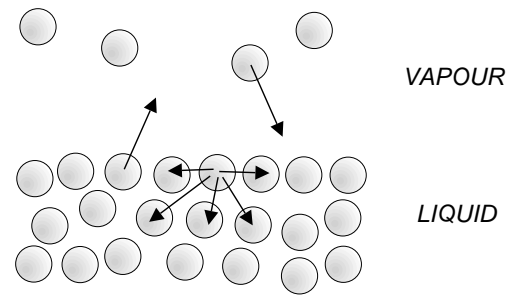


RAOULT'S LAW

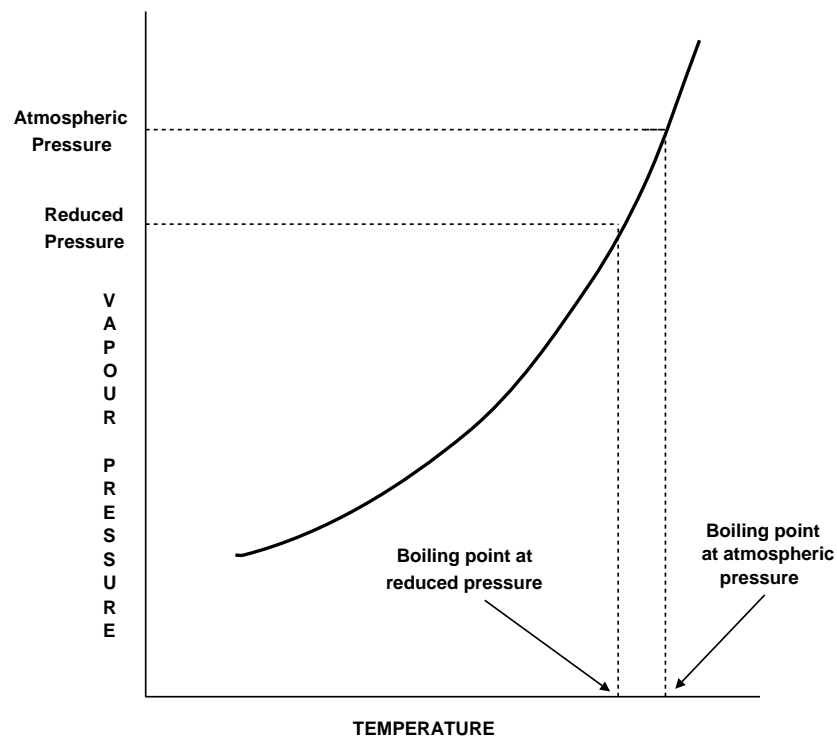
Vapour Pressure

If a liquid is placed in a sealed tube and the space above it evacuated, any molecules which escape from the surface of the liquid will be contained and thus exert a pressure. As more molecules enter the space, the possibility of some re-entering also increases.



Eventually a state of dynamic equilibrium exists where as many particles are leaving as are returning. The pressure at this stage is known as the Saturated Vapour Pressure (SVP). This value is constant for a particular liquid at constant temperature. The value increases exponentially with temperature as can be seen in the diagram below.

THE VARIATION OF VAPOUR PRESSURE WITH TEMPERATURE



Boiling

A liquid boils when its vapour pressure reaches that of the atmospheric (or applied) pressure.

Decreasing the pressure lowers the boiling point

Liquids can be distilled below their normal boiling point; avoids the risk of decomposition

Increasing the pressure raises the boiling point

Pressure cookers work on this principle; water boils above 100°C so food cooks quicker.

Raoult's Law

'The vapour pressure of a solvent in a solution equals the vapour pressure of the pure solvent multiplied by its mole fraction.'

$$\text{mole fraction of a component} = \frac{\text{number of moles of that component}}{\text{total number of moles present}}$$

Example Calculate the mole fractions of each component in a mixture containing heptane C_7H_{16} (150g) and hexane C_6H_{14} (43g).

$$\text{Moles of heptane} = 150/100 = 1.5 \text{ mol}$$

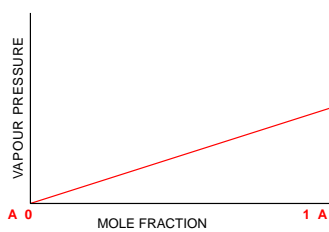
$$\text{Moles of hexane} = 43/86 = 0.5 \text{ mol}$$

$$\text{Total} = 2 \text{ mol}$$

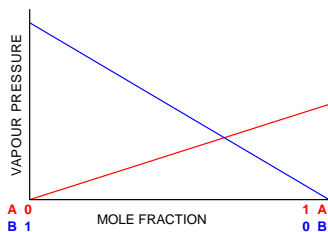
$$\text{Mole fractions heptane} = 1.5/2 = 0.75$$

$$\text{hexane} = 0.5/2 = 0.25$$

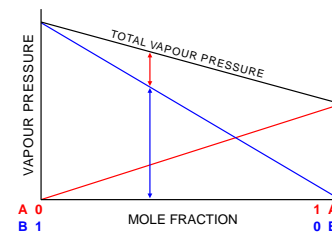
In a mixture of volatile liquids, the total vapour pressure will be the sum of the individual vapour pressures.



Vapour pressure variation of a single volatile liquid in a mixture.



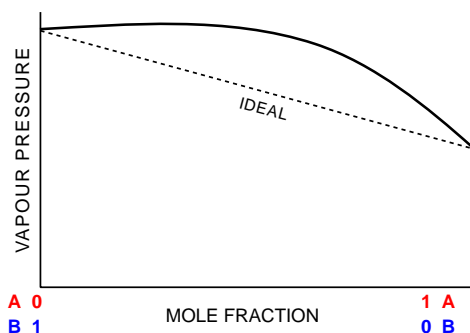
Vapour pressure variation of two liquids in a mixture.
A is more volatile - it has the lower boiling point.



Total vapour pressure is the sum of the individual vapour pressures.

Deviations

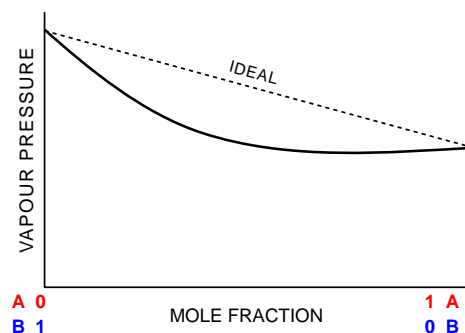
- very few liquids obey Raoult's Law
- liquids which obey it are called IDEAL LIQUIDS
- for NON-IDEAL liquids, the shape of the vapour pressure curve is affected



POSITIVE DEVIATION

Vapour pressure is greater than ideal

The different molecules in the liquid mixture must not attract each other as much; it is easier to turn them into vapour.



NEGATIVE DEVIATION

Vapour pressure is less than ideal

The different molecules attract each other more than if they were on their own; it is easier to turn them into vapour.

