makes them faster. *(higher)*

Q11 Describe at least 3 different methods that very fast cars use to slow them down. Explain how they work. *(higher)*

Structure and function of body systems

Knowledge organiser

Multicellular organisms are made up of many cells and have five levels of organisation:

cell – the smallest building block of an organism

tissue – a group of specialised cells working together

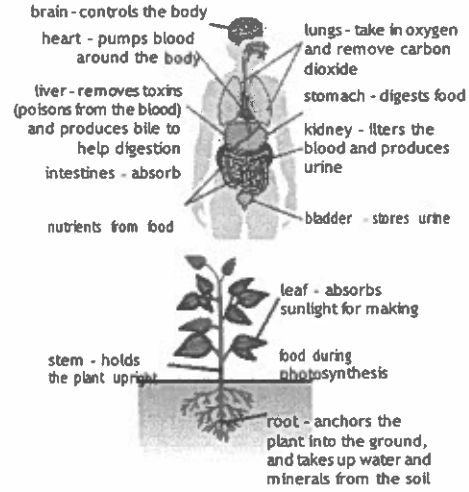
organ – a group of tissues working together

organ system – a group of organs working together

multicellular organism – a group of systems working together

increasing complexity

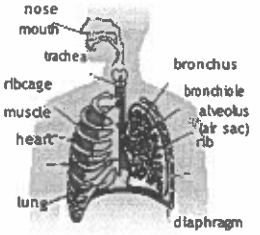
Plant and animal organs



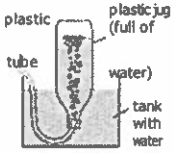
Respiratory system

The respiratory system is involved in:

- breathing in oxygen (for **respiration**)
- breathing out waste carbon dioxide.



Measuring lung volume



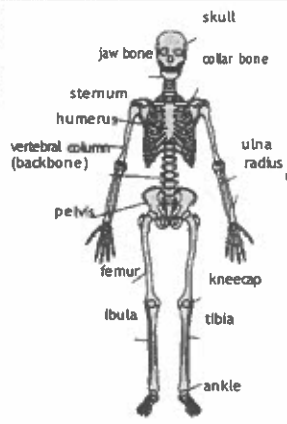
When you breathe out fully into the plastic tube, air from your lungs pushes water out of the bottle.

volume of air in the plastic bottle

=

lung volume

Skeleton



All the bones in your body make up your skeleton.

The four main functions of the **skeleton** are to:

- support the body
- protect vital organs
- help the body move
- make blood cells (in the **bone marrow**).

Joints occur between two or more bones.

They allow the skeleton to bend.

Three types of joint are:

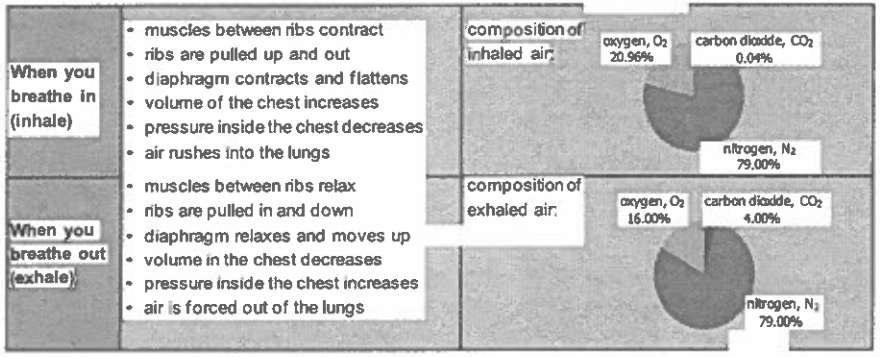
1 **Hinge joints**
forwards/backwards movements only, e.g., knees

2 **Ball-and-socket joints**
movement in all directions, e.g., shoulders

3 **Fixed joints**
no movement allowed, e.g., the skull

In a joint:
- your bone is protected with **cartilage**
- the two bones are held together by **ligaments**.

What happens when we breathe?



Muscles

Muscles are a type of tissue – lots of muscle cells work together to cause movement.

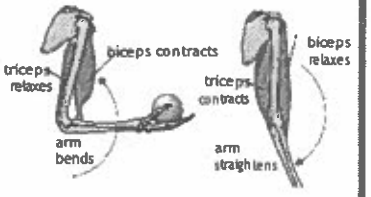
Types of muscle include:

- cardiac (heart) muscle
- smooth muscle
- skeletal muscle

Muscles are attached to bones by **tendons**.

Muscles produce movement by **contracting** (getting shorter).

If a muscle contracts it pulls the bone, causing it to move.



Antagonistic muscles

Pairs of muscles that work together are called **antagonistic** muscles.

When one contracts the other relaxes.

For example, biceps and triceps work together to bend and straighten the forearm.

Key words

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

alveolus antagonistic bone bone marrow cell contract cartilage diaphragm exhale inhale joint ligament lung

multicellular organ organ system respiration respiratory system ribcage skeleton tendon tissue trachea volume

Structure and Function of Body Systems
Homework Questions

Q1 Learn the correct spelling for all the keywords in this topic and write down the definitions for the following.
exhale inhale antagonistic alveolus multicellular diaphragm respiration

Q2 Draw a Levels of Organisation triangle for the respiratory system.

Q3 Write a story outlining the journey of an oxygen molecule from the air to the muscles of a running puppy.

Q4 Explain the difference between breathing and respiration.

Q5 Describe how the named muscles of your arm move the bones when lifting an object from the floor to the table.

Q6 Explain why multi-cellular organisms have many organ systems whereas unicellular organisms do not. *(higher)*

Q7 Describe the role of the rib muscles and diaphragm muscles in brething.

Q8 Describe and explain the different composition of breathed in and breathed out air. *(higher)*

Q9 Explain how the antagonistic muscles in the leg move when we take a step. *(higher)*

Q10 What parts of the body do air have to pass through before the oxygen in it can get into the blood?

Q11 List the 5 levels of organisation in multi-cellular organisms from smallest to largest.

C1 Elements, atoms, and compounds

Knowledge organiser

Atoms

An **atom** is the smallest part of an element that can exist.

There are 100 types of atom – one for each of the 100 elements that exist naturally.

Each type of atom has different properties (e.g., size or mass).

Elements

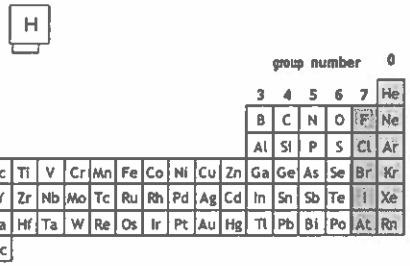
An **element**:

- cannot be broken down into other substances
- is made of one type of atom only.

Examples of elements include gold, potassium, carbon, and hydrogen.

The names and symbols of all the elements can be found on the **periodic table** of elements.

Elements in the periodic table are grouped together by their properties, which are different for each element.



The **chemical symbol** for an element is universal – it is the same in every language, even if the name of the element is different.

Some examples of chemical symbols for common elements are:

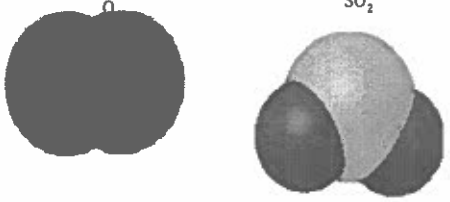
hydrogen	H	sulfur	S
carbon	C	sodium	Na
oxygen	O	chlorine	Cl
nitrogen	N	magnesium	Mg

Molecules

A **molecule** is more than one atom chemically joined together.

Molecules can be made up from:

several of the same type of atom (elements)	two or more types of atoms (compounds)
e.g., oxygen gas O_2	e.g., sulfur dioxide SO_2



Different elements have different masses. So, in a molecule, the different atoms that make it up have different masses.

For example, a molecule of water has two hydrogen atoms and one oxygen atom.

Chemical formulae

A **chemical formula** tells you the relative number of atoms of each element that is in the compound.

H_2O

two hydrogen atoms for every oxygen atom.

$MgCl_2$

two chlorine atoms for every one magnesium atom.

$NaOH$

one sodium atom for every one oxygen atom, and every one hydrogen atom

When you are writing chemical formulae, write the numbers:

- to the right of their chemical symbol, just below the line.
- smaller than the chemical symbols.

Compounds

- are made of two or more *different* atoms strongly joined together.
- can be broken down into other substances.

Naming compounds

In a compound made of a metal and a non-metal, the name of the metal comes first.

for example, iron bromide, magnesium fluoride

If the non-metal atom is oxygen, it is called oxide. If the non-metal atom is chlorine, it is called chloride.

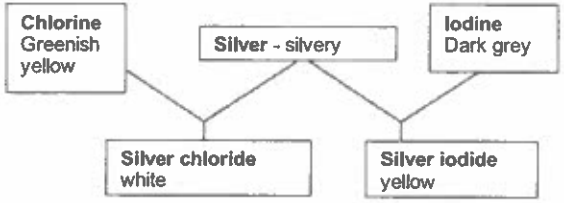
for example, copper oxide, sodium chloride

In a compound made of a non-metal and oxygen, oxygen comes second and is called monoxide if there is one oxygen atom or dioxide for two oxygen atoms.

for example, carbon monoxide, sulfur dioxide

When atoms join together to make a compound, the compound has properties that are different to the properties of the atoms that make them up.

For example, the colours of the silver compounds are very different from the colours of the elements that make them up:



Keywords

atom	element	compound	molecule	formula	periodic table	periodic table	chemical symbol

Elements, atoms, compounds
Homework questions

Q1 Define the following terms;
Element atom molecule compound chemical formula

Q2 List the first 20 elements in order of their atomic number.

Q3 State the number of each type of atom in H_2O, H_2, H_2SO4.

Q4 Carbon dioxide is a compound made up out of which two elements?

Q5 Write the formula of sulfur dioxide.

Q6 Draw and label diagrams to show how you could make models of the molecules: H2O, H2, H2SO4. *(higher)*

Q7 What happens to the chemical properties when atoms form compounds?

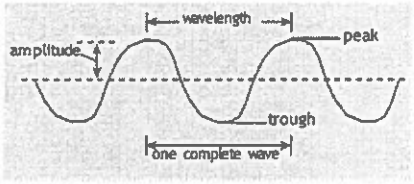
Q8 Explain the differences between elements and compounds.

P1 Sound

Knowledge organiser

Properties of waves

A wave is an **oscillation or vibration** that transfers energy. Matter is not transferred. Waves can be longitudinal or transverse.



Amplitude – distance from the middle to the top or bottom of the wave

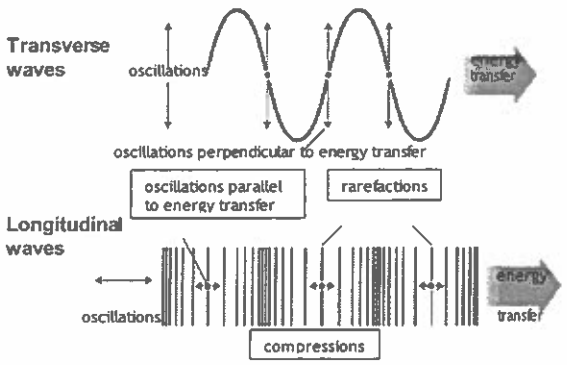
Wavelength – distance between a point on the wave to the same point on the next wave

Trough – bottom of the wave **Peak** – top of the wave

Frequency – how many waves go past a particular point in a second, measured in **hertz** (Hz) or kHz

If waves meet they **superpose**. This means they add up or cancel out, depending on if they are in time with each other or not.

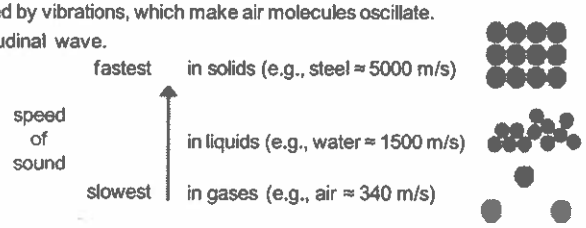
Transverse and longitudinal waves



Sound waves

Sound is produced by vibrations, which make air molecules oscillate.

Sound is a longitudinal wave.



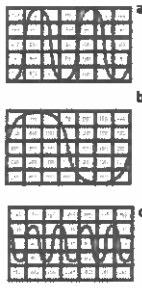
Waves can be **reflected** from a surface. The wave hitting the surface is the **incident wave**, and the wave bouncing off is the **reflected wave**.

A reflected sound wave is heard as an echo. The time delay of an echo can be used to work out the distance to an object.

Ultrasound (waves >20 kHz) is used to make images of unborn babies, in medical scans, and for underwater (sonar) searches.

Measuring sound

Oscilloscopes are instruments that give a visual representation of a sound wave. The taller the waves, the more energy that is in the wave and higher the volume. The more waves there are in the screen, the higher the frequency and the pitch is higher.



Humans can hear frequencies 20 Hz to 20 kHz. Above this is ultrasound. Below this is **infrasound**.

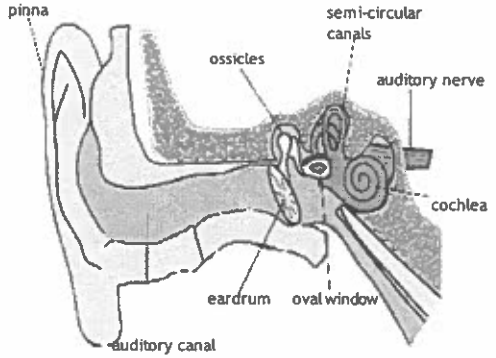
Sound volume is measured in **decibels** (dB). The decibel scale is not linear – a 10dB increase is 10 times the volume

Recording and playing sounds

In a microphone sound waves hit a **diaphragm** making it vibrate. This produces an electrical signal by moving a coil of wire over a magnet. Speakers are the opposite to microphones – an electrical signal is turned into sound by moving a cone backwards and forwards.

Hearing

Your ear is made of many specially adapted structures that detect and transmit sound waves, allowing you to hear noises.



Part of ear	Structure	Function
outer ear	**pinna**	directs sound into auditory canal
	auditory canal	sound travels through it to reach the eardrum
	eardrum	vibrates and passes vibrations to the ossicles
middle ear	**ossicles**	tiny bones that **amplify** sound
inner ear	**cochlea**	contains fluid and hair that produce an electrical signal
	semi-circular canals	helps you keep your balance

Hearing damage be caused by a number of factors, for example:

- loud sounds or injury, causing damage to the hairs in the cochlea (permanent).
- Canal blocked with wax (curable)

Key words

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

amplify **amplitude** **auditory canal** **auditory nerve** **cochlea** **compression** **decibel** **diaphragm** **eardrum** **frequency** **hertz** **incident wave** **infrasound** **oscillation** **oscilloscope** **ossicle** **oval window** **peak** **pinna** **pitch** **rarefaction** **reflected** **semi-circular canal** **superpose** **transverse** **trough** **ultrasound** **vibration**

Sound

Homework questions

Q1 What is a wave and what does it transfer? Draw a wave pattern and label all the parts.

Q2 Make a glossary of these keywords.

amplitude frequency wavelength peak or crest trough
transverse wave longitudinal wave

Q3 . Explain why sound cannot travel through a vacuum.

Q4 Describe how an ultrasound image can be made of a baby.

Q5 Describe how an ear works.

Q6 Explain how loud music can damage your hearing.

Q7 Explain how ultrasound can be used to calculate how far away an object is.

Q8 Find out what a mosquito anti-teen device is. Describe how it works and describe any problems people have with it. *(higher)*

Q9 Research an experiment that can work out the speed of sound.

Separation techniques

Knowledge organiser

What are mixtures?

Mixtures are different substances found together, but not chemically bonded. This means the different substances can be **separated** from each other.

In a **compound**, different substances are chemically bonded together, while in a mixture they are not.

The substances that make up a mixture keep their own properties and are easy to separate.

You can change the amounts of the substances in a mixture.

You can tell the difference between a **pure substance** and an **impure substance** – a pure substance has a single, sharp melting point, while an impure substance (a mixture) has a range of temperatures for its melting point.

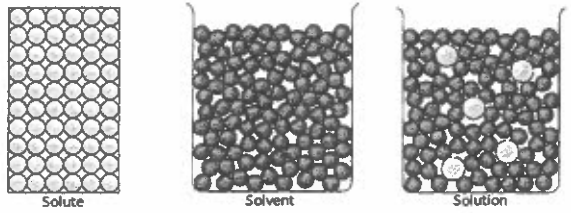
Solutions

Solutions are a type of mixture made of two parts:

1 **Solvent**: the liquid that makes up most of the solution.

2 **Solute**: the substance that is added to the solvent and **dissolves** into it.

The solute usually starts as a solid, and its particles break away from each other and move into the solvent.



Solubility

The **solubility** of a solute means how much solute can dissolve in a certain volume of solvent at a specific temperature.

- Different solutes have different solubilities in different solvents.
- Increasing the temperature often increases the solubility.
- Soluble substances can dissolve, **insoluble** substances cannot.

Saturated: when so much solute has been added to the solvent that no more can dissolve, we say the mixture is saturated.

How can we separate mixtures?

Filtration

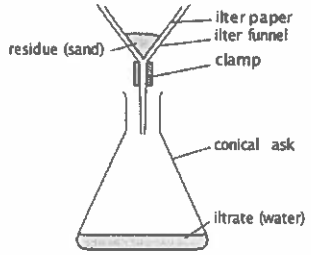
A method to separate a mixture of an insoluble solid and a liquid.

1 **Filter paper** has extremely small holes in it.

2 Particles in a liquid or solution are so tiny that they can fit through the holes.

3 Larger particles of the solid are too big to fit through the holes and are held back by the paper.

- **Residue**: solids left behind in the filter paper.
- **Filtrate**: the liquid that passes through the filter paper.

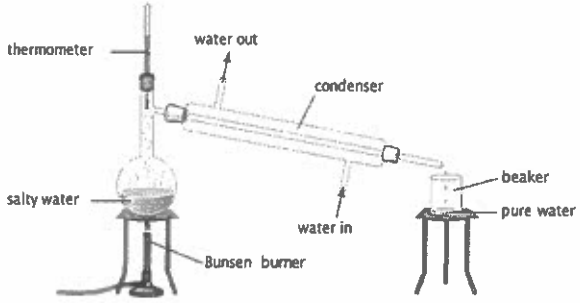


Distillation

A method that separates a solute and a solvent while keeping the solvent.

1 The solution is heated so the solvent turns into a gas (it evaporates).

2 The gas is then cooled down (it condenses) in a **condenser**, where it turns back into a liquid and can be collected.

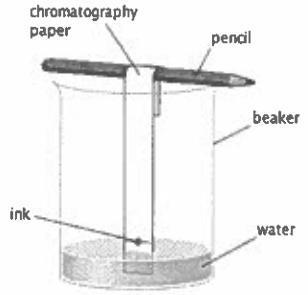


Chromatography

A method used to separate mixtures that are soluble in the same solvent.

1 A mixture like ink is placed on a piece of paper, which is placed in a solvent.

2 As the solvent moves up the paper it separates all the different constituents (parts) of the ink, producing a **chromatogram**.

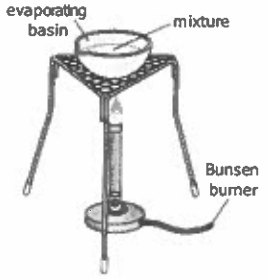


Evaporation

A method to separate a solute and a solvent, keeping the solute.

1 The solution is heated then left in an evaporating basin until all the solvent evaporates.

2 The solute is left behind as a solid.



KEY WORDS

Make sure you can write definitions for these key terms.

chromatography **chromatogram** **compound** **condenser** **dissolve** **distillation** **evaporation** **filter paper** **pure substance** **residue**

filtrate **filtration** **filter paper** **impure substance** **insoluble** **mixture** **pure substance** **residue** **impure substance** **insoluble** **mixture**

Homework questions

Separating Techniques

Q1 Find 3 mixtures at home. Explain what components there are in each mixture

Q2 What are the definitions of mixture, compound, solvent, solute and solution?

Q3 Draw a diagram of a solution

Q4 What is solubility? How does temperature affect solubility?

Q5 Describe the process of filtration using the terms: residue, filtrate, insoluble, solid and liquid.

Q6 What is distillation?

Q7 Explain how evaporation is used to make table salt. Include pictures or diagrams

Q8 Describe how you could use chromatography to identify the different inks in a pen

Reproduction

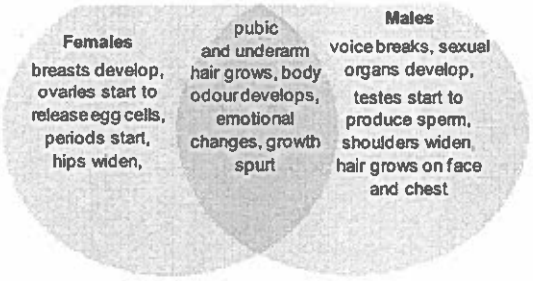
Knowledge organiser

Human reproduction

Adolescence

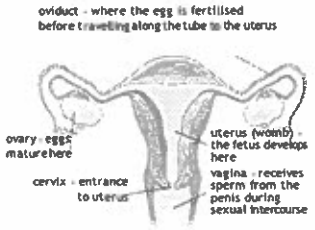
The time during which you change from being a child to being an adult is called **adolescence**. The physical changes that happen between the ages of 9–14 are called **puberty**.

These changes include:

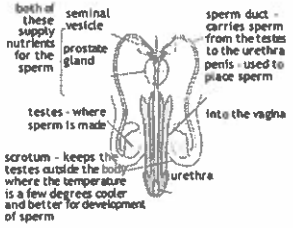


Reproductive systems

female

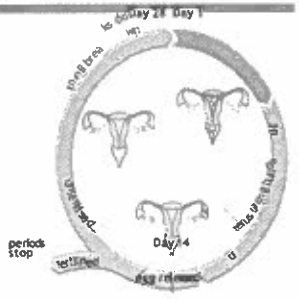


male



The menstrual cycle

Day 1 – blood from uterus lining leaves the body through the vagina.
Day 5 – bleeding stops. Uterus lining begins to re-grow.
Day 14 – an egg cell is released from one of the ovaries (**ovulation**).
The egg cell travels through the oviduct towards the uterus.



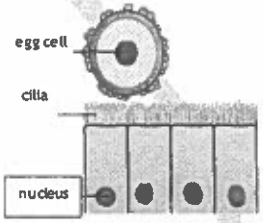
Methods of contraception

Condoms – A thin layer of latex rubber that prevents semen being released into the vagina.

Contraceptive pill – a daily tablet that contains hormones. It prevents pregnancy by stopping ovulation.

Fertilisation

An egg is released every month.



The egg cell is moved along the

Sperm cells are produced in the **testicles/testes.**

Sperm are mixed with nutrients and fluid from the glands to form **semen.**

During sexual intercourse a male will release semen into the vagina (**ejaculation**).

If a sperm meets the egg **fertilisation** may happen.

The fertilised egg may then **implant** in the uterus lining and form an **embryo** (ball of cells)

the main steps in a baby's development (**gestation**) during pregnancy

There are three important structures in the uterus during gestation:

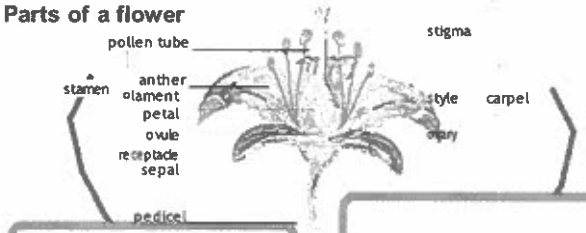
placenta – where substances pass from female to **foetus**

umbilical cord – connects the fetus to the placenta

fluid sac – shock absorber that protects the baby

Plant reproduction

Parts of a flower



Stamen
male part of the flower
- the **anther** produces pollen
- the **filament** holds up the anther

Carpel
female part of the flower
- the **stigma** is sticky to catch grains of pollen
- the **style** holds up the stigma
- the ovary contains **ovules**

Pollination

Pollination is the fertilisation of the ovule, which occurs when pollen is transferred from an anther to the stigma. Pollination can occur due to insects or the wind.

cross-pollination
between two **different** plants

self-pollination
between the male and female parts of the **same** plant

Fertilisation

The tube grows out of the pollen grain and down through the style.

The pollen nucleus moves down the tube.

The pollen nucleus joins with the ovule nucleus. Fertilisation takes place and a seed will form.

The ovules become seeds and are dispersed away from each other and from the parent plant. This is so they have space to grow and do not compete for resources such as nutrients. Dispersal can be by wind, animal, water or by explosion.

Germination

When a seed starts to grow it is called **germination**.

To germinate, seeds need:
- water – for the seed to swell and the embryo to start growing
- oxygen – for respiration and transferring energy for germination

Key Words

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

adolescence anther carpel cervix cilia contraception contraceptive pill ejaculation Embryo fertilisation foetus filament fluid sac fruit gametes germination gestation implantation menstrual cycle condom ovary petal oviduct ovule placenta pollen pollination puberty scrotum seed seed dispersal semen sepal sex sexual intercourse sperm duct stamen stigma style testes umbilical urethra uterus vagina

Reproduction
Homework Questions

Q1 Learn the spellings of all the keywords in this topic. Write down the definitions of the following words.
Puberty oviduct implantation semen urethra menstrual cycle pollination ovule

Q2 List four changes that happen to both boys and girls during puberty.

Q3 Write a story of the journey of a sperm from ejaculation to fertilisation *(Extended writing)*

Q4 Describe how the baby is born after 40 weeks in the uterus.

Q5 Explain the importance of the placenta to the developing foetus.

Q6 Carry out research to describe and compare the different methods of contraception.*(higher)*

Q7 Describe what happens to the ovule in a plant after pollination.

Q8 Compare the methods of seed dispersal and explain which method you think is most effective.

Q9 What three things does a seed need to germinate?

Q10 Producing seeds 'costs' the plant a lot of energy. Explain why you think this is a good or a poor use of energy. *(higher)*

Q11 Why should a pregnant woman avoid smoking and drinking alcohol?

C1 Acids and alkalis

Knowledge organiser

Acids and alkalis

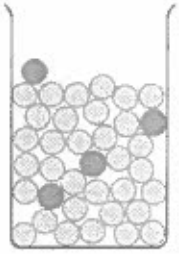
Acids and **alkalis** are special solutions which are chemical opposites to each other.
If a solution is exactly between acid and alkaline it is **neutral**.

Acids and alkalis can be:

concentrated

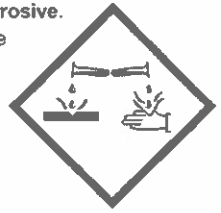
Lots of acid/alkali particles in a small amount of water

dilute



A small number of acid/alkali particles in a lot of water.

Some acids and alkalis are **corrosive**.
This means that they can cause burns if they get on your skin.



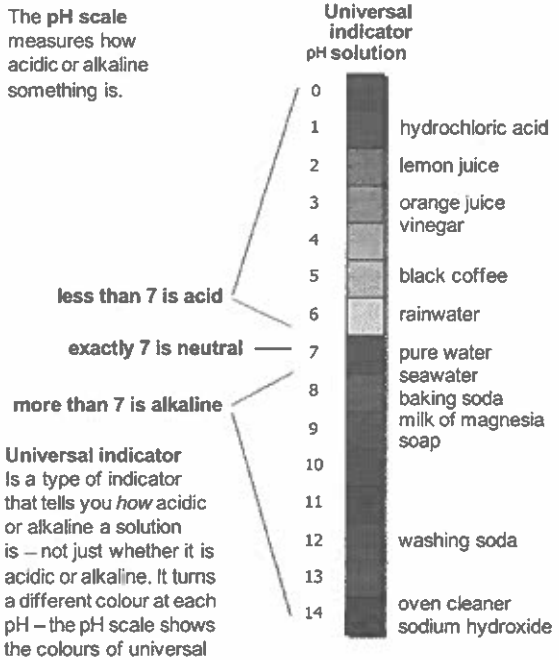
Acids and alkalis can be extremely dangerous, depending on the type of acid/alkali and its concentration.
As a general rule the more concentrated the solution, the more dangerous it can be.

Indicators

If you want to know if something is an acid or alkali, you need to use an **indicator.** Indicators contain a dye that turns different colours in acidic and alkaline solutions.

Litmus paper is a type of indicator. It can be either **red** paper or **blue** paper.
In acid – **blue** paper turns **red**
In alkali – **red** paper turns **blue**.

The **pH scale** measures how acidic or alkaline something is.



Universal indicator
Is a type of indicator that tells you *how* acidic or alkaline a solution is – not just whether it is acidic or alkaline. It turns a different colour at each pH – the pH scale shows the colours of universal indicator in solutions of different pH.

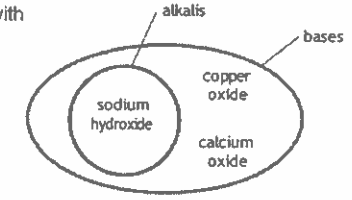
Reactions with acids

When an acid reacts with a metal element or compound a **salt** is formed.
The hydrogen atoms of the acid are replaced with atoms of the metal element.

$$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$$

zinc + sulfuric acid → zinc sulfate + hydrogen

A **base** is a compound that can react with an acid to make a **neutral** solution.
This is called **neutralisation**.
Bases that are soluble in water are alkalis.



Neutralisation reactions produce water and a salt.

base + acid → salt + water

for example,

sodium hydroxide + hydrochloric acid → sodium chloride + water
copper oxide + sulfuric acid → copper sulfate + water

Metals can also react with acids, but they produce a salt and hydrogen gas.
for example,

magnesium + hydrochloric acid → magnesium chloride + hydrogen

Naming salts

The name of the metal comes first, e.g., **magnesium** chloride.

Different acids produce different types of salt:

- hydrochloric acid produces metal **chlorides**
- sulfuric acid produces metal **sulfates**
- nitric acid produces metal **nitrates**

P1 Space

Knowledge organiser

Space

A **galaxy** is a collection of billions of **stars**. The Earth is in the **Milky Way** galaxy.

Planets are large objects that orbit stars, and do not **produce** light.

Asteroids are rocky objects smaller than planets, that also orbit stars.

Satellites are objects that orbit planets. This includes **natural satellites** (moons) and **artificial satellites** (e.g., the International Space Station).

Meteors are bits of rock which burn up in Earth's atmosphere. They are called **meteorites** once they hit the ground.

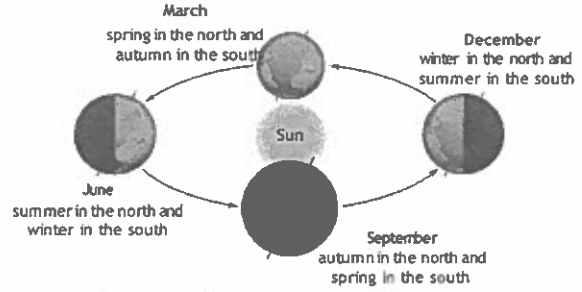
The Universe contains billions of **Galaxies** contain billions of **Stars** are orbited by **Planets, asteroids, and comets** planets may have **Moons**

The Earth

The Earth is the only place we have found life in the **Universe**.

It takes a **year** for the Earth to orbit the Sun - 365.2442 days. We add one day every fourth year (a leap year) because of the extra 0.2442 days.

The Earth's **axis** is tilted 23.4 degrees, which causes **seasons** (which have different day lengths and temperatures).

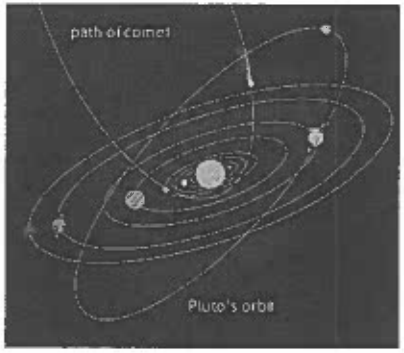


The Earth spins on its axis every 24 hours, giving us **day** and **night**.

The Solar System

Our **Solar System** is everything that orbits around the Sun. This includes:

- Inner planets – the **terrestrial** (rocky) planets
  - Mercury, Venus, Earth, Mars
- **Asteroid belt** (including the **dwarf planet** Ceres)
- Outer planets – the **gas giants**
  - Jupiter, Saturn, Uranus, Neptune
- Kuiper belt objects (such as Pluto)
- **Comets** (balls of ice)



The further a planet is from the Sun, the colder its temperature is (apart from Venus, because of its thick atmosphere).

Gravity pulled gas and dust together to form the Sun about 5 billion years ago. The planets then formed from a spinning disc of gas and dust around the Sun.

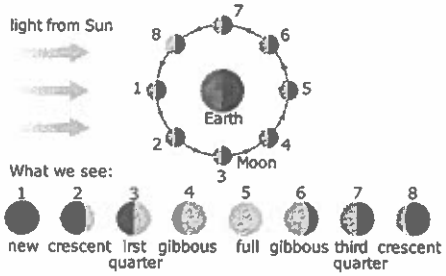
An exoplanet is a planet that is orbiting a star that is not the Sun. A group of stars is called a **constellation**. Different constellations are seen in winter and summer because the Earth is moving around the Sun.

The Moon

The **Moon** orbits the Earth every 27 days and 7 hours. It takes the same amount of time to spin on its axis, so we always see the same side.

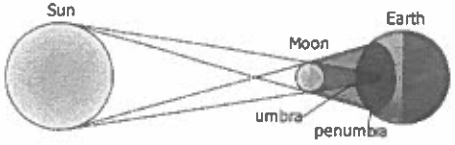
Phases of the moon

As the Moon moves around the Earth different parts are lit by the Sun, so it looks different to us.



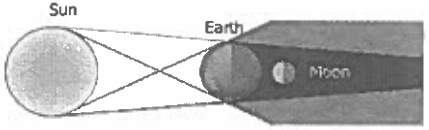
Solar eclipses

The Moon blocks light hitting part of the Earth. The **umbra** is the region of total darkness (like night), and the **penumbra** is where the light is partially blocked.



Lunar eclipses

The earth stops light hitting the Moon.



Key words

Make sure you can write definitions for these key terms

artificial satellite **asteroid** **asteroid belt** **astronomer** **axis** **comet** **constellation** **dwarf** **ellipse** **galaxy** **gas giant** **hemisphere** **lunar eclipse** **meteor** **meteorite** **Milky Way** **natural satellite** **total solar eclipse** **season** **star** **phases of the moon** **penumbra**

Space
Homework Questions

Q1 What are the 4 terrestrial planets?

Q2 Which planets are the gas giants?

Q3 Describe how the Moon was formed and explain what evidence we have for this.

Q4 Describe what an asteroid is and what an asteroid belt is.

Q5 Describe the difference between a meteor and a meteorite. Explain the consequences of a meteorite colliding with Earth.

Q6 Write down the meanings of the following words.

Star galaxy universe ellipse satellite
constellation lunar month solar eclipse penumbra

Q7 What causes summer?

Q8 What causes winter?

Reactions

Knowledge Organiser

A **chemical reaction** is a change in which atoms rearrange and join together differently to make new substances. **Physical changes** are changes that do not make new substances.

Equations

The substances that you start with in a reaction are called reactants, and the ones you finish with are the products.

We can represent a reaction with a **word equation.**

The reactants are on the left
The products are on the right
There is an → from the reactants to the products

copper + oxygen → copper oxide

reactants **products**

We can also use a **balanced formula equation** to represent a reaction.

$$2Cu + O_2 \rightarrow 2CuO$$

A balanced formula equation shows:

- the formula of each substance in the reaction
- how the atoms are rearranged
- the relative number (ratio) of atoms of each substance.

If a chemical reaction is happening you might:

1. see flames or sparks
2. notice a smell
3. Here fizzing or a bang
4. feel the temperature of the reaction mixture going up or down

Speed of reactions

Some reactions are very fast but others can be very slow.

Adding a **catalyst** can speed up a reaction, for example, to make a product more quickly.

Different reactions require different catalysts.

A catalyst isn't used up in the reaction but helps the reaction along.

Chemical reactions are normally not **reversible.**

This means that you cannot turn the products back into reactants.

What happens during a reaction?

All chemical reactions involve an energy transfer to or from the surroundings:

Energy transfer	Temperature of surroundings	Type of reaction	Example
from the surroundings to the reaction mixture	decreases	**endothermic**	thermal decomposition
to the surroundings from the reaction mixture	increases	**exothermic**	combustion

Conservation of mass

In a reaction, atoms are not created or destroyed – they are just rearranged.

The total mass of the reactants is always equal to the total mass of the products. This is called **conservation of mass.**

If the mass seems to increase, it is because atoms have been added from a gas.

magnesium + oxygen (gas) → magnesium oxide

If the mass seems to have decreased, it is because atoms have rearranged and formed a gas that has escaped.

calcium + water → calcium hydroxide + hydrogen (gas)

Changes of state are not chemical reactions, but they are reversible. This is called a **physical change.**

This is because no new substances are made.

For example, Water, ice, and steam are all made of molecules of the same substance (H_2O) in different states, and the change from one state to another is reversible.

Types of reaction

Thermal decomposition reactions

A **decomposition** reaction is when a substance breaks down into simpler substances.

Most decomposition reactions need heat to happen – this is called **thermal decomposition.**

Oxidation is when substances react with oxygen.

Combustion is a type of oxidation reaction where a **fuel** reacts (burns) with oxygen this transfers energy by heating.

Petrol, diesel, and coal are all **fossil fuels** and take millions of years to form.

They cannot be replaced when used, and will eventually run out, so are called **non-renewable** (finite).

Fossil fuels produce carbon dioxide and water when combusted. Extra carbon dioxide released into the air can cause climate change.

Hydrogen can also be combusted and used as fuel.

This may be better than using fossil fuels because it only produces water as a product.

$$2H_2 + O_2 \rightarrow 2H_2O$$

Key Words

Make sure you can write a definition for these key

balanced equation | catalyst | chemical reaction | combustion reaction | conservation of mass | decomposition | endothermic change | exothermic change | fossil fuel | fuel | non-renewable | oxidation reaction | physical change | product | ratio | reactants

Reactions
Homework questions

Q1 Write down the meanings of the following words.
Chemical reaction fossil fuel non-renewable decomposition conservation of mass

Q2 Explain what the difference is between a physical change and a chemical change. Give an example for each.

Q3 Explain what a word equation is. Give 3 examples of word equations.

Q4 State whether burning fuels is exothermic or endothermic. Explain your answer.

Q5 10g of Zinc Carbonate is heated to form 7g of Zinc Oxide. Calculate the mass of carbon dioxide that would be formed.

Q6 Write a paragraph to compare exothermic and endothermic reactions. Include examples to illustrate your answer.

Q7 Research the term thermal decomposition. Give a word equation for the thermal decomposition of copper carbonate. Explain how evolved carbon dioxide would be tested for. *(higher)*

Q8 Investigate the term oxidation. Write the word equation for the oxidation of iron.

Notes

	Monday	Tuesday	Wednesday	Thursday	Friday
Form					
P1					
P2					
P3					
P4					
P5					