Chapter 11: Liquids & Intermolecular Forces

Kahoot!

1. Which of the following are polar molecules? Kr, MgO, I_2, PH_3
2. Which force below increases in strength as the molecular weight of the compound increases? Hydrogen bonding, Ion-dipole, Dipole-dipole, London dispersions
3. Which compound below is NOT capable of forming hydrogen bonds? CH_4, NH_3, H_2O, HF
4. Which compound has the strongest intermolecular force? CaO, NH_3, H_2, HF
5. Which compound has the strongest intermolecular force? F_2, Cl_2, Br_2, I_2
6. Which compound has the strongest intermolecular force? NO, CCl_4, H_2S, Ne
7. Which property is NOT affected by intermolecular forces? Boiling point, Color, Melting point, Viscosity
8. The ease of changing the charge distribution in a molecule is called its ___. Conductivity, Solubility, Polarizability, Viscosity
9. Which compound below has the highest boiling point? H_2O, H_2S, H_2Se, H_2Te
10. Which element below has the highest boiling point? Kr, F_2, Cl_2, Br_2
11. When heat is added to ice at zero degrees Celcius, what happens? T increases, T decreases, T doesn't change, a supercritical fluid forms
12. The highest temperature at which a substance can exist in its liquid state is called its ___ point. Boiling, Freezing, Triple, Critical
13. At high altitudes, the boiling point of water is ___. 100°C, > 100°C, < 100°C, = T_f
14. The substance that would evaporate most easily is one with ___ forces and a ___ molar mass. Weak; large, Weak; small, Strong; large, Strong; small
15. Which compound has the highest vapor pressure? H_2O, H_2S, H_2Se, H_2Te
16. Which element has the highest vapor pressure? Kr, F_2, Cl_2, Br_2
17. Wat does the triple point describe? Equilibrium of 3 phases, Where 3 phases meet, How 3 phases form, How 3 points are created

WhiteBoard Examples

Clausius-Claperon Example: What is the heat of vaporization of X if the vapor pressure at 0^0C is 250 torr and the vapor pressure at 100^0C is 500 torr? (answer: 5.80 kJ/mol)

What do we know? T_1 = 0°C + 273.15 = 273.15K, P_1 = 250 torr, T_2 = 100°C + 273.15 = 373.15K, P_2 = 500 torr

What do we want to know? ΔH_{vap}

What relationships do we know? $\ln\left(\frac{P_{vap,T_1}}{P_{vap,T_2}}\right) = \frac{\Delta H_{vap}}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$

The work:

$$\frac{R}{\left(\frac{1}{T_2} - \frac{1}{T_1}\right)} \ln\left(\frac{P_{vap,T_1}}{P_{vap,T_2}}\right) = \frac{\Delta H_{vap}}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right) \cdot \frac{R}{\left(\frac{1}{T_2} - \frac{1}{T_1}\right)}$$

$$\Delta H_{vap} = \frac{R}{\left(\frac{1}{T_2} - \frac{1}{T_1}\right)} \ln\left(\frac{P_{vap,T_1}}{P_{vap,T_2}}\right) = \frac{8.3145 \frac{J}{mol \cdot K}}{\left(\frac{1}{373.15K} - \frac{1}{273.15K}\right)} \ln\left(\frac{250torr}{500torr}\right) = 5874J$$