P4 Atomic Structure

Atoms and Isotopes	Atoms are very small, having a radius of in the region of 1×10^{-10} metres The nucleus is 1/10,000 smaller $=1 \times 10^{-14}$m across. Most of the mass of an atom is concentrated in the nucleus. The electrons are arranged at different distances from the nucleus (different energy levels). The electron arrangements may change with the absorption of electromagnetic radiation (move further from the nucleus; a higher energy level) or by the emission of electromagnetic radiation (move closer to the nucleus; a lower energy level).	Green	Amber	Red
Mass number, atomic number, isotopes	Be able to identify the atomic (proton) number, mass number. Know that the number of electrons = number of protons in a neutral atom and why. Calculate the number of neutrons. Know the definition of the term isotope. Know how ions are produced (positive and negative).	Green	Amber	Red
The development of the model of the atom	Description and explanation of the following: The plum pudding model (JJ Thomson) The 3 observations and implications of the Rutherford alpha scattering experiment. **Rutherford's** initial nuclear model. Bohr's atom (electron energy levels) Chadwick and the implications of the discovery of the neutron.	Green	Amber	Red
Atoms and Nuclear radiation	Define the following terms**:** 1. **Radioactive** 2. **Activity** 3. **Count rate** 4. **The Becquerel (Bq)** Identify the structure, nature and properties (relative mass, relative charge, range in air, penetrability and ionising power) of: **Alpha particles** **Beta particles** **Gamma rays**	Green	Amber	Red
Nuclear equations	Be able to complete nuclear equations for: **Alpha decay** **Beta decay** Be able to describe the changes in the nucleus that occur on each decay.	Green	Amber	Red

	Explain why there is no change of element when **gamma radiation** is emitted.			
Half life	Definition of **half-life.** Determining half-life from data/ graphs Students should be able to calculate the overall reduction, expressed as a ratio, in a radioactive emission after a given number of half-lives. (HT only)	Green	Amber	Red
Contamination	Explain the difference between **contamination** and **irradiation**. Describe the **negative effects on body tissue** of extended irradiation by nuclear radiation. Interpreting data on exposure and dose.	Green	Amber	Red
Background radiation (Physics only)	Background radiation is around us all of the time. It comes from: • natural sources such as rocks and cosmic rays from space • man-made sources such as the fallout from nuclear weapons testing and nuclear accidents. The level of background radiation and radiation dose may be affected by occupation and/or location. Radiation dose is measured in Sieverts (Sv)	Green	Amber	Red
Uses of nuclear radiation (Physics only)	How nuclear radiations are used in medicine for the: • exploration of internal organs • Control or destruction of unwanted tissue. You should be able to: • describe and evaluate the uses of nuclear radiations for exploration of internal organs, and for control or destruction of unwanted tissue (cancer treatment). • Evaluate the perceived risks of using nuclear radiations in relation to given data and consequences with reference to the half-life of the isotope used.	Green	Amber	Red
Nuclear Fission (Physics only)	Describe what fission is. Describe the process of induced nuclear fission (involving a neutron). Describe the setting up of a chain reaction. Distinguish between controlled fission (in a power station) and uncontrolled fission (in a bomb), explaining how it is controlled in a nuclear reactor (moderator, coolant and control rods). Students should be able to draw/interpret diagrams representing nuclear fission and how a chain reaction may occur.	Green	Amber	Red
Nuclear Fusion (Physics only)	Fusion is the joining of two light nuclei to form a heavier nucleus. In this process, some of the mass may be converted into the energy of radiation. This process fuels the sun.	Green	Amber	Red