Key!

Ch.11 Continued

Define the following terms:

Viscosity: the resistance of a liquid to flow. This increases with stronger intermolecular forces, and decreases with higher temperature.

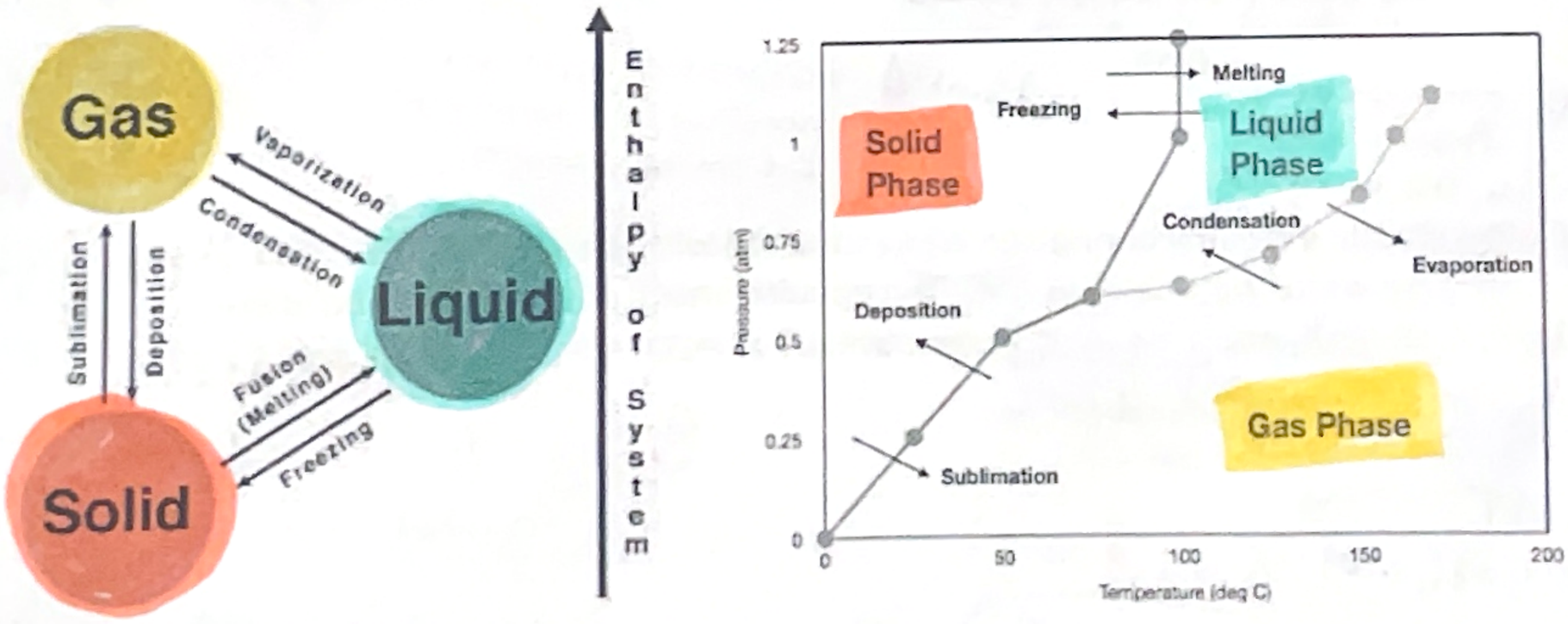
Surface tension: The energy or work required to increase the surface of a liquid due to intermolecular forces.

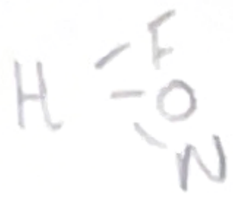
Capillary action: The rise of liquids up narrow tubes.

Cohesive forces: Intermolecular forces that bind similar molecules to one another.

Adhesive forces: Intermolecular forces that bind a substance to a surface.

Phase Change Diagrams:

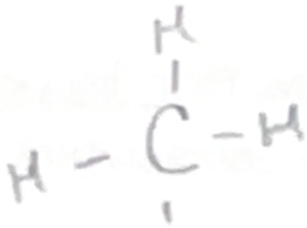




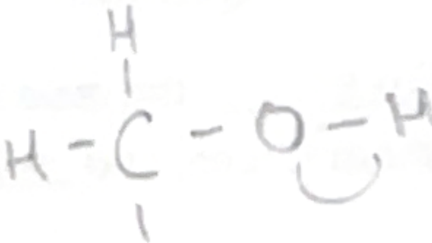
5 lp (3) = 8 4+4=8

Determine the type of intermolecular forces for each compound: **NH3** (Ammonia), **CH4 (Methane)**, and **CH3OH** (Methanol). List the compounds in order of increasing boiling point.

- Polar molecule
- Hydrogen bonding



- Non polar molecule
- London dispersion

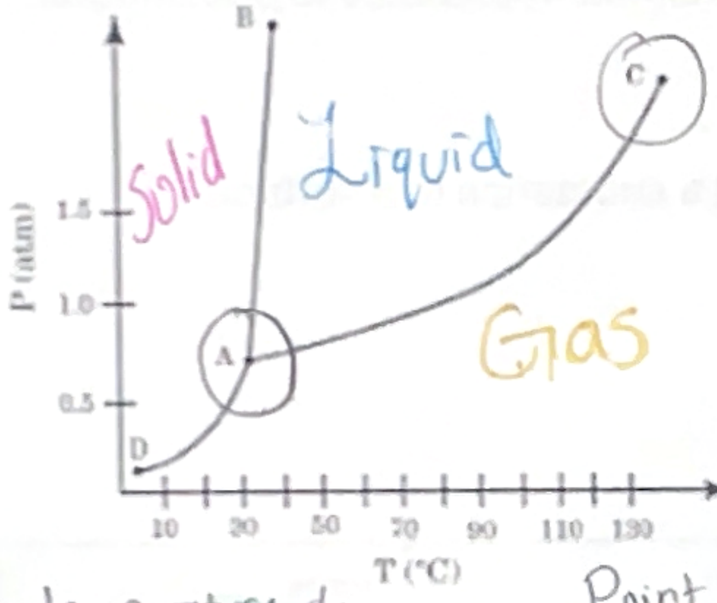


- Polar
- Hydrogen bonding

$CH_4 < NH_3 < CH_3OH$

Which of the following compounds exhibit hydrogen bonding? **HF**, **NH_3**, **C_2H_6**, and **HCl**

Label what spots A and C represent. Label solid, liquid, and gas in the diagram.



Point A - triple point: point on diagram at which the 3 states of matter coexist.

Point C - Critical point: point on diagram at which substance indistinguishable btwn gases + liquid state.

Point B: temperature & Pressure where ice and liquid are in equilibrium

Point A: temperature & pressure where ice and water vapor are in equilibrium

Calculate the enthalpy change (in kJ) associated with the conversion of 25.0 grams of ice at -4.00 °C to water vapor at 109.0 °C. The specific heats of ice, water, and steam are 2.09 J/g·K, 4.18 J/g-K, and 1.84 J/g-K, respectively. For H2O, Δ = 6.01 kJ/mol and Δ = 40.67

① $\Delta T_1 = 0° - (-4.00°C) = 4.00°C$

$q = mC\Delta T$

$= (25.0g)(2.09\ J/g\cdot K)(4.00\ K)$

$= 209\ J \rightarrow 0.209\ kJ$

② $n = \frac{m}{m_{H_2O}} = \frac{25.0\ g}{18.015\ g/mL} = 1.388\ mol$

$q_2 = 1.388\ mol \cdot 6.01\ kJ/mol = 8.34\ kJ$

③ $\Delta T_3 = 100°C - 0°C = 100°C$

$q_3 = mC\Delta T$

$= (25.0\ g)(4.18\ J/g\cdot K)(100K) = 10450\ J = 10.45\ kJ$

④ $q_4 = n \cdot \Delta H_{vap}$

$= 1.388\ mol \cdot 40.67\ kJ/mol = 56.45\ kJ$

⑤ $\Delta T_5 = 109°C - 100°C = 9°C$

$q = mC\Delta T$

$= (25.0\ g)(1.84\ J/g\cdot K)(9\ K)$

$= 414\ J \rightarrow 0.414\ kJ$

⑥ $q_{total} = 75.863 \rightarrow 75.9\ kJ$

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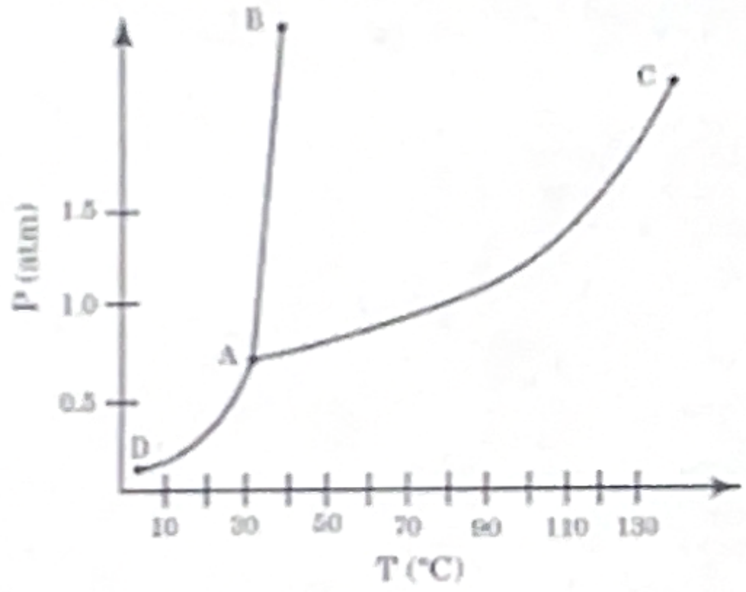

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① Warm the ice from -4.00°C to 0.0°C

$q_1 = m C \Delta T$

② Melt the ice at 0.0°C to liquid water

$q_2 = n \cdot \Delta H_{fusion}$

③ Warm the liquid water from 0.0°C to 100.0°C

Specific heat of water = 4.18 J/g·K

$q_3 = mC\Delta T$

④ Vaporize water at 100.0°C to steam

$q_4 = n \cdot \Delta H_{vaporization}$

⑤ Warm steam from 100.0°C to 109.0°C

specific heat of steam = 1.84 J/g·K

$q_5 = m C \Delta T$

⑥ Calculate total enthalpy change

$\Delta H_{total} = q_1 + q_2 + q_3 + q_4 + q_5$