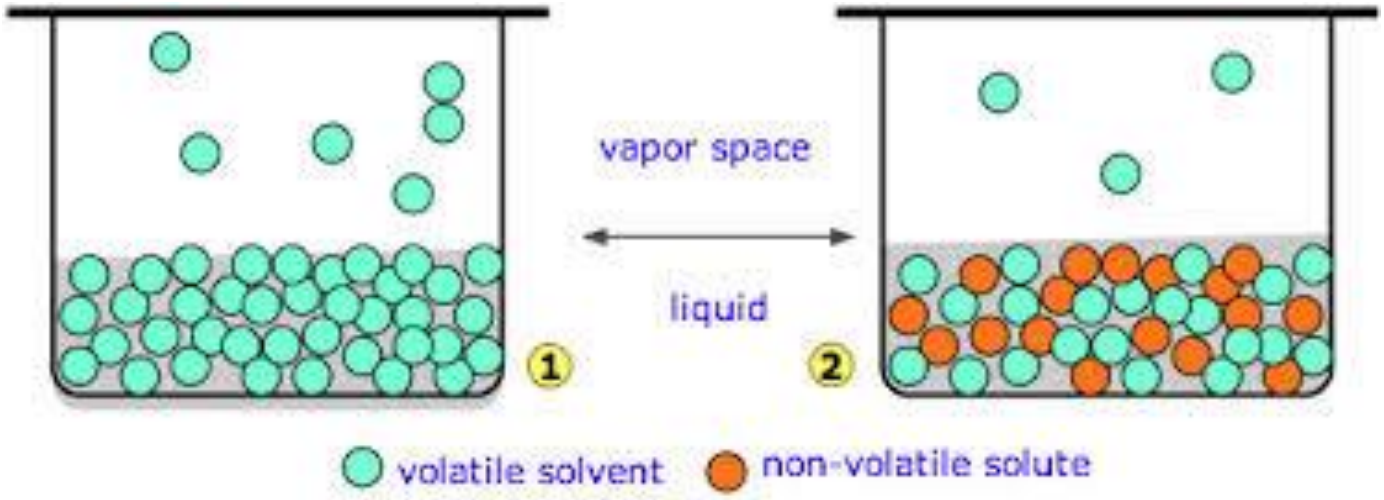
Vapour Pressure Continued



Outcomes:

- Use KMT to describe the process of evaporation/ condensation. *Include: IMF's, random motion, volatility, dynamic equilibrium*
- Operationally define vapour pressure
- Operationally define normal boiling point in terms of vapour pressure

Vapour Pressure:

We have seen that all liquids have a **normal boiling point**

→ ***Temp. at which a liquid boils at standard pressure.***

We have also learned that **BOILING** is the point which **VAPOUR PRESSURE** is **EQUAL** to **ATMOSPHERIC PRESSURE**. Therefore boiling is a function of air pressure:

$$P_{vap} \geq P_{atm}$$

Vapour Pressure:

Volatility

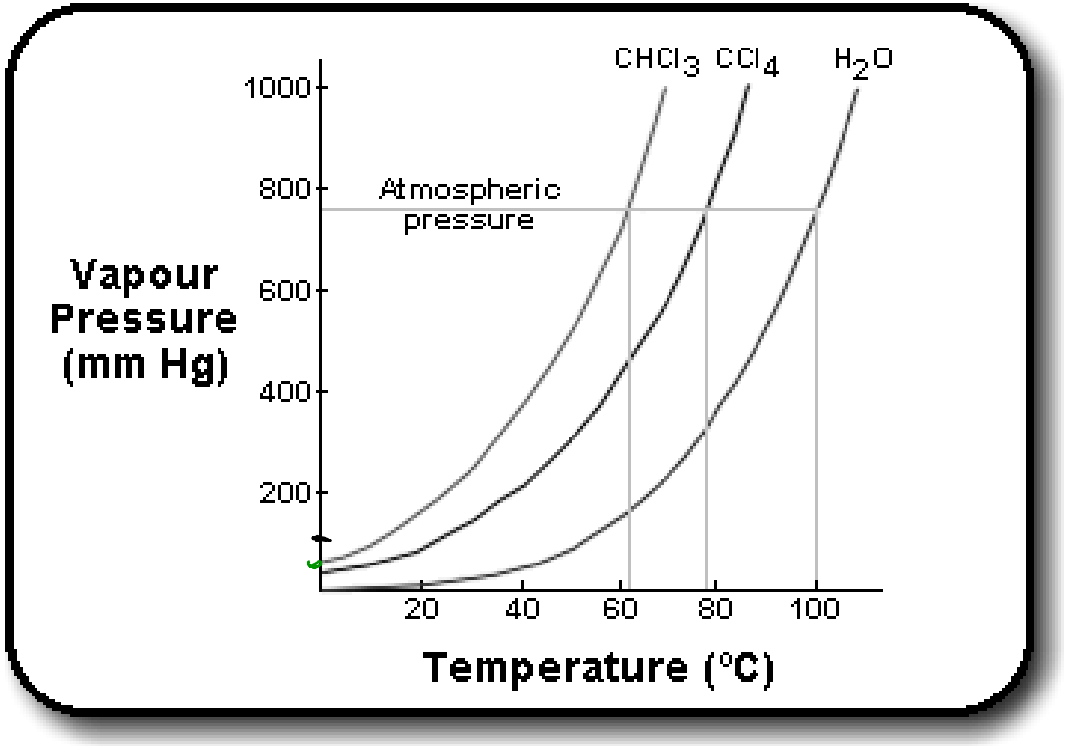
- Liquids that boil at **LOW TEMPS** and evaporate **RAPIDLY** at room temp are called **VOLATILE**.
- Volatile liquids have **HIGHER VAPOUR PRESSURES** than non-volatile liquids.
- Examples are **ALCOHOLS** (***rubbing alcohol***).

Vapour Pressure Graphs

- Using a **MANOMETER** we can construct a graph of vapour pressures of a liquid at varying temperatures. The graph can then be used to:
- Find **NORMAL** boiling points
- Find boiling points at different **PRESSURES**
- Compare **IMF'S** and rates of **EVAPORATION**

Examples:

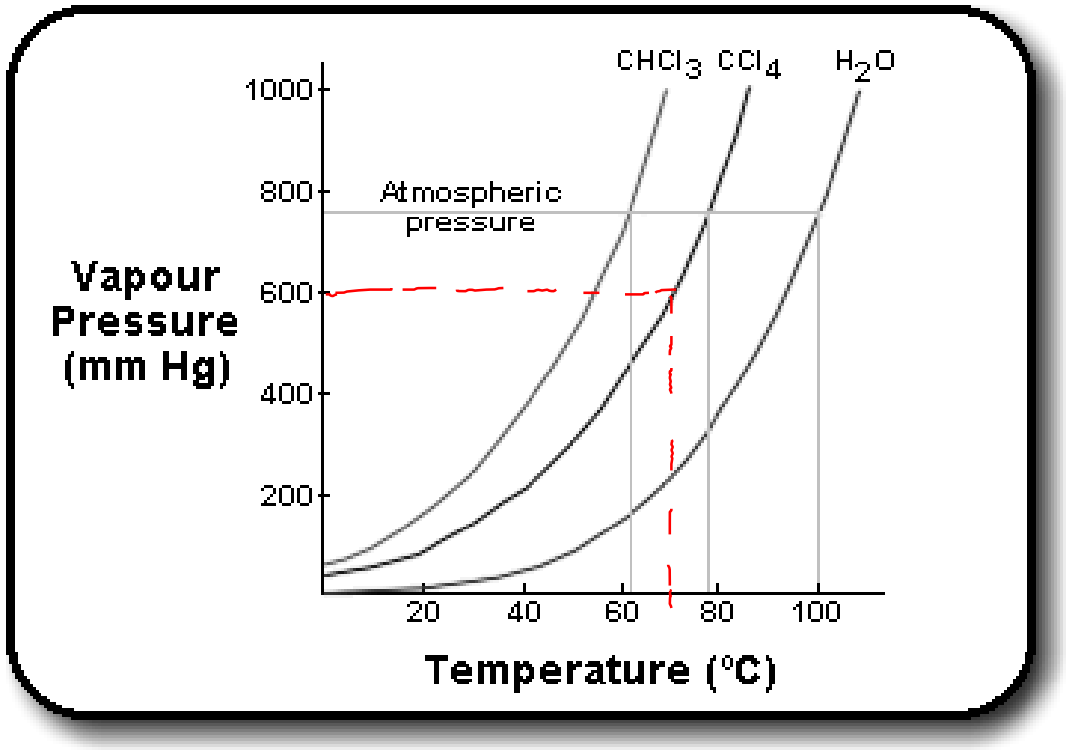
Answer the following questions based on the graph below:



1. What is the approximate vapour pressure of trichloromethane ($CHCl_3$) at 0°C?

≈ 75 mmHg

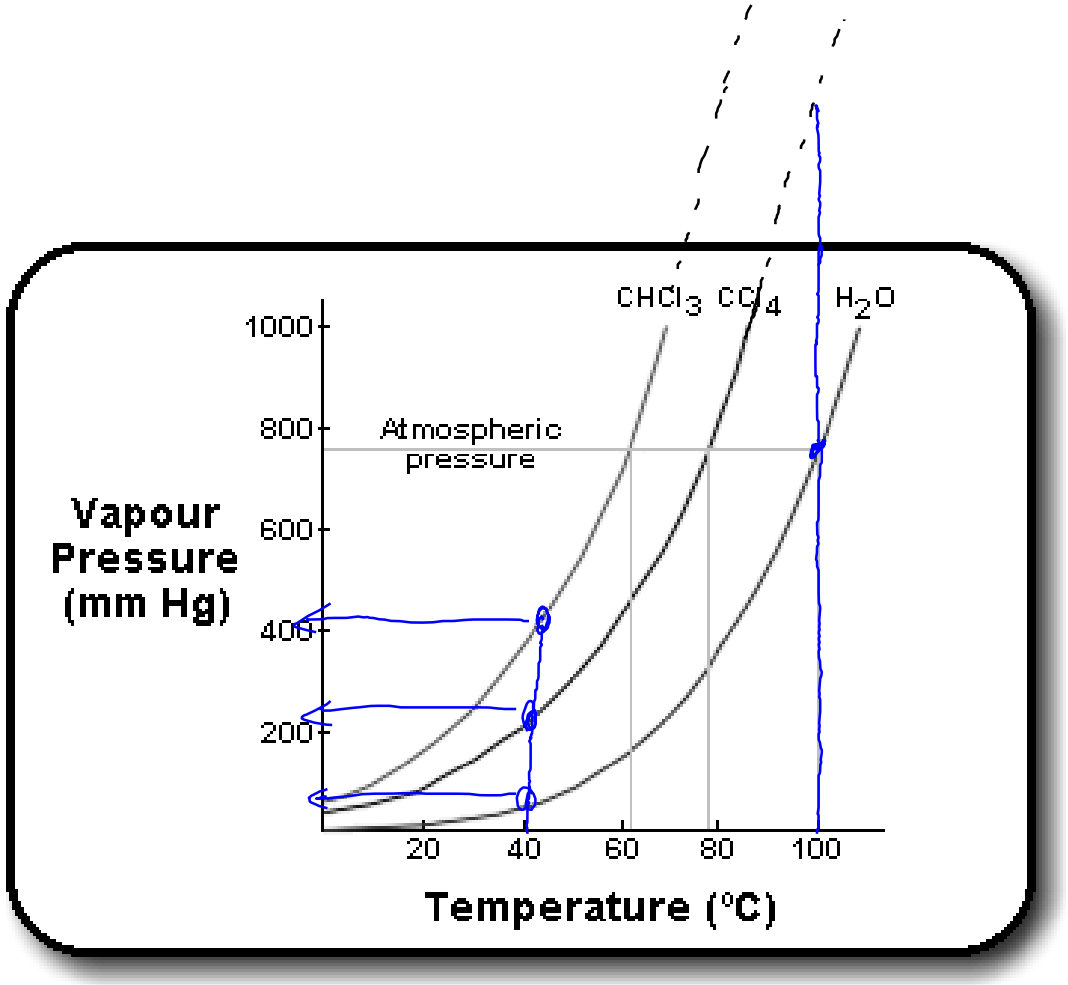
Examples:



2. At what temperature is the vapour pressure of carbon tetrachloride 600 mm Hg?

$\simeq 71^{\circ}C$

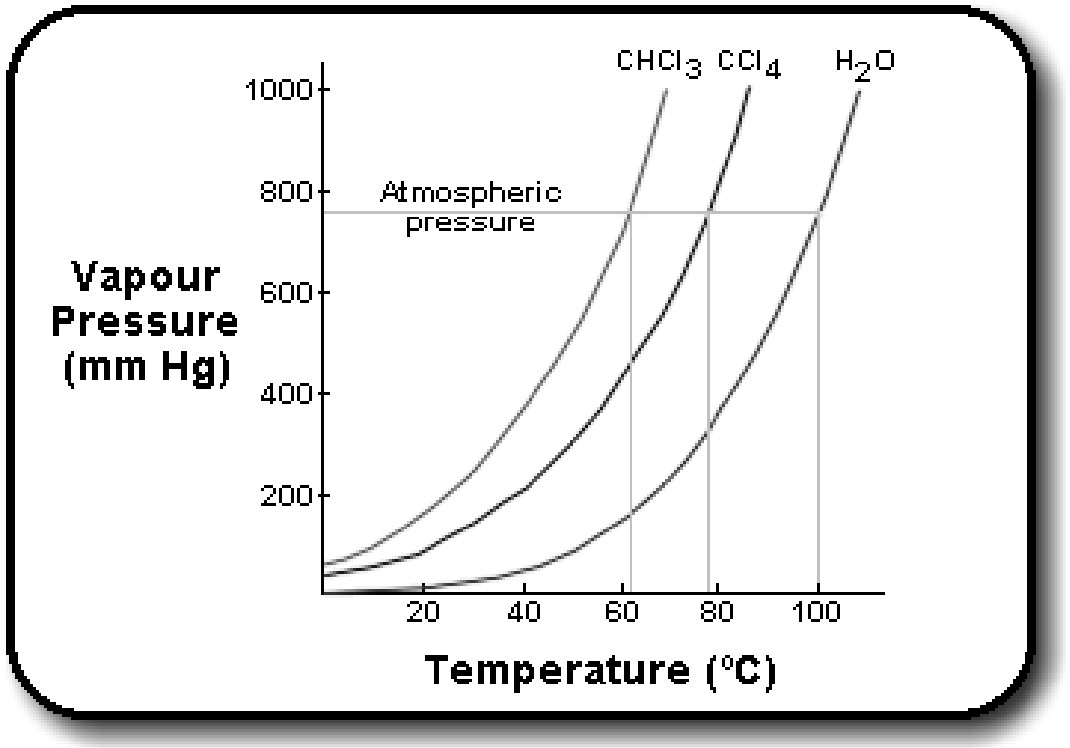
Examples:



3. Which substance has the highest vapour pressure?

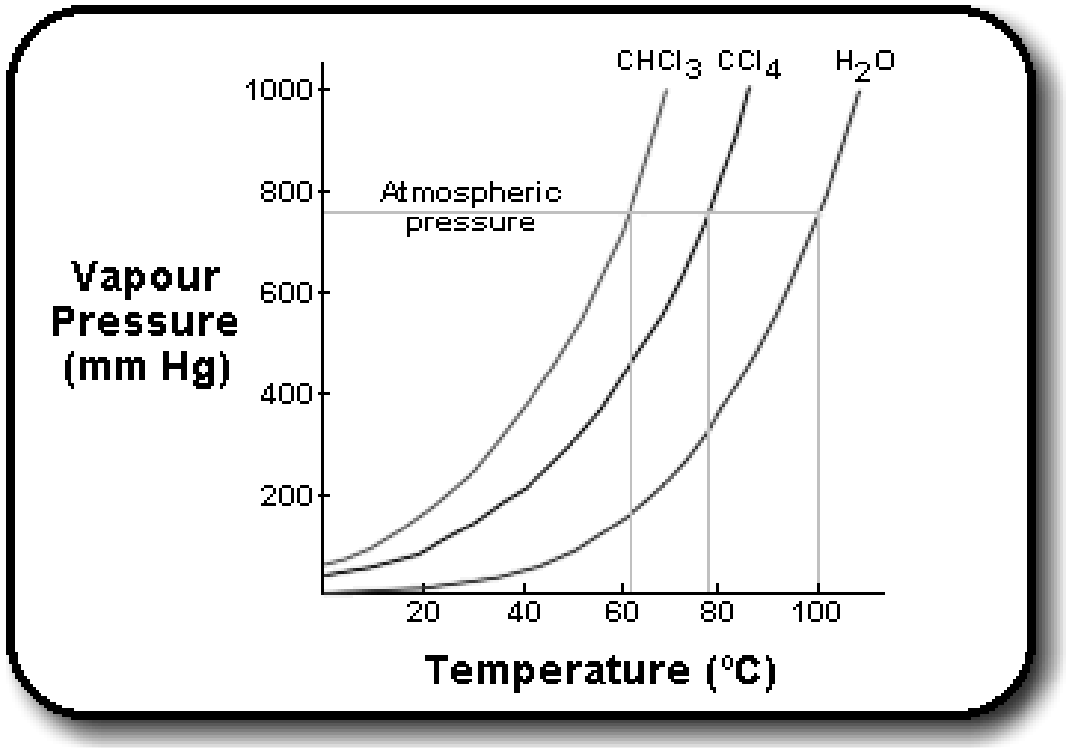
$CHCl_3$

Examples:



4. Which substance would evapourate:
   a) Fastest at room temp? $CHCl_3$
   b) Slowest at room temp? H_2O

Examples:



5. Which substance has the:

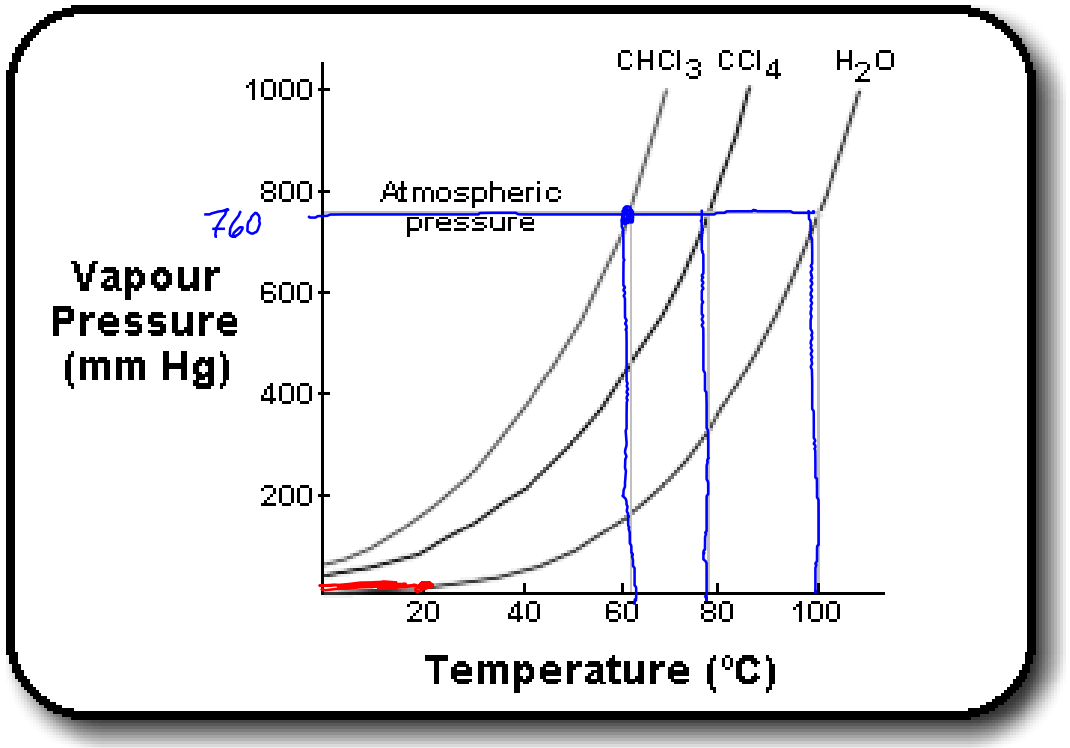
a) Strongest intermolecular forces? H_2O

b) Weakest intermolecular forces? $CHCl_3$

Examples:

P_{VAP}

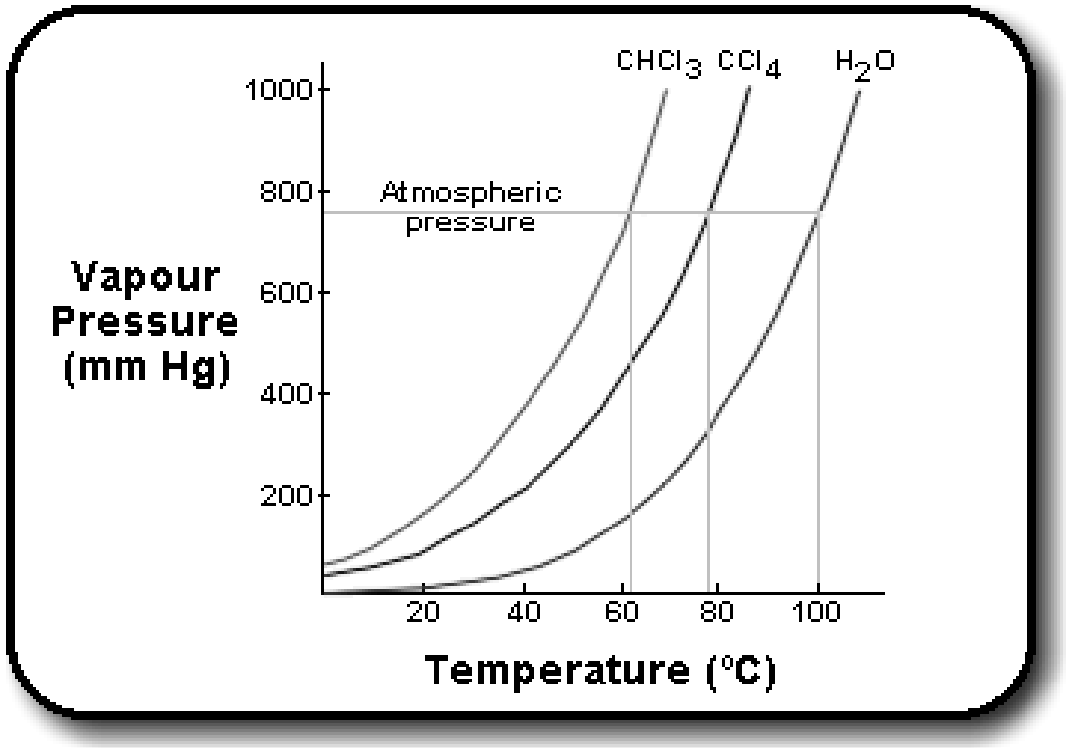
P_{ATM}



6. What are the normal boiling points of the three substances?

$CHCl_3 \simeq 62°C$ $CCl_4 \simeq 79°C$ $H_2O = 100°C$

Examples:



7. What would be the boiling point of CCl_4 in Banff (about 635 mm Hg)