Evaporation
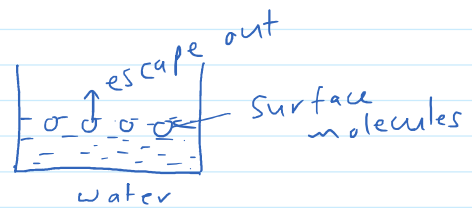
Spontaneous conversion of liquid molecules present at surface into vapour molecules is known as evaporation.

escape out
surface molecules
water

Factors affecting rate of evaporation

i) Temperature: (T)

   Evaporation increases with increase in temperature

$$r_E \propto T$$

ii) Surface area (SA)

   More is surface area, more is rate of evaporation

$$r_E \propto SA$$

iii) Nature of intermolecular forces of attraction (IMFA)

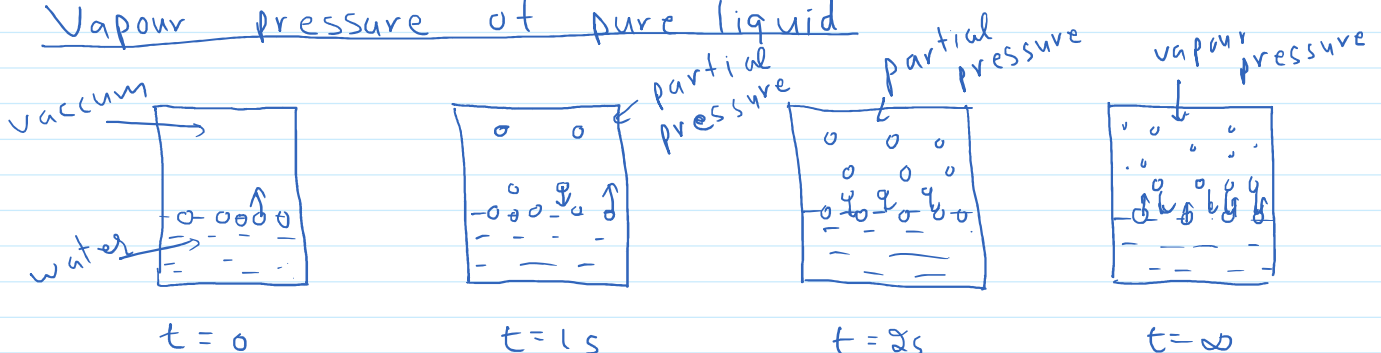   Rate of evaporation is less for liquids having more IMFA.
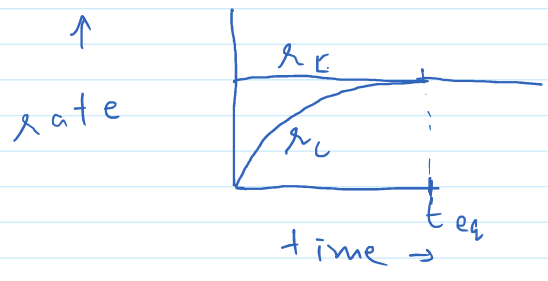
$$r_E \propto \frac{1}{IMFA}$$

IV) Humidity

   More is humidity lesser is rate of evaporation of water. Dry air has tendency to absorb moisture, hence it increases rate of evaporation.

$$r_E \propto \frac{1}{Humidity}$$

Vapour pressure of pure liquid

vaccum

water

partial pressure

partial pressure

vapour pressure

$t = 0$ $t = 1s$ $t = 2s$ $t = \infty$

$r_E \rightarrow$ evaporation r_E ✓ $r_E \rightarrow$ same $\underline{r_E = r_C}$

$r_c \rightarrow$ condensation $r_c \neq 0$ ✓ $r_c \rightarrow$ increase $r_c = r_E$
    $= 0$

$r_E > r_C$ $r_E > r_C$ $r_E > r_C$

rate

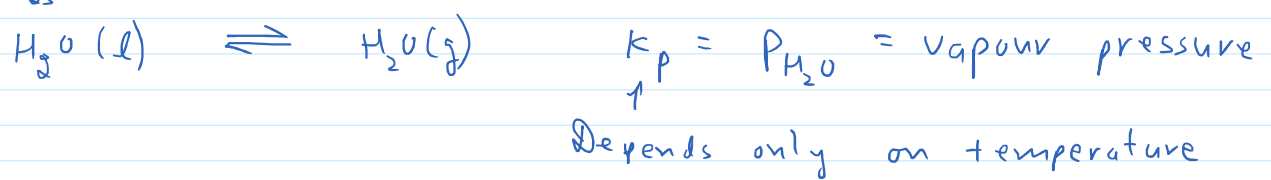r_E

r_C

time $\rightarrow$ t_{eq}

Partial pressure exerted by vapours of a liquid which are in dynamic equilibrium with the liquid in a closed container is called vapour pressure of the liquid.

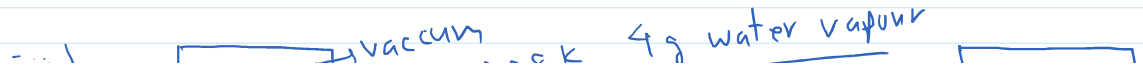## Characteristics of vapour pressure.

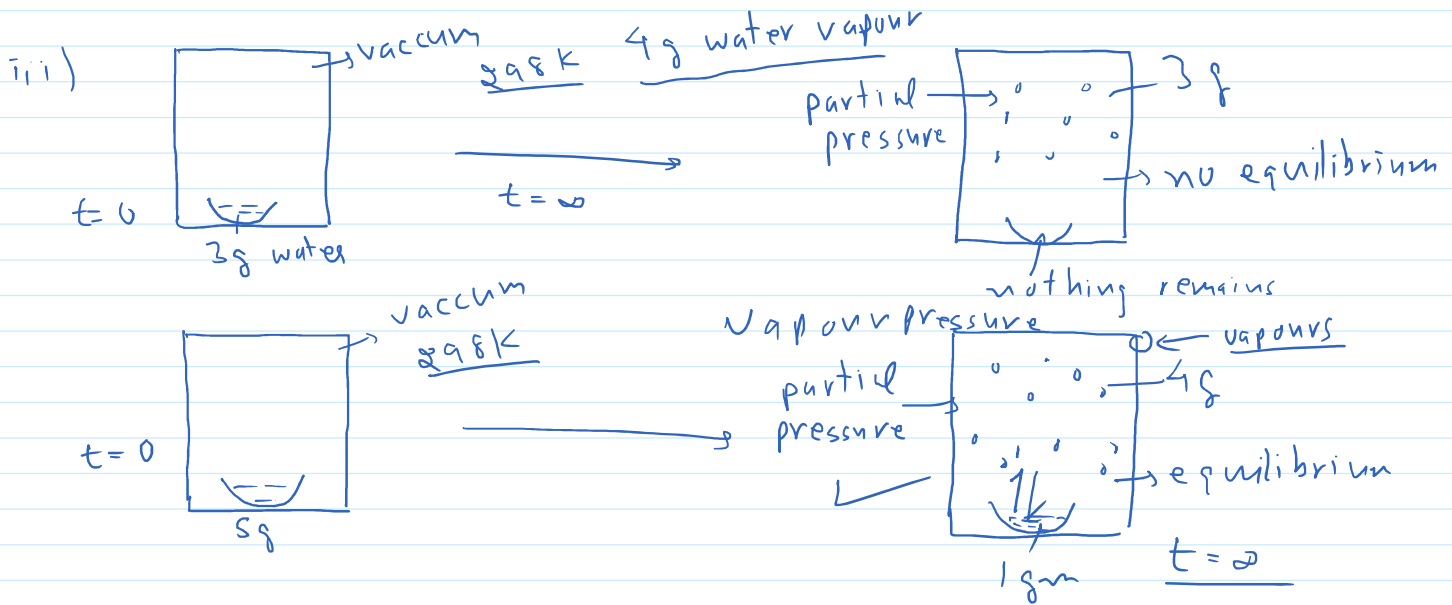i) Vapour pressure of any liquid does not depend upon amount of liquid, volume of vessel or shape of vessel.

$298 K$

1   2

Vapour pressure $\rightarrow$ same in both cases

$4s$

$298 K$ 3

$r_E(3) > r_E(1)$

$V.P(3) = V.P(1)$

$2s$

$H_2O(l) \rightleftharpoons H_2O(g)$ $K_p = P_{H_2O} =$ vapour pressure
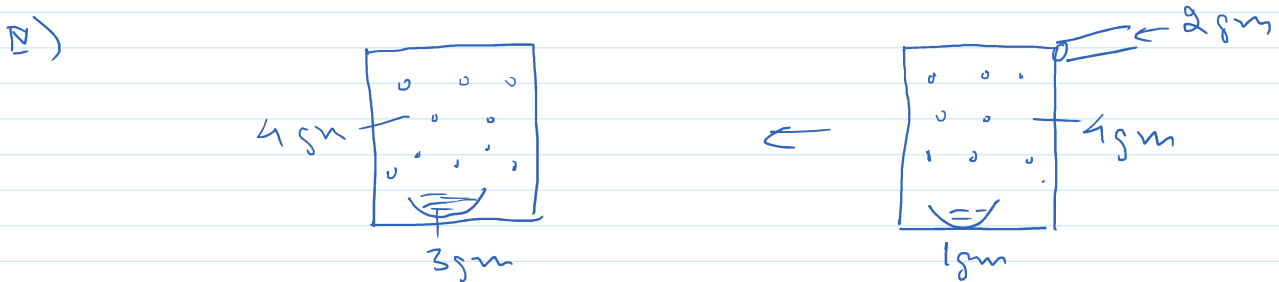
Depends only on temperature

ii) Vapour pressure of any liquid depends only on temperature of the liquid. Vapour pressure of pure liquid A is denoted by $P_A^o \leftarrow$ pure liquid $V.P \propto T$.

vaccum   ok   4g water vapour

iii)

t=0
3g water

→ vaccum
298K

t = ∞

4g water vapour

partial → 3g
pressure

→ no equilibrium

nothing remains

t = 0
5g

→ vaccum
298K

Vapour pressure

partial
pressure

← vapours
4g

→ equilibrium

1gm   t = ∞

Liquid kept in a container evaporates until all of the liquid evaporates or liquid reaches in equilibrium with the vapours.

IV)
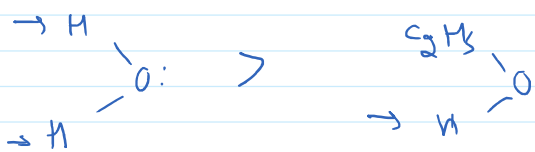

4gm

3gm

←

← 2gm

4gm

1gm

Vapour pressure is maximum value of partial pressure at a given temperature.

V) Vapour pressure α $\dfrac{1}{\text{Intermolecular forces of attraction}}$

Honey → v.P less

water → v.P more

eg: H_2O , C_2H_5OH

→ H
   \
    O: >
   /
→ H

C_2H_5
   \
    O
   /
→ H

$P^o_{C_2H_5OH}$ > $P^o_{H_2O}$ ∵ IMAF$_{H_2O}$ > IMAF$_{C_2H_5OH}$

Volatile substance:

Substances having definite value of vapour pressure are called volatile substances. $P^0 \neq 0$

eg: H_2O, C_2H_5OH, C_6H_6

Non-volatile substances

Substances having zero vapour pressure.

eg: solids. $P^0 = 0$.

Question