1. As shown in Figure 24.26 of the course textbook, the d-d transitions of \([\text{Ti(H}_2\text{O)}_6]\)^{3+} produces an absorption maximum at a wavelength of 500 nm. (a) What is the magnitude of \(\Delta\) for \([\text{Ti(H}_2\text{O)}_6]\)^{3+} in kJ/mol? (b) What is the spectrochemical series? How would the magnitude of \(\Delta\) change if the H\(_2\)O ligands in \([\text{Ti(H}_2\text{O)}_6]\)^{3+} were replaced with NH\(_3\) ligands?

2. Draw the crystal-field energy-level diagrams and show the placement of electrons for the following complexes: (a) \([\text{Mn(H}_2\text{O)}_6]\)^{2+} (high spin), (b) \([\text{IrCl}_6]\)^{2–} (low spin).

3. (a) How can we calculate \(\Delta S\) for an isothermal process? (b) Does \(\Delta S\) for a process depend on the path taken from the initial to the final state of the system? Explain.

4. Indicate whether each of the following processes produces an increase or decrease in the entropy of the system:
   (a) \(\text{CO}_2\) (s) \(\rightarrow\) \(\text{CO}_2\) (g)
   (b) \(\text{CaO}\) (s) + \(\text{CO}_2\) (g) \(\rightarrow\) \(\text{CaCO}_3\) (s)
   (c) \(\text{HCl}\) (g) + \(\text{NH}_3\) (g) \(\rightarrow\) \(\text{NH}_4\text{Cl}\) (s)
   (d) 2 \(\text{SO}_2\) (g) + \(\text{O}_2\) (g) \(\rightarrow\) 2 \(\text{SO}_3\) (g)

5. The normal freezing point of 1-propanol (C\(_3\)H\(_8\)O) is –127 °C. (a) Is the freezing an endothermic or exothermic process? (b) In what temperature range is the freezing of 1-propanol a spontaneous process? (c) In what temperature range is it a nonspontaneous process? (d) Is there any temperature at which liquid and solid 1-propanol are in equilibrium? Explain.