YEAR 10 2023-2024 SPR 2

‘An ambitious curriculum that meets the needs of all’

Medium Term Planning - Topic: Atomic Structure

Curriculum Intent	In addition to working further on objectives from Years 7-9, pupils will be taught, following National Curriculum guidelines, the following this topic:
Skills/Assessment Objective Links	• The nuclear model and its development in the light of changing evidence. • Masses and sizes of nuclei, atoms and small molecules. • Differences in numbers of protons, and neutrons related to masses and identities of nuclei, Isotope characteristics and equations to represent changes. • Ionisation; absorption or emission of radiation related to changes in electron orbits. • Radioactive nuclei: emission of alpha or beta particles, neutrons, or gammarays, related to changes in the nuclear mass and/or charge. • Radioactive materials, half-life, irradiation, contamination and their associated hazardous effects, waste disposal. • Nuclear fission, nuclear fusion and our Sun’s energy.
Spiritual, moral, social, and cultural development	**SMSC:** Ionising radiation is hazardous but can be very useful. Throughout this topic students learn about the tradeoffs society makes between these risks and benefits, discussing the moral and social implications of both. Although radioactivity was discovered over a century ago, it took many nuclear physicists several decades to understand the structure of atoms, nuclear forces and stability. Students learn about the scientific model and how we develop our understanding of the world around us as a global community. **PSHE/British Values:** Early researchers suffered from their exposure to ionising radiation. Rules for radiological protection were first introduced in the 1930s and subsequently improved. Students learn about the requirements for laws to keep people safe and the ethical considerations for new research. Today radioactive materials are widely used in medicine, industry, agriculture and electrical power generation. Students learn about many possible career areas and the importance of safety and oversight in radioactive material industries. **Skills Builder:** Understanding how scientific ideas develop over time (the scientific model). Use and interpretation of models. Analysis and evaluation skills. Understanding and using probability. Discussing and debating opposing arguments.
Numeracy	**Arithmetic and numerical computation:** Recognise and use expressions in decimal form. Recognise and use expressions in standard form. Use ratios, fractions and percentages. Make estimates of the results of simple calculations. **Handling data:** Use an appropriate number of significant figures. Find arithmetic means. Construct and interpret frequency tables and diagrams, bar charts and histograms. Understand the terms mean, mode and median. Use a scatter diagram to identify a correlation between two variables. Make order of magnitude calculations. **Algebra:** Understand and use the symbols: =, <, <<, >>, >, ∝ , ~ . Change the subject of an equation. Substitute numerical values into algebraic equations using appropriate units for physical quantities. Solve simple algebraic equations. **Graphs:** Translate information between graphical and numeric form. Understand that y = mx + c represents a linear relationship. Plot two variables from experimental or other data. Determine the slope and intercept of a linear graph. Draw and use the slope of a tangent to a curve as a measure of rate of change. Understand the physical significance of area between a curve and the x-axis and measure it by counting squares as appropriate. **Geometry and trigonometry:** Use angular measures in degrees. Visualise and represent 2D and 3D forms including two dimensional representations of 3D Objects. Calculate areas of triangles and rectangles, surface areas and volumes of cubes.

Literacy	**Vocabulary Tier 2:** Alpha, Beta, Gamma, nucleus/nuclei, radiation, fusion, fission, irradiation, contamination. **Vocabulary Tier 3: H**alf-life, decay, radioactive, radioactivity, activity, Becquerel, ions, isotopes, contamination. **Reading:** Students are given opportunity to develop their skills in specified tasks that develop disciplinary literacy. Throughout the GCSE Physics and Combined Science course they develop their understanding of the requirements of exam questions and the key terminology in questions. In addition, they read practical methodology and translate this to actions in laboratory tasks. **Writing:** Students construct answers independently and through class teaching. Their answers range from single word answers to the planning and writing of 6-mark "extended writing" tasks that require linking of multiple concepts from a topic. These often develop students ability to construct written evaluations of contrasting situations, where the use of comparative connectives are required. **Oracy:** Students are regularly given the opportunity to practice their scientific vocabulary in class discussion, through choral response and in giving instruction to others during practical activities.
Becoming future ready	**Careers/Employability:** Medical treatment and diagnosis (radiology), medical research, nuclear power, nuclear fusion research and R&D, infrastructure repair and maintenance, military, environmental conservation and repair, food supply logistics, archaeology and earth science, theoretical and particle Physicist.
Adaptation **QFT/SEND Provision**	Throughout this topic, quality first teaching will provide differentiation: **By product:** Assessments have opportunities for students to achieve all grades, with structured questions and opportunities for development of extended writing for all abilities. **By resource:** PowerPoints, worksheets and booklets are differentiated as appropriate and produced in conjunction with class teachers for students who would benefit from additional scaffolding of resources in order to achieve their potential. **By Intervention**: by providing different levels of supervision and support, including the specific deployment of teaching assistants within lessons. Structured intervention is planed and delivered based on summative assessment results. **By Progressive Questioning:** exploring pupils' understanding through interactive dialogue. **By Grouping:** according to prior attainment, gender, social preference. **By Task:** Pupils should be involved in the identification of targets which are meaningful to them and in the selection of an appropriate task from the given range. **By Offering Optional Activities:** In class or as homework, to extend learning. This QFT/SEND provision will be explicit within the lesson-by-lesson schemes of work.
Implementation Curriculum Delivery	To be able to: • P.4.1.1.a. - I can describe the basic structure of an atom as a positively charged nucleus surrounded by negatively charged electrons at different distances from the nucleus, which vary with the absorption or emission of electromagnetic radiation • P.4.1.2.a. - I can state that the radius of a nucleus is less than 1/10000 of the radius of an atom.

Learning Outcomes (Knowledge)	• P.4.1.2.b. - I can relate differences between isotopes to differences in conventional representations of their identities, charges and masses • P.4.1.3.a. - I can describe why the evidence from Rutherford's scattering experiment led to a change in the atomic model, describing differences between the plum pudding model of the atom and the nuclear model of the atom • P.4.2.1.a. - I can describe and apply the idea that the activity of a radioactive source is the rate at which its unstable nuclei decay, measured in becquerel (Bq), or counts per second, by a Geiger-Muller tube • P.4.2.1.b. - I can describe the penetration through materials, the range in air and the ionising power for alpha particles, beta particles and gamma rays • P.4.2.1.c. - I can apply knowledge of the uses of radiation to evaluate the best sources of radiation to use in a given situation • P.4.2.2.a. - I can use the names and symbols of common nuclei and particles to complete balanced nuclear equations, by balancing the atomic numbers and mass numbers • P.4.2.3.b (HT) - I can determine the half-life of a radioactive isotope from given information and calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives • P.4.2.4.a. - I can compare the hazards associated with contamination and irradiation, and outline suitable precautions taken to protect against any hazard the radioactive sources may present • P.4.2.4.b. - I can discuss the importance of publishing the findings of studies into the effects of radiation on humans, and sharing findings with other scientists so that they can be checked by peer review
Current learning to be developed in the future within:	• Topic 6 – Waves • Topic 8 – Space.
Assessment	Refer to assessment maps for formative and summative assessment opportunities.
Impact	Attainment and Progress – Refer to assessment results / data review documentation.