

# Science Curriculum

2020/21



## Science Department Statement of Intent

**“For there is hope for a tree, if it be cut down, that it will sprout again, and that its shoots will not cease.” Job 14:7**



*Science at St Joseph's delivers the opportunity for students to understand the beauty and wonder of God's world and their role in that world and society. We are committed to developing the minds of life-long learners in an environment of the Gospel values through the skills of observation, investigation, communication, critical thinking, logical reasoning and independent study.*

### Aims of the Science Department

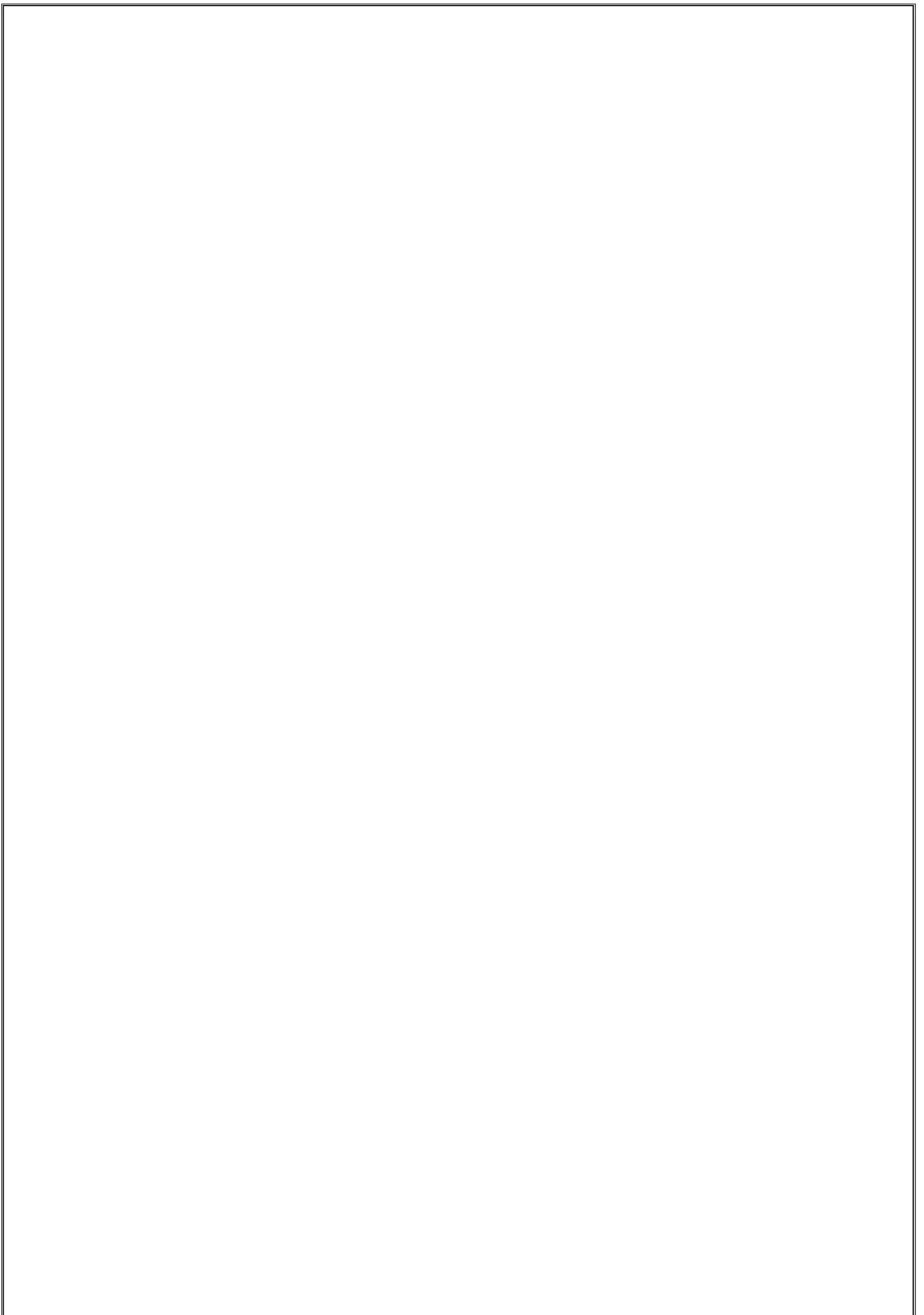
- i. Science is taught so that students become familiar with natural phenomena in their environment and develop as scientists in our world with logical reasoning and scientific enquiry.
- ii. Science is taught so that students witness the broad overviews of scientific principles and the ways in which these are exemplified and applied in the service of our communities.
- iii. Science learning is to prepare children to make a difference to our society once they leave education. They can go on to become doctors, agricultural officers, engineers, etc. with their determined goal of life.
- iv. Science teaching aims at helping children in their life to use the gifts of science every day.
- v. Science teaching is to make the students wonder about things and to make them put question out of curiosity.
- vi. Science teaching aims to educate students to understand the system of observation, guess and experiment which is known as scientific method.

## 8 REASONS WHY KIDS SHOULD SCIENCE MORE

The teachings of science perfectly complement children's natural curiosity and help them to develop important life skills. Here are just a few of those skills:

- 1 CRITICAL THINKING**  
The ability to thoroughly and objectively evaluate information is one of the greatest skills that you can possess, critical thinking opens up new pathways of thought in the brain that are vital for a child's cognitive development.
- 2 RESILIENCE**  
The feeling of accomplishment that comes from conquering difficult subjects gives a child confidence that will last through their entire life. Resilience is now known as one of the most important markers of life success.
- 3 CONSTANTLY LEARN AND IMPROVE**  
Scientists are constantly trying to disprove their own theories in order to improve the validity of their findings. Kids studying science learn to love learning for learning's sake, whether succeeding or failing.
- 4 BECOME A SUPERHERO**  
Scientists discover things that improve people's lives all of the time, whether they set out to or not. Scientists get to apply their energies and their efforts to causes that really matter to them, and many times see the results firsthand.
- 5 PRESERVES SENSE OF WONDER**  
Science is about pursuing big questions about the world in very specific ways. In order to be a good scientist, it's vital to maintain the sense of wonder and the curious questioning about the natural world that kids are born with.
- 6 PROVIDES A METHOD OF QUESTIONING**  
One of the very first things kids learn about science is the Scientific Method, which is about determining what is true by forming hypotheses and testing them with experiments.
- 7 BECOME A BETTER CONSUMER**  
The ability to intake information claimed to be scientific fact and to evaluate its credibility is important. Children are much more likely to grow up savvy consumers in a world increasingly governed by statistics.
- 8 BECOME A BETTER PERSON**  
The scientific method of questioning and testing everything is not just for academic research: Through studying science, kids will learn to better their health, to never stop learning, to better understand the world around them, and to find a way to make it better.

**PSYSCI.CO**



## **Science Department Overview of Intent**

### **Year 7**

By the end of Year 7 our Scientists will develop a scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics. Students will develop an awe and wonder of science and a curiosity for what else we can learn about the world through enquiry based learning.

#### **Subject Content**

- Forces, Particle model, Cells, Electricity, Chemical reactions, Ecology, Waves, Growing up, Space, Structure of the Earth and Energy
- Development of practical skills throughout the year

### **Year 8**

By the end of Year 8 our Scientists will develop an understanding of the nature, processes and methods of science through different types of enquiries that help them to answer scientific questions about the world around them. Students will develop informed and ethical opinions about the big scientific questions facing society and make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements.

#### **Subject Content**

- Forces, Periodic table, Bioenergetics, Waves, Environmental chemistry, Body systems, Electricity

### **Year 9**

By the end of Year 9 our Scientists will have developed a keen understanding of how scientific principles are applied in context, in everyday life. They will have improved their understanding of fundamental ideas in biology, chemistry and physics. Practical skills will be further embedded through the study of Required Practical Activities.

#### **Subject Content**

- Cells, organisation, infection and response
- Atomic structure & Periodic table, Bonding, structure & properties, Chemical Changes
- Particle model of matter, Energy, Electricity

### **Year 10**

By the end of Year 10 our Scientists will enhance their skills to communicate effectively in Science and apply knowledge to unfamiliar concepts. They will have improved their understanding of big ideas in biology, chemistry and physics and be able to see links between disciplines and concepts. Practical skills will be further embedded through the study of

Required Practical Activities, with a particular focus on critically evaluating techniques and data.

### **Subject Content**

- Bioenergetics, Homeostasis & response, Inheritance
- Energy changes, Rate of reaction, Organic Chemistry and Chemical Analysis
- Atomic structure & radioactivity, Forces, Waves

### **Year 11**

By the end of Year 11 our Scientists will be ready for the next stage of their scientific education. They will have a firm understanding of all the big ideas in Science and be able to incisively link these ideas to a wide range of contexts – and articulate in a clear, logical and reasoned manner when explaining, analysing and evaluating. They will be able to apply their understanding of a range of Required Practical Activities independently to unseen practicals.

### **Subject Content**

- Variation & evolution, Ecology
- Atmosphere, Using resources
- Waves, Electromagnetism
- Consolidation of GCSE material and RPAs

## SMSC, GV and FBV in Science

**Spiritual** – what we **believe** about purpose and meaning of life  
**Moral** – principles that guide our **choices** based on our beliefs  
**Social** – how we **relate to self and others** influenced by our beliefs  
**Cultural** – ways in which we **do things** based on our beliefs

**God asks “why?” ..... but Science asks “how?”**



### Gospel Values

Service  
 Truth & Justice  
 Forgiveness & Mercy  
 Purity & Holiness  
 Faithfulness  
 Tolerance & Peace  
 Sacrifice  
 Humility & Gentleness  
 Dignity & Compassion  
 Integrity

Fundamental British Values (FBV)		Gospel Value
Democracy	Making decisions together. The right to an opinion/voice.	Service & Sacrifice. Humility & Gentleness.
Rule of Law	Understanding rules & their importance Following rules to develop order	Truth & Justice. Forgiveness & Mercy.
Individual Liberty	Freedom of speech for all. The right to make our own choices.	Faithfulness & Integrity. Purity & Holiness.
Mutual respect	Treating others as you would want to be treated. Respect for each other. Working together.	Dignity & Compassion.
Tolerance	Learning about different faiths & cultures. Listen to other viewpoints. Learning about diversity.	Tolerance & Peace

The Science department has a document covering appropriate and detailed questions which could be the focus of discussion in Science.

“Seeds of great discoveries are constantly floating around us, but they only take root in minds well prepared to receive them”

Joseph Henry

“DNA is like a computer program but far, far more advanced than any software ever created”

Bill Gates

“Strive not to be a success, but rather to be of value”

Albert Einstein

“Gravity explains the motion of the planets, but it cannot explain who sets the planets in motion”

Sir Isaac Newton

“It always seems impossible until it's done”

Nelson Mandela

“When you realise the value of all life, you dwell less on what is past and concentrate more on the preservation of the future”

Diane Fossey



## **SMSC in Science**

### *Spiritual Development:*

Sometimes science and spiritual ideas do cause conflict but in a modern society it is important to understand why these conflicts arise so we can respect the views of others and move forward. It is also seen more often that science is able to stand alongside the spiritual beliefs of many. This is looked at often from a neutral stand point within science lessons.

### *Moral Development:*

Our understanding of Science has allowed us to develop technology we couldn't have imagined 50 years ago. Now however, we must start deciding if we should we do all the scientific activities we are able to or morally should we decide not to. This can be as simple as should we test medicines for humans that could save lives on animals causing them cruelty? It could be as complex as should we allow somatic or germ line cell therapy. Moral development is a vital part of any scientist's development.

### *Social Development:*

Science is changing our society. People are driving more efficient cars, more people are putting solar panels on their rooftops. Our society has become dependent on scientific developments which we could not have foreseen 50 years ago but also our lives are likely to change significantly in the future because of our reckless damaging activities to the environment as a human society. Students must consider their impact on the world around them and start to look at what we can do to help the next generation have a habitable planet.

### *Cultural Development:*

Scientific development comes from all across the world, from people of all backgrounds and cultures. Some of science's most important discoveries have come from other parts of the world and it's important for students to understand this. It is also important to understand how the different cultures around the world can have different impacts on the planet and what impact more economically developed countries have on poorer areas. This will also be vital into the future as we need to monitor the impact of quickly developing cultures around the world on our environment.

Science contributes to our students' SMSC development through:

- Encouraging students to reflect on the wonder of the natural world.
- Awareness of the ways that Science and Technology can affect society and the environment.
- Consideration of the moral dilemmas that can result in scientific developments.
- Showing respect for differing opinions, on creation for example.
- Co-operation in practical activity.
- Raising awareness that scientific developments are the product of many.

## Promoting British Values in Science

### *The Rule of Law*

Law is an integral part of science. New research into drug design, stem cell technology, genetic engineering, mining, engineering, mobile phone and computer research all have to follow strict laws that govern their safety and application. From patenting work to following British Safety Standards, to destroying a cloned embryo before the cells can specialise, civil and criminal law must be considered by all scientists developing new and existing technology. We actively promote civic institutions so that students value and appreciate the local the Health system, the Police, the justice system and Social Services and how Science has an active role in the day to day functioning of these establishments.

### *Mutual Respect and Tolerance*

Science has many complex ethical issues from genetic engineering, cloning, drug testing and pollution to nuclear power stations. Students are expected to weigh up both sides of any argument and provided reasoned response that underpins their own stance to these issues. This is done through class discussion, links with industry and careers in lessons and other extracurricular visit and events throughout the year.

### *Democracy*

Science is a universal language and discipline that can be used anywhere in the world regardless of race, language or religion. We show how Scientists collaborate worldwide to share data, theories and conclusion. Through topics such as evolution, biodiversity and variation, we emphasise how we are all the same species regardless of ethnicity, background or beliefs. This supports the British ethos behind democracy.

### *Individual Liberty*

From inventing the World Wide Web, to mobile phones, Stem Cell Transplants and DNA Fingerprinting, our country and scientists have contributed much to our modern life. The Science department promotes, through its teaching and education about scientists such as Charles Darwin, Robert Hooke, Watson and Crick, Rosalind Franklyn and Marie Curie. By setting these examples and role models we endeavour to support a new wave of scientists who will contribute positively to modern Britain. The fundamental principle of Science is to understand the world in such a way as to improve the quality of life for all species that inhabit it.





## Key Areas of Literacy

<p><b>Vocabulary</b></p> <p><b>Key issues</b>      Technical and specialist words Appropriate usage Correct spelling Understand meaning</p> <p><b>Common difficulties</b></p> <ul style="list-style-type: none"> <li>❑ Time and lots repetition needed to ensure new words are internalised into working vocabulary and linked to appropriate concepts.</li> <li>❑ Ordinary words with alternative meanings can be difficult as it causes cognitive conflict. There may be a precise scientific and an everyday meaning to the same word e.g. mass, element.</li> </ul> <p><b>Supporting strategies</b></p> <ul style="list-style-type: none"> <li>❑ Introduce words using a multisensory approach e.g. orally, visually, kinaesthetically</li> <li>❑ Use vocabulary frequently using open questions</li> <li>❑ Use words in sentences to keep reflecting back</li> <li>❑ Use models and picture to help visualise the word</li> <li>❑ Use flash cards to test students understanding</li> <li>❑ Ask students to explain using pictures to encourage language development</li> <li>❑ Use visual clues e.g. hand signals</li> <li>❑ Use poetry, rhymes, raps and rhythms to aid memory and link to modern culture</li> <li>❑ Get students to make own word lists to collect new words and test and check their meaning</li> </ul>	<p><b>Oracy</b></p> <p><b>Key issues</b>      Use language precisely Listen to others and respond by building on ideas and views</p> <p><b>Common difficulties</b></p> <ul style="list-style-type: none"> <li>❑ Constant use and repetition are essential. Words which are not frequently used are easily forgotten</li> <li>❑ Often little planned time in lessons to “talk”</li> <li>❑ One word answers for fear of getting it wrong</li> </ul> <p><b>Supporting Strategies</b></p> <ul style="list-style-type: none"> <li>❑ Teacher model good use of scientific language</li> <li>❑ Use questions to review past knowledge and understanding, check understanding, encourage the learner to think and to practice the language</li> <li>❑ Use a range of questioning strategies</li> <li>❑ Allow students “thinking” time</li> <li>❑ Offer students challenge</li> <li>❑ Use games to encourage meaningful peer group talk and embed new word and concepts</li> <li>❑ Use small group discussion to develop student understanding through conversation in a less threatening atmosphere</li> </ul>
<p><b>Reading</b></p> <p><b>Key issues</b>      Strategies to help reading for understanding Locating and using information Summarising Synthesise learning from reading</p> <p><b>Common difficulties</b></p> <ul style="list-style-type: none"> <li>❑ Students often cannot relate to the type of science texts used in school in terms of language and style</li> <li>❑ Children often prefer fiction to non-fiction texts</li> <li>❑ Children prefer to use interactive methods of discovering information e.g. Internet</li> <li>❑ Limited range of text that can be offered to students</li> <li>❑ Weak readers can lack the ability to scan and skim read</li> <li>❑ Students prefer to copy chunks of text without checking their relevance</li> </ul> <p><b>Supporting Strategies</b></p> <ul style="list-style-type: none"> <li>❑ Develop activities to promote meaningful reading experiences e.g. EXIT model</li> <li>❑ Activities prior to reading that give students a desire to find out more e.g. using a contents page or index</li> </ul>	<p><b>Writing</b></p> <p><b>Key issues</b>      Correct spelling and punctuation Follow grammatical conventions Organise work in a logical and coherent form</p> <p><b>Common difficulties</b></p> <ul style="list-style-type: none"> <li>❑ Many students are reluctant writers</li> <li>❑ Poor handwriting and spelling can make writing difficult to interpret</li> <li>❑ Lack of understanding what they are being asked to write about</li> <li>❑ Time pressure in lessons to get ideas or work down onto paper</li> </ul> <p><b>Supporting Strategies</b></p> <ul style="list-style-type: none"> <li>❑ Plan to incorporate the different forms of scientific writing into lessons e.g. recount and report, instruct etc.</li> <li>❑ Use different types of text</li> <li>❑ Get students to analyse prose to look for key words and phrases</li> <li>❑ Get students to criticise and improve on received text</li> <li>❑ Encourage use of a variety of genre e.g. narrative, descriptive, persuasive, reports, imaginative when appropriate</li> </ul>

- ❑ Activities associated with reading to make the data processing easier e.g. DARTS, cloze procedure, sequencing, underlining
- ❑ Activities following reading to encourage reformulation of the information into personal knowledge e.g. table/diagram completion, summarising

- ❑ Use writing frames where appropriate, encouraging children to use it as a guide line and eventually manage without
- ❑ Encourage children to redraft work in lessons using teacher comments
- ❑ Develop skills in note taking by using short simple activities e.g. jot down key words, note observations on teachers demo
- ❑ Teach students how to summarise text e.g. crosswords, catchword
- ❑ When asking students to write analysis and evaluations teach them the specialist vocabulary and phrases needed e.g. the relationship between, the gradient of the line..., my results do not support my prediction.

 **Science** 

USE THESE TIPS TO IMPROVE YOUR WRITING IN SCIENCE!

**VOCABULARY**

**Command Words Descriptions**

- LIST** To produce a list of words, sentences or comments
- STATE** To describe the main points in precise terms. Use brief, clear sentences. Omit details or examples.
- DESCRIBE** To write a detailed account or verbal picture in a logical sequence or story form
- EXPLAIN** Give reasons/causes. Show understanding

**Common Misspelt Words**

- Accurate
- Anomaly
- Anomalous
- Beginning
- Comparison
- Conclude
- Dependent
- Evaluate
- Precise
- Function
- Immediately
- Independent
- Measure
- Membrane
- Prove
- Reliable
- Results
- Repeatable
- Science
- Scientific
- Separate
- Successful
- Temperature
- Therefore
- Thermometer
- Unfortunately
- Outlier

**Element symbols and compound formulae**

All element symbols start with a capital letter. If there is a second letter in an element symbol, it is a lower case letter.

Na ✓ NA ✗

In a compound formula, numbers should be smaller than the letters and slightly below them. This is called a subscript.

CO2 ✗ CO<sub>2</sub> ✓

Ions have a superscript - small numbers above the letters.

Mg2+ ✗ Mg<sup>2+</sup> ✓

 **Science** 

USE THESE TIPS TO IMPROVE YOUR WRITING IN SCIENCE!

**VOCABULARY**

**Cohesive Devices**



and...

but... in fact... because... when...

if... when... as... unless... although... however... since... because... even... though... near the end...

in addition... similarly... whereas... if... even...

Use complex sentences occasionally. Vary sentence length and word order to keep the reader interested.

**Openers**



The... My... I...

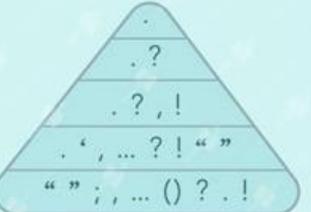
Because... After... First... Then... Next... Last... In the end... In... At... Another time...

Answer this... After... Although... Afterwards... Before... Eventually... Sometimes... Often...

Initially... Due to... As a result... First... Second... Finally... Even though... However... Before very long... However... in order to... Despite... As a result... When... I felt as... Although... Just... Subsequently...

Having decided... Use complex sentences occasionally. Vary sentence length and word order to keep the reader interested.

**Punctuation**



... ?

... ? , !

... ' , ... ? ! " "

" " ; , ... ( ) ? !

**1. Aim**

What do you want to find out?

**Hypothesis**

Testable statement, e.g. the length of a wire affects the resistance of a wire.

**3. Method**

- What did you do, or what will you do, in the experiment?
- This should be in bullet points or numbered stages.
- Use the correct scientific vocabulary
- Impersonal writing, for example "the liquid was poured into the beaker" not "Miss poured the liquid into the beaker".

**4. Results**

What did you find out?

Results should be recorded in the form of a table and / or a graph.

Units should be included in the table heading and graph axes.

**6. Evaluation**

- What went well in the experiment?
- What did not go well in the experiment?
- What would you change next time?
- What have you learned?
- Use correct scientific vocabulary.

**2. Prediction**

What do you think the result will be?

**5. Analysis of data**

Are your results accurate?

- close to the line of best fit

Are your results respectable?

- small error bars / ranges

Are your results reliable?

- no over lap of error bars / ranges

**7. Conclusion**

What have you learned from the results?

How does what you have learned, link back to your prediction?

Use the correct scientific vocabulary.

## Promotion of Careers in Science

One way the department supports the schools' CEIAG programme through the embedding of careers information in our SOL. Each unit of study includes a link to relevant STEM careers. The activities may take the form of a discussion about which careers may use the information gleaned in the lesson; or watching a video / reading an article about a real-life scientist applying the content in context; researching scientists and the impact their work has had on our lives; or thinking about the skills developed in a lesson and how they could be used in the workplace. For example:

**LEARN****Do now**

### Careers link: Genetic counsellor

- **What is a genetic counsellor?**

Genetic counsellor is someone who advise people & families affected by or at risk of genetic disorders to help them understand and adapt to the medical and psychological impact



- **What skills would a genetic counsellor need?**

Communication & interpersonal skills	Report writing
Empathy	Research skills
Analytical skills	Prioritising and organisational
Medical knowledge of condition	Taking blood etc.

**THINK: where in school have you developed or practised these skills?**

In addition, the majority of our classrooms have displays showcasing real-life scientists and their work, or guidance on careers. For example:





## Careers, Employability and Enterprise Audit across the Curriculum

Curriculum area SCIENCE Staff LMR Date May 2020

Year group	How does your subject contribute to the Careers, Employability and Enterprise curriculum?	What are the activities used?	Developing yourself through careers, employability and enterprise education	Learning about careers and the world of work	Developing your career management, employability and enterprise skills
7	Careers link in each unit – in context British Science Week activities Displays about hidden scientists  "H&S in the lab" Regular Self-Assessment during lessons	A variety e.g. <ul style="list-style-type: none"> <li>Videos about the science in context e.g. dinner lady talking about a balanced diet, material scientist when learning about polymers, astronaut when learning about space</li> <li>"What skills would <u>this</u> job need + where done in Science?" with some familiar and more obscure roles (info from Prospects)</li> </ul> Skills for staying safe in Science	3	4  6	10,14
8	Careers link in each unit – in context British Science Week activities Displays about hidden scientists Regular Self-Assessment during lessons	As above	3	4, 6	10,14
9	Careers link in each unit – in context Displays about hidden scientists BBC Young Reporter STEM events	As above Hands on activities at BBC Media City		4,6	10,14

For details of the CDI Careers Framework [www.thecdi.net](http://www.thecdi.net)  
March 2018

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	"Radioactive" cinema trip as part of International Women's Day "Physics Olympics"  "Surprising Science" Regular Self-Assessment during lessons Medical Society	Presentation by female Professor, screening of the film pre-release Real-life application of physical sciences to engineering challenges Hands on activities about the practical applications of chemistry and geology  Bi-weekly sessions to engage and enthuse those wanting to pursue medical careers	3  2	4-6	11,12,14
10	Careers link in each unit – in context Displays about hidden scientists "Medical Marvels" Regular Self-Assessment during lessons Medical Society	As above  Presentation about medical careers, hands-on dissections & suturing  Bi-weekly sessions to engage and enthuse those wanting to pursue medical careers	3 2	4,6  4-6	10,14  11,12,14
11	Careers link in each unit – in context Displays about hidden scientists Regular Self-Assessment during lessons	As above	3	4,6	10,14

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For details of the CDI Careers Framework [www.thecdi.net](http://www.thecdi.net)  
March 2018

## **Science Structure**

The Science department is made up of an experienced team of staff who are highly dedicated and specialised to their subject area. Qualifications are offered up to GCSE Level including AQA Trilogy Combined Science and individual GCSEs in Biology, Chemistry and Physics. A small cohort of students entering Y9 in 2020/21 will study towards AQA Entry Level Certificate in Science (Single Award) – to embed ideas from Year 7 and Year 8 and prepare for the rigour of GCSE.

Students are encouraged to be innovative and think about how Science affects everything we do: from how we function to the science behind our cameras and the components of the food we eat. The department provides lessons that are active and engaging, maximising the interest and enthusiasm of our students, so that lessons are thoroughly enjoyed and understood.

We have a Curriculum Leader for Science, and a Second in Science who are supported by a team of 8 Teaching Staff. Their teaching is complemented by 3 laboratory technicians who work in our laboratory preparation rooms to ensure that all of the practical Science lessons go ahead smoothly. We have six science laboratories and endeavour to promote lessons that are imaginative, creative and involving current affairs.

### *Curriculum Structure*

Students in Year 7 and Year 8 are follow a programme of study which aligns to the National Curriculum for Science 2014, and is underpinned by AQAs Big Ideas in Science. Our scheme of learning aims to stimulate students' curiosity in the world around them and enable to develop investigative and evaluative skills in preparation for GCSE.

Each unit of work is built around the development of a particular investigative skill alongside the improvement in knowledge and understanding of scientific concepts.

Year 7:

- Unit 1 – Skills for Science
- Unit 2 – Forces
- Unit 3 – Particle model of matter
- Unit 4 – Cells
- Unit 5 – Electricity
- Unit 6 – Metals, acids & alkalis
- Unit 7 – Interdependence
- Unit 8 – Waves
- Unit 9 – Space & Earth
- Unit 10 – Reproduction & variation

- Unit 11 – Energy transfers

Year 8:

- Unit 1 – Skills for Science
- Unit 2 – Forces
- Unit 3 – Periodic Table & materials
- Unit 4 – Bioenergetics
- Unit 5 – Waves
- Unit 6 – Climate & Earth
- Unit 7 – Systems
- Unit 8 – Magnets & Electromagnets

- Unit 9 – Reactions

- Unit 10 – Inheritance & Evolution

Science is one of the core subjects of the National Curriculum and therefore it is compulsory in Years 9, 10 and 11.

In Year 9 to 11 students study Science from the AQA suite of GCSE qualifications. Students will either follow the programme of study towards:

- Entry Level Certificate (Single Award)
- GCSE Combined Science – Trilogy
- Or GCSE Biology, GCSE Chemistry and GCSE Physics

An overview of the topics in the courses is shown below:

### *Biology*

1. Cell biology
2. Organisation
3. Infection and response
4. Bioenergetics
5. Homeostasis and response
6. Inheritance, variation and evolution
7. Ecology

### *Chemistry*

8. Atomic structure and the periodic table
9. Bonding, structure, and the properties of matter
10. Quantitative chemistry
11. Chemical changes
12. Energy changes
13. The rate and extent of chemical change
14. Organic chemistry
15. Chemical analysis
16. Chemistry of the atmosphere
17. Using resources

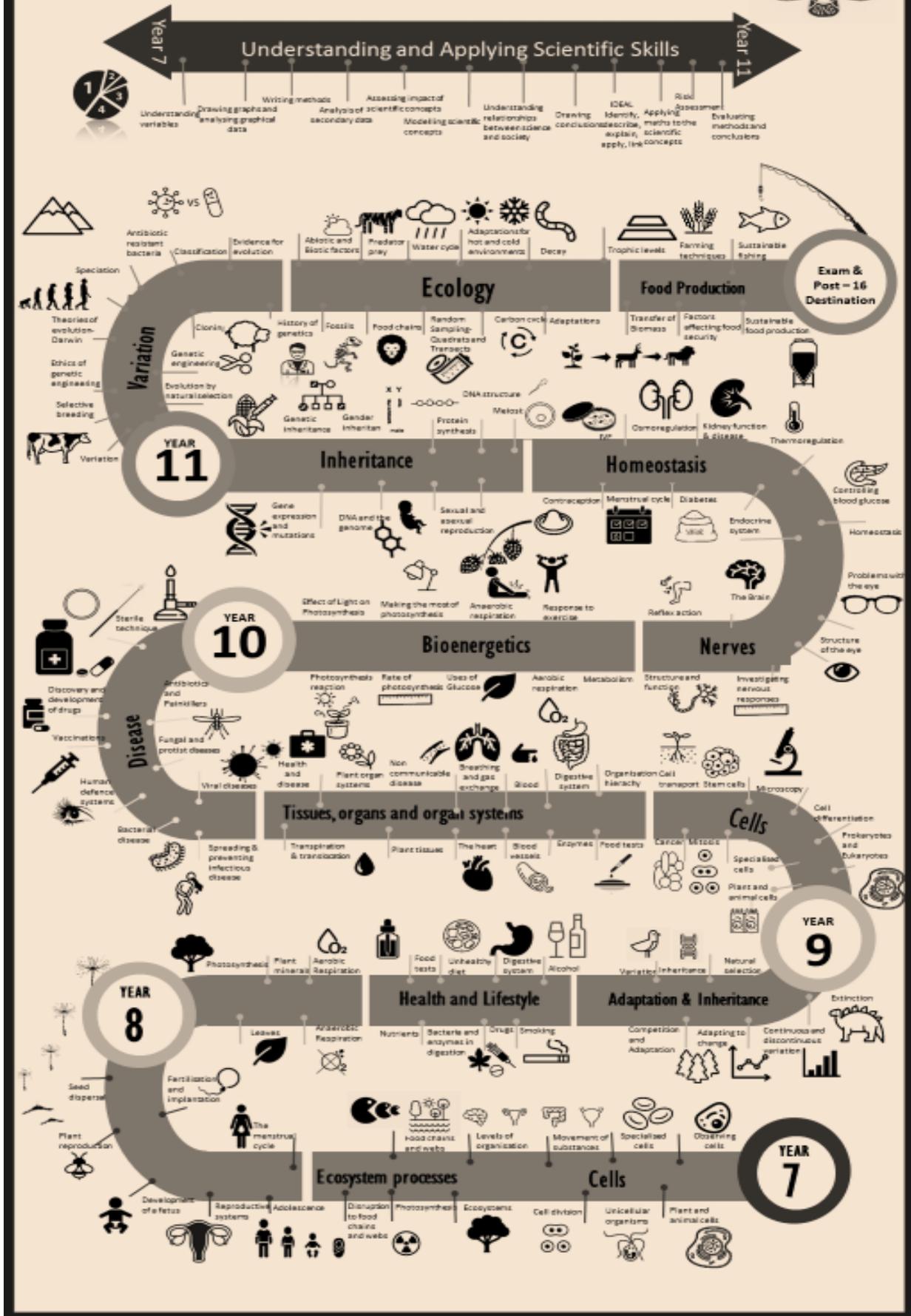
### *Physics*

18. Energy
19. Electricity
20. Particle model of matter
21. Atomic structure
22. Forces
23. Waves
24. Magnetism and electromagnetism

*Students that are sitting GCSE Physics will also study*

25. Space

# Biology Learning Journey



## **Assessment Principles**

Year 7 begins our 5-year spiral curriculum. The scheme of learning and lesson outcomes are within the relevant areas on the shared drive. There are 10 key ideas which are covered and revisited across the first two years at St Joseph's. Teaching of these units should focus on mastery of skills before moving on, this will ensure that students to progress through the curriculum each year. Required Practical Activities have been introduced into the teaching from Year 7 to support students in their academic and scientific development. The progression through the units for attainment is set out in the progression scales which should be used alongside curriculum planning and assessment.

For AQA Science the specification and scheme of learning are within the relevant areas of the shared drive. Also within these areas are teaching resources and materials Progression scales also support the tracking of skills and content through the GCSE specifications. Teaching order and unit deadlines can also be found in the shared curriculum area.

Class books will contain all notes from lessons, assessed tasks and all homeworks. They should have a front cover on the front of the book and then progression scales at appropriate points depending on the year group and topics. Regular recall activities should be self-marked or peer-marked, and staff should use a variety of AFL techniques and strategies to inform planning. Class books should predominantly use peer and self-assessment as a method of marking with student responses to this marking as appropriate. SOLs have been updated to ensure there are a range of appropriate opportunities and tools embedded into our shared resources to enable effective SA and PA – though the development of these and student skill and accuracy remains an area for us to work on as a team.

Class books should be teacher-marked using the standardised assessment materials for each unit, and feedback should enable students to actively engage in the feedback process by answering specific questions or improving specific areas of their work. Wherever possible, feedback should link to the topic-specific progression scales. Again, there are a variety of tools to support teachers to provide effective feedback.

Assessment books will support as the tracking behind student progress. They should be set up with a skills based progression scales for the year group and an assessment tracker in the front of the book. It should contain end of unit assessments.

Teacher marking should be used to assess the pieces of work using the progression scales to provide a constructive next step for the student, which should be responded to using purple pen. The results of the assessment should be tracked on the student tracker, therefore indicating a students' areas for development.

Each end of unit assessment should be supported by Whole-Class Feedback and a Personal Question Level Analysis, which should also be included in the Assessment book. PQLA will be both knowledge and skills based, and linked to progression scales allowing students to take

ownership of areas for development. This will provide students with a more detailed understanding of their “gaps to address” within this topic, and guidance to support the improvement of exam technique. Where appropriate model answers should be shared. The development of the most appropriate tools and format for whole-class feedback will be an area for the department to consider and explore in 2020/21.

## Examples of whole-class feedback

**LEARN** EOU 6 H test: Whole-class feedback **Next steps**

**KNOWLEDGE & UNDERSTANDING**

**Selective breeding** if not given the characteristic that is desired in the info, then you should identify what it might be. Two parents with the characteristic are bred, the BEST of the offspring are then bred, and this is repeated over many generations not just repeated!

**GMO** Resistance to herbicide is an advantage as these crops are not killed when weed killer is used. BUT the competition is, so there is a better yield as the crop do not have to compete for water, light or nutrients.

The agar contains glyphosphate as not all plant cells will take in the plasmid. Then the plant cells that DO NOT CONTAIN the desired gene are killed, so only the GM cells survive. (Hard).

**Classification** Kingdom, phylum, class, order, family, genus, species. The genus and species are given in the info – the binomial name! It is a worm, so belongs to kingdom Animalia.

**How do you work out if they are the same species?** Breed them. If the offspring can also breed then they are the same species. The offspring would not be able to breed if they were a different species.

**Mitosis & meiosis** Learn the difference! Mitosis makes cloned cells – this happens in growth of a foetus and throughout the lifetime of a multicellular organism. Meiosis makes gametes with half the number of chromosomes.

**TECHNIQUE**

**Evaluate** means talk about the two sides. Where you are asked to evaluate evidence this means to weigh up how the evidence supports the claim, and how the evidence doesn't support the claim. ALWAYS look at the data and the claim – in this case the evidence is about glyphosphate, but the claim is about GM crops (only one person spotted this – well done Nathan).

**Punnett Squares** learn the terms heterozygous, homozygous dominant, homozygous recessive and what they mean. Underline in the info whether the characteristic is caused by a recessive or dominant allele. ALWAYS circle the offspring that answer the question rather than just giving the % affected.

**Model answers**

Glyphosate is a herbicide.  
Crop plants have been genetically modified to make them resistant to glyphosate.

Q1) Why is it an advantage to make crop plants resistant to glyphosate?  
It is an advantage because the farmer gets a better yield from his crops and because not much competition from water, nutrients from weeds as glyphosate kills them but not the crop.

Very rarely, a new case of Marfan syndrome can occur because of a mutation during meiosis.  
Explain how a mutation during meiosis could affect every cell in one offspring.  
Meiosis creates gametes or sex cells which fuse with another gamete to start the process of mitosis. The genetic code is then duplicated with the mutation existing in every body cell.

Selective breeding has been used for centuries to produce racehorses.  
Describe the steps involved in selective breeding to produce a racehorse.  
• Find similar horses with similar (desired) characteristic suited for racehorses  
• breed the two horses  
• pick the offspring where the desired characteristic is more pronounced  
• breed these two offspring and repeat the process over generations until the result is a breed of horses that are well suited to being racehorses.

Draw a Punnett square diagram to determine the probability of the child having the syndrome.  
Woman  

	B	b
b	Bb	bb
b	Bb	bb

  
 Probability = 50%

## **Forming judgements for data drops**

It is important that data drops accurately reflect an individual's learning journey, and vital that they are consistent across the department.

All end of unit assessments align with the principles outlined by JNC, Ofqual and AQA – in terms of proportion of marks available for the various Assessment Objectives, mathematical skills and practical skills. Boundaries at GCSE are linked to historical published boundaries and observed trends. End of unit assessment boundaries incorporate a buffer. To this end, these tests offer a reliable snapshot of performance against the criteria students will be judged upon at the end of their studies.

When forming data drops, teachers should consider all assessment including: homeworks, retrieval activities in lesson, standardised assessed pieces and end of unit assessments. Grades entered should reflect a best fit. Teachers should also apply professional judgement and consider a student's attitude to learning when forecasting future attainment.

In Year 7 and Year 8, data drops are NOT linked to grades – and instead communicate the students' progress linked to KS2 prior attainment (above expected, expected, below, well below expected progress). To ensure consistency, this is standardised using our departmental progress tracker.

Data drop entries are Quality Assured by HOD and AHOD to ensure agreed principles have been followed fairly and consistently. Exam marking is moderated internally, and our approach verified externally via the Bolton Hub for Science.

# Generic progression scale

	Step 5	Step 6	Step 7	Step 8	Step 9	Step 10	Step 11	Step 12
A01 Remember	<p>Remember a range of basic facts and put them into structured sentences in a topic.</p> <p>Describe some of the risks and benefits of some scientific discoveries.</p>	<p>Remember a wide range of basic facts.</p> <p>Use some key words and phrases for any topic studied.</p>	<p>Remember key facts about most areas of Science.</p> <p>Use appropriate terminology in answers (key words and phrases)</p>	<p>Describe key facts about most areas of Science.</p> <p>Use appropriate terminology in answers (key words, phrases and units)</p>	<p>Use appropriate terminology in answers (key words, phrases and units)</p> <p>Describe relationships between scientific advances, their ethical implications and the benefits and risks associated with them.</p>	<p>Use appropriate scientific language when recalling scientific detail</p> <p>Use appropriate SI units on answers</p> <p>Explain in the risks and benefits of scientific advances</p>	<p>Recall all key areas of Science through accurate scientific explanations.</p> <p>Use accurate and appropriate scientific language and units</p>	<p>Recall all key areas of Science</p> <p>Always use appropriate and accurate scientific language and the correct SI units</p> <p>Explain the relationships between scientific advances, their ethical implications and the benefits and risks associated with them.</p>
A02 Application	<p>Apply knowledge effectively in a range of contexts.</p> <p>Sometimes use data to support evidence.</p> <p>Consistently use equations in calculations.</p>	<p>Use theories to make simple explanations of events.</p> <p>Consistently use and sometimes rearrange equations in calculations.</p>	<p>Interpret data and use it to support evidence.</p> <p>Rearrange equations in calculations.</p>	<p>Apply knowledge effectively in a range of contexts.</p> <p>Use theories to make detailed explanations of events.</p> <p>Interpret data and use it to support evidence.</p> <p>Rearrange equations in calculations.</p> <p>Understand standard form</p>	<p>Apply knowledge effectively in a range of contexts.</p> <p>Use theories to make detailed explanations of events.</p> <p>Interpret data and use it to support evidence.</p> <p>Rearrange equations in calculations.</p>	<p>Always apply knowledge effectively in a wide range of contexts.</p> <p>Always use theories to make detailed explanations of events.</p> <p>Always make effective use of data to support evidence.</p> <p>Consistently rearrange multi-step calculations</p> <p>Use standard form</p>	<p>Apply knowledge effectively in a wide range of contexts.</p> <p>Use theories to make detailed explanations of events.</p> <p>Make effective use of data to support evidence.</p> <p>Consistently rearrange equations in complex calculations</p> <p>Use appropriate sig figs</p>	<p>Apply knowledge effectively in a wide range of contexts.</p> <p>Use scientific theories to make detailed explanations of events.</p> <p>Make effective use of data to support evidence.</p> <p>Consistently rearrange equations in complex unseen calculations</p>
A03 Analyse and Evaluate	<p>Evaluate basic information to develop simple arguments and explanations.</p> <p>Recognise anomalous results and spot some causes of error in experimental procedures.</p>	<p>Write reasoned explanations of a conclusion based on the experimental data</p> <p>Consistently draw conclusions consistent with the available evidence.</p>	<p>Evaluate information to develop arguments and explanations.</p> <p>Identify some causes of error and uncertainty in data or experimental procedures.</p>	<p>Evaluate data with reference to potential sources of random and systematic error.</p> <p>Evaluate the reliability of methods in detail.</p> <p>Suggest further questions that may arise from results of investigations and data analysis and evaluation.</p>	<p>Evaluate the reliability of methods in detail</p> <p>Suggest further questions that may arise from results of investigations and data analysis and evaluation.</p>	<p>Evaluate information systematically to develop arguments and explanations.</p> <p>Draw detailed, evidence-based conclusions</p> <p>Identify causes of error and uncertainty in data or experimental procedures.</p>	<p>Suggest detailed improvement to methods where reliability may be a concern</p> <p>Critically analyse qualitative and quantitative data to draw logical, well-evidenced conclusions</p>	<p>FOR ALL RPAS</p> <p>Critically analyse qualitative and quantitative data to draw logical, well-evidenced conclusions of scientific conclusions</p>
A03 Experimental Procedures	<p>Identify variables in an investigation</p>	<p>Explain the importance of sampling technique and control variables.</p> <p>Accurately make and record observations and measurements</p>	<p>Correctly use an appropriate number of decimal places.</p> <p>Select and apply appropriate experimental techniques</p>	<p>Accurately make and record observations and measurements.</p> <p>Plan an experiment and explain the importance of repeat readings</p>	<p>Make more complex and quantitative predictions using scientific knowledge and understanding</p>	<p>Plan valid and reliable experimental methods to test a hypothesis</p> <p>Safely carry out practical investigations by creating a full risk assessment</p>	<p>Justify the choice of experimental methods and apparatus</p> <p>Explain accuracy, precision, resolution and reliability</p>	<p>Plan, justify, and carry out a safe, reliable and valid investigation to</p> <p>Use all the correct scientific language throughout.</p>

## Example GCSE topic-specific progression scale for C2

	Step 5	Step 6	Step 7	Step 8	Step 9	Step 10	Step 11	Step 12
AO1 Remember	Explain the properties of 3 states of matter with reference to the particle model	Describe conservation of mass in change of state	Explain temperature in changes of state	Recognise, give examples and describe the structure of fullerenes	Explain changes of state using energy & bonding	Explain chemical bonding using electrostatic forces	Explain how bonding and properties are linked	Explain the strength of covalent bonds
	Draw diagrams to represent bonds	Explain how electrons are involved in bonding	Identify polymers from their unit formula	Explain how properties of materials link to their structure and bonding	Draw dot and cross diagrams for ionic compounds and small molecules	Explain when ionic compounds conduct electricity	Explain how metallic bonding is enabled by delocalised electrons	Explain properties of nanoparticles linking to surface area to volume ratio
	Describe giant structures	Explain the differences in properties of materials	Describe properties of different structures	Use state symbols in equations (s), (l), (g) & (aq)	Describe the purpose of lead-tin alloy	Explain the properties of graphene	Explain similarities of graphite to metals	Deduce molecular formula from models/diagrams
	Use word equations	Use word and symbol equations	Explain how metal atoms are held together	Calculate surface area :volume ratio	Explain why alloys are harder due to structure	Explain why properties of diamond differ to graphite using structure & bonding	Work out charge on ions from their group number	Relate intermolecular forces to properties of polymers
AO2 Application	Describe dissolving in terms of particles	Use data to predict the states of substances	Explain properties of metals & non-metals with reference to their structure	Relate the melting points of ionic compounds to the forces between ions	Describe limitations of models to represent giant structures	Work out empirical formula	Explain why alloys have different properties to elements	Explain limitations of diagrams and models
	Sometimes use data to support evidence.	Link uses to properties	Define ions	Make more complex and quantitative predictions using scientific knowledge and understanding	Draw detailed, evidence-based conclusions.	Justify the choice of experimental methods and apparatus	Suggest detailed improvement to methods	Compare nano-dimensions to dimensions of atoms/molecules
	Evaluate basic information to develop simple arguments and explanations.	Interpret diagrams to determine structure types	Evaluate information to develop arguments and explanations.	Plan an experiment and explain the importance of repeat readings	Safely carry out practical investigations by creating a full risk assessment	Explain accuracy, precision, resolution and reliability	Critically analyse data to draw logical, well-evidenced conclusions	Use all the correct scientific language throughout.
AO3 Analyse and Evaluate	Recognise anomalous results	Explain the importance of sampling technique and control variables	Identify some causes of error	Accurately make and record observations and measurements	Make more complex and quantitative predictions using scientific knowledge and understanding	Describe limitations of models to represent giant structures	Explain why alloys have different properties to elements	Explain limitations of diagrams and models
	Identify variables in an investigation	Accurately make and record observations and measurements	Correctly use an appropriate number of decimal places	Plan an experiment and explain the importance of repeat readings	Make more complex and quantitative predictions using scientific knowledge and understanding	Draw detailed, evidence-based conclusions.	Explain why alloys have different properties to elements	Explain limitations of diagrams and models
AO3 Experimental Procedures		Explain the importance of sampling technique and control variables	Correctly use an appropriate number of decimal places	Plan an experiment and explain the importance of repeat readings	Make more complex and quantitative predictions using scientific knowledge and understanding	Draw detailed, evidence-based conclusions.	Explain why alloys have different properties to elements	Explain limitations of diagrams and models
		Accurately make and record observations and measurements	Correctly use an appropriate number of decimal places	Plan an experiment and explain the importance of repeat readings	Make more complex and quantitative predictions using scientific knowledge and understanding	Draw detailed, evidence-based conclusions.	Explain why alloys have different properties to elements	Explain limitations of diagrams and models

## Examples of use of Progression Scales

When sharing outcomes:

Activate

WALT

- AO1.5 Identify the major parts of the brain
- AO1.6 Describe their function
- AO1.10 Describe how brain function is researched
- AO2.12 Explain why investigating the brain and treating disorders is difficult
- AO3.12 Evaluate the risks & benefits of brain therapy

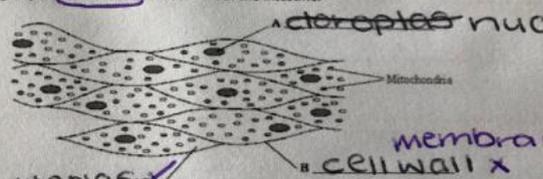
When completing tasks:

C/W RPA 1 6 September, 201

LO: to investigate cells using a light microscope

Do now:  
complete  
exam  
question

AO1 step 5, AO2 step 6 muscle = animal  
The diagram shows a group of muscle cells from the wall of the intestine.



Labels in diagram: chloroplast, nuc, Mitochondria, membran, cell wall x, cytoplasm

(a) On the diagram, use words from the box to name the structures labelled A, B and C.

cell membrane ~~cell wall~~ chloroplast ~~cytoplasm~~ ~~nucleus~~

(b) How are these muscle cells adapted to release a lot of energy?

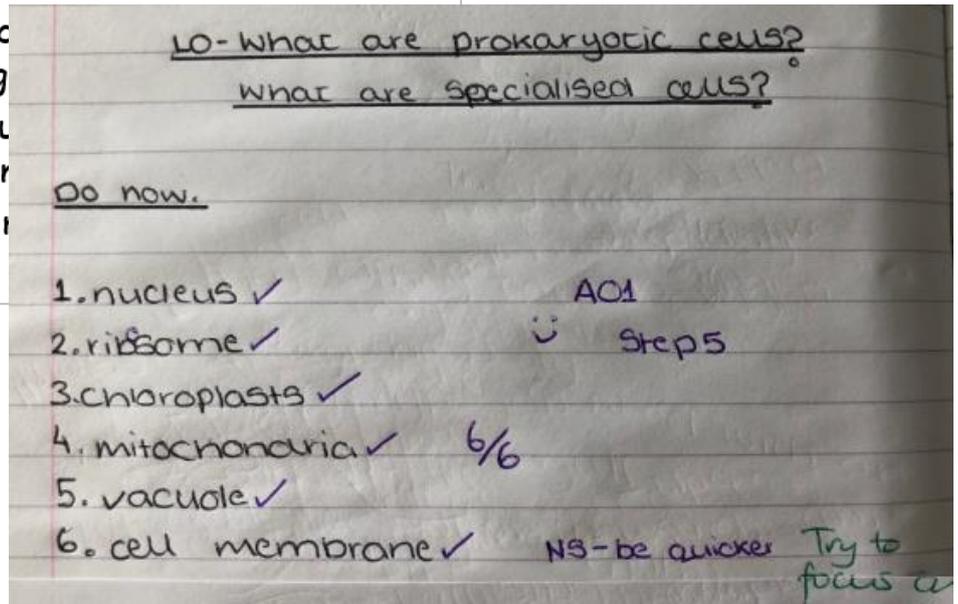
there is lots of mitochondria.  
they release lots of energy  
through respiration.

ssed  
Self

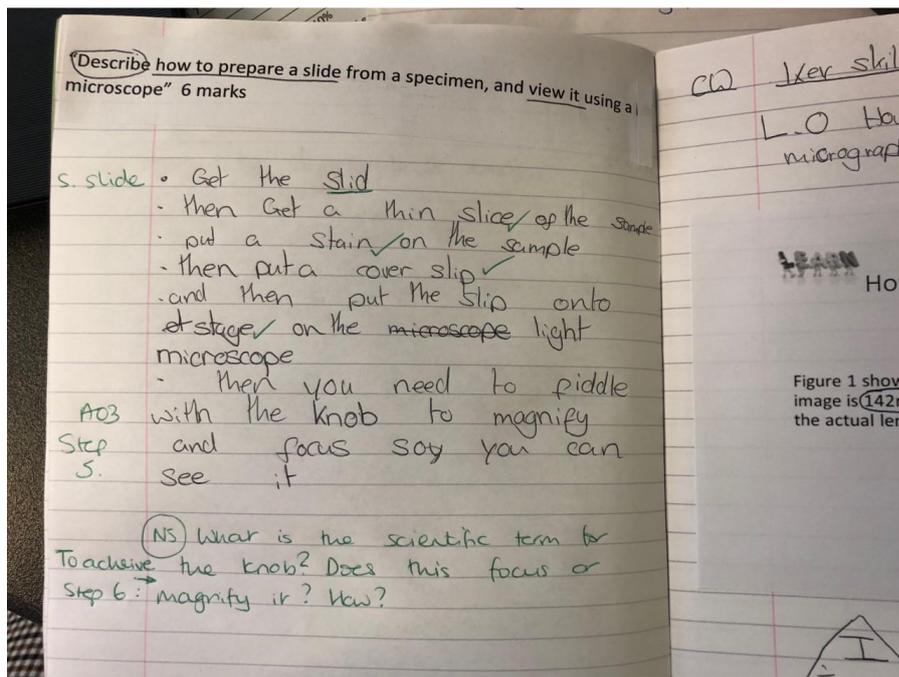
When self- or peer-assessing

**LEARN** Add WWW & NS **Next Steps**

- AO2 5 - Apply the equation  $I = A / M$
- AO2 7 - Change the subject of the formula
- AO2 7 - Simply convert mm to  $\mu\text{m}$
- AO2 7 - Complete calculations involving a unit change
- AO2 9 - Practise questions that need me to use standard form
- AO2 10 - Attempt more complex calculations



In teacher-feedback:



To support student ownership following a test (i.e. PQLA):

Q	Content	RAG
1	AO2.5 Use data to support evidence AO3.5 identify variables	
2	AO2.6 Consistently draw conclusions using available evidence AO2. 8 Interpret data and use it to support evidence	
3	AO1.5 Identify parts of a cell AO1.6 Discuss the role of hormones in the body	
4	AO1.6 Discuss role of hormones in the body AO1.5 Identify methods of contraception AO3.10 (Evaluate) the use of different contraception	
5	AO1.8 Describe the pathway for transition of nerve impulses AO1.9 Understand reflexes AO2.7 Compare nerve and hormone control	
7	AO1.6 discuss roles of hormones in the body AO2. 8 Interpret data and use it to support evidence AO1.9 Describe in detail the components of body control systems	
8	AO1.8 Describe the pathway for transition of nerve impulses AO1.9 Understand reflexes AO3.5 Identify variables in an investigation AO3.7 Select and apply appropriate experimental techniques AO2. 8 Interpret data and use it to support evidence AO3.9 Evaluate the reliability of methods in detail	

## **Enrichment and Extra-Curricular**

We take every opportunity to make links to contexts where science is applied in everyday life and highlight relevant careers in our SOL, as we want students to experience the awe and wonder of science and we have a firm belief in the role of science education in preparing students for life as a well-rounded citizen, and inspiring students to contribute to the field in the future. The achievement of this vision is further supported by extracurricular activities, trips and visits.

The Science department offers weekly enrichment during P6 and also other activities and trips/visits as they arise from external providers.

Ongoing Science offer to be reviewed in 2020:

- Science Club
- Eco-Club
- Medical society – for KS4 students interested in a career in medicine, dentistry and veterinary science
- Period 6 Revision
- Small-group intervention using form time

Extra-curricular visits in the past have included:

- BBC Young Reporter – a hands on experience at BBC Media City (Salford) showcasing STEM careers in the media,
- Radioactive Film preview – to engage lower-achieving and PP girls in contextual science and to celebrate women in STEM
- Medical Marvels – for more-able KS4 students interested in medical careers
- Surprising Science – an opportunity to visit a local college, for students interested in pursuing Science at A level
- Chem Quiz – an annual hands on chemistry challenge, run by RSC and MMU
- GCSE Separate Science masterclasses – pitched at Grade 8/9 students at the lead school for Science in Bolton (Sharples)
- Physics Olympics – an annual hands-on physics and engineering challenge hosted by Bolton School boys' division
- Salters' Festival of Chemistry - an annual hands on chemistry challenge