Even More Stuff On Vapour Pressure

YouTube – Rail car crush

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

Is it a vapour or a gas????

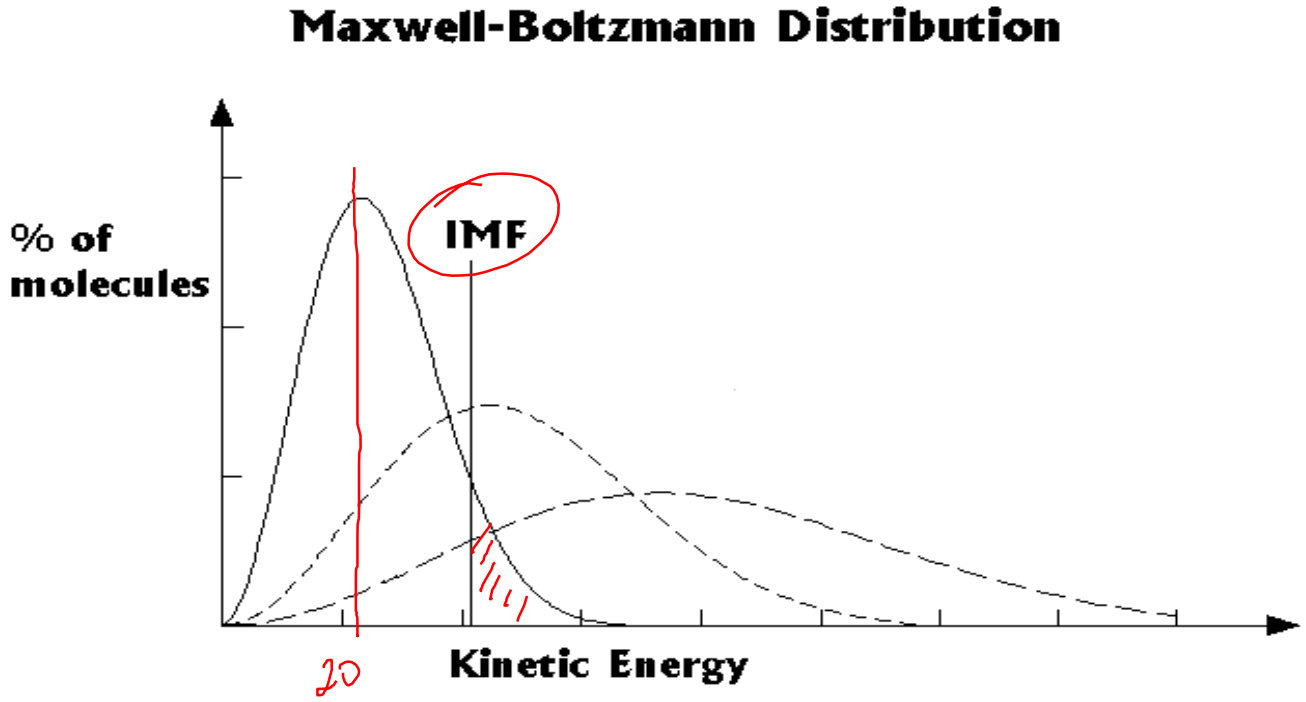
Vapour is the term applied to the **GAS** of any compound that is **NORMALLY** found as a **LIQUID** (there are **WATER** and **GAS** vapours, but not **OXYGEN** vapours)

Consider a beaker of liquid:

- The liquid is made of **MOLECULES**.
- These molecules have **IMF'S** acting on them
- Molecules on the **SURFACE** have about **HALF** as many **NEIGHBORS**, therefore less **FORCE** holding them in the liquid.
- Recall that a larger **SURFACE AREA** will increase the rate of **VAPORIZATION** (more **SURFACE** molecules).

Is it a vapour or a gas????

For a molecule of liquid to become a vapour, it must have enough kinetic **ENERGY** to overcome the **IMF'S**.



At a given temperature, only a fraction of molecules have enough energy to escape.

Application of P_{vap}:

Why is the air drier in winter than summer?

- **KINETIC ENERGY** is **PROPORTIONAL** to **TEMPERATURE** (***more heat, more energy***).

- This means that, in summer, **MORE** water molecules will have enough **ENERGY** to overcome the **IMF'S** and escape to the vapour phase.

- The **OPPOSITE** is true in the winter.

Practical Values:

Importance of Freezing Point

- Cars need **COOLANT** to run properly
- Coolant is a mixture of **ANTIFREEZE** (ethylene glycol) and water
- Different **MIXTURES** of these two liquids will result in different **FREEZING POINTS**.
- We want to mix the liquids to ensure that the coolant will not **FREEZE** in the winter and cause engine damage.

Importance of Boiling Point

- Knowing boiling point is important in cars (same as above)
- It is also important in **DISTILLATION** → separation of two or more liquids.
- We can separate two liquids if we know their boiling points:

- Ex) Water (b.p. = 100°C) and Ethanol (b.p. = 78.3°C)

→ if we boil the mixture, at 78.3°C, the **ETHANOL** will **EVAPORATE** and the **WATER** will be **LEFT BEHIND**.

Practical Values:

Importance of Vapour Pressure

- If you know vapour pressures at various temperatures, we will know the **BOILING POINT** of a liquid at any pressure.
- This is important for **COOKING** instructions for areas at different **ALTITUDES**.

Ex) At Pikes Peak Colorado (elev. 4300m) water boils at 86°C

→If you make **KRAFT DINNER** at Pikes Peak, you will have to cook the noodles **LONGER**, since they will be getting less **HEAT** **(ENERGY)**.