1. a. Classify each of the following as molecular, ionic or other.

   \[
   \text{CF}_2\text{Cl}_2 \quad \text{CO}_2 \quad \text{KF} \quad \text{HNCl}_2 \quad \text{MgSO}_4 \quad \text{Xe} \quad \text{PF}_3 \quad \text{HOCI}
   \]

   b. Show the Lewis structure of each substance you classified as molecular. For ionic compounds, write charges on the cation and anion.

   c. Give the total number of electrons in each compound.

   d. Draw and name the VSEPR shape for molecular compounds.

   e. Indicate whether the substance is polar or nonpolar.

   f. Name the dominant intermolecular force in each substance.

   g. Place the compounds in order of increasing predicted melting point.

2. a. Classify each of the following as molecular, ionic or other.

   \[
   \text{CF}_4 \quad \text{SeF}_4 \quad \text{NaBF}_4 \quad \text{H}_2\text{NOH} \quad \text{CaS} \quad \text{Ar} \quad \text{SO}_3 \quad \text{HOOH}
   \]

   b. Show the Lewis structure of each substance you classified as molecular. For ionic compounds, write charges on the cation and anion.

   c. Give the total number of electrons in each compound.

   d. Draw and name the VSEPR shape for molecular compounds.

   e. Indicate whether the substance is polar or nonpolar.

   f. Name the dominant intermolecular force in each substance.

   g. Place the compounds in order of decreasing predicted boiling point.

3. Classify the following solids as molecular, network (covalent), metallic, ionic or atomic.

   a. benzene, 

   b. diamond 

   c. krypton 

   d. Cd 

   e. copper(II) chloride 

   f. ice 

   g. S\textsubscript{8} 

   h. Mg\textsubscript{3}(PO\textsubscript{4})\textsubscript{2} 

   i. quartz (SiO\textsubscript{2}) 

   j. P\textsubscript{4}
4. For the two dimensional arrays shown below, draw a set of lattice points, a single primitive unit cell and a centered unit cell.

a. △ △ △ △ △ △ △ △ △
   △ △ △ △ △ △ △ △ △
   △ △ △ △ △ △ △ △ △
   △ △ △ △ △ △ △ △ △
   △ △ △ △ △ △ △ △ △

b. * * * * * * * * * *
   * * * * * * * * * *
   * * * * * * * * * *
   * * * * * * * * * *
   * * * * * * * * * *

5. How many whole atoms are in a primitive cubic unit cell?

6. How many whole atoms are in a body-centered cubic unit cell?

7. How many whole atoms are in a face-centered cubic unit cell?

8. Polonium crystallizes in a sc unit cell with a density of 9.20 g/cm³. Calculate the radius of a Po atom.

9. Copper crystallizes in a fcc unit cell, and has an atomic radius of 128 pm. Calculate the density of copper.

10. The radius of iron is 124 pm, and it crystallizes in a bcc unit cell, what is the volume of the unit cell?

11. For the heating curve below:
12. Calculate the energy released when 12.76 g of CH₂FCF₃ goes from 0.0 °C to –75.0 °C.

- normal mp CH₂FCF₃(s) –101.0 °C
- normal bp CH₂FCF₃(ℓ) –26.6 °C
- ΔH_vaporization CH₂FCF₃(ℓ) 22.02 kJ/mole
- s CH₂FCF₃(ℓ) 1.423 J/g.°C
- s CH₂FCF₃(g) 0.875 J/g.°C

13. Given the phase diagram of xenon, Xe, answer the following:

   ![Phase Diagram](image)

   a. Estimate the normal boiling point of xenon.
   b. Estimate the normal melting point of xenon.
   c. Estimate the vapor pressure of Xe(ℓ) at –110 °C.
   d. Is Xe(ℓ) or Xe(s) more dense? Explain.

14. Calculate the difference in solubility of nitrogen (mole fraction in air = 0.78) in blood at sea level (P = 1.0 atm) versus 10 m underwater (P = 2.0 atm). Assume that blood is identical to water and k_N₂ = 7.0 x 10⁻⁴ mole/L·atm.

15. Calculate the concentration of oxygen gas in water at sea level and 1.00 atm. The partial pressure of oxygen gas is 0.21 atm and Henry’s constant for oxygen (in water at RT) is 1.3 x 10⁻³ M·atm⁻¹.

16. Is solid iodine (I₂), more soluble in benzene (see #3), or chloroform, CH₃Cl?
17. Classify the following as molecular or ionic. What is the value of \( i \) for each when dissolved in water?

   a. copper(II) chloride  
   b. \( \text{CH}_3\text{F} \)  
   c. \( \text{Mg}_3(\text{PO}_4)_2 \)  
   d. sucrose, \( \text{C}_{12}\text{H}_{22}\text{O}_{11} \)  
   e. benzene, \( \text{C}_6\text{H}_6 \)  

18. A solution is prepared by dissolving 5.00 g of glucose, \( \text{C}_6\text{H}_{12}\text{O}_6 \), in 100.0 g of water. Calculate:

   a. the vapor pressure of water at 90 °C. The vapor pressure of pure water at 90 °C is 525.8 torr.  
   b. the boiling point of the solution.  

19. a. Calculate the freezing point of a solution of 2.00 moles of \( \text{NaCl} \) in 100.00 mL of water (density of water = 1.00 g/mL).  
   b. Calculate the freezing point of a solution of 2.00 moles of \( \text{CaCl}_2 \) in 100.00 mL of water.