JOHN PORT SPENCER ACADEMY

Science

Curriculum Overview
Key Stage – KS3 Year -7

Joy | Progress | Success | Act with care, kindness, respect and integrity

Location of resources:	JOHN Science Staff - Documents
Curriculum intent and rationale:	At John Port Spencer we believe in developing a passion for Science. We set high expectations of students to ensure that they can excel in Biology, Chemistry and Physics. In doing so our students are ambitious of what they can achieve. We have an inclusive curriculum in which all students of all abilities have an opportunity to progress at all levels. Our curriculum is designed so that: - Students develop their knowledge and understanding of scientific concepts, building on previous knowledge, so that their understanding deepens over time - Students develop working scientifically skills to that they can predict, plan, carry out, analyse and evaluate their practical scientific investigations - Students are curious about the world around them and are encouraged to ask questions to develop more depth in their understanding. - Students can communicate their ideas, explaining them using the correct scientific language - Students ideas are challenged so that misconceptions are identified and addressed. - Students are inspired to consider a science related career.
National Curriculum Links:	The national curriculum for KS3 science aims to ensure that all pupils: - Develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics - Develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them - Are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future. Scientific knowledge and conceptual understanding.

What content needs to be covered? Key Knowledge and skills / misconceptions to address
By the end of the year students will know:

Term 1	Term 2	Term 3
Students will learn key knowledge and skills about: **Cells and organisation** **Nature of Matter** **Forces** **Challenge:** Students find learning about cells challenging due to several factors, including the abstract nature of cell structures and functions, the complexity of cellular processes, and the difficulty in visualizing and understanding concepts at a microscopic level. Specifically, difficulties arise in grasping the three-dimensional structure of cells, relating structure to function, and comprehending processes like photosynthesis and respiration. **Surface to volume ratio.** This is a challenging idea and involves several mathematical calculations. **Forces** Students find understanding forces challenging due to several reasons, including the abstract nature of forces, misconceptions about how forces act, and difficulties in visualizing and applying force concepts. Specifically, students often struggle with: 1) Forces as interactions between objects, not just properties of objects: They may think forces are something an object possesses rather than a result of interaction. 2) Distinguishing between force and motion: They may think a force is needed to maintain motion, rather than recognizing that a force is needed to change motion. 3) Balancing forces: They may struggle to understand how balanced forces can result in no change in motion.	**Students will learn key knowledge and skills about:** **Reproduction** **Pure and impure** **Energy** **Challenge:** Students often find it challenging to grasp the concept of pure and impure substances, particularly distinguishing between the two and understanding their properties. Many struggle with the idea that everyday materials, like orange juice, are actually mixtures, not pure substances. The melting and boiling points of pure substances are also a source of confusion, as impurities can alter these points. Hormones- to extend the more able we have added in the hormones that control the menstrual cycle. Stem cells – the idea of differentiation and specialized cells can be a challenge. Rf calculations this is a higher level skill to distinguish between different solutes.	**Students will learn key knowledge and skills about:** **Heath and systems** **Periodic table** **Waves** **Challenge:** students often find waves challenging due to their abstract nature, complex terminology, and the need to understand wave behaviour and properties in a way that is not always intuitive. Specifically, difficulties arise in differentiating between wave types, understanding superposition, and visualizing wave propagation. Visking tubing practical and explanations. This is a difficult practical and the understanding of diffusion is required to explain the science. Reactivity explanations. Students can be challenged to look at reactivity and make complex predictions about reactivity and displacement. Atomic structure and links to reactivity. We can extend students by teaching the atomic structure and linking this to the reactivity of elements.

4) Applying force concepts to real-world scenarios: They may have difficulty visualizing and applying force concepts to everyday situations.

Magnification calculations – rearranging of equations and conversions of units.

Misconceptions:

Elements in molecules are compounds e.g. Hydrogen. Students may find the conversion of units difficult. This may arise from the use of prefixes or may be due to uncertainty around converting units of time. Students may not appreciate that forces may be non-contact as well as contact. Students may not understand that fluids can apply a pressure or that this is caused by the motion of particles.
Students may not understand that the motion of objects often arises from the combination of forces.
Students may think that if an object is stationary there cannot be any forces acting on it. They may also think that if an object is moving at a steady speed there must be a steady force causing that to happen. The idea that a force is needed to keep an object moving, that objects "run out" of force, and that forces only come from living things or machines. Additionally, students often struggle with the concept of balanced and unbalanced forces, friction, and the relationship between force, mass, and acceleration. Students may not understand that forces exist when objects interact.

Subject specific terminology
Cell, adapted, diffusion, stoma, surface area, nucleus, volume, variable

Atoms, element, compound, formula, condense, evaporate, matter, melt, freeze, physical, chemical, pressure,

Air resistance, force, effort, elastic, moment, Newton, balanced, contact force, speed, weight, mass, lever. Gravity, upthrust,

Working scientifically

- **Hypothesis:** A testable prediction or explanation.
- **Experiment:** A scientific procedure to test a hypothesis.
- **Control:** A standard for comparison in an experiment.
- **Variable:** A factor that can change in an experiment.
- **Independent Variable:** The factor that is changed or manipulated.
- **Dependent Variable:** The factor that is measured in response to the independent variable.
- **Control Variable:** Factors kept constant during an experiment.
- **Observation:** Using senses to gather information.
- **Prediction:** A statement about what might happen in the future.
- **Evidence:** Data or information that supports a claim.
- **Conclusion:** A statement based on the results of an experiment.
- **Reliability:** The consistency of results.
- **Validity:** Whether an experiment measures what it is intended to measure.

Students find the abstract nature of energy challenging to grasp. It's not a substance they can easily interact with, and it exists in many forms, making it difficult to visualize and understand its conservation. Additionally, everyday language about energy often differs from its scientific definition, leading to confusion.

Misconceptions

Students may believe that some plants are female and others male, rather than understanding that flowering plants have both male and female parts.
Use of the word pure. Pure orange juice for example is not pure in scientific terms

Students may see energy as something that is ‘used up’, as in ‘I can’t run any further, I’ve run out of energy’; they may think that once a fuel or some other energy resource is depleted, this energy ceases to exist.
Students may be confused about the difference between stores of energy and transfers. They may see that fuel is a store but not that a heated object can be a store (a thermal store).

Subject specific terminology

Birth, amnionic fluid, cervix, fallopian tube, uterus, infertility, egg, ovum, puberty, testis, penis, vagina, prostate gland, oviduct, ovary

Dissolve, hazard, impure, insoluble, risk, solubility, soluble, solvent

Conduction, convection, radiation, Joule, power, renewable, thermal conductor, Watt, kinetic, Sankey diagram, potential

Misconceptions:

Students may think that when waves are travelling, the medium itself travels in the same direction that the wave travels (instead of oscillating and returning to its starting position).
Students may struggle to use the correct new terminology to apply to waves. For example, they may not fully grasp that frequency means the number of waves passing a certain point every second, or that the amplitude of a wave means its displacement from a position of being undisturbed.

Students may believe that all fats or carbohydrates are bad for us, particularly if they hold the view above of diet as ‘on a diet’.

Students may struggle to appreciate the calorie as a unit of energy. They may be aware of the joule as a unit of energy.

Subject specific terminology

Addiction, anus, carbohydrate, digestion, fibre, protein, intestine, stomach, fat, lips, obesity, saliva, enzyme

Atomic mass, atomic number, group, period, ductile, halogen, alkali metal,
Noble gas, sonorous, trend, transition metal.

Amplitude, wavelength, frequency, hertz, longitudinal, transverse, vacuum, opaque, lens, incidence, refraction, reflection, retina, spectrum, transparent, convex, concave

Previous learning that is particularly relevant:

Atoms are the building blocks of all materials Cells are the building blocks of living organisms Forces can be contact or non- contact	The part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. Reproduction is the making of new life. Materials have 3 states of matter	Students identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat. Identify that humans and some other animals have skeletons and muscles for support, protection and movement Atoms are the building blocks of materials and that they are very small.
Future Learning - How content prepares students for future units, Key Stage 4 : All topics are an introduction to AQA trilogy and Triple science. Paper 1 and 2. Key skills and words are found throughout their GCSE topics.		

Outcomes:
By the end of the year pupils will be able to

Pupils should be able to:

- Answer questions that demonstrate their scientific knowledge and understanding in Biology, Chemistry and Physics.
- Make predictions, plan and carry out a range of practical work safely and record their results
- Conclude and evaluate their results, making suggestions for improvements
- Identify and classify sources of error
- Apply mathematical concepts such as calculating a mean, drawing a graph and using equations
- Explain how scientific theories might change as new evidence develops and the importance of Peer review

Assessment Strategy How we know our students are knowing and remembering more –
Data from hunting not fishing, formative and summative assessment/s is used to adapt teaching and provide targeted challenge and intervention, supporting SEND and disadvantaged pupils.

Formative: Sticky starters Questioning Use of mini whiteboards Homework – low stakes tests Development tasks – whole class and individual Extended writing tasks Practical investigations and write ups	**Summative (& cumulative)** End of unit tests (3 per half term) Extended writing questions Investigation write ups.	**Opportunities to revisit past learning: All starters have previous learning on them.** Opportunities for homework (including apps): Online homework set on Sparx Revision tasks using BBC KS3 Bitesize

How is the curriculum adapted to meet the needs of SEND and disadvantaged pupils, while maintaining high expectations?

Many of the concepts in science involve abstract ideas. We use visuals and physical models the help students understand fundamental theories like the particle model – a threshold concept which allows them to understand further phenomena. We also use dual coding to help students visualise what it looks like and help them retain this into their long term memory.

There is lots of subject specific vocabulary which is pre taught at the beginning of the lesson. A focus of repeating these key words and returning to them is used to help students retain these in their long term memory.

We use scaffolding techniques to help SEN students make progress. This may be sentence starters, key words to use in order in individual support in starting the task.

These are main strategies we use in Science with our disadvantaged students

- They experience success in every lesson, increasing confidence and a belief in themselves
- Demonstrating excellence to them so that they understand what they are aiming for to increase the expectation of what they can achieve
- Support with resources at home. Many of our disadvantaged students have lower attendance, sometimes through no fault of their own. Having a workbook and revision guides, knowing what sections to complete if they are away helps support their learning and means that they can understand the lesson when they return.

- Priority seating and first for feedback in live marking and hunting not fishing technique

Wider Curriculum and Enrichment – cultural capital and real world application -

Enriching experiences:

Science club afterschool
Competitions

Our curriculum supports the school value of:

Joy	*Foster enthusiasm and engagement by* Engaging experiments, allowing students to actively participate and use these to understand concepts. Opportunities to take science outside, particularly with the Ecology unit. Model building and hands on activities to help with abstract concepts. Games and quizzes to make the learning interactive. A wide range of variety so lessons, although the same format, lessons are not all the same. Working in pairs and groups on activities to engage students with their peers.
Progress	*We monitor and support progress through* Formative feedback, extended writing tasks and clear success criteria. We will regularly analyse misconceptions and dedicate development time in lessons.
Success	*We celebrate success* by Science superstars Test results postcards Excellence points Certificates for key practical work and Bunsen licence
Act with care, kindness, respect, and integrity	*We build meaningful connections with our students* by promoting a safe classroom which is supportive and allows students to ask questions about their learning. Students are expected to work with others safely during practical work.

Literacy, Oracy and disciplinary language:

Key words on all knowledge organisers
Extended writing tasks for all units
Use of scientific key words on starters and throughout resources

Cross-Curricular opportunities / Opportunities to develop 'character':

History – key scientific discoveries/Darwin and evolution
History of medicine

Geography- rocks and Earth

Food technology – nutrition and food groups/microorganisms and disease

Maths- calculations and graph drawing

PE – circulation and breathing/respiration

PRE - ethical issues

Our curriculum supports personal development by:

Careers / Employability skills:
How does the curriculum link to the following employability skills:

Listening – Active listening, which involves focused attention and understanding of what others are saying. It's essential for effective communication, collaboration, and problem-solving. Active listening demonstrates respect, builds rapport, and helps individuals grasp information accurately and efficiently.

Speaking – Speaking skills are crucial for science professionals as they enable effective communication of complex information, collaboration in teams, and successful presentation of research findings. These skills are essential for securing and excelling in scientific careers, encompassing clear and concise communication.

Problem solving – Problem-solving is a crucial employability skill, particularly in science fields, as it involves identifying and analysing problems, developing solutions, and evaluating their effectiveness. Scientific problem-solving relies on critical thinking, creativity, and a systematic approach to finding solutions. Employers highly value candidates who demonstrate

		strong problem-solving abilities, as these skills are transferable to various work situations and contribute to career success. **Aiming high** – Setting ambitious goals, developing relevant skills, and actively seeking opportunities for growth and advancement. It involves proactive planning, a positive attitude towards challenges, and the ability to learn from setbacks. This approach is crucial for success in scientific careers, as it enables individuals to tackle complex problems, collaborate effectively, and contribute to innovation. **Critical thinking –** Critical thinking is a crucial employability skill, particularly valuable in science-related fields. It involves actively analyzing information, evaluating evidence, and solving problems using reasoned judgment. For science graduates, critical thinking is essential for data analysis, research design, and navigating complex scientific concepts **Staying positive –** Staying positive and developing a growth mindset are crucial for success in science-related careers. A positive attitude, resilience, and adaptability are valuable employability skills that can be cultivated through self-reflection, practice, and seeking support. These qualities enhance problem-solving, foster innovation, **Leadership –** Leadership skills, in particular, demonstrate an individual's ability to motivate, manage, and influence others, making them valuable assets to any organization **Teamwork –** Teamwork is a crucial employability skill involving working effectively with others to achieve a shared goal. It encompasses various sub-skills like communication, problem-solving, active listening, and conflict resolution. Developing these skills enhances collaboration, efficiency, and overall productivity **Creativity –** Creativity is a highly valued employability skill across all fields, including science and technology. It enables individuals to approach problems with innovative solutions, adapt to change, and contribute to advancements. **Employment Sectors discussed include:** The **career profiles** show how the science in that unit relates to the rest of life and expose pupils to a broad range of roles and diverse representations of careers, building pupils' cultural capital and science identity.

		This involves careers such as doctors, gene therapists, radiographers, opticians, hearing specialists, nutritionists, pharmacists, engineers and pilots. The profiles can be used in a variety of ways to suit each class and may provide a stimulus for further links between what they are learning and careers that this links with.

Curriculum impact is evaluated through pupil study, work scrutiny, and progress data. Findings inform regular curriculum review to ensure continuous improvement.

When was this curriculum last reviewed? Include date	What changes were made and why?	How is ongoing improvement ensured?
Summer 2025	**More working scientifically to embed the key skills required for KS4**	