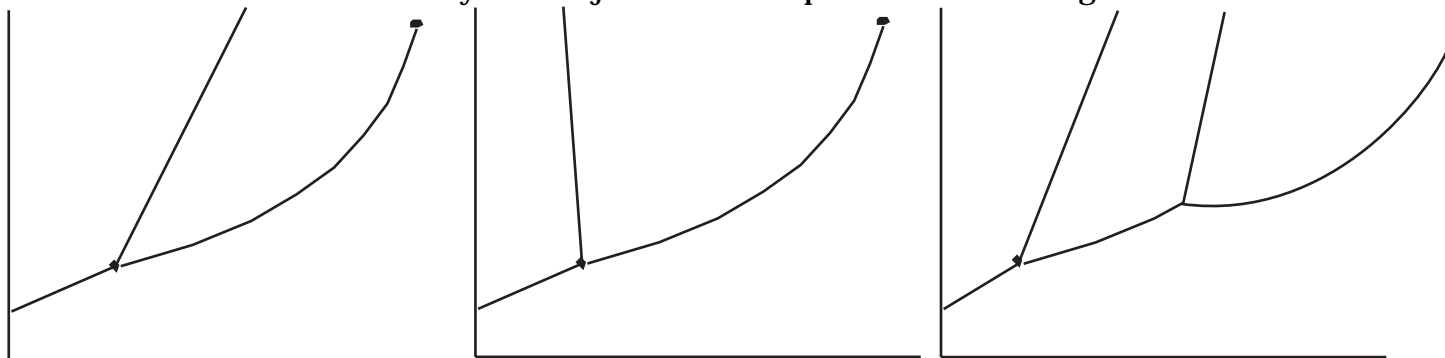


## 1. Fill in the blank

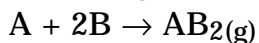
- \_\_\_\_\_ is the temperature at which the vapor pressure is equal to 1 atm.
- An equilibrium mixture of ice and water will turn completely to \_\_\_\_\_ if the pressure is reduced.
- \_\_\_\_\_ is the amount of energy required to increase the surface area of a liquid by unit area.
- If the \_\_\_\_\_ of a substance is above 1 atm, a solid will sublime instead of melt when heated at normal pressure.
- If the \_\_\_\_\_ of a substance is below room temperature, a gas cannot be liquified under pressure at room temperature.

## 2. Identify each of the phase diagrams below as either water, carbon dioxide, or sulphur. For each, identify the approximate position on the diagram of the point (25°C, 1 atm). Label the axes and identify the major areas and points on each diagram.



- What will happen (increase, decrease, no change) to the equilibrium vapor pressure of a pure liquid if
  - the container is sealed and the air is pumped out?
  - the external pressure on the liquid is increased?
  - the temperature is increased?
  - a nonvolatile solute is added?
  - the surface area of the liquid is increased?
- Indicate for each substance if it should be more soluble in water or in benzene ( $C_6H_6$ ) tetrachloride:
  - $I_2(s)$
  - $KNO_3(s)$
  - $CH_3OH(l)$
  - $C_{10}H_8(s)$
- What is the vapor pressure of a solution prepared by mixing 5.00 mol of pentane ( $C_5H_{12}$ ) (vapor pressure 511 mm Hg) with 15.00 mol hexane ( $C_6H_{14}$ ) (vapor pressure 150 mm Hg).

6. What are the freezing and boiling points of a solution of 8.000 g benzoic acid ( $C_7H_6O_2$ ) dissolved in 200.0 g benzene ( $C_6H_6$ )? ( $k_f = 5.12\text{ }^\circ\text{C/m}$ ,  $T_f^\circ = 5.5\text{ }^\circ\text{C}$ ,  $k_b = 2.53\text{ }^\circ\text{C/m}$ ,  $T_b^\circ = 80.1\text{ }^\circ\text{C}$ )
7. Calculate the osmotic pressure of a 0.00100 M solution of NaCl.
8. The following data were collected in a study of the rate of the reaction



[A] (M)	[B] (M)	initial rate ( $M\text{ s}^{-1}$ )
0.015	0.25	$4.5 \times 10^{-4}$
0.030	0.25	$9.0 \times 10^{-4}$
0.030	0.50	$1.8 \times 10^{-3}$

Determine the rate law and the rate constant (with correct units) for the reaction.

9. The decomposition of cyclobutane,  $C_4H_8 \rightarrow 2\text{ }C_2H_4$  is first order, with a rate constant of  $3.05 \times 10^{-2}\text{ s}^{-1}$  at  $525\text{ }^\circ\text{C}$ . If the initial concentration of  $C_4H_8$  is 0.500 M, what is the concentration after 35.0 s? What is the half life of the reaction?
10. For a given reaction,  $k = 1.6 \times 10^5$  at 400 K and  $8.7 \times 10^7$  at 600 K. Calculate  $E_a$  for the reaction.
11. For the reaction
- $$NO + O_3 \rightarrow NO_2 + O_2$$
- the following mechanism has been proposed:
- $$O_3 \rightarrow O_2 + O$$
- $$NO + O \rightarrow NO_2$$

Write the rate law expected if the first step is slow.

Write the rate law expected if the first step is fast and the second step is slow.