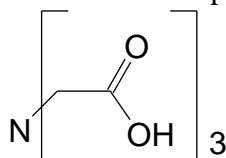
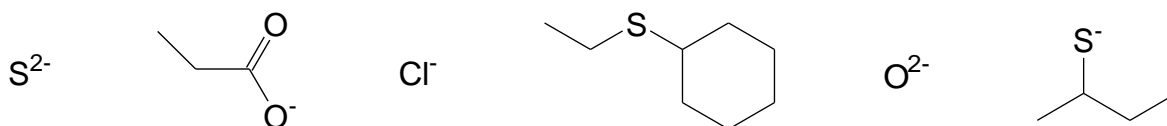


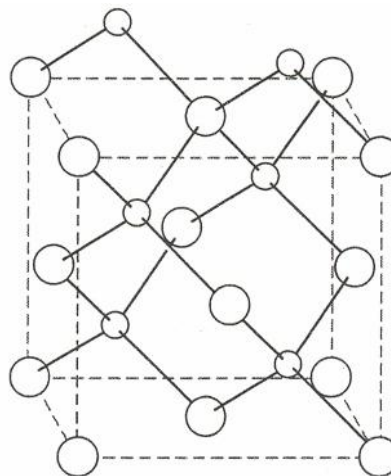
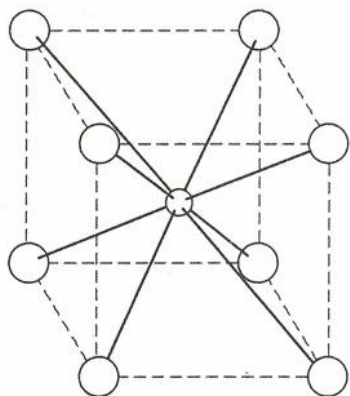
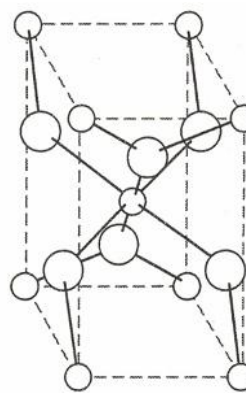
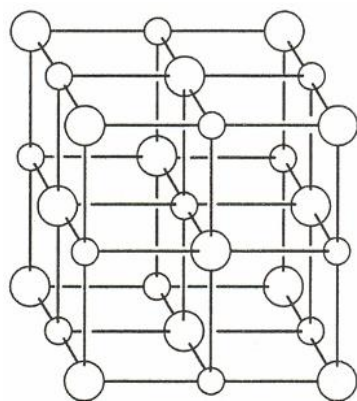
- The dissolution of rubidium chloride in water has an entropy change of  $+14.5 \text{ J/mol}\cdot\text{K}$ . When magnesium chloride is dissolved in water, the entropy change is  $-23.3 \text{ J/mol}\cdot\text{K}$ . Explain.
- Nitrilo-tris(acetic acid) forms very stable complexes with a variety of metal ions, especially those more to the left side of the Periodic Table. Explain.



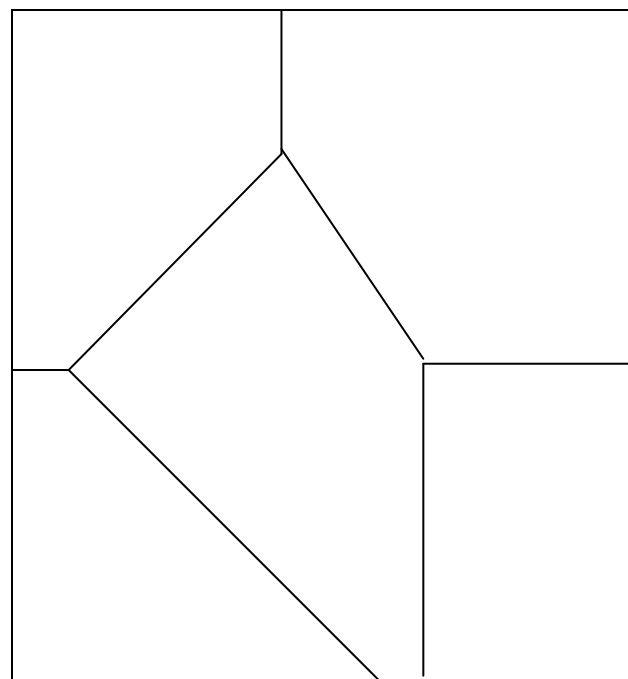
- Rank the following bases from hardest to softest. Explain your ranking. Suggest a metal ion that you would expect to form a stable complex with each of these ligands and explain why.



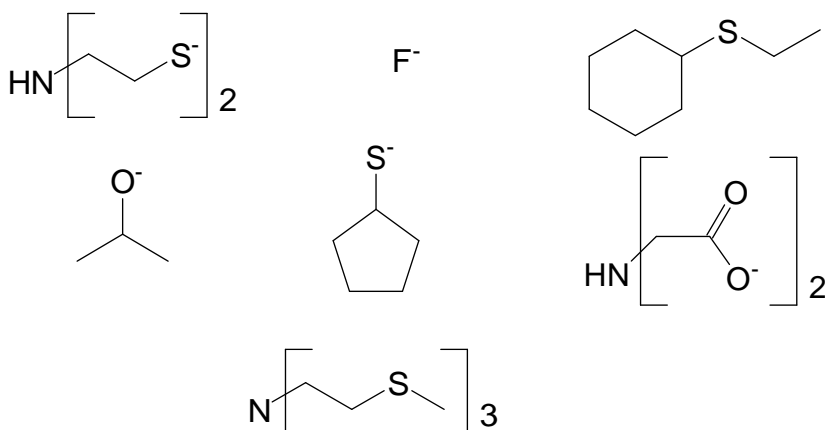
- You have crystallized Zirconium(IV) sulfide and are attempting to determine the unit cell of its crystal lattice. Which of the following unit cells is reasonable? Explain.



5. A technician in your lab has conducted a series of measurements and constructed the following Pourbaix Diagram. Unfortunately, your careless technician forgot to label the diagram and has just left for a 2-week vacation. You know that the technician measured properties over  $0 < \text{pH} < 14$  and  $-1.5\text{V} < E_{\text{red}}^{\circ} < +1.5\text{V}$ . You also know that the species involved are:  $A$ ,  $A^+$ ,  $A^{3+}$ ,  $\text{AOH}$ ,  $\text{A}(\text{OH})_3$ ,  $[\text{A}(\text{OH})_4]^{3-}$ ; but *not all of these species appear on the diagram!* Label the diagram, including the axes. Explain your choices. If all six of the species were to appear on the Pourbaix diagram, where would you expect the “extra” one to appear? Redraw the diagram to include all six.



6. You have combined aqueous solutions of potassium dichromate ( $\text{K}_2\text{Cr}_2\text{O}_7$ ) and thallium(I) chloride. Will a reaction occur? Why or why not? If a reaction will occur, write the correctly balanced equation. Will pH have an effect upon this reaction? If so, what will be the effect? The equilibrium of a system can be made more product-favored by including a ligand in the system that will form a very stable complex with one or more of the products (but not a very stable complex with the reactants). If you had the following ligands available to add to your reaction, which would you add to make the reaction more product-favored? Explain your choice(s). (There may be more than one.)



|                  |                              |
|------------------|------------------------------|
| $\text{Tl}^{3+}$ | $\text{Cr}_2\text{O}_7^{2-}$ |
| 1.25             | 1.38                         |
| $\text{Tl}^+$    | $\text{Cr}^{3+}$             |
| -0.34            | -0.42                        |
| $\text{Tl}$      | $\text{Cr}^{2+}$             |
|                  | -0.9                         |
|                  | $\text{Cr}$                  |