2024 Higher Chemistry Paper 1 – Q3

Section: Chemical Changes and Structure
Topic: Structure & Bonding (Pure vs Polar Covalent)

Question summary (Q3):
Which of the following contains pure covalent bonds?
A CO_2 B H_2S C PH_3 D CF_4

Worked Solution:
• Pure covalent ≈ non-polar covalent: the two atoms in the bond have (effectively) the same electronegativity, so electrons are shared equally.
• CO_2: C=O bonds are polar (O ≫ C in electronegativity) → not pure covalent.
• H_2S: S–H bonds are moderately polar (S > H) → not pure covalent.
• CF_4: C–F bonds are strongly polar (F ≫ C) → not pure covalent.
• PH_3: P and H have almost the same electronegativity → P–H bonds are effectively non-polar (pure covalent).

Final Answer: C — PH_3

Revision Tips:
• “Pure covalent” ≈ negligible electronegativity difference (e.g. H–H, Cl–Cl, or near-equal pairs like P–H).
• “Polar covalent” when there is a significant electronegativity difference (C–O, C–F, S–H).
• Molecular shape can cancel dipoles for overall polarity, but bond polarity depends on the two atoms joined.