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

   CF₂Cl₂  CO₂  KF  HNCl₂  MgSO₄  Xe  PF₃  HOCl

   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**.

   CF₄  SeF₄  NaBF₄  H₂NOH  CaS  Ar  SO₃  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

   ![benzene](image)

   b. diamond

c. krypton

d. Cd

e. copper(II) chloride

f. ice

g. S₈

h. Mg₃(PO₄)₂

i. quartz (SiO₂)

j. P₄
4. For the two dimensional arrays shown below, draw a set of lattice points, a single
primative unit cell and a centered unit cell.

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

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

5. How many atoms (lattice points) are in a primitive (simple) cubic unit cell?

6. How many atoms (lattice points) are in a body-centered cubic unit cell?

7. How many atoms (lattice points) are in a face-centered cubic unit cell?

8. Polonium crystallizes in a \textit{sc} unit cell with a density of 9.20 \text{g/cm}^3. Calculate the radius of a Po atom.

9. Copper crystallizes in a \textit{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 \textit{bcc} unit cell, what is the volume of the unit cell.

11. For the \textbf{heating curve} below:

\begin{itemize}
    \item a. (name of \(\Delta H\))
    \item b. (name of \(\Delta H\))
    \item c.
    \item d.
    \item e. (name of \(\Delta H\))
    \item f. (name of phase change)
\end{itemize}
12. Calculate the energy released when 12.76 g of CH$_2$FCF$_3$ goes from 0.0 °C to –75.0 °C.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal mp CH$_2$FCF$_3$(s)</td>
<td>–101.0 °C</td>
</tr>
<tr>
<td>Normal bp CH$_2$FCF$_3$(l)</td>
<td>–26.6 °C</td>
</tr>
<tr>
<td>ΔH$_{vaporization}$ CH$_2$FCF$_3$(l)</td>
<td>22.02 kJ/mole</td>
</tr>
<tr>
<td>s CH$_2$FCF$_3$(l)</td>
<td>1.423 J/g.°C</td>
</tr>
<tr>
<td>s CH$_2$FCF$_3$(g)</td>
<td>0.875 J/g.°C</td>
</tr>
</tbody>
</table>

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

![Phase diagram of xenon](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$_{N_2}$ = 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 (I$_2$), more soluble in benzene (see #3), or chloroform, CH$_3$Cl?
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. CH$_3$F
   c. Mg$_3$(PO$_4$)$_2$
   d. sucrose, C$_{12}$H$_{22}$O$_{11}$
   e. benzene, C$_6$H$_6$

18. A solution is prepared by dissolving 5.00 g of glucose, C$_6$H$_{12}$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 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 CaCl$_2$ in 100.00 mL of water.