Chemistry

Standard level

Paper 2

Practice paper

Topic: Electron Configuration (SL)

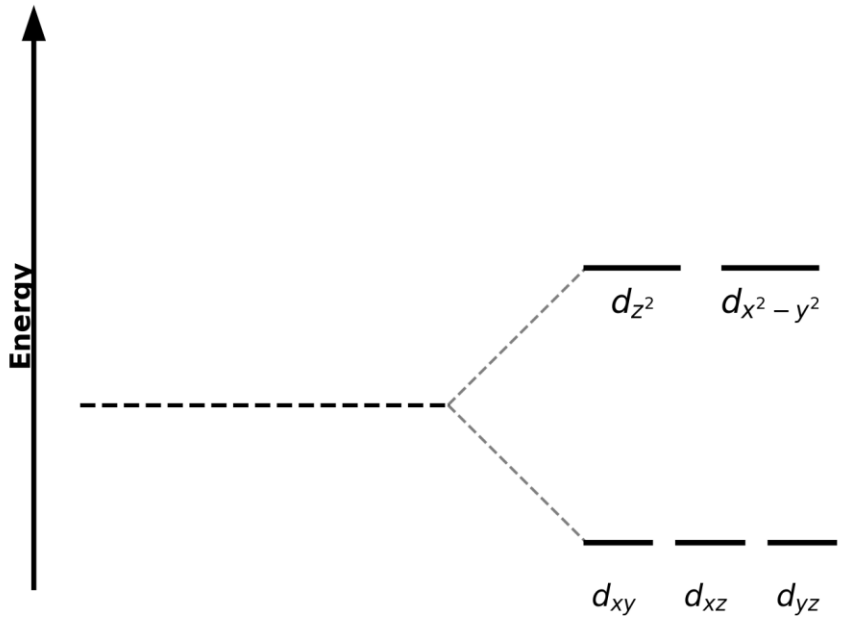
1. Transition metals create color through ligand field splitting. The diagram below shows the d-orbitals in an octahedral field.

(a) Define the term 'degenerate' in the context of atomic orbitals. [1]

(b) State the relationship between the energy difference (ΔE) in the split d-orbitals and the wavelength of light absorbed by the complex. [1]

(c) Explain how the identity of the ligands surrounding a transition metal ion influences the color of the complex. [2]

(d) Substance X absorbs light at a wavelength of 410 nm. Refer to the Data Booklet to deduce the color observed. **[1]**



Octahedral

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2. Electron configurations for transition metals and their ions.
   (a) Justify the configuration of Copper as [Ar] $3d^{10}$ $4s^1$ rather than [Ar] $3d^9$ $4s^2$. [2]
   (b) Deduce the electron configurations for the following species: [2]
      (i) Fe^{3+} ion
      (ii) Zn atom

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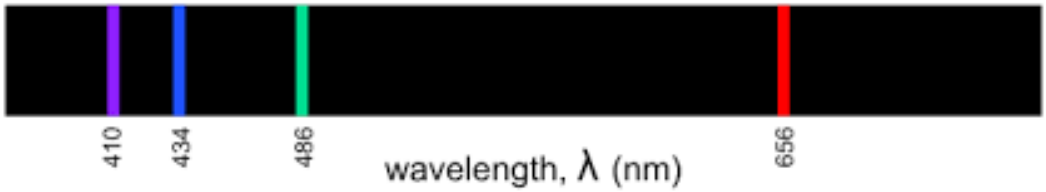
3. The Bohr model provides a foundation for the quantum mechanical model of the atom.
   (a) Draw an energy level diagram showing the 1s, 2s, 2p, 3s, 3p, 4s, and 3d sublevels in order of increasing energy according to the Aufbau principle. [3]
   (b) Explain, with reference to the hydrogen spectrum, why the energy levels converge at higher n integers. [2]
   (c) Calculate the energy required, in Joules, to ionize a hydrogen atom in its ground state (n=1) if the convergence limit of the Lyman series occurs at 91.2 nm. **[3]**



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