Park Community School

Handbook

2023-2024

Department Aims and Vision

The main aims of the science department are:

1. To ensure that all pupils are engaged and enjoy being in science. Promote curiosity of science.

2. To promote the real-life applications of science in everyday life by a clear focus on cultural capital.

3. To allow students to work as scientists, by using practical skills to enhance the learning of content.

The vision of the department consists of the 4Cs, these are consistency, curriculum, challenge and collaboration.

- ***Consistency*** in our teaching and our approach to the success of all pupils.
- Having a broad, engaging and ambitious ***curriculum*** to ensure that we allow pupils to solve problems and apply knowledge to a range of different contexts. Allowing students to ask questions and to promote curiosity in KS3.
- To ***challenge*** the thinking of students and promote independence in and out of the classroom.
- To ***collaborate*** and share good practice and to celebrate the strengths of the department and also give support and develop our weaknesses when necessary

Science Curriculum

Intent

Science has something to offer every student, suiting all abilities and all aspirations. Our aim is to develop worldly citizens through boosting cultural capital.

During KS3 in science, we promote awe and wonder. We want our students to be curious about the world around them and be confident to ask questions and investigate a range of possibilities.

Our curriculum is designed to build upon the learning in KS2 and enable students to develop the necessary skills when working as a scientist. Vocabulary is very important in science and we develop the amount of science specific words learnt by students and ensure these are practised by orally and in written work.

Once at KS4, we build upon the key skills and knowledge learnt in KS3 and continue to master these and apply to a range of contexts.

Implementation

We fully promote literacy and use fortnightly news articles on current issues/stories to promote cultural capital in KS3 and to allow students to understand the world around them.
In KS3, we currently complete termly awe and wonder specific lessons; these are designed to allow exploration of student's own questions.
We have a centralised SOW designed to ensure NC covered with appropriate levels of challenge. Includes working scientifically skills to be covered and assessed.
For KS4, we have a centralised SOW designed to ensure AQA specification is covered from grades 1-9.
We improve and master the working scientifically skills built upon from KS3, while covering the required practical elements of the course.
Clear focus on expanding scientific vocabulary to ensure fluency in both written and verbal answers.
Fully embedded maths skills that are required, with clear links with maths methods and vocabulary used.

Impact

During KS3, we want students who ready for KS4 with necessary skills and knowledge to build upon and are 'GCSE ready'.
Students have high aspirations and enjoyment of science when leaving KS3 and students are able to achieve age related expectations (ARE) or above and are fully prepared for their GCSE.
Once in KS4, our aim is to increase the number of students going onto study a science subject at higher education.

The perfect request sheet

Name	1	2	3	4	5
Mon	Year Grp, Room, No. in class. Demo or class set. List of equipment & ref to SOW.				
Tues					
Weds					
Thurs					
Fri					

Red lines – what this looks like in science

Strand	Expectation	How this can be seen in science.
Reading	Students are expected to read aloud	Including; exam questions, text on screen, textbooks, methods for practical's
	Teacher actively models reading	During I do activities or during the modelling of exam questions
	Reading materials are of a high quality	
	Summarise/ synthesise- reading model added	Key methods from required practicals
First 5	Teacher Greets at the door monitoring entry to lesson – narrates positive	G01 – Outside door, G02 – Technology side, G03 – Lined up at wall, G04 – lined up towards stairs, G05 – Lined up between doors, G06 – lined up outside door, G07 – lined up down stairs
	Do it Now task	Written/on slide prior to LOs – expected to complete in silence – teacher is 'seen' watching and monitoring class
	Objectives, Map & Keywords shared	LO's not written, title and keywords written. Keywords written in margin.
Classroom	Classroom tidy	Check equipment, sinks and floor
	Smart displays support learning	
	Seating plan in place	Boy/girl. Can change during investigations.
Teaching	Teaching is based on clear objectives	KS3 – National curriculum KS4 – Specification
	Questioning is used regularly to check to understanding and assess: ✓ Cold call with wait time ✓ No opt out ✓ Right is right ✓ White boards used to check for understanding	Most students per lesson, targeted students and not always hands up unless suitable. Wait time given and name asked at the end of the question to ensure all students are thinking High ratio of participation
	Modelling is used to promote progress i.e.: metacognitive and/ or WAGOLL	During question modelling activities OR exam questions fortnightly
	Students orally rehearse responses to questions	Kagen strategies (Round Robin, Think pair share, Rally robin)
	Students are expected to 'get stuck'/ think hard	4B's, assessments – applications to think hard Comfort, stretch, panic
	Take 5	Interleaving activities – will cover previous learning
Feedback	Frequent assessment of learning impacts progress	Assessments – Yr 7-9 as per scheme of work. Deep marking and feedback with allocated review time and completion of whole class feedback sticker. In-flight marking per fortnight – each student book to be marked fortnightly during lesson time. KS4 – Exit tickets used regularly to check for understanding of precise knowledge.
	Regular written feedback given as per dept policy	
	Feedback is effective i.e.: impacts on progress	
	Review of assessments - class based and individual	Review time allocated in lessons – includes green penning for improvements and extension questions, exam questions. Inside cover of exercise books shows summary of all assessments completed
Final 5	Learning is reviewed/ summarised/ questioned	As plenary
	Students behind chairs in silence	
	Teacher dismisses at door	
Making positive choices	System used as necessary	Merits awarded
	Low level disruption is addressed swiftly	Using school behaviour policy
	Calm and consistent manner every lesson	

Schemes of Work - Overview

All schemes of work include:

1. Scheme of Work (produced in a PowerPoint format)
2. Front sheet for all schemes which contain National curriculum/specification content and all practical equipment required for the lesson.
3. At the beginning of each topic, a precise learning checklist is shared.
4. Big Picture of scheme for students (in exercise books)
5. Assessments as prescribed per topic – KS3.
6. Guided reading tasks for KS3 – at least one per topic
7. Years 7-9: Multiple choice tests (three times per year)
8. Homework (google form for KS3 fortnightly – Week A, KS4 weekly seneca and routinely revision tasks set)

Rosenshine's Principles *(taken from Rosenshine's principles in action; Tom Sherrington 2019)*

The following is a list of instructional procedures that underpin our teaching and fundamentally link into our schemes of work;

- Begin a lesson with a short review of previous learning (Do now/starters/Take 5)
- Present new material in small chunks with student practice after each step
- Limit the amount of material students receive at one time
- Give clear and detailed instructions and explanations
- Ask a large number of questions and check for understanding (whole class involvement)
- Provide high level of active practice for all students
- Guide students as they begin to practice
- Think aloud and model steps (metacognition and oral rehearsal is promoted)
- Provide models of worked-out problems
- Ask students to explain what they had learned
- Check the response of all students
- Provide systematic feedback and corrections
- Use more time to provide explanations
- Re-teach material when necessary
- Prepare students for independent practice
- Monitor students when they begin independent practice

All teachers to have a model exercise book – use with visualiser, for WAGOLLs etc

Schemes of work

All schemes of work are written and are fully linked to National curriculum and exam specification.
They include any keywords that should be covered in the scheme, the working scientifically skills that are covered and the assessments that would be completed.
The front sheet for each topic also shows any previous knowledge from KS2/KS3 and where this topic fits in to KS4.

See example below:

Topic 1: Body systems

Precise knowledge:
Explain the role of each nutrient in the body.
Describe how to test food for starch, lipids, sugar, and protein.
Describe some health issues cause by an unhealthy diet.
Calculate the energy requirements of different people.
Describe the process of digestion.
Describe the structure and function of the main parts of the digestive system.
Describe the role of enzymes in digestion.
Describe how the parts of the gas exchange system are adapted to their function
Describe the process of inhaling and exhaling
Describe how a bell jar can be used to model what happens during breathing
Explain how to measure lung volumes

Vocabulary Focus:
Nutrition, Soluble, Digestion, Exchange, Adaptation

Previous knowledge:
- recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function
- describe the ways in which nutrients and water are transported within animals, including humans.
- describe the simple functions of the basic parts of the digestive system in humans
- describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene.

Next steps…

KS4 links:
Biology Paper 1—Organisation

For each lesson, there are objectives;
KS3 – They are aimed at *Age related expectations* (ARE) and *At greater depth* (AGD)
KS4 – They are aimed at grade 4, grade 6 and grade 8.
They also cover practical or demonstration that could be covered. Equipment is clearly listed for ordering with the technicians.

KS3 – Year 7

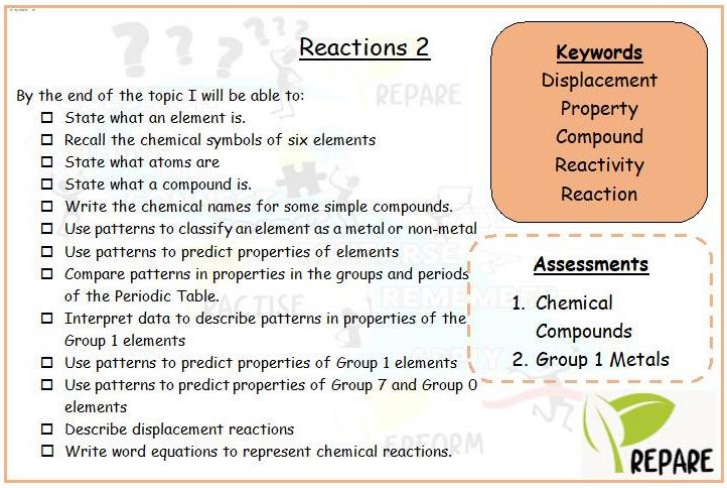
Lesson No. and Title	Learning objectives	National Curriculum	Working scientifically skills	Practical equipment
1. Observing cells *Possible exit ticket - microscopes*	ARE – To explain how to use a microscope and state the magnification. AGD – To calculate a range of magnifications.	• cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope		**PRAC—Observe prepared slides under microscope** Microscopes and prepared slides **WS8** – Reading and using a given method **WS10** – Selecting the correct equipment
2. Cells	ARE – To correctly draw and label a plant and animal cell. AGD – To explain the functions of the components of animal and plant cells.	• the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts		

KS3 and KS4 – Precise learning checklist

At the beginning of each topic, a precise learning checklist is given to students and stuck into exercise books. This lists all the key information that will be covered during that topic. This is to ensure students have the big picture of the topic and are able to use this for revision prior to assessments/tests.
Students should tick off each time knowledge has been taught/revised/assessed, this should mean the checklist has multiple ticks.

Below are examples for both KS3 and KS4:

KS3:



Reactions 2

By the end of the topic I will be able to:

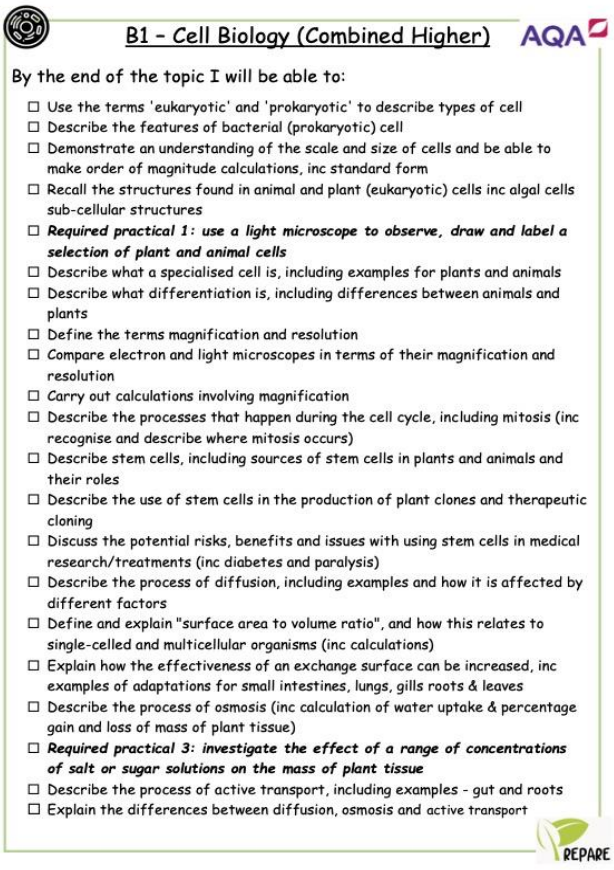
- ☐ State what an element is.
- ☐ Recall the chemical symbols of six elements
- ☐ State what atoms are
- ☐ State what a compound is.
- ☐ Write the chemical names for some simple compounds.
- ☐ Use patterns to classify an element as a metal or non-metal
- ☐ Use patterns to predict properties of elements
- ☐ Compare patterns in properties in the groups and periods of the Periodic Table.
- ☐ Interpret data to describe patterns in properties of the Group 1 elements
- ☐ Use patterns to predict properties of Group 1 elements
- ☐ Use patterns to predict properties of Group 7 and Group 0 elements
- ☐ Describe displacement reactions
- ☐ Write word equations to represent chemical reactions.

Keywords
Displacement
Property
Compound
Reactivity
Reaction

Assessments
1. Chemical Compounds
2. Group 1 Metals

REPARE

KS4:

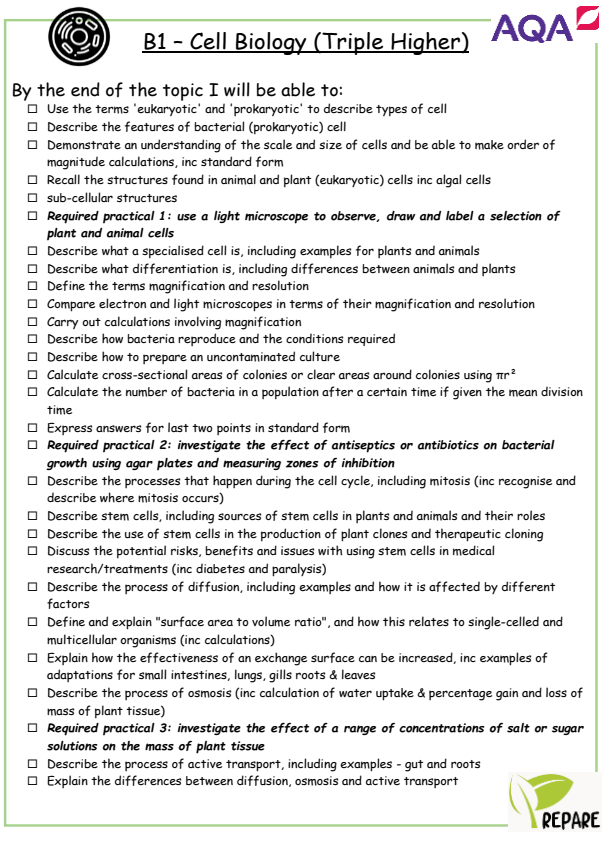


B1 – Cell Biology (Combined Higher) AQA

By the end of the topic I will be able to:

- ☐ Use the terms 'eukaryotic' and 'prokaryotic' to describe types of cell
- ☐ Describe the features of bacterial (prokaryotic) cell
- ☐ Demonstrate an understanding of the scale and size of cells and be able to make order of magnitude calculations, inc standard form
- ☐ Recall the structures found in animal and plant (eukaryotic) cells inc algal cells sub-cellular structures
- ☐ ***Required practical 1: use a light microscope to observe, draw and label a selection of plant and animal cells***
- ☐ Describe what a specialised cell is, including examples for plants and animals
- ☐ Describe what differentiation is, including differences between animals and plants
- ☐ Define the terms magnification and resolution
- ☐ Compare electron and light microscopes in terms of their magnification and resolution
- ☐ Carry out calculations involving magnification
- ☐ Describe the processes that happen during the cell cycle, including mitosis (inc recognise and describe where mitosis occurs)
- ☐ Describe stem cells, including sources of stem cells in plants and animals and their roles
- ☐ Describe the use of stem cells in the production of plant clones and therapeutic cloning
- ☐ Discuss the potential risks, benefits and issues with using stem cells in medical research/treatments (inc diabetes and paralysis)
- ☐ Describe the process of diffusion, including examples and how it is affected by different factors
- ☐ Define and explain "surface area to volume ratio", and how this relates to single-celled and multicellular organisms (inc calculations)
- ☐ Explain how the effectiveness of an exchange surface can be increased, inc examples of adaptations for small intestines, lungs, gills roots & leaves
- ☐ Describe the process of osmosis (inc calculation of water uptake & percentage gain and loss of mass of plant tissue)
- ☐ ***Required practical 3: investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue***
- ☐ Describe the process of active transport, including examples - gut and roots
- ☐ Explain the differences between diffusion, osmosis and active transport

REPARE



B1 – Cell Biology (Triple Higher) AQA

By the end of the topic I will be able to:

- ☐ Use the terms 'eukaryotic' and 'prokaryotic' to describe types of cell
- ☐ Describe the features of bacterial (prokaryotic) cell
- ☐ Demonstrate an understanding of the scale and size of cells and be able to make order of magnitude calculations, inc standard form
- ☐ Recall the structures found in animal and plant (eukaryotic) cells inc algal cells
- ☐ sub-cellular structures
- ☐ ***Required practical 1: use a light microscope to observe, draw and label a selection of plant and animal cells***
- ☐ Describe what a specialised cell is, including examples for plants and animals
- ☐ Describe what differentiation is, including differences between animals and plants
- ☐ Define the terms magnification and resolution
- ☐ Compare electron and light microscopes in terms of their magnification and resolution
- ☐ Carry out calculations involving magnification
- ☐ Describe how bacteria reproduce and the conditions required
- ☐ Describe how to prepare an uncontaminated culture
- ☐ Calculate cross-sectional areas of colonies or clear areas around colonies using πr^2
- ☐ Calculate the number of bacteria in a population after a certain time if given the mean division time
- ☐ Express answers for last two points in standard form
- ☐ ***Required practical 2: investigate the effect of antiseptics or antibiotics on bacterial growth using agar plates and measuring zones of inhibition***
- ☐ Describe the processes that happen during the cell cycle, including mitosis (inc recognise and describe where mitosis occurs)
- ☐ Describe stem cells, including sources of stem cells in plants and animals and their roles
- ☐ Describe the use of stem cells in the production of plant clones and therapeutic cloning
- ☐ Discuss the potential risks, benefits and issues with using stem cells in medical research/treatments (inc diabetes and paralysis)
- ☐ Describe the process of diffusion, including examples and how it is affected by different factors
- ☐ Define and explain "surface area to volume ratio", and how this relates to single-celled and multicellular organisms (inc calculations)
- ☐ Explain how the effectiveness of an exchange surface can be increased, inc examples of adaptations for small intestines, lungs, gills roots & leaves
- ☐ Describe the process of osmosis (inc calculation of water uptake & percentage gain and loss of mass of plant tissue)
- ☐ ***Required practical 3: investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue***
- ☐ Describe the process of active transport, including examples - gut and roots
- ☐ Explain the differences between diffusion, osmosis and active transport

REPARE

Exercise books

There are 4 different exercise books used in science:

1. Year 7, 8, 9 - Orange book (periodic table on the back cover)
2. KS4 Biology – Green book (common cells on back cover)
3. KS4 Chemistry – Pale pink book (periodic table on the back cover)
4. KS4 Physics – Blue book (physics equations on back cover)

On the inside cover of all books, there will be an assessment page to stick in. It must be completed by the student as each assessment is completed. An example is shown below:

ERFORM

Year 7 Assessments

What grade are you working at?

What do we have evidence for?

Topic	Assessment	Grade	Effort Rating
Identity 	1. DNA Discovery		☆☆☆☆☆
	2. Variation in a family		☆☆☆☆☆
	3. Adaptations of a bear		☆☆☆☆☆
	4. Evolution and extinction		☆☆☆☆☆
Reactions 1 	1.Acids and Alkalis		☆☆☆☆☆
	2.Neutralisation		☆☆☆☆☆
	3.Solubility		☆☆☆☆☆
	4.Separating mixtures		☆☆☆☆☆

For each assessment students enter their grade into the table.
They must score their effort for that particular task (score out of 5)

KS4 Big picture

BIG PICTURE

There are six papers: two biology, two chemistry and two physics. Each of the papers will assess knowledge and understanding from distinct topic areas.

Physics Paper 1

Area of specification	Subtopics	Required Practical
Energy	Energy changes in a system, and the ways energy is stored before and after such changes Conservation and dissipation of energy National and global energy resources	Specific heat capacity
Electricity	Current, potential difference and resistance Series and parallel circuits Domestic uses and safety Energy transfers	Resistance I-V characteristics
Particle model of matter	Changes of state and the particle model Internal energy and energy transfers Particle model and pressure	Density
Atomic structure	Atoms and isotopes Atoms and nuclear radiation Hazards and uses of radioactive emissions and of background radiation	None

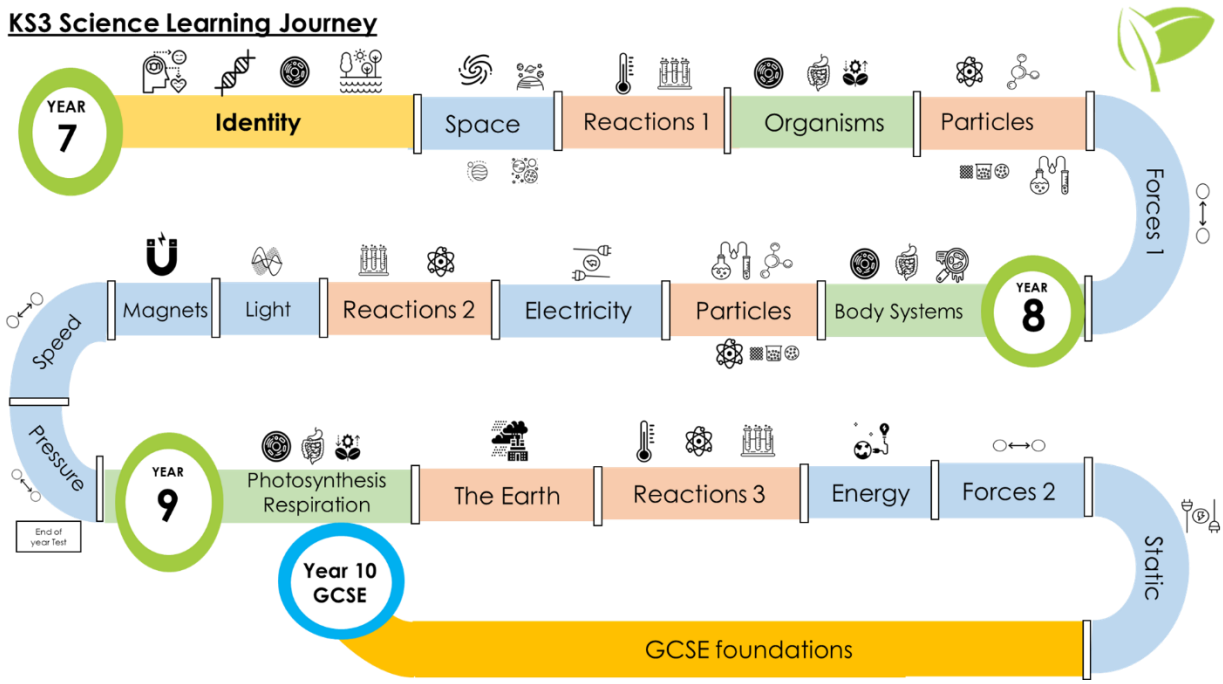
Physics Paper 2

Area of specification	Subtopics	Required Practical
Forces	Forces and their interactions Work done and energy transfer Forces and elasticity Pressure Forces and motion Momentum	Acceleration Force and extension In a spring
Waves	Waves in air, fluids and solids Electromagnetic waves	Waves – in liquid and solid
Magnetism and electromagnetism	Permanent and induced magnetism, magnetic forces and fields The motor effect	None

How it is assessed:
- Written exam: 1hr 15minutes
- Foundation and Higher tiers
- 70 marks
- 16.7% of GCSE

A mixture of multiple choice, structure, closed short answer and open response.

KS3 Big picture

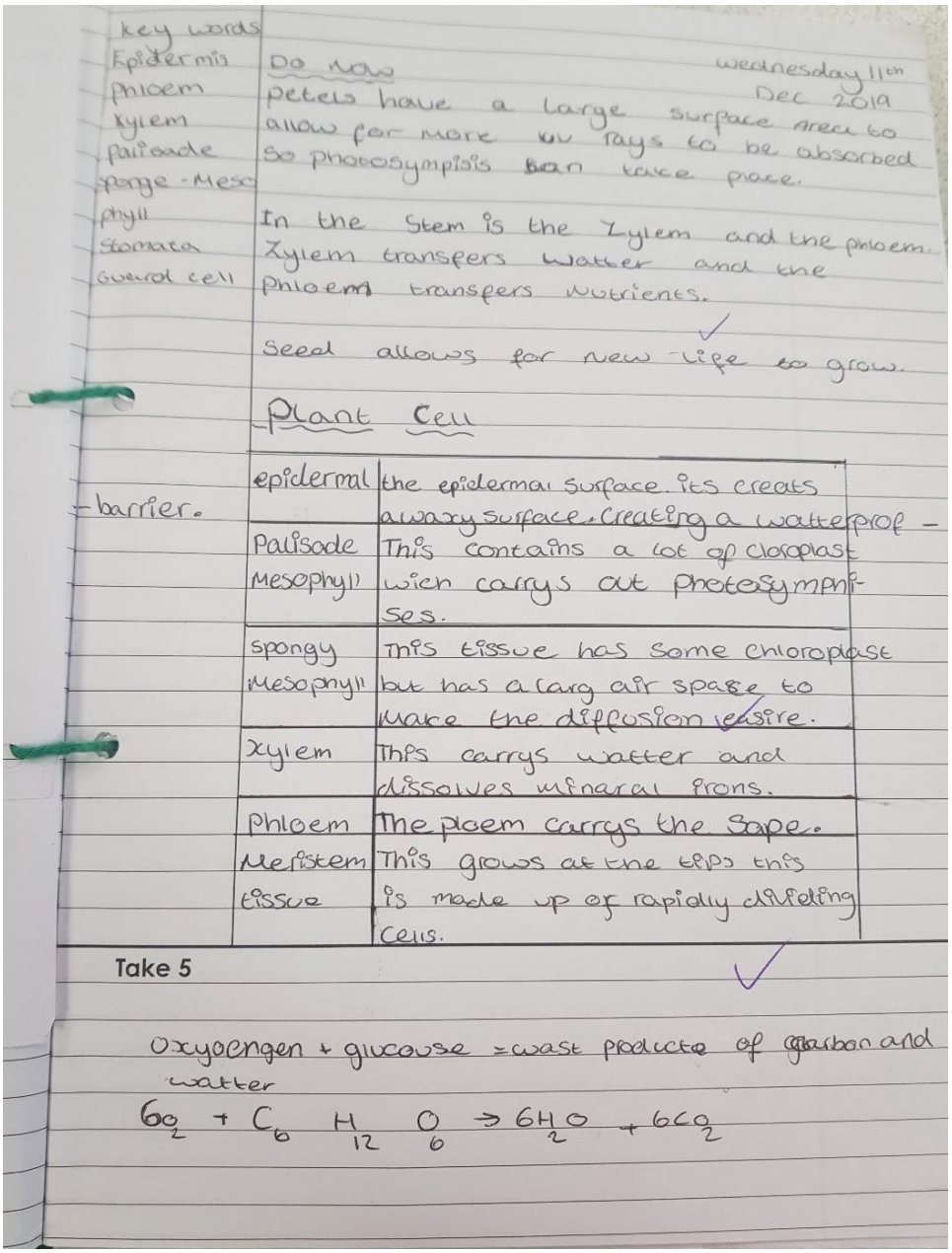


These should be discussed with students in the first lesson and referred back to as often as possible. For KS4, once topics or required practicals are completed, they should be ticked off.

Exercise book expectations:

1. Exercise books are printed larger than A4 so all worksheets are neatly stuck in.
2. Assessments will be stuck into books (not folded and stuck on one page) with the relevant model answer and feedback. (Assessments are printed on purple paper)
3. Pencil and ruler are used to draw any diagrams and tables.
4. Title and date should be in books but objectives do not need to be written but must be discussed with class at the beginning of the lesson and referred back to at the end of the lesson.
5. Keywords for the lesson should be written in the margin clearly.

See WAGOLL below:



Key words
Epidermis
Phloem
Xylem
Palisade
Spoge - Meso
phyll
Stomata
Guard cell

Do Now — Wednesday 11th Dec 2019

Petels have a large surface area to allow for more UV rays to be absorbed so photosympisis can take place.

In the Stem is the Xylem and the phloem. Xylem transfers water and the Phloem transfers Nutrients.

Seed allows for new life to grow.

Plant Cell

epidermal	the epidermal surface. its creats a waxy surface, creating a watterprof barrier.
Palisade Mesophyll	This contains a lot of cloroplast wich carrys out photosymphises.
spongy Mesophyll	This tissue has some chloroplast but has a larg air spase to make the diffusion easire.
Xylem	This carrys watter and dissolves mineral irons.
Phloem	The ploem carrys the Sape.
Mefistem tissue	This grows at the tips this is made up of rapidly dividing cells.

Take 5

Oxyoengen + glucouse = wast products of garbon and watter

$6O_2 + C_6H_{12}O_6 \rightarrow 6H_2O + 6CO_2$

KS3 Assessments

Assessments are used with all classes and should be completed at identified points. They are used to check the progress of the class and ensure that key concepts are fully understood by all.

KS3 assessments are written so all students are able to access the key knowledge that needs to be assessed. They begin with a simple WT (working towards) task which is multiple choice or link key terms and continue with questions aimed at assessing ARE (Age related expectations) with an element of AGD (At greater depth).

Below is an example of a KS3 assessment:

Year 7 – Identity Assessment 3

1 – **WT**

What statement best describes an adaptation?

a) A feature or behaviour that helps an organism reproduce
b) A feature or behaviour that helps an organism survive
c) How an organism evolves

2 – **ARE/AGD**

The grizzly bear is an organism found living in forest areas. Using the photo, describe and explain the adaptations the bear has and justify the reasons for these adaptations. Include any seasonal change that may occur.

_____

_____

During the lesson

Students would be given the assessment at the end of a sequence of learning to check understanding. It is completing at the end of the lesson and given in to the teacher to mark.

It must be marked prior to the next lesson ready for feedback and any improvements or extension activities to be given.

In between the lesson

When marking each piece of work, the feedback sheet for each student should be highlighted. This includes highlighting included statements in green and missing information in pink.

On the student's assessment, spellings and any key information that is incorrect should be highlighted in pink and any great sentences should be highlighted green.

Extension questions should be identified, common spelling mistakes and any other questions that could be used to further understanding of the key concept.

The spreadsheet also needs to be completed. The grade given should be entered. Teachers should use whole class feedback to help further identify common areas of misunderstanding to inform teaching.

Back in lesson

Assessment 3 – FEEDBACK - Adaptation

AO1 - WT	AO2 - ARE	AO3 - AGD
1 - Correct statement identified: Adaptation is… A feature or behaviour that helps an organism survive.	2 - Thick fur to keep warm in cold conditions Claws for catching prey Sharp teeth for eating prey Colour of fur for camouflage Layers of fat to insulate in cold conditions Any suitable examples *At least three adaptations described*	2 - Grizzly bears ***hibernate*** during the winter season Increase fat stores prior to ***hibernating*** Lose fur and fat tissue during the summer season

Keyword spelling

Students are issued with their individual feedback sheet. It should be clear where areas of strength are and areas for development, according to the coloured highlighting.

Students are the expected to green pen in missing information, correct incorrect information or to re-write their response if appropriate.

Extension questions should also be completed in green pen, these should be written on the board for students to answer in the given space. The questions should be class specific and linked to the given topic/task.

WAGOLL's may be used where necessary and strong students work shared using the visualiser.

Grades need to be recorded in the front of exercise books and effort levels given.

A follow up question/task may be used to show the concept is fully understood.

KS4 Assessments

Alongside exam questions for GCSE classes, a range of exit tickets must be completed throughout each topic. These exit tickets are designed to focus on precise knowledge identified as a department that are key to exam success. These are not exam questions but bespoke questions created by the department. They should be quick to mark as the expectation is to mark them ready for the following lesson.

There is at least one exit ticket per topic but teachers are able to create more for their group if required.

Example of exit ticket below:

Exit Ticket 1 – Chemistry 1

1. All substances are made up of ……
2. Select which is an example of an element and a compound, and justify why?

   H_2O O_2

Element:

……

……

Compound:

……

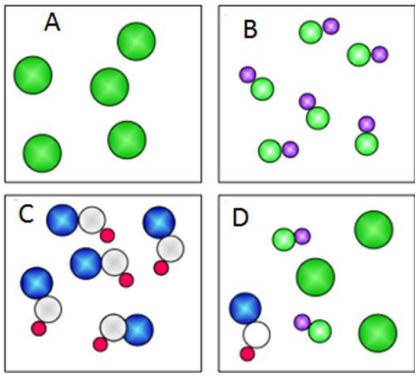
……

3. Identify the element, compounds and mixture in the diagrams below.

   Element =

   Compound =

   Mixture =



4. Complete the word equation:

   Magnesium + Fluorine ⟶ ……

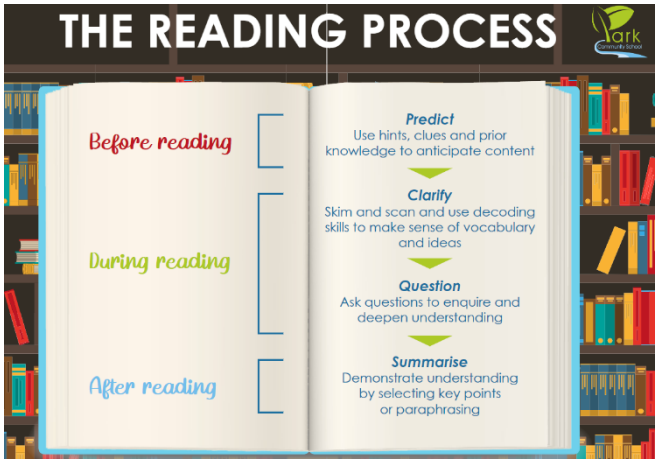
5. Calcium sulfate, $CaSO_4$.

   Number of elements = ……

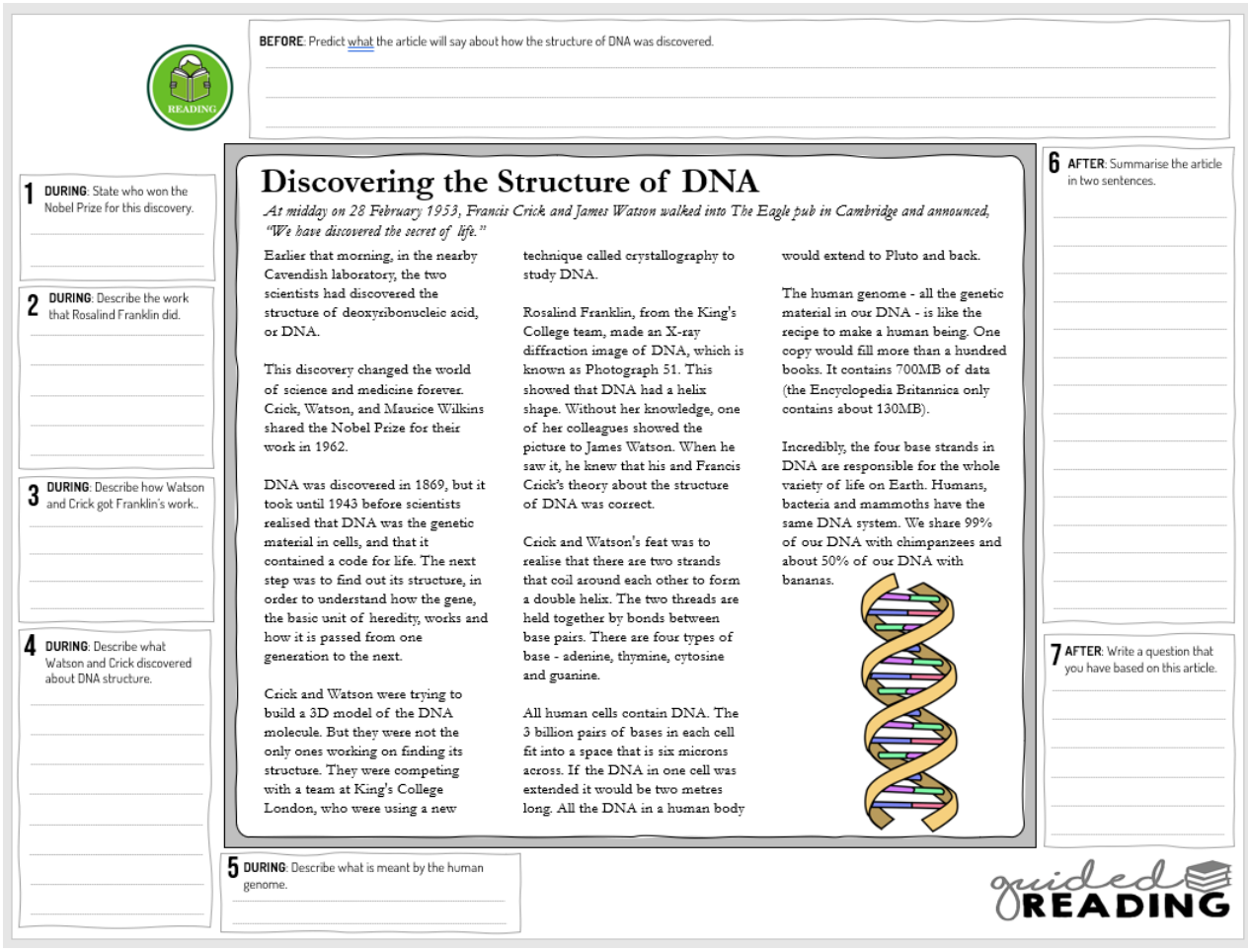
   Number of atoms = ……

KS3 – Guided Reading

Each KS3 topic will have a specific guided reading task to complete. These will be printed on A3 buff paper and will be glued neatly into books on a double page.



These guided reading tasks follow the schools own reading process. Students are expected to predict what the article is about – this is the BEFORE question at the topic of the article. There are then a range of questions that are answered during the reading (the reading could be done as a whole class read or teacher read depending on the class). Once the article has been read and the DURING questions have been answered, students then complete the AFTER activities. These will be either a summary of the article or demonstration of knowledge gained from the text.



READING

BEFORE: Predict what the article will say about how the structure of DNA was discovered.

1 DURING: State who won the Nobel Prize for this discovery.

2 DURING: Describe the work that Rosalind Franklin did.

3 DURING: Describe how Watson and Crick got Franklin's work..

4 DURING: Describe what Watson and Crick discovered about DNA structure.

Discovering the Structure of DNA

At midday on 28 February 1953, Francis Crick and James Watson walked into The Eagle pub in Cambridge and announced, "We have discovered the secret of life."

Earlier that morning, in the nearby Cavendish laboratory, the two scientists had discovered the structure of deoxyribonucleic acid, or DNA.

This discovery changed the world of science and medicine forever. Crick, Watson, and Maurice Wilkins shared the Nobel Prize for their work in 1962.

DNA was discovered in 1869, but it took until 1943 before scientists realised that DNA was the genetic material in cells, and that it contained a code for life. The next step was to find out its structure, in order to understand how the gene, the basic unit of heredity, works and how it is passed from one generation to the next.

Crick and Watson were trying to build a 3D model of the DNA molecule. But they were not the only ones working on finding its structure. They were competing with a team at King's College London, who were using a new technique called crystallography to study DNA.

Rosalind Franklin, from the King's College team, made an X-ray diffraction image of DNA, which is known as Photograph 51. This showed that DNA had a helix shape. Without her knowledge, one of her colleagues showed the picture to James Watson. When he saw it, he knew that his and Francis Crick's theory about the structure of DNA was correct.

Crick and Watson's feat was to realise that there are two strands that coil around each other to form a double helix. The two threads are held together by bonds between base pairs. There are four types of base - adenine, thymine, cytosine and guanine.

All human cells contain DNA. The 3 billion pairs of bases in each cell fit into a space that is six microns across. If the DNA in one cell was extended it would be two metres long. All the DNA in a human body would extend to Pluto and back.

The human genome - all the genetic material in our DNA - is like the recipe to make a human being. One copy would fill more than a hundred books. It contains 700MB of data (the Encyclopedia Britannica only contains about 130MB).

Incredibly, the four base strands in DNA are responsible for the whole variety of life on Earth. Humans, bacteria and mammoths have the same DNA system. We share 99% of our DNA with chimpanzees and about 50% of our DNA with bananas.

5 DURING: Describe what is meant by the human genome.

6 AFTER: Summarise the article in two sentences.

7 AFTER: Write a question that you have based on this article.

guided READING

KS3 – Vocabulary

Along side the reading tasks for KS3, increasing the vocabulary of our students is a clear focus.

Tier 1 Vocabulary	High frequency words in casual conversation.
Tier 2 Vocabulary	Words found more frequently in written forms of communication or in conversation between those more academic.
Tier 3 Vocabulary	Words that appear in specialist domains or fields of study.

Each KS3 scheme will have 3-5 words (predominantly tier 2) that will be the vocabulary focus for the topic. These words have been identified as key terms that are important for students to fully understand and use in both written and verbal answers.

Tier 2-3 vocabulary for KS3 listed below:

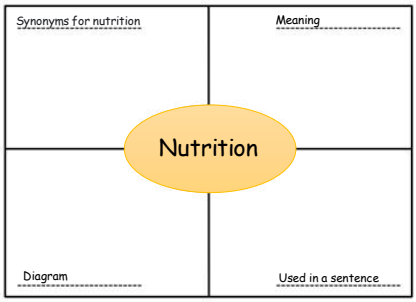
Adaptation	Efficiency	Particles
Adaptations	Electromagnet	Permanent
Arrangement	Electron	Porous
Atmosphere	Emitter	Potential Difference
Atom	Equilibrium	Pressure
Attract	Ethanol	Product
Attraction	Evaporation	Properties
Biodiversity	Evolution	Property
Charge	Exchange	Proton
Collapse	Exert	Radiation
Collide	Exploration	Reactant
Combustion	Extension	Reaction
Compaction	Fermentation	Reactivity
Component	Force	Reduction
Composites	Gas	Repel
Compound	Glucose	Repulsion
Compression	Induced	Resistance
Condensation	Inheritance	Resources
Conduction	Interaction	Resultant
Convection	Iodine	Series
Current	Limit	Soluble
Decomposition	Lunar	Specialised
Deficit	Magnification	Speed
Density	Multicellular	Starch
Deposit	Neutralisation	Static
Depth	Neutron	System
Digestion	Non-contact	Variation
Discharge	Nutrition	Vector
Displacement	Ohms	Voltage
Dissolving	Orbit Solar	Weight
Ecosystem	Parallel	Weightless

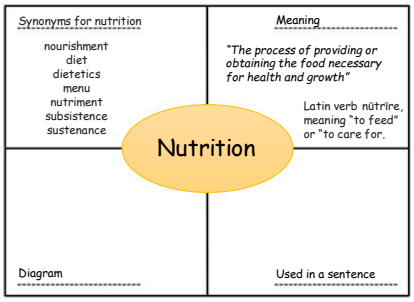
Frayer Model

The Frayer model will be used to facilitate some of this vocabulary. Below is an example of what this will look like.

Frayer model stickers will be used (same ones used in English). The PowerPoint will have the template and an example that can be used as a model for teachers and students.

Meaning of the word must be include and linked to the root of the word (as per the root word display in each science lab)





Student Talk

- **Say it** … *put your insecurities aside and say it aloud to the group.*

How – You say the word clearly and request the students to repeat it as a class. Individuals to repeat it. Encourage them to be loud and confident with the word. *"RESPECT".*

Why - Feeling how the word feels to say and how it sounds will improve memory and allow for quick teacher assessment.

- **Write it** … *compose the word.*

How – Write the word on the board, modelling the forming of the letters. Request the students write the word in their book. *Respect*

Why – Writing forces your brain to process information in a more detailed sensory way, which helps you successfully load that information into your memory.

- **Define it** … *apply a statement about the word.*

How – Show and read a student friendly definition of the word. Request students independently (in silence) record their own. Students to turn to face a partner and Time Pair Share their definition. Select a couple to share ideas. *"Respect to means to me …"*

Why – Words can mean different things at different times. Knowing a words root will help you to understand the meaning of other words with similar roots. The students forming their own definition will be an assessment of that understanding.

- **Use it in a full sentence with accuracy** … *develop the word in a context.*

How – Show students a model of the word in a sentence. Request students independently (in silence) record their own. Students to turn to face a partner and Time Pair Share their definition. Select a couple to share ideas.
"I show respect by listening to others' ideas"

Why – Students words in context measures their understanding of the meaning and use of the word. This will allow the teacher to assess and revisit stages if required.

Assessments – Testing

KS3

Year 7, 8 and 9 are tested three times per year and these tests consist of a range of multiple-choice questions targeted on key concepts that should be secured. The other questions are a range of application questions.

Testing weeks:

KA1 – 4th December

KA2 – 11th March

KA3 – 24th June (Full exam paper completed in the sports hall)

KS4 – Year 10

Year 10 will complete past exam papers twice throughout the year. They will test knowledge from the current year and previous years learning. There may be additional testing throughout the year if required.

Testing weeks:

KA1 – 13th November (Biology and Chemistry paper 1)

KA2 – 25th March (Biology, Chemistry and Physics paper 1)

KA3 – 10th June (Biology, Chemistry and Physics paper 1)

KS4 – Year 11

Year 11 have two mock fortnights scheduled and they will complete as many past papers as possible during these weeks.

Mock fortnights:

KA1 – 30th October (ALL papers completed)

KA2 – 22nd January (ALL papers completed)

Assessments – Judging progress

KS3

To ensure consistency across the department this will be judged using the assessment tracker and further checked through moderation of books and assessments in department meetings.
The tracker will show overall grades for each assessment, allowing an average to be calculated at each key assessment point.
The tracker would be used to give clear areas for development when at parents evening and feeding back to the individual. It will allow teachers to identify underachievers and those that need extra support. It will be reviewed regularly and discussed at department meetings.

Included in these trackers, homework and any other tests scores are recorded and a holistic approach is used when entering any Key Assessment data.

KS3/KS4 Grades

To support with assigning grades to KS3 students, the following guidance must be followed:

KS3 Grade	KS4 AO	Activity
Working Towards	AO1	Recalling Listing Stating Identifying Defining Naming
Age Related Expectation	AO2	Describing Comparing Constructing Predicting Calculate independently
At Greater Depth	AO3	Explaining in detail Justifying Evaluating Concluding Rank with reasons Linking key concepts

KS4

To assess and judge progress in GCSE, students will complete a number of exam questions to practise exam skills and knowledge. These exam questions are chosen by the class teacher and should be included/planned into lessons at least three times per week.

Alongside this, KS4 have a series of mock weeks to allow students to perform their knowledge and skills and to allow teachers to judge progress.

Threshold testing

Year 11 will complete a range of threshold tests – these tests are primarily focused on key scientific skills. Students will complete three sets of threshold papers:

1. Graphs
2. Methods / Planning
3. Data Interpretation

These papers require very little scientific knowledge but focus on skills. Two threshold tests are completed per topic above. This is so impact and improvement can be evidenced. IT also allows for targeted intervention to occur with students if needed.

After the completion of these test, time should be taken to go over these specific questions in detail during lessons.

Walking Talking Mocks – WTM

A walking talking mock (WTM) is used to reinforce key knowledge/skills in an exam setting. This allows the teacher to clearly show the thinking process needed when approaching and tackling an exam question.

Teacher uses the visualiser to model this process. They read the question clearly and then will:

- Underline keywords in the question – define these words using questioning.
- Box the command word in the question and glance at the marks for the question.
- Answer the question using bullet points

During the WTM, teachers will use the mark scheme to ensure that the answers are precise and would achieve maximum marks.

Exam feedback/Review

After a series of mock exams, students will receive feedback on areas of strength and weakness. See example below.

Combined Science Mock Review Higher – February 2023

Name: Wright, Jorja **Class: 11S1/Sc1 [LCO]** **Target: 7-7**

Biology Paper 1	
Q1. Bacteria and disease	9/9
Q2. Cell division	11/14
Q3. Enzymes and digestion	11/15
Q4. Photosynthesis	1/9
Q5. Tumors	7/14
Q6. The heart	6/9

Biology Paper 2	
Q1. Water and carbon cycle	10/16
Q2. Water pollution	3/6
Q3. Quadrats	5/9
Q4. Fertilisers (graph)	9/12
Q5. Blood glucose	7/18
Q6. Classification and populations	7/11

Chemistry Paper 1	
Q1. Salts	7/9
Q2. Electrolysis	4/8
Q3. Reactivity – Plan	4/6
Q4. Group 7 elements	7/10
Q5. Structure and bonding	2/9
Q6. Acids and bond energies	7/11
Q7. Metals and conduction	3/17

Chemistry Paper 2	
Q1. Chromatography	9/10
Q2. Potable water	3/10
Q3. Rate of reaction – sodium thio	9/12
Q4. Hydrocarbons	4/12
Q5. Earth's atmosphere and resources	3/16
Q6. Catalysts and equilibrium	2/10

Physics Paper 1	
Q1. Power and national grid	6/8
Q2. Specific heat capacity	13/15
Q3. Energy stores and springs	1/10
Q4. Pressure	4/12
Q5. Circuits - current	12/14
Q6. Radiation	6/11

Physics Paper 2	
Q1. Waves	9/11
Q2. Speed and acceleration	8/12
Q3. Velocity and momentum	5/8
Q4. Motor effect – Fleming's Left hand rule	2/7
Q5. Infrared	6/11
Q6. Thinking distance	4/9
Q7. Acceleration	9/12

Students will use this very specific feedback to create an 'areas of focus' list. This will allow students to be precise on the areas they need to revise and focus on during independent study.

Students also receive an overview of the exams completed. This contains number of marks per paper and then the overall grade. This is linked to the number of marks needed for their target grade or the next grade.

Mock 2 - Combined Science Mock Review January 2023

Wright, Jorja	Target: 7-7	Marks needed to achieve target grade: Mock 1: 201 Mock 2: 202

Biology	Chemistry	Physics
Paper 1: 45/70	Paper 1: 34/70	Paper 1: 42/70
Paper 2: 41/70	Paper 2: 30/70	Paper 2: 43/70
	Grade: 87	Total: 235/420

Once exams have been completed, during the review and feedback process students will 'green pen' specifically chosen questions. Using the results from the whole class, the weakest questions should be reviewed. This process should NOT be for the whole paper.

During 'green penning' students should correct those questions incorrectly answered or not attempted. This process should be modelling under the visualiser by the teacher using the mark scheme.

Homework

KS3

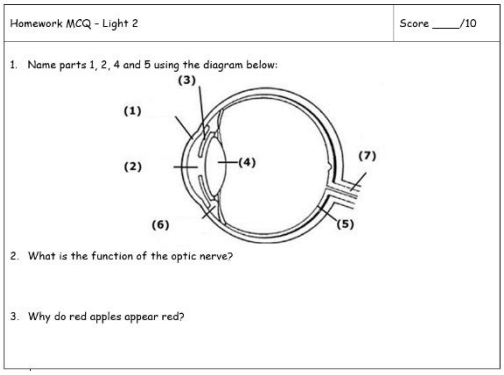
Homework for Year 7,8 and 9 is given on a fortnightly basis on a Week A on a Monday morning.

It will consist of a 10 mark Google forms quiz set on Google Classroom.

Reminders sent to parents/students to promote completion.

Google Form quizzes are graded as follows:
WT – 1-3 points
ARE – 4-6 points
AGD – 7-10 points

During Week B, teachers must go over any misconceptions from that week's homework. The questions which have not been answered correctly should be chosen and given again to the class to complete as a do now activity. Example shown:


Homework MCQ – Light 2 Score ____/10

1. Name parts 1, 2, 4 and 5 using the diagram below:

(3) (1) (2) (4) (7) (6) (5)

2. What is the function of the optic nerve?

3. Why do red apples appear red?

Students who completed homework regularly should be sent reward postcards and rewarded at the end of each term.

KS4

Homework for Year 10 and 11 will be set using Seneca on a weekly basis. It will cover content previously covered to promote retrieval practice and revision.

Scores should be recorded in exercise books weekly and merits given to those achieving the highest scores.

To promote independent study, KS4 students are expected to complete suitable revision activities after most lessons. This will follow the Homework/Revision Policy.

Teaching groups

7 P band		7 S band	
7S1/Sc1	ZTH	7S2/Sc1	AYE
7S1/Sc2	AYE	7S2/Sc2	LGR/LFI
7S1/Sc3	LCO	7S2/Sc3	TSH
7S1/Sc4	LFI/TSH	7S2/Sc4	BRE/AYE

8 P band		8 S band	
8S1/Sc1	AYE	8S2/Sc1	LCO
8S1/Sc2	BRE	8S2/Sc2	SBN
8S1/Sc3	JBY	8S2/Sc3	LCV/BRE
8S1/Sc4	LGR	8S2/Sc4	ZTH

9 P band		9 S band	
9S1/Sc1	LGR	9S2/Sc1	SBN
9S1/Sc2	AYE	9S2/Sc2	ZTH
9S1/Sc3	ZTH	9S2/Sc3	LFI
9S1/Sc4	BRE	9S2/Sc4	TSH

10 P band		10 S band	
10S1/Sc1	LCO	10S2/Sc1	LGR
10S1/Sc2	LFI	10S2/Sc2	ZTH
10S1/Sc3	BRE	10S2/Sc3	MTU
10S1/Sc4	MTU	10S2/Sc4	AYE
		10S3/Sc1 (INS)	MTU/LGR

11 P band		11 S band	
11S1/Sc1	MTU	11S2/Sc1	BRE
11S1/Sc2	LFI	11S2/Sc2	MTU
11S1/Sc3	LGR	11S2/Sc3	LFI
11S1/Sc4	ZTH	11S3/Sc1 (INS)	JBY

Triple Science	
10C/Ts1	LCO
11B/Ts1	BRE

Curriculum Route – KS3

Week Commencing	Year 7	Year 8	Year 9
4th Sept	Identity	Body Systems	Photosynthesis and Respiration
11th Sept			
18th Sept			
25th Sept			Reactions 3
2nd Oct			
9th Oct			
16th Oct			
Half Term			
30th Oct	Identity	Electricity	Earth Science
6th Nov			
13th Nov			
20th Nov			Forces 2
27th Nov		Reactions 2	
4th Dec	Space		
11th Dec			
Xmas Holiday			
2nd Jan	Reactions 1	Reactions 2	B1 – Cells and Microscopes
8th Jan			
15th Jan			
22nd Jan			
29th Jan		Science Fair	
5th Feb			
Half Term			
19th Feb	Organisms	Light and Sound	C1 – Atoms and Periodic Table
26th Feb			
4th March			
11th March			
18th March			
25th March			
Easter Holiday			
15th April	Forces	Magnets	P1 – Energy
22nd April			
29th April			
6th May		Speed	
13th May			
20th May			
Half Term			
3rd June	Particles	Pressure	B3 – Infection and Response
10th June			
17th June			
24th June	Overspill Revision End of Year Tests	Overspill Revision End of Year Tests	
1st July			
8th July			
15th July			

Assessment Schedule and Guided reading– KS3

- Guided reading tasks to be confirmed (page updated)

Year 7	Year 8	Year 9
Identity 1. DNA Discovery 2. Variation in a family 3. Adaptations of a bear 4. Evolution and extinction	**Body Systems** 1. Digestive system 2. Breathing and gas exchange	**Photosynthesis and Respiration** 1. Photosynthesis vs Respiration
Guided Reading Discovering of DNA First Galapagos Tortoise	**Guided Reading**	**Guided Reading**
Space -Guided Reading Moon Landing		
Reactions 1 1. Neutralisation 2. Separating mixtures	**Reactions 2** 1.Chemical compounds 2.Group 1 metals	**Earth** 1.Recycling materials
Guided Reading	**Guided Reading**	**Guided Reading**
Organisms 1. Animal and plant cells 2. Fertilisation 3. Feeding relationships	**Electricity** 1.Series and Parallel	**Reactions 3** 1.Metals and acids 2.Displacement reactions
Guided Reading Zacharias Janssen	**Guided Reading**	**Guided Reading**
Forces 1. Forces 2. Floating	**Light & Sound** 1.Reflection 2.Refraction	**Energy** 1. Generating electricity
Guided Reading Shape shifting cuts	**Guided Reading**	**Guided Reading**
Particles 1.States of matter 2.Diffusion	**Magnets** 1.Electromagnets	**Forces 2** 1. Hooke's Law
Guided Reading The future of smart clothing	**Guided Reading**	**Guided Reading**
	Speed 1.Distance-time graphs and speed	
	Guided Reading	
	Pressure 1.Gas pressure	
	Guided Reading	

Curriculum Route – KS4 Combined Higher

Week commencing	Year 10 (LFI-8)	Year 11 (MTU-8)
4th Sept	B1	C6
11th Sept		
18th Sept		C7
25th Sept	B2	
2nd Oct		C8
9th Oct		C9
16th Oct		
Half Term		
30th Oct	B2	C10
6th Nov	C2	
13th Nov		P2
20th Nov		
27th Nov	C3	P3
4th Dec		P4
11th Dec		
Xmas Holiday		
2nd Jan	P1	P5
8th Jan		
15th Jan	P2	P6
22nd Jan		
29th Jan	B4	P7
5th Feb		
Half Term		
19th Feb	B4	B5
26th Feb	C4	
4th March		B6
11th March		
18th March		**Revision**
25th March	C5	
Easter Holiday		
15th April	C5	**Revision**
22nd April	P3	
29th April		
6th May		10th May Bio P1 am
13th May	P4	17th May Chem P1 am
20th May		22nd May Phys P1 pm
Half Term		
3rd June	P4	7th June Bio P2 am
10th June		11th June Chem P2 am 14th June Phys P2 am
17th June	Airbrick	
24th June	Work Experience	
1st July		
8th July	Airbrick	
15th July		

Curriculum Route – KS4 Triple

Week commencing	Year 10 Higher (14)	Year 10 Foundation (8)	Year 11 (8)	Year 11 (BRE-6)
4th Sept	B1	B1	B5	**Chemistry** Organic chem Polymers Chem analysis Materials Haber process
11th Sept				
18th Sept	B2			
25th Sept		B2	B6	
2nd Oct	C2			
9th Oct			B7	
16th Oct				
Half Term				
31st Oct	C3	C2	MOCK FORTNIGHT	**Physics** Thermal Static Radiation Moments Pressure Momentum
7th Nov				
14th Nov			C6	
21st Nov	P1	C3	C7	
28th Nov			C8	
4th Dec		P1	C9	
12th Dec	P2		C10	
Xmas Holiday				
2nd Jan	P2	P1	P1	**Physics** Waves Lenses Black body radiation Magnetism
8th Jan		P2		
15th Jan	B4		P2	
22nd Jan	C4		MOCK FORTNIGHT	
29th Jan		B4		
5th Feb			P3	
Half Term				
19th Feb	C5	C4	P4	**Revision**
26th Feb			P5	
4th March	P3			
11th March			P6	
18th March		C5		
25th March	P4		P7	
Easter Holiday				
15th April	P4	P3	**Revision**	
22nd April				
29th April	C6			
6th May		P4	10th May Bio P1 am	
13th May	C7		17th May Chem P1 am	
20th May			22nd May Phys P1 pm	
Half Term				
3rd June	Airbrick		7th June Bio P2 am	
10th June			11th June Chem P2 am 14th June Phys P2 am	
17th June				
24th June	Work Experience			
1st July				
8th July	Airbrick			
15th July				

Week A

AMon:1	AMon:2	AMon:3	AMon:4	AMon:5	ATue:1	ATue:2	ATue:3	ATue:4	AWed:1	AWed:2	AWed:3	AWed:4	AWed:5	AThu:1	AThu:2	AThu:3	AThu:4	AThu:5	AFri:1	AFri:2	AFri:3	AFri:4	AFri:5
10S2/Sc1	10S2/Sc1	11S1/Sc1	10S3/Sc1	10S1/Sc1	11S2/Sc1	9M2/Sc1	8M1/Sc1	8M2/Sc2	11S1/Sc1	10S1/Sc1	10S1/Sc1	9M2/Sc1	9M1/Sc1	11S2/Sc1	10S2/Sc1	10S2/Sc1	11S3/Sc1	10S1/Sc1	11S1/Sc1	11S1/Sc1	11S2/Sc1	11S2/Sc1	9M1/Sc1
LGR G02	LGR G02	MTU G04	LGR INS2	LCO G01	BRE G01	SBN G01	AYE G03	SBN G04	MTU G04	LCO G01	LCO G01	SBN G01	LGR G02	BRE G01	LGR G02	LGR G02	JBY INS1	LCO G03	MTU G04	MTU G04	BRE G01	BRE G01	LGR G02
10S2/Sc2	10S2/Sc2	11S1/Sc2	9M2/Sc2	10S1/Sc2	11S2/Sc2	9M2/Sc3	8M1/Sc3	8M2/Sc4	11S1/Sc2	10S1/Sc2	10S1/Sc2	9M2/Sc4	9M1/Sc2	11S2/Sc2	10S2/Sc2	10S2/Sc2	8M1/Sc1	10S1/Sc2	11S1/Sc2	11S1/Sc2	11S2/Sc2	11S2/Sc2	9M1/Sc2
ZTH G06	ZTH G06	LFI G05	ZTH G06	LFI G05	MTU G04	LFI G05	JBY G04	ZTH G06	LFI G05	LFI G05	LFI G05	TSH G07	AYE G03	MTU G04	ZTH G06	ZTH G06	AYE G03	LFI G05	LFI G05	LFI G05	MTU G04	MTU G04	AYE G03
10S2/Sc3	10S2/Sc3	11S1/Sc3	9M2/Sc3	10S1/Sc3	11S2/Sc3	8M1/Sc2	8M1/Sc4		11S1/Sc3	10S1/Sc3	10S1/Sc3	8M1/Sc1	9M1/Sc4	11S2/Sc3	10S2/Sc3	10S2/Sc3	8M1/Sc2	10S1/Sc3	11S1/Sc3	11S1/Sc3	11S2/Sc3	11S2/Sc3	9M1/Sc3
MTU G04	MTU G04	LGR G02	LFI G05	BRE G07	LFI G05	BRE G07	LGR G02		LGR G02	BRE G07	BRE G07	AYE G03	BRE G07	LFI G05	MTU G04	MTU G04	BRE G01	BRE G07	LGR G02	LGR G02	LFI G05	LFI G05	ZTH G06
10S2/Sc4	10S2/Sc4	11S1/Sc4	9M2/Sc4	10S1/Sc4	9M1/Sc1	7M2/Sc1	8M2/Sc1		11S1/Sc4	10S1/Sc4	10S1/Sc4	8M1/Sc4	8M2/Sc2		10S2/Sc4	10S2/Sc4	8M1/Sc4	10S1/Sc4	11S1/Sc4	11S1/Sc4	7M1/Sc2	8M2/Sc1	9M1/Sc4
AYE G03	AYE G03	ZTH G06	TSH G07	MTU G04	LGR G02	AYE G03	LCO G07		ZTH G06	MTU G04	MTU G04	LGR G02	SBN G04		AYE G03	AYE G03	LGR G02	MTU G04	ZTH G06	ZTH G06	AYE G03	LCO G07	BRE G07
9M2/Sc1	7M1/Sc3	7M2/Sc1		8M1/Sc3	9M1/Sc2	7M2/Sc2	7M1/Sc1		8M2/Sc1	10S3/Sc1	10S3/Sc1		8M2/Sc4			9M1/Sc4	8M2/Sc2	9M2/Sc1	8M2/Sc2	8M1/Sc1	7M1/Sc3	8M2/Sc4	7M1/Sc4
SBN G01	LCO G07	AYE G03		JBY G02	AYE G03	LGR G02	ZTH G06		LCO G07	LGR INS2	LGR INS2		ZTH G06			BRE G07	SBN G04	SBN G01	SBN G07	AYE G03	LCO G07	ZTH G06	TSH F03
9M2/Sc3	7M1/Sc4	7M2/Sc3		8M2/Sc3	9M1/Sc3	7M2/Sc3	7M1/Sc4		8M2/Sc3	7M1/Sc1	9M2/Sc2						7M1/Sc1	9M2/Sc2	8M2/Sc3	8M1/Sc2		7M2/Sc1	
LFI G05	LFI G05	TSH S04		LCV G03	ZTH G06	TSH F03	LFI G05		LCV G01	ZTH G06	ZTH G06						ZTH G06	ZTH G06	BRE G01	BRE G01		AYE G03	
		7M2/Sc4			9M2/Sc4				7M2/Sc4	7M1/Sc2	7M2/Sc3						7M1/Sc3	8M1/Sc3				7M2/Sc2	
		BRE G07			TSH G07				BRE G03	AYE G03	TSH G02						LCO G07	JBY G02				LGR G02	
											7M2/Sc4						7M1/Sc4						
											AYE G03						TSH F03						

Week B

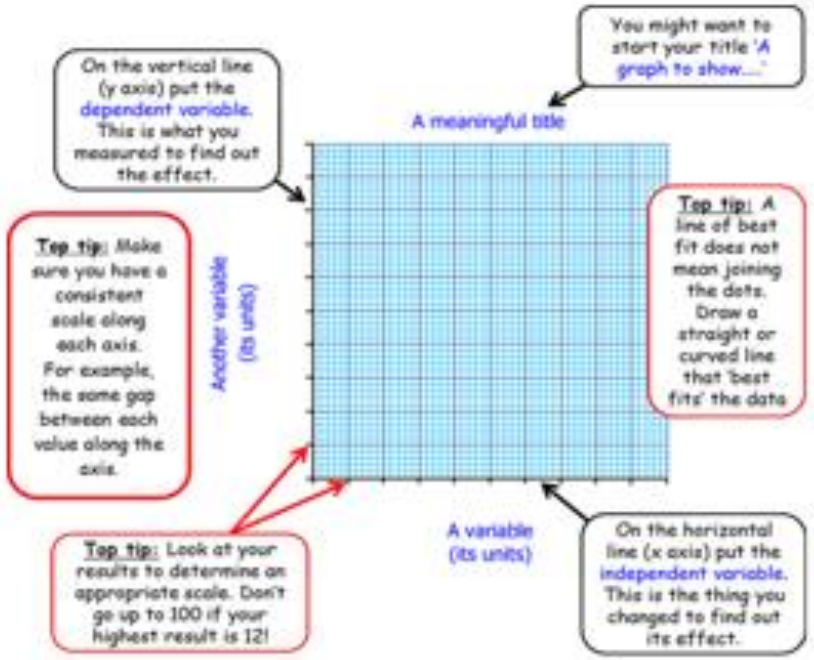
BMon:1	BMon:2	BMon:3	BMon:4	BMon:5	BTue:1	BTue:2	BTue:3	BTue:4	BWed:1	BWed:2	BWed:3	BWed:4	BWed:5	BThu:1	BThu:2	BThu:3	BThu:4	BThu:5	BFri:1	BFri:2	BFri:3	BFri:4	BFri:5
10S2/Sc1 LGR G02	10S2/Sc1 LGR G02	10S3/Sc1 MTU INS2	11S3/Sc1 JBY INS1	10S1/Sc1 LCO G01	11S2/Sc1 BRE G01	9M1/Sc2 AYE G03	11S1/Sc1 MTU G04	11S3/Sc1 JBY INS1	11S1/Sc1 MTU G04	11S3/Sc1 JBY INS1	10S1/Sc1 LCO G01	8M2/Sc1 LCO G07	9M1/Sc1 LGR G02	11S2/Sc1 BRE G01	11S3/Sc1 JBY INS1	10S2/Sc1 LGR G02	8M1/Sc2 BRE G01	10S1/Sc1 LCO G03	11S1/Sc1 MTU G04	11S1/Sc1 MTU G04	11S2/Sc1 BRE G01	11S2/Sc1 BRE G01	9M1/Sc1 LGR G02
10S2/Sc2 ZTH G06	10S2/Sc2 ZTH G06	9M2/Sc3 LFI G05	10S3/Sc1 MTU INS2	10S1/Sc2 LFI G05	11S2/Sc2 MTU G04	9M1/Sc3 ZTH G06	11S1/Sc2 LFI G05	9M2/Sc2 ZTH G06	11S1/Sc2 LFI G05	10S1/Sc1 LCO G01	10S1/Sc2 LFI G05	8M2/Sc4 ZTH G06	9M1/Sc3 ZTH G06	11S2/Sc2 MTU G04	10S2/Sc1 LGR G02	10S2/Sc2 ZTH G06	8M1/Sc3 JBY G04	10S1/Sc2 LFI G05	11S1/Sc2 LFI G05	11S1/Sc2 LFI G05	11S2/Sc2 MTU G04	11S2/Sc2 MTU G04	9M1/Sc3 ZTH G06
10S2/Sc3 MTU G04	10S2/Sc3 MTU G04	9M2/Sc4 TSH S04	9M2/Sc2 ZTH G06	10S1/Sc3 BRE G07	11S2/Sc3 LFI G05	9M1/Sc4 BRE G07	11S1/Sc3 LGR G02	9M2/Sc3 LFI G05	11S1/Sc3 LGR G02	10S1/Sc2 LFI G05	10S1/Sc3 BRE G07	7M2/Sc1 AYE G03	9M1/Sc4 BRE G07	11S2/Sc3 LFI G05	10S2/Sc2 ZTH G06	10S2/Sc3 MTU G04	8M2/Sc1 LCO G07	10S1/Sc3 BRE G07	11S1/Sc3 LGR G02	11S1/Sc3 LGR G02	11S2/Sc3 LFI G05	11S2/Sc3 LFI G05	9M1/Sc4 BRE G04
10S2/Sc4 AYE G03	10S2/Sc4 AYE G03	8M1/Sc3 JBY G04		10S1/Sc4 MTU G04	9M1/Sc1 LGR G02	7M2/Sc3 TSH F03	11S1/Sc4 ZTH G06	8M2/Sc1 LCO G07	11S1/Sc4 ZTH G06	10S1/Sc3 BRE G07	10S1/Sc4 MTU G04	7M2/Sc3 TSH G01	9M2/Sc4 TSH S04		10S2/Sc3 MTU G04	10S2/Sc4 AYE G03	8M2/Sc4 ZTH G06	10S1/Sc4 MTU G04	11S1/Sc4 ZTH G06	11S1/Sc4 ZTH G06	7M1/Sc1 ZTH G06	9M1/Sc2 AYE G03	9M2/Sc1 SBN G01
		8M1/Sc4 LGR G02		9M1/Sc2 AYE G03	9M2/Sc4 TSH F03		8M1/Sc2 BRE G01	8M2/Sc3 LCV G02	8M1/Sc1 AYE G03	10S1/Sc4 MTU G04	7M1/Sc2 AYE G03	7M2/Sc4 BRE G02	8M2/Sc2 SBN G04		10S2/Sc4 AYE G03	7M1/Sc3 LCO G07	7M2/Sc2 LGR G02	9M2/Sc1 SBN G01		8M1/Sc1 AYE G03	7M2/Sc1 AYE G03	8M2/Sc3 LCV G02	7M1/Sc2 AYE G03
		7M1/Sc1 ZTH G06		9M1/Sc3 ZTH G06	8M2/Sc2 SBN C06		7M2/Sc1 AYE G03		8M1/Sc2 BRE G01	8M1/Sc4 LGR G02			8M2/Sc3 LCV F04		9M2/Sc3 LFI G05	7M1/Sc4 TSH F03	7M2/Sc3 TSH F03	9M2/Sc2 ZTH G06				8M2/Sc4 ZTH G06	7M1/Sc3 LCO G07
		7M1/Sc2 AYE G03		7M2/Sc2 LGR G02	7M1/Sc1 ZTH G06								7M2/Sc2 LFI G05				7M2/Sc4 AYE G03	8M1/Sc3 JBY J02					7M1/Sc4 TSH F03
					7M1/Sc2 AYE G03								7M2/Sc4 AYE G03					8M1/Sc4 LGR G02					7M2/Sc2 LFI G05
					7M1/Sc3 LCO G07																		

A scientist can...

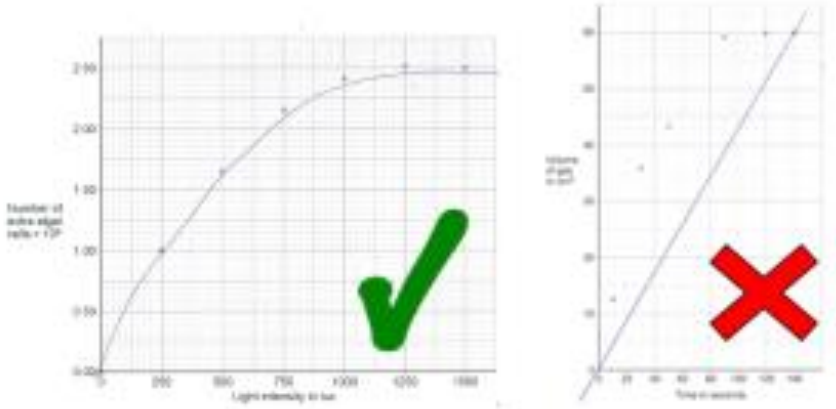
	7	8	9	10+
Working scientifically		To formulate a hypothesis		
	To form basic predictions	To link predictions to variables		To produce a sketch graph to show the prediction of results
	To read and follow a given method	To write a basic method with known equipment	To write method that would provide valid results	
	To identify variables		To include a control group	To apply variables and control groups to required practicals
	To name equipment	To describe the purpose of chosen equipment	To justify use of equipment with appropriate resolution/precision	
	To identify hazards, risks and precautions			To apply hazards to required practicals
	To identify possible sources of error and recognise anomalies	To identify sources of zero error and random error	To identify sources of systematic error	To apply the different types of error to required practicals
	To state a basic conclusion	To link the variables in a conclusion	To justify a conclusion using data and scientific knowledge	
	To recognise limitations in an investigation	To identify limitations and suggest improvements – repeatability/reproducibility		Identify limitations and suggest improvements that would increase validity
Representing data	To record data in a given table	To construct a table (considering variables) to collect valid results		
	To calculate mean average from a set of data	To recognise any anomalies in a set of data and remove from further calculations	To calculate range and uncertainty from a set of data	
	To plot points on a given axes and draw appropriate line of best fit	To draw a graph with appropriate scales, labels and plots	To show uncertainty on a graph	To recognise and construct a tangent at a given data point on a graph
	To identify the type of graph (linked to type of data)			
	To describe the basic trend of a given graph and read off values (increase, decrease, plateau)	To link the trend in the graph to variables (gradient)	To use lines of best fit on a graph to make predictions	To describe complex patterns, with multiple variables using appropriate terminology
		To convert basic units (kilo, minutes, hours, seconds, Newtons, Amps)		To use standard form and powers
	To calculate using given equations	To rearrange equations using the FIFA model		To calculate multi-step equations

Stuck Resources

Graphs



Lines of best fit...



Calculation questions...

F Formula – Write the equation

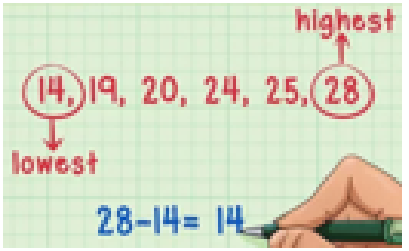
I Insert values – Underline numbers in question & put into equation

F Fine tune – Rearrange the equation if needed

A Answer – Calculate the answer – UNITS!

$$\text{Mean} = \frac{\text{sum of all values}}{\text{total number of values}}$$

Range =



Independent Variable – The one you change & are investigating

Dependent Variable – What you measure (written in results table)

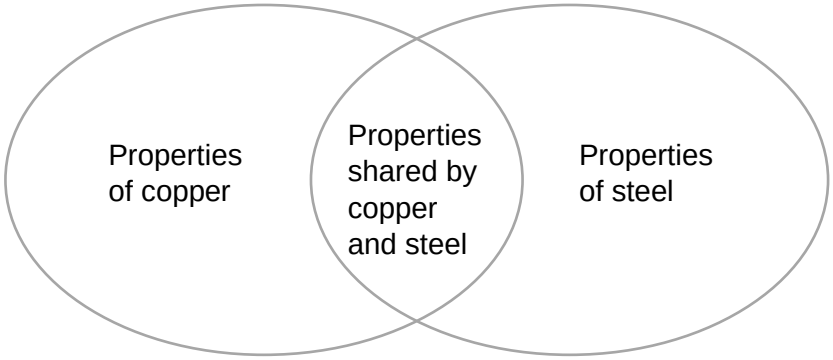
Controlled Variables – Kept the same to ensure test in fair & valid

Appendix C– How we at Park teach Science

Exam command words

Compare

Set out a sheet with a Venn diagram of two overlapping ovals. For example, if the task was to compare copper and steel, the diagram might look like this:



Then give students some sentence templates, for example:

- Copper and steel are different because copper is _____ and steel is _____.
- Copper and steel are both _____.
- When comparing copper and steel it is important to think about: _____.
- When comparing copper and steel it might be useful to measure: _____.

Structures like these will help students focus not only on similarities and differences, but also on key characteristics and features that could be quantified.

This approach can be applied to a variety of contexts – for example, comparing mammals and birds, or ammeters and voltmeters.

Useful vocabulary:

- same, similar, similarity, both have, both are, both appear to …, etc.
- differ, different to, different from, difference between, this one … on the other hand …, however.

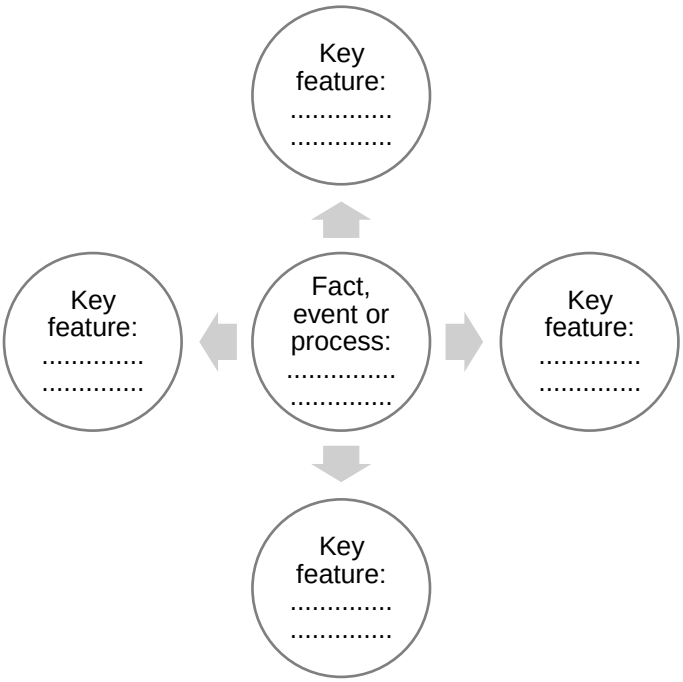
Useful structures:

When comparing two things and producing a written account:

- use the first paragraph to describe similarities and the second to describe differences OR
- use the first paragraph to describe the significant features of one, the second paragraph to identify how the second thing is similar to the first, and the third paragraph to suggest how it is different OR
- devote a paragraph to each feature, then explore whether this is something that is a similarity or a difference.

Describe

Create a kind of spider diagram on a sheet of paper similar to the one below. In the middle there should be space for what is being described – for example, a palisade cell in a leaf, the water cycle or an object undergoing constant acceleration.



Ask students to identify and add important features around it. Finally, ask them to check each one
and ask:

- Is what we have written accurate?
- Is it significant?
- Is there any more detail we can usefully add?

Design/plan/describe a method

This is a good way of getting students, especially reluctant writers, to engage with recording their experiences. Give them table templates to complete to help them structure their response. For example, they may record the purification of rock salt in the following way:

What I did	What I did it to	How I did it
I crushed	*the lumps of rock*	*using a mortar and pestle.*
I added	*water to the crushed rock*	*stirring it in to dissolve the salt.*
I filtered	*the mixture*	*using a filter paper and funnel.*
I evaporated	*the water*	*using a Bunsen burner.*

The important things for students to consider are:

- whether they have included all the necessary steps
- whether they have put them in the right order.
- whether someone following that sequence would get a valid outcome.

Useful vocabulary:

- first, next, then, finally, …
- relevant verbs (see first column above)
- relevant nouns (see second and third columns above).

Useful structures:-

- Template above
- First, …
- Next, …
- Then, …
- Finally, …

Evaluate

There are three key features here. Students need to make a judgement, support it with evidence and make sure the evidence is well linked.

Useful vocabulary:

- therefore, because, as a result, …
- the evidence is, the data show, for example, this is because, …
- also, in addition, furthermore, …
- however, on the other hand, …

Useful structures:

The acronym PEE stands for Point, Evidence, Explain and is a useful structure for *evaluate* questions. For example, using ideas about atmospheric pollution, a PEE response might be structured as follows:

Point	Evidence	Explain
I think that it is better to use electric buses in towns than ones with diesel engines.	Diesel engines release poisonous gases such as nitrogen oxides. Nitrogen oxides can cause respiratory diseases such as asthma.	Switching from diesel buses to electric ones would reduce the emission of dangerous gases and therefore reduce health issues.

Explain

The important aspects here are to be clear about causal links and to provide an appropriate amount of detail. Causal links are a cornerstone of science, so it is crucial that students understand them and explain them clearly in their writing. This can be the basis for some useful discussion and questioning. For example, in the table below all the phrases on the right are true, but only one of them explains why more sugar dissolves.

If a beaker of water is heated it will dissolve more sugar …	because …	heating the water also makes the beaker hotter. heating the water increases evaporation if the water is hotter the molecules are moving around with more energy. the sugar also gets hotter.

Activities such as this encourage students to think through causal links and become used to this kind of reasoning.

Useful vocabulary:

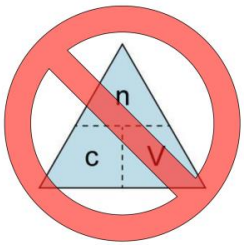
- because, due to, so, since, as, …
- therefore, as a result, thus, …
- makes, produces, causes, …

(All taken from AQA GCSE Science 9-1 Extended Response Questions Teacher Resource Pack)

FIFA for the GCSE Physics calculation

The FIFA method is an AQA mark scheme-friendly* way of approaching GCSE Physics calculation questions.
The FIFA method:

1. Avoids the use of formula triangles
2. Minimises the cognitive load on students when approaching calculations.



Why we shouldn't use formula triangles

Formula triangles are bad news. They are a cognitive dead end.
The use of formula triangle also increases (rather than decreases) the cognitive load on students when carrying out calculations. For example, if the concentration *c* is 0.5 mol dm^{-3} and the number of moles *n* required is 0.01 mol, then in order to calculate the volume *V* they need to:

- recall the relevant equation and what each symbol means and hold it in working memory
- recall the layout of symbols within the formula triangle and either (a) write it down or (b) hold it in working memory
- recall that *n* and *c* are known values and that *V* is the unknown value and hold this information in working memory when applying the formula triangle to the problem

The FIFA acronym stands for:

- FORMULA – Recall the equation or look it up on the equation sheet
- INSERT VALUES – Highlight the numbers in the question and put them into the equation
- FINE TUNE - this often, but not always, equates to rearranging the formula or check units
- ANSWER - Calculate

See below for a range of worked examples.

HIGHER EXAMPLE:

1. Add the rubric at the side of the question
2. Recall the relevant equation as it is not given on the Data and Formula Sheet. Write it down. *This is an important step as once it is written down they no longer have to hold it in their working memory.*
3. Insert the values.
4. Fine tune what we have written down in order to calculate the final answer. In this instance, the "fine tuning" process equates to a simple algebraic rearrangement. However, it is useful to leave room for some "creative ambiguity" here as we can also use the "fine tuning" process to resolve difficulties with units.
5. Input the values on a calculator to give a final answer.

A car which is moving has kinetic energy.

The faster a car goes, the more kinetic energy it has. The kinetic energy of this car was 472 500 J when travelling at 30 m/s.
Calculate the total mass of the car.
Show clearly how you work out your answer and give the unit.

Formula $E_k = 0.5 \times m \times v^2$

Insert values $472\,500 = 0.5 \times m \times 30^2$

Fine Tune $\frac{472\,500}{0.5} = m \times 30^2$

$\frac{472\,500}{0.5 \times 30^2} = m$

Answer Mass of the car = 1050 kg

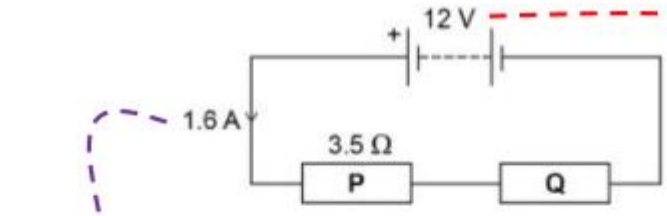
(Total 5 marks)

The key idea here is to be as positive and encouraging as possible. Even if all they can do is recall the formula and remember that mass is measured in kg, there is an incremental gain. A mark or two here is always better than zero marks.

FOUNDATION EXAMPLE 1:

1. Clearly indicate where the data came
2. The fine tune stage is not needed, so we can move straight to the answer.

A student built the circuit shown in the diagram below.



(b) Calculate the total resistance of the circuit in the diagram above.

Use the equation:

Formula

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

Insert values

$$R = \frac{12}{1.6}$$

~~Fine Tune~~

Answer

Total resistance = 7.5 Ω

(2)

FOUNDATION EXAMPLE 2:

(c) The resistance of **P** is 3.5 Ω.

Calculate the resistance of **Q**.

Formula $R_{total} = R_1 + R_2$

Insert values $7.5 = 3.5 + R_2$

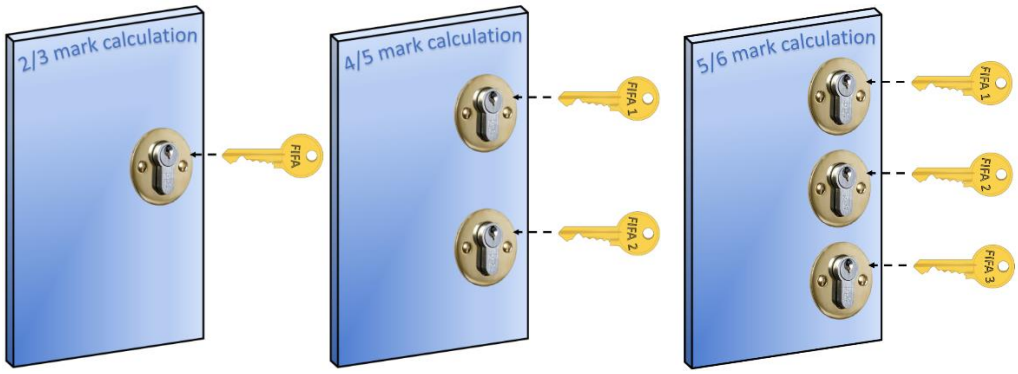
Fine Tune $7.5 - 3.5 = R_2$

Answer

Resistance of **Q** = 4.0 Ω

(1)

Using FIFA method for Higher grade questions:



Some lolly pop moulds are filled with cola and placed in a freezer.

The cola is initially at a temperature of 8 °C and freezes at 0 °C.

The specific heat capacity of the cola is 4190 J / kg °C and its latent heat of fusion is 337 kJ / kg.

A total of 111 kJ of internal energy is transferred from the cola in order to cool it and freeze it.

Find the mass of the cola. Give your answer to 2 significant figures **[6 marks]**

	FIFA 1		FIFA 2
Formula	$\Delta E = mc\Delta\theta$	F	$E = mL$
Insert values	$\Delta E = m \times 4190 \times (8 - 0)$	I	$E = m \times 337$ kJ
Fine-tune	$\Delta E = m \times 4190 \times 8$	F	$E = m \times 337 \times 1000$
	$\Delta E = m \times 32520$		$E = m \times 337000$
Answer	$\Delta E = 33520m$	A	$E = 337000m$

FIFA 3

F $\Delta E + E =$ Total energy transferred

I $33520m + 337000m = 111$ kJ

F $370520m = 111$ kJ

$370520m = 111\,000$

$m = \frac{111000}{370520}$

A $m = 0.30$ kg (2 s.f.)

Graphs

KS4 – Steps for graph drawing and interpretation

Drawing a Graph

1. Type of data - continuous or discontinuous – what type of graph needs to be drawn?

2. Variables – independent (x axis) and dependent (y axis)

3. Scales – what is each square worth? What is the maximum value for each axis?

4. Labelling axis – what does each axis represent and UNITS

5. Plot with small crosses – line of best fit(straight or curved) if appropriate

Interpreting a Graph

1. Type of data - continuous or discontinuous

2. Variables – independent (x axis) and dependent (y axis)

3. Scales (each box in each direction is worth....)

4. Annotate – increase, decrease, or plateau; rate of change (gradient) Relationship - proportional, linear, inversely proportional

5. Interpreting – use 'data' points and chunk patterns to explain general trend

APPLY

'I do' introduced – Teacher models how to use the steps

Animation builds up on PowerPoint or alternatively use visualiser

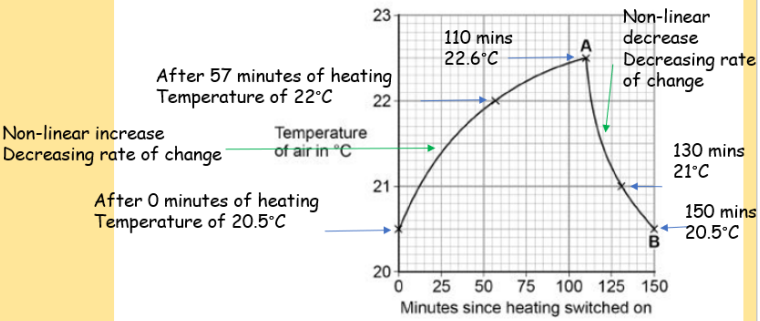
'I do' to success!

5. Interpreting – use the important changes and data points to explain what the graph shows.

When the heating is initially turned on the temperature is 20.5°C. The temperature then increases fast initially and then slows down over the course of 110 minutes until it reaches a maximum of 22.6°C. For the next 40 minutes (110 minutes until 150 minutes) the temperature decreases at a much faster rate than it increased and does so in a non-linear manner until it reduces back to the original temperature of 20.5°C. Overall the temperature increased to a maximum but then decreased at a much faster rate to the same temperature it started at.

Figure 2 shows how the temperature of the house changes over a 150 minute period

Figure 2



'You do' practise opportunities given

Slightly simplified version of KS4.

Drawing a Graph

1. Type of data - continuous or discontinuous – what type of graph needs to be drawn?

2. Variables – independent (x axis) and dependent (y axis)

3. Scales – what is each square worth? What is the maximum value for each axis?

4. Labelling axis – what does each axis represent and UNITS

5. Plot with small crosses and join

Interpreting a Graph

1. Type of data - continuous or discontinuous (categorical)

2. Variables – what is being changed and what is being measured?

3. Scale – how much is each box worth in each direction?

4. Labelling – label important changes and data points (numbers)

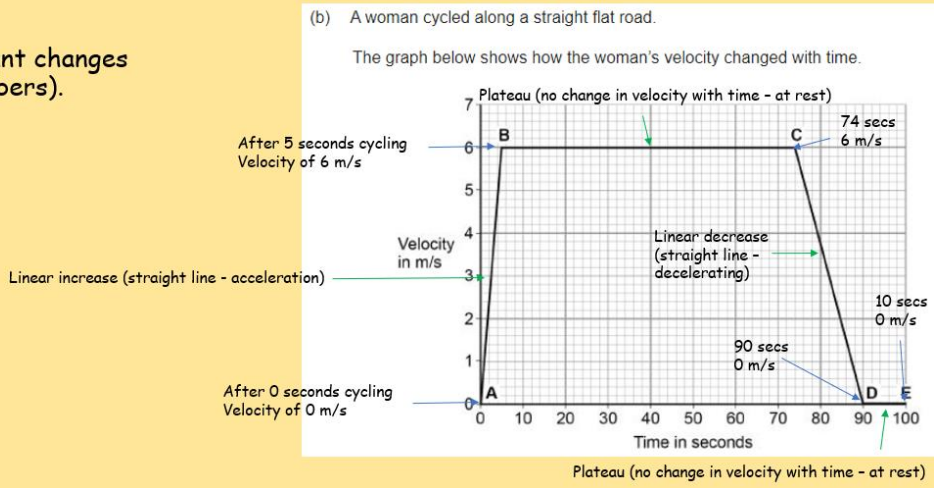
5. Interpreting – use the important changes and data points to explain what the graph shows

'I do' introduced – Teacher models how to use the steps

Animation builds up on PowerPoint or alternatively use visualiser

'I do' to success!

4. Labelling – important changes and data points (numbers).



'You do' practise opportunities given

Tables

KS3 and KS4 – Steps for interpreting data from a table.

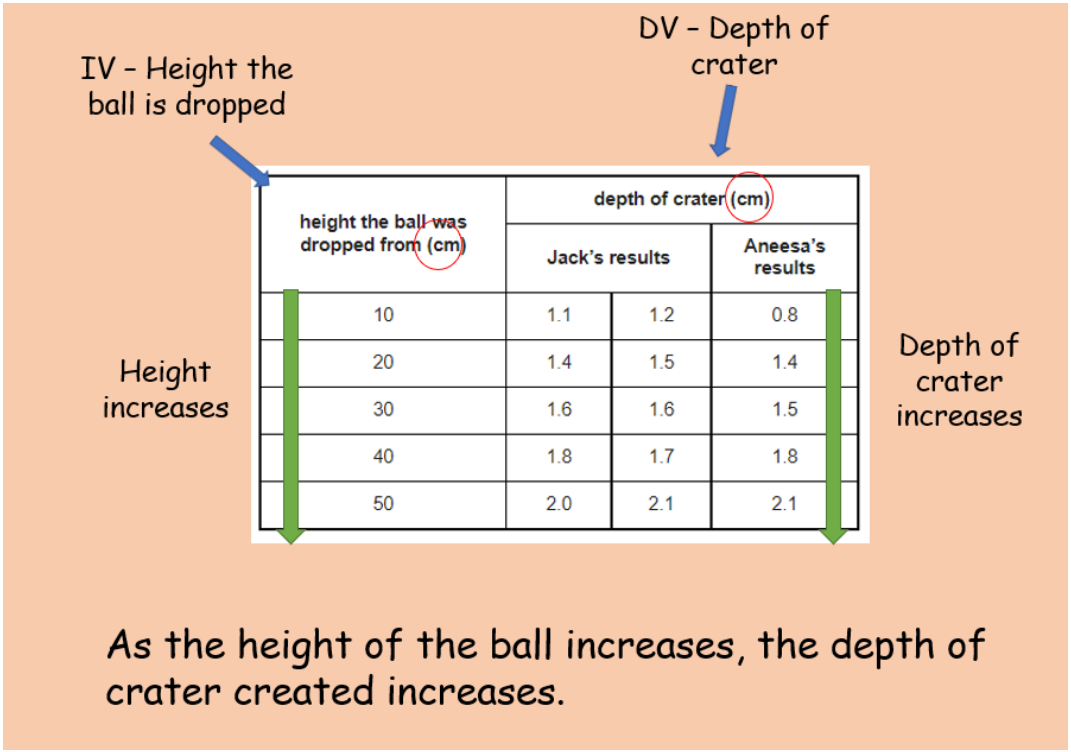
Skill builds from KS3 to KS4 depending on data and number of variables being compared.

How to interpret a TABLE

1. Identify variables
2. Units
3. Patterns and trends
- Identify the highest and lowest values (Positive and negative)
- Is there a pattern?
- Anomalous results (unusual results that do not fit the pattern)
- Differences between values
4. Relationship between variables (what it shows)

'I do' introduced – Teacher models how to use the steps

Animation builds up on PowerPoint or alternatively use visualiser



height the ball was dropped from (cm)	depth of crater (cm)		
	Jack's results		Aneesa's results
10	1.1	1.2	0.8
20	1.4	1.5	1.4
30	1.6	1.6	1.5
40	1.8	1.7	1.8
50	2.0	2.1	2.1

'You do' practise opportunities given

Planning/Writing a Method

KS3 and KS4 – Steps for planning a method, including variables and equipment used.

Planning/Writing a Method

Step 1) Plan your method!!

1. Identify what you are changing (independent variable) and what you are recording (dependent variable)
2. Equipment – Brainstorm what equipment you might need and HOW you will use it.
3. Control Variables – What do you need to keep the same?
4. What specific measurements are you going to make (what is the range of the IV)
5. If stated, consider your risk assessment (what are the hazards, what are the minimising actions?

'I do' introduced – Teacher models how to use/apply the steps

Animation builds up on PowerPoint or alternatively use visualiser

Modelled Example (I do): A question you might recognise…. Show your planning, do not cross it out!

0 2 . 6 Describe a method to investigate how the temperature changes when different masses of ammonium nitrate are dissolved in water.

You do **not** need to write about safety precautions.

[6 marks]

1. IV and DV

IV – Changing the masses of ammonium nitrate

DV – Temperature CHANGE

2. Equipment:

Temperature – Thermometer

Solutions – Beaker (or better – a polystyrene cup with lid) inside a beaker

Mass of ammonium nitrate – measuring scales/balance

3. Control Variables:

1. Same volume of water
2. Same type of water (spring, tap, fizzing)
3. Same cup / beaker
4. Same starting temperature of solution

4. Specific Measurements

This is your plan, so make up the measurements you will test. Keep it simple. E.g. 1g, then 2g, 3g, 4g and 5g. To see a clear pattern, you need at least 5 changes to the IV. Remember you always do X3 repeats and calculate an average.

5. Risk Assessment – It has told you NOT to write about it. But what could you say?

Let's put all that together into a written method.

1. Get 5 beakers with polystyrene cups inside and add 100cm^3 of still tap water to each using a measuring cylinder.
2. Add a lid to the cup and record the starting temperature of each with a thermometer.
3. Using a balance measure out 1g, 2g, 3g, 4g and 5g of ammonium nitrate, one mass for each beaker.
4. Add them to each cup and record the final temperature
5. Calculate the temperature change by doing final temp – starting temperature.
6. Repeat this X3 for each mass
7. Calculate an average temperature change for each mass.

Then mentally highlight you have included everything:

IV
DV
Equipment
Control Variables
Specific Measurements

Risk Assessment – If needed

'You do' practise opportunities given

The below can be used to scaffold, self/peer assess or reflect.

Step	Complete Y/N	What must I include?
1. IV DV		
2. Equipment		
3. Control Variables		
4. Specific Measurements		
5. Risk Assessment – If needed		

Notes

Notes