2024 Higher Chemistry Paper 1 – Q1

Section: Chemical Changes and Structure
Topic: Periodicity (Ionisation Energy)

Question summary (Q1):
The difference between the first ionisation energies of sodium and chlorine is mainly due to the difference in:
A number of electrons B number of neutrons C number of protons D mass of each atom.

Worked Solution:
• First ionisation energy = energy required to remove one mole of electrons from one mole of gaseous atoms.
• Sodium has 11 protons; chlorine has 17 protons.
• A higher number of protons increases the nuclear charge → stronger attraction between nucleus and electrons.
• This stronger attraction in chlorine means a higher first ionisation energy compared with sodium.
• Therefore, the key factor is the difference in number of protons.

Final Answer: C — number of protons

Revision Tips:
• First ionisation energy depends mainly on:
  – Nuclear charge (number of protons).
  – Distance of outer electrons from nucleus.
  – Electron shielding by inner shells.
• Across a period: ionisation energy generally increases as protons increase and atomic radius decreases.