THE HAMBLE SCHOOL
SCIENCE DEPARTMENT

A Parent's Guide to

Key Stage 3 Science

At The Hamble School we follow a bespoke Key Stage 3 course which is very different to previous curricula. In previous years KS3 Science has been geared towards SATs exams and, as a result, were primarily focussed on learning facts to answer the exam questions. Our current course focuses on two sets of skills: Explanation and Enquiry. Since these are skills rather than knowledge, they can be practiced time and again, each time developing them in response to feedback.

The skill of Explanation can be broken down into the application of the 'Big Ideas'. Big Ideas are concepts that can be used to explain seemingly unrelated topics. In Science these are: Forces; Particles; Energy; Cells; Interdependence, although we concentrate primarily on the first four.

The skill of Enquiry can be broken down into: Planning; Data Analysis and Numeracy; Conclusions; Evaluations. A precise list of the skills that students are required to demonstrate is listed on our assessment ladders.

You can support your child in achieving Securing or Mastering in these skills by repeatedly asking them to explain what is happening in the world around them. This Parent's Guide is devoted to helping you decide if they can do so correctly.

Owing to the bespoke nature of our approach, there are no directly relevant resources made by other providers. Revision guides, textbooks and websites will provide the context and detail of our modules as we all follow the national curriculum and so can be useful. But it will be up to the student to relate it back to the fundamental Big Ideas.

At the Hamble School, the Science team firmly believe that in adopting this approach, students starting their GCSE course will have the skills to understand topics that they have not studied before. Moreover they will be able to make links between topics they studied – in turn aiding memory. We recognise that when it comes to GCSE exams students will have to revise facts to recall them in their exams. We prepare them for revision at KS3 by having students memorise the definitions of keywords for homework. This is another aspect that you can greatly help them with.

Verbally testing them on the spellings of words listed on the word search and the definition lists supplied as crosswords, would be extremely useful. Without key vocabulary students, will be unable to access and understand the questions or express themselves precisely and accurately in their responses. It is said that 6000 words cover 90% of Russian texts, but KS3 science requires 13,000 subject specific words which are listed in WilliamsWords.co.uk science dictionary. Please note the topics are from the QCA schemes of work written for the previous National Curriculum.

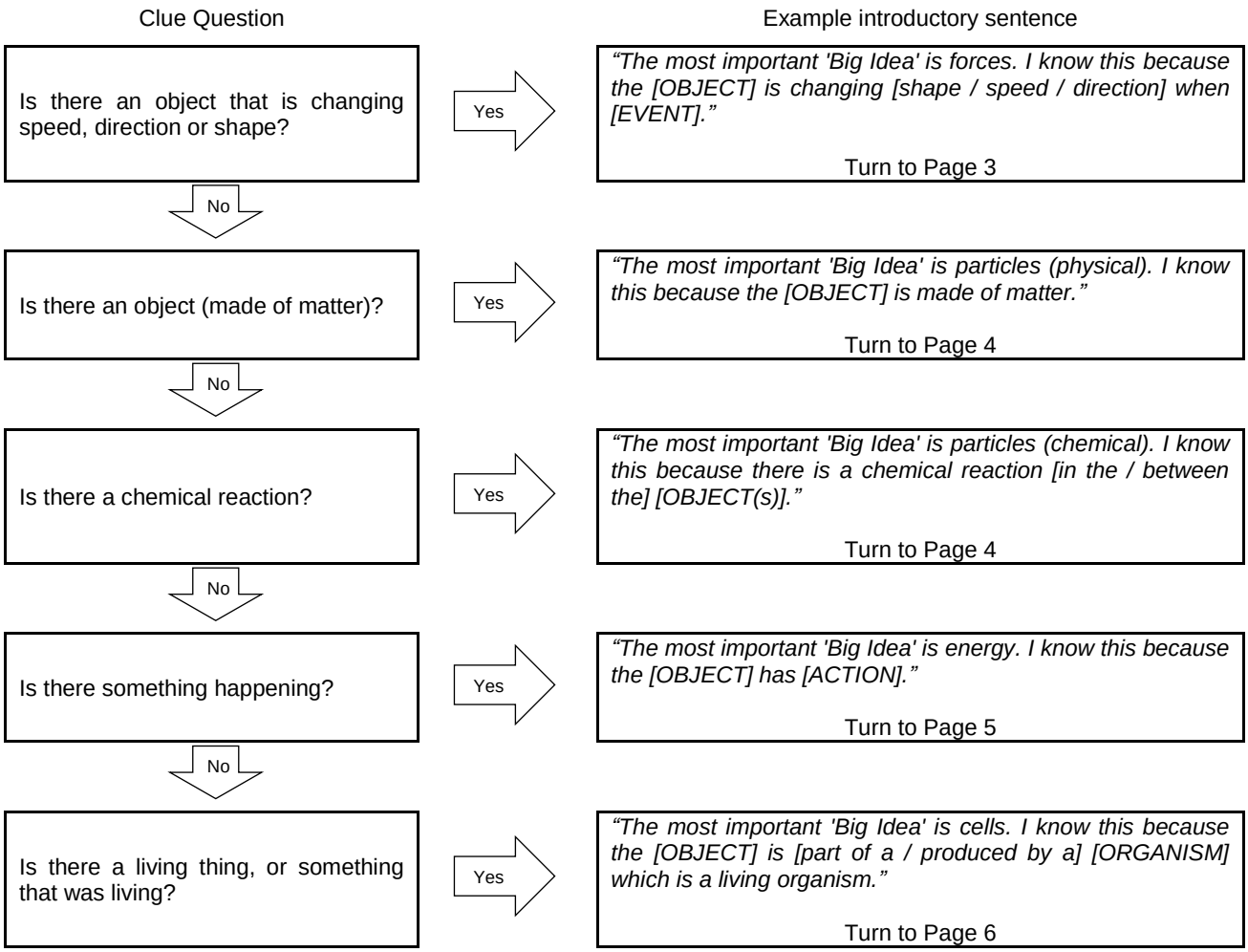
Explanations

When attempting to explain something in Science we start by identifying the Big Idea, the developing this by justifying why we chose a particular Big Idea - this is in the form of the clue. We next name or describe some details to do with the Big Idea, before linking the detail together.

In the example sentence structures in the sections that follow, phrases in the square brackets need to be replaced. If words in square brackets are written in all capitals then it describes what should go in its place, otherwise an appropriate selection needs to be made.

Choosing the 'Big Idea'

To find the correct Big Idea we must see if we can find any of the clues by asking the following questions.



In reality there will be more than one Big Idea in a typical situation. In fact to produce an explanation of a high standard, students should be able use more than one Big Idea and then link each of them together.

Forces

We must identify the forces involved in the situation by asking the following questions:

Is there something moving through the air?	Yes	*"The force involved is air resistance from the [OBJECT] moving through the air."*
No		
Is there something moving through water?	Yes	*"The force involved is water resistance from the [OBJECT] moving through the water."*
No		
Is there an engine?	Yes	*"The force involved is thrust from the engine."*
No		
Is there (or an attempting to) rubbing or sliding of surfaces?	Yes	*"The force involved is friction between the [SURFACE 1] sliding against SURFACE 2]."*
No		
Is there an object in a gravitational field (near a planet)?	Yes	*"The force involved is weight from the mass of the [OBJECT] being attracted to the Earth."*
No		
Is something floating?	Yes	*"The force involved is upthrust from the [FLUID] surrounding the [OBJECT]."*
No		
Is something being stretched?	Yes	*"The force involved is tension in the [OBJECT] that is being stretched."*
No		
Is something being squashed?	Yes	*"The force involved is compression in the [OBJECT] that is being squashed."*
No		
Is there a solid being pushed on?	Yes	*"The force involved is a reaction force from the [SOLID OBJECT] being pushed on by the [OBJECT]."*
No		
Is there a magnetic object in a magnetic field?	Yes	*"The force involved is magnetic force from the [MAGNETIC OBJECT] being in the magnetic field created by [OBJECT CREATING MAGNETIC FIELD]."*
No		
Is there a charged object in an electric field?	Yes	*"The force involved is electrostatic from the [CHARGED OBJECT] being in the electric field created by [OBJECT CREATING ELECTRIC FIELD]."*

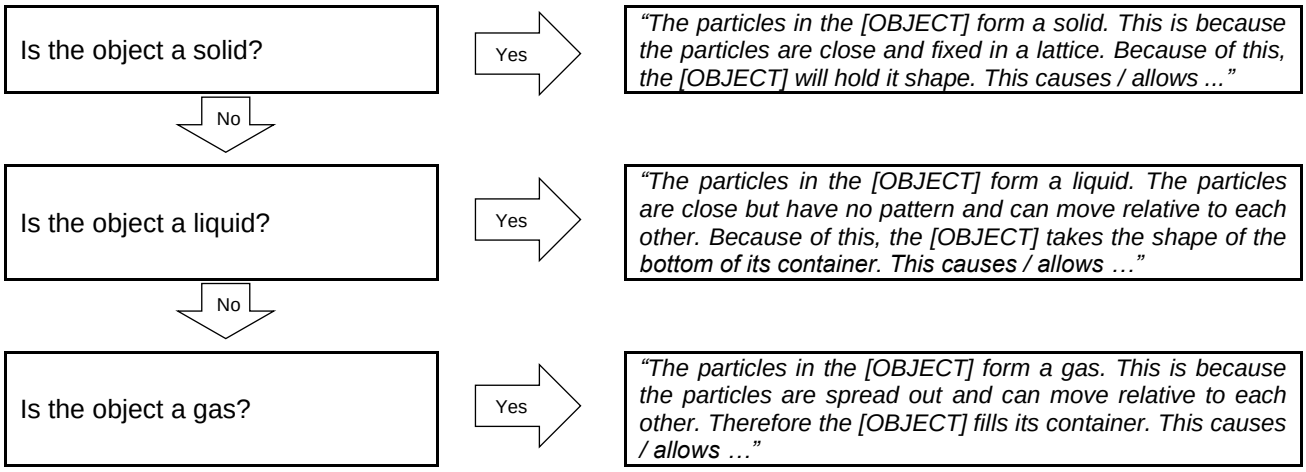
We then go on to compare the forces we have just named, by asking the following:

Is one force greater than the other force it is in line with?	Yes	*"The [NAMED FORCE] force is greater than the [NAMED FORCE] force. The forces are unbalanced, so there is a resultant force [DIRECTION], which causes an acceleration. Therefore the [OBJECT] changes [speed / direction]."*
No		
Are the forces that are in line with each other equal?	Yes	*"The [NAMED FORCE] force is equal to the [NAMED FORCE] force. The forces are balanced, so there is no resultant force, so there is no acceleration. Therefore the [OBJECT] travels at a constant speed."*

Particles

The Big Idea of particles is split into explaining the physical arrangement for changes of state and their rearrangement during a chemical reaction.

Particles – Physical



If there is a change in state (eg melting a solid to liquid) then the changes in particle arrangement could be described as well.

Particles – Chemical

For chemical reactions there are no more questions to ask. We can therefore use the structure outlined below. The structure is written for two compounds reacting to produce a single compound. It will need to be adjusted if, for example, more than chemical is produced.

"The names of the reactant particles involved are [NAME OF REACTANT PARTICLE 1: MOLECULES / ATOMS / IONS] from [CHEMICAL 1] and [NAME OF REACTANT PARTICLE 2: MOLECULES / ATOMS / IONS] from [CHEMICAL 2].

The names of the reactant particles involved are [NAME OF MOLECULES / ATOMS / IONS] in the [CHEMICAL THAT IS PRODUCED].

The [NAME OF REACTANT PARTICLE 1] and the [NAME OF REACTANT PARTICLE 2] collide.

This causes the [NAME OF REACTANT PARTICLE 1] to split into [NAME OF SMALLER PARTICLES FROM PARTICLE 1]. While the [NAME OF REACTANT PARTICLE 2] splits into [NAME OF SMALLER PARTICLES FROM PARTICLE 2].

The [NAME OF SMALLER PARTICLES FROM PARTICLE 1] and the [NAME OF SMALLER PARTICLES FROM PARTICLE 2] then bond together forming [NAME OF NEW PARTICLES / CHEMICAL].

Energy

We must identify the energies involved in the situation by asking the questions outlined below. Note that sentences will likely have to be combined as there will be more than one type of energy involved.

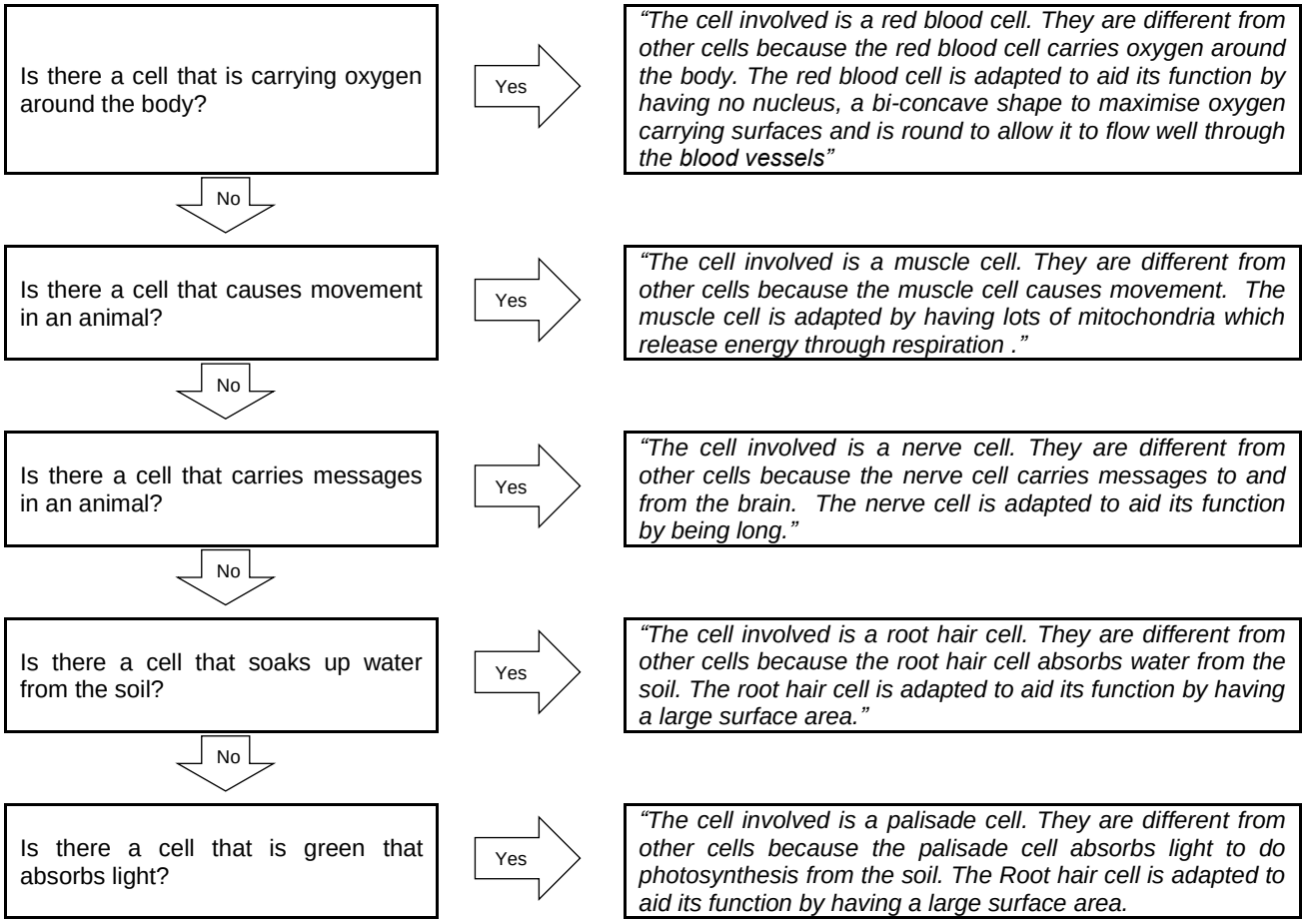
Is there an object plugged into the mains or that contains a battery?	Yes	*"The energy involved is electrical in the [OBJECT]."*
No		
Is there a noise?	Yes	*"The energy involved is sound coming from the [OBJECT]."*
No		
Is there an object that changes temperature?	Yes	*"The energy involved is thermal in the [OBJECT]."*
No		
Is there a light?	Yes	*"The energy involved is light in the [OBJECT]."*
No		
Is there an object moving?	Yes	*"The energy involved is kinetic in the [OBJECT]."*
No		
Is there a radioactive object?	Yes	*"The energy involved is nuclear potential stored in the radioactive [OBJECT]."*
No		
Is there an object being burnt or a chemical reaction?	Yes	*"The energy involved is chemical potential stored in the [OBJECT]."*
No		
Is there an object high up?	Yes	*"The energy involved is gravitational potential stored in the [OBJECT] being while it is high up."*
No		
Is there an object that is being stretched, squashed, bent or twisted?	Yes	*"The energy involved is elastic stored in the [OBJECT] that is being [stretched / squashed / bent / twisted]."*

Since energy cannot be created or destroyed, we go on to state where the energy came from and where it goes (Think 'Cotton Eye Joe') using the following sentence structure:

"The [SOURCE ENERGY TYPE] energy in the [SOURCE OBJECT] is [transformed into / transferred to] [RESULTING ENERGY TYPE] energy in the [OBJECT WITH RESULTING ENERGY]. This cause [ACTION / EVENT]."

Cells

When attempting to explain something using cells at home, you are likely to be looking at the cells themselves as we would do in class. Therefore the questions below are starting from a marcoscopic starting point rather than the microscopic we might use in lessons.



The most important thing we are looking for is a link between what makes cells special (different from other cells) to enable them to do their function, rather than the name of the cell itself.

Marking Up

In order for students to self-asses their work and ensure they have not missed anything out, we use a form of 'marking up' to annotate their work.

Ideally using a green pen, we would circle the Big Idea names and circle with a tail the justification – this is to resemble a magnifying glass identifying the 'clue'.

*"*The most important Big Idea is Forces because the car changed speed."

Next we add boxes to named detail or description.

"The energies involved are kinetic energy and gravitational potential energy. "

We underline the use of the named detail. This will normally link from one box to another.

"The palisade cells have lots of chloroplasts so they can do lots of photosynthesising."

Finally we look for a sentence that links big ideas together. We overline and underline between the circled big ideas.

"Carbon dioxide particles diffuse into the cell."

Assessing work

Student will generally gain the highest rung in a continuous Big Idea. This means it is far better that a student does one big idea fully before adding a second Big Idea. It also means students need to learn the structure of a Big Ideas explanation as without Big Ideas, lots of relevant detail will gain very little credit.

Ladder 'Rung' Description	Progress Statement	Memory Phrase
Identify the correct big idea and give a reason why you chose it.	Yr7 Emerging	Big Idea
Use a big idea to explain the science.	Yr7 Developing	Name
Use a big idea to explain the science through making links.	Yr7 Securing Yr8 Emerging	Use
Use two big ideas to explain the science.	Yr7 Mastering Yr8 Developing	Twice
Use two big idea linked together to explain the science.	Yr8 Securing	Link
Link more than two Big Ideas to an answer.	Yr8 Mastering	Links
Include the implications of the science beyond what is asked in the question.	Yr8 Work Above	Implication

Enquiry

Through the content across all three disciplines of Biology, Chemistry & Physics students will be taught to:

Scientific attitudes

- Pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility
- Understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review
- Evaluate risks

Experimental skills and investigations

- Ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience
- Make predictions using scientific knowledge and understanding
- Select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables
- Use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety
- Make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements
- Apply sampling techniques

Analysis and evaluation

- Apply mathematical concepts and calculate results
- Present observations and data using appropriate methods, including tables and graphs
- Interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions
- Present reasoned explanations, including explaining data in relation to predictions and hypotheses
- Evaluate data, showing awareness of potential sources of random and systematic error
- Identify further questions arising from their results

Measurement

- Understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature
- Use and derive simple equations and carry out appropriate calculations
- Undertake basic data analysis including simple statistical techniques

There are three types of investigations that we use at Hamble:

1. Given some (safe) equipment, students experiment to make as many observations they can. We then seek to explain these observations using the Big Ideas.

2. Following a method to find a specific result or simply learning a standard method.

3. An ‘Enquiry’ in which students are given an aim and identify the variables in it. They then add detail to an outline method and produce a risk assessment for it. They then collect data, analysis it, write a conclusion and then evaluate the method and data collected.

Investigation types 1&2 will generally be used within the normal taught lessons. While the three lessons a topic are devoted to type 3 and form 50% of the assessment for that topic.

The Enquiry Assessment Ladders form a detailed list of the skill that student should acquire in order to succeed at GCSE. It is not possible to demonstrate all of the skills in each of the investigations as they are not always applicable to that investigation.

The Students that make most rapid progress, use the ladders to work out what skill they need to develop and then demonstrate during their subsequent enquiry work. We expect a student to demonstrate each skill three times to ensure that it has been embedded.

For both these reasons a piece of work may be, for example, a securing standard, but overall the student may get a lower reported overall progress statement.

Further Resources

To further support your student, we have also produced the following resources that are available on the school website via the following address: www.MrCorfe.com/KS3

- Writing frames
    - Single Big Idea with extra clues
    - Multi Big Idea
- Big Idea Thinking Map
- General Keyword list
- Mind Map Skelton

Module List

Year 7	1B	Introduction to Cells	1C	Introduction to Particles	1P	Introduction to Forces
	2B	Plant Reproduction & Ecology	2C	Elements Compounds and Mixtures	2P	Introduction to Energy
	3B	Photosynthesis	3C	Separating Mixtures	3P	Motion & Space
Year 8	4B	Diet and Digestion	4C	Chemical Reactions	4P	Waves & Sound
	5B	Human Reproduction	5C	The Earth and Atmosphere	5P	Machines
	6B	The Respiratory system	6C	The Periodic Table and Acid Reactions	6P	Magnetism and Electrical Fields
Year 9 Term 1	7B	Evolution	7C	Rocks and Materials	7P	Light
	8B	Drugs Project	8C	Recycling Project	8P	Electricity

BBC Bitesize topics

Year 7	1B	Living Organisms	1C	States of matter Physics: Solids, liquids and gases	1P	Forces and movement: Forces
	2B	Reproduction: Plant and Ecosystems and habitats	2C	Atoms, elements and the periodic table: Atoms, elements and compounds	2P	Energy: Energy stores and transfers
	3B	Respiration and gas exchange: Photosynthesis	3C	Atoms, elements and the periodic table: Pure and impure chemical substances and Atoms, elements and the periodic table: Separating mixtures	3P	Forces and movement: Motion and Space
Year 8	4B	Nutrition, digestion and excretion	4C	Chemical reactions and tests and Acids, alkalis and salts: The pH scale and neutralisation	4P	Waves: Features of waves and Waves: Sound waves
	5B	Reproduction: Human	5C	Earth and the environment: The Earth	5P	Forces and movement: Pressure and Energy: Fuels and energy resources
	6B	Respiration and gas exchange: Respiration and Health and disease: Health Page 2	6C	Atoms, elements and the periodic table: The periodic table and Acids, alkalis and salts: Acids and bases	6P	Electromagnetism and magnetism and Electricity: Static electricity
Year 9 Term 1	7B	Inheritance and genetics	7C	Earth and the environment: Rocks, Earth and the environment: The rock cycle and Materials	7P	Waves: Light waves
	8B	Health and disease: Health Page 3	8C	Earth and the environment: Impact of human activity	8P	Electricity: Electric current and potential difference

If viewed digitally, the titles above are hyperlinks.

Homework

A topic will generally last for four weeks and so there will be four, 30 minutes, homeworks per topic:

1. Learn the keywords
2. Enquiry
3. Learn definitions of keywords
4. Redrafting of assessment

The first homework in a topic will generally be to learn the spellings of keywords. This will begin with a wordsearch, but continue with learning the spellings in your child's preferred method, such as 'Look Cover Write Check'. This activity can be further extended to looking up the definitions of words the student does not know and therefore gain a head start on their use in lessons.

The second homework will be related to the enquiry assessment, this is likely to be to finish a graph of the data collected in lessons or maybe writing a conclusion and/or evaluation for the data.

The third homework will be to learn the definitions for the keywords. This will begin with completing a crossword, the clues for which are the words definition. The homework continues with revising, practising and testing understanding of meaning. Depending on your child's preferred revision method, they may wish to make flashcards with the word on one side and the definition on the other.

If your child does not yet know how they best revise, these homeworks can be used as a way of evaluating the different revision methods. Revision and learning is a personal thing and we do not expect all students to produce the same revision materials, they will be assessed on what they have learnt rather than how much they produced to do so. However we do expect that the wordsearch is completed and stuck in their books as a reference tool.

The fourth homework will be related to the Progress Observation Opportunity assessment. Students will have reflected on feedback in class and then will redraft / improve their response for homework.

Extension Homework

In addition to this there is an extension homework aimed at the students that wish to attain Mastery. Over the course of a term, students will complete an in depth project in which they plan and conduct an experiment into something they are interested. Each stage is designed to be done over a four week topic, adding a fifth homework for those that have learnt the require vocabulary:

Stage 1a: Find an area of interest

Stage 1b: Identify the variables, write a method & perform a risk assessment

Stage 2a: Conduct a preliminary test

Stage 2b: Collect Data

Stage 3: Explanation and Implications

Benefits of word puzzles

Adapted from 'www.theschoolrun.com/10-ways-word-puzzles-can-help-your-child'

1. They help with spelling

Word games can help to reinforce spellings in your child's mind, particularly in the case of puzzles like crosswords, where it's crucial to spell linked words correctly to be able to complete the task. You can also use word puzzles to inject a bit of fun into learning spellings.

2. They make your child work faster

'Word puzzles are really good for improving children's processing speed, so they are able to arrive at the correct answer, faster,' says Denise Yates, chief executive of Potential Plus UK. 'Even very bright children can sometimes be slow at processing, but it can be improved with practice.' This doesn't just help with literacy, but also with other classroom tasks that require quick thinking.

3. They boost working memory

Working memory is the 'conductor' of the memory system, helping both long-term and short-term memory to work together. Word puzzles, such as crosswords, where your child has to access vocabulary and definitions from memory, can help to improve working memory, which, in turn, can have a knock-on effect on learning and achievement.

4. They extend vocabulary

The more words your child encounters and understands, the broader their day-to-day vocabulary will become. 'Word puzzles are a great way to increase your child's exposure to old and new vocabulary, and to think about the different definitions of words, especially if you encourage him to use a dictionary to look up any words he's unsure of,' says Denise.

5. They encourage problem-solving

Many word puzzles require not just a good vocabulary and a knack for spelling, but the ability to think logically and strategically. For example, crosswords make your child think about how the words interact on the grid. 'Children often start out thinking that they can't possibly tackle a problem, but by the time they've solved three or four clues, they've tuned in to what's required,' says Denise.

6. They're good for competitive kids

If your child is racing his sibling to see who can solve a puzzle fastest, it can encourage a healthy sense of competition, and provide an incentive for children who struggle with motivation. 'Boys, in particular, tend to like puzzles that have a competitive element,' says Denise. 'Trying, failing and trying again is also a good way to build up resilience and sportsmanship.'

7. They're fun for the whole family

Solving word puzzles can be a good opportunity to have some regular bonding time with your child. 'You'll also be modelling a love of language, which is then passed on to your child,' Denise adds. It doesn't matter how much support your child receives, it is engagement with the vocabulary that is important.

8. They help with test preparation

The first section of the Progress Observation Opportunity tests student ability of the keywords. Moreover, the learning and revision of these spellings and definitions of keywords will build skills vital for learning the 'facts' required at GCSE.