P4 Atomic Structure Learning Journey
Combined Science

What have I done previously in my learning journey?	
Previously….	**You have learnt previously about atoms, elements and compounds. This has involved:** • Learning about a simple atomic model, symbols, relative atomic mass, electronic charge and isotopes • Learning about how the model of the atom has developed over time
In this topic…	Ionising radiation is hazardous but can be very useful. 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. Early researchers suffered from their exposure to ionising radiation. Rules for radiological protection were first introduced in the 1930s and subsequently improved.

We will develop our learning by studying the following each lesson:	RAG	Skills in Science checklist
P4.01 Atomic Structure • Describe the basic structure of an atom • Describe how the distance of changed particles vary with the absorption or emission of electromagnetic radiation • Define electrons, neutrons, protons, isotopes and ions		☐ Scientific methods ☐ Practical ☐ Number skills ☐ Application ☐ Communication
P4.02 Discovering the Nucleus • Describe how the atomic model has changed over time due to new experimental evidence • Describe and explain the alpha scattering experiments		☐ Scientific methods ☐ Practical ☐ Number skills ☐ Application ☐ Communication
P4.03 Radioactivity • 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) by a Geiger-Muller tube • Describe the penetration through materials, the range in air and the ionising power for alpha particles, beta particles and gamma rays • Apply knowledge of the uses of radiation to evaluate the best sources of radiation to use in a given situation		☐ Scientific methods ☐ Practical ☐ Number skills ☐ Application ☐ Communication
P4.04 Nuclear Equations • Describe what happens to an atom when it undergoes radioactive decay • Write nuclear decay equations • Deduce the nature of decay using changes to mass and charge		☐ Scientific methods ☐ Practical ☐ Number skills ☐ Application ☐ Communication
P4.05 Half-Life • Define half-life of a radioactive isotope • HT ONLY: 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		☐ Scientific methods ☐ Practical ☐ Number skills ☐ Application ☐ Communication
P4.06 Contamination and Irradiation • Compare the hazards associated with contamination and irradiation and outline suitable precautions taken to protect against any hazard the radioactive sources may present • 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		☐ Scientific methods ☐ Practical ☐ Number skills ☐ Application ☐ Communication

Key Vocabulary

Atom	**Absorption**	**Emission**	**Electrons**	**Neutrons**	**Protons**	**Isotopes**	**Ions**	**Alpha**
Beta	**Gamma**	**Becquerel**	**Geiger-muller tube**	**Penetration**	**Ionising power**	**Half-life**	**Contamination**	**Radiation**

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Future Learning	Studies at AS-level and A-level include Quantum and nuclear physics • photons and particles: • photon model to explain observable phenomena • evidence supporting the photon model • wave-particle duality, particle diffraction • nuclear decay: • connections between nature, penetration and range of emissions from radioactive substances • evidence for existence of nucleus • activity of radioactive sources and idea of half-life • modelling with constant decay probability leading to exponential decay • nuclear changes in decay • nuclear energy: • fission and fusion processes • $E = mc^2$ applied to nuclear processes • calculations relating mass difference to energy change
In careers	Today radioactive materials are widely used in medicine, industry, agriculture and electrical power generation. • Nuclear Medicine Technologist - £44,087 per year • Nuclear Engineer - £38, 141 per year