1. Without reference to a periodic table, name in periodic order, each of the transition elements in row 3 of the periodic table.

    Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn

2. Arrange the following ligands in order of increasing Δ observed with a given metal ion: Br, C₂O₄²⁻, Cl⁻, CN⁻, CO₃, en (ethylene diamine), F⁻, NH₃, H₂O

    Br⁻ < Cl⁻ < F⁻ < C₂O₄²⁻ < H₂O < NH₃ < CN⁻ < CO₃⁻ < CO

3. Draw energy diagrams for the splitting of d orbitals in:
   an octahedral field; a tetrahedral field; a square planar field

   \[ \begin{array}{cccc}
   z^2 & x^2 - y^2 & xy & xz \\
   yz & z^2 & x^2 - y^2 & xy \\
   \end{array} \]

4. For the [Cr(H₂O)₆]²⁺ ion, the mean pairing energy, P, is found to be 23,500 cm⁻¹. The magnitude of Δ is 13,900 cm⁻¹. Calculate the crystal field stabilization energy for the complex in configurations corresponding to high spin and low spin states. Which complex is more stable?

   \[
   \begin{align*}
   \text{high spin} & \quad -4 \Delta = -8350 \text{cm}^{-1} \\
   \text{low spin} & \quad 4 \Delta + P = -16 \Delta + P = -16(13900 \text{cm}^{-1}) + 23500 \text{cm}^{-1} = 1280 \text{cm}^{-1}
   \end{align*}
   \]

   (Extra credit)

   Without reference to a periodic table, name in periodic order, each of the transition elements in row 4 of the periodic table.

    Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, Cd