Demonstrate understanding of atoms, photons and nuclei

Phenomena, concepts and principles of atoms, photons and nuclei:

The Bohr model of the hydrogen atom; the photon; the quantisation of energy; discrete atomic energy levels; electron transition between energy levels; ionisation; atomic line spectra (infrared, visible and ultraviolet); the photoelectric effect; the electron volt; description of the particle/wave duality of light; nuclear binding energy and mass deficit; conservation of mass-energy for nuclear reactions.

Relationships:

$E = hf$ $\quad hf = \phi + E_K$ $\quad E = \Delta mc^2$ $\quad E_n = -\frac{hcR}{n^2}$

$\frac{1}{\lambda} = R(\frac{1}{S^2} - \frac{1}{L^2})$

Checklist:

- ❒ Appreciate the history of the discovery of atomic spectra: Lyman, Balmer, Pfund.
- ❒ Demonstrate knowledge of the photon, the quantisation of energy, discrete atomic energy levels. Electron transition between energy levels; ionisation
- ❒ Demonstrate a knowledge of the production of emission and absorption spectra
- ❒ Explain Atomic line spectra (infrared, visible and ultraviolet): Rydberg formula for the hydrogen atom
- ❒ Calculate the energy associated with a particular emission or absorption line using E = hf
- ❒ Define the electron volt.
- ❒ Describe Rutherford's explanation and hence his model for the atom
- ❒ Describe the Bohr model of the hydrogen atom
- ❒ Understand how the energy level diagram arises, and calculate the various energy levels
- ❒ Demonstrate an understanding of major conservation laws: Conservation of linear momentum, charge, nucleon number and mass-energy for nuclear reactions (fission, fusion: alpha, beta and gamma decay)
- ❒ Understand atomic structure
- ❒ Recall the history of radioactivity and its discovery
- ❒ Describe the effects of radioactive decay
- ❒ Write and balance equations for nuclear transformations
- ❒ Explain the terms "fission" and "fusion". Describe these terms using equations
- ❒ Apply the equation $E = mc^2$
- ❒ Understand the terms "binding energy", "mass deficit" and carry out numerical calculations
- ❒ Demonstrate an understanding of the photoelectric effect experiment
- ❒ Recall the relationship between E and f for an electromagnetic wave
- ❒ Apply Einstein's equation for the photo electric effect to practical situations
- ❒ Describe the particle/wave duality of light