Mark Scheme - Electron Configuration (SL)

Paper 1A

- A

- B

- A

- B

- B

- D

- D

- B

- B

- A

- A

- B

- B

- C

- B

- B

- C

- B

- A

- B

Paper 1B

- 1. (a) 4 marks: Correct axes with labels (1), all points plotted correctly (1), smooth best-fit line (1), linear trend through origin (1).

- 1. (b) 0.40 absorbance corresponds to a concentration of roughly 0.08 mol dm^{-3} (reading from graph) [1].

- 1. (c) At λ_{max}, the absorbance is highest, which minimizes the relative error in measurements and provides maximum sensitivity [1].

- 2. (a) $E = hc/\lambda$. $E = (6.63 \times 10^{-34} \times 3.00 \times 10^{8}) / (486 \times 10^{-9}) = 4.09 \times 10^{-19}$ J [3].

- 2. (b) Visible Balmer series: $n_{initial} > 2$, $n_{final} = 2$ [1].

Paper 2

- 1. (a) Degenerate: Orbitals that have the same energy level [1].

- 1. (b) $\Delta E = hc/\lambda$; Wavelength is inversely proportional to splitting energy [1].

- 1. (c) Different ligands exert different electrostatic fields on the d-orbitals [1], causing different splitting gaps (ΔE) and thus absorption of different wavelengths [1].

- 1. (d) 410 nm absorbs violet light. Observed color is the complementary color: Yellow [1].

- 2. (a) [Ar] $3d^{10}$ $4s^{1}$ has a fully-filled 3d subshell, which offers extra stability compared to the partially filled subshell in [Ar] $3d^{9}$ $4s^{2}$ [2].

- 2. (b) (i) Fe^{3+}: [Ar] $3d^{5}$ [1]. (ii) Zn: [Ar] $3d^{10}$ $4s^{2}$ [1].

- 3. (a) Correct order: 1s < 2s < 2p < 3s < 3p < 4s < 3d [3].

- 3. (b) As the principal quantum number (n) increases, the energy differences between successive levels decrease, causing the emission lines to merge at the high-frequency series limit [2].

- 3. (c) Ionization energy at convergence limit (91.2 nm): $E = hc/\lambda = (6.63 \times 10^{-34} \times 3.00 \times 10^{8}) / (91.2 \times 10^{-9}) = 2.18 \times 10^{-18}$ J [3].