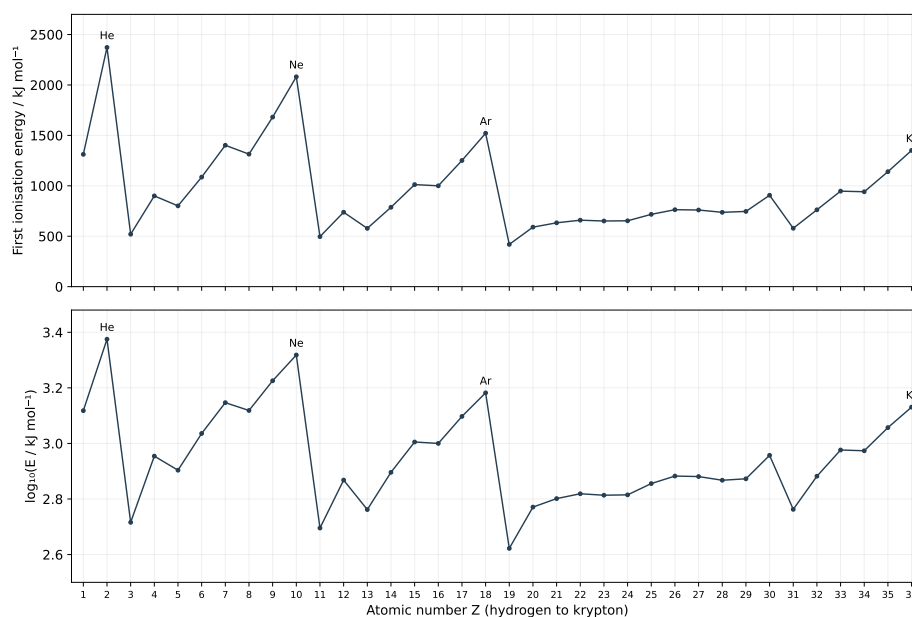


Solutions

Original authored marking guidance; accept equivalent reasoning and sensible plotting accuracy.

2.1 K s-block, Sc d-block and As p-block. He is s-block because its electrons occupy $1s^2$; the column reflects its full outer shell and chemical behaviour, not a p-electron configuration.

2.2



Linear axes labelled with Z and energy/unit and a consistent scale; all linear points correctly placed. Log axis labelled and scaled, all transformed points correctly placed. He, Ne, Ar and Kr identified as the noble-gas peaks; same ordered data on both plots with no substitution of successive ionisations for different atoms. Accept a correctly labelled logarithmically scaled energy axis.

3.1 He→Li, Ne→Na and Ar→K. The new outer shell puts the electron further from the nucleus with increased shielding; this outweighs the increase in nuclear charge, so less energy removes it. A log axis compresses the large numerical range and makes proportional changes easier to compare.

3.2 Be [He] $2s^2$; B [He] $2s^2 2p^1$: the B electron is removed from the higher-energy 2p sub-shell, outweighing increased nuclear charge. N [He] $2s^2 2p^3$ has singly occupied p orbitals; O [He] $2s^2 2p^4$ has a first pair, whose repulsion makes one electron easier to remove. No new occupied shell is added in these comparisons.

3.3 Li/Be metallic; B/C giant covalent; N₂/O₂/F₂ simple molecular and Ne monatomic. Carbon melting requires overcoming many strong covalent bonds in its giant structure. Melting nitrogen overcomes attractions between N₂ molecules, retaining the covalent triple bonds inside each molecule. The diagram of a molecule does not imply a giant covalent lattice.

3.4 Valid internal decreases include Be→B, N→O, Mg→Al, P→S, Ti→V, Fe→Co, Co→Ni, Zn→Ga and As→Se. Melting involves the solid's bonding/structure and attractions be-

tween its particles, rather than removal of one electron from gaseous atoms; first ionisation alone does not determine it.