YAKEEN NEET 2.0

2026

Solutions

Physical Chemistry | Lecture -02

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Topics to be covered

1. Revision of Last Class
2. Henry law & its numericals
3. Vapour Pressure,
4. Magarmach Practice Questions, Home work from modules

Rules to Attend Class

1. Always sit in a peaceful environment with headphone and be ready with your copy and pen.
2. Never ever attend a class from in between or don't join a live class in the middle of the chapter.
3. Make sure to revise the last class before attending the next class & always complete your Magarmach Practice Questions.
4. Never ever engage in chat whether live or recorded on the topic which is not being discussed in current class as by doing so u can be blocked by the admin team or your subscription can be cancelled.

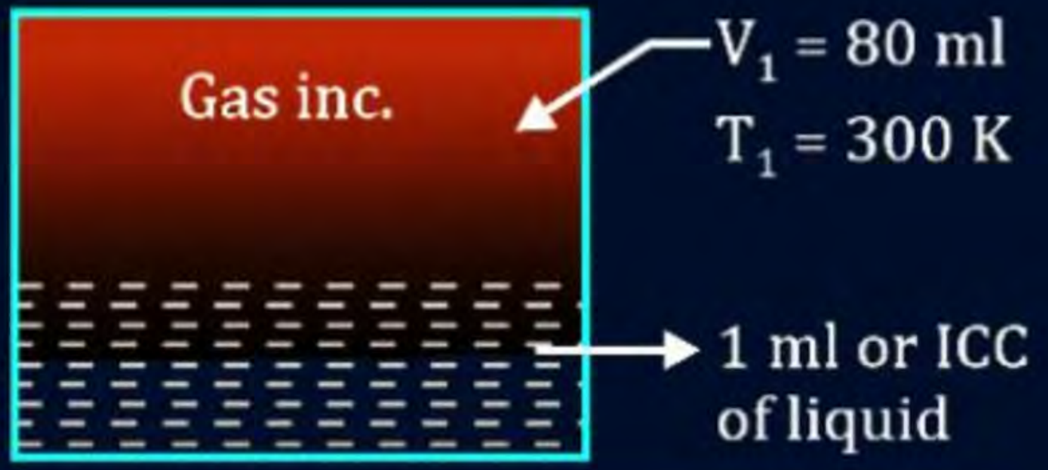
Rules to Attend Class

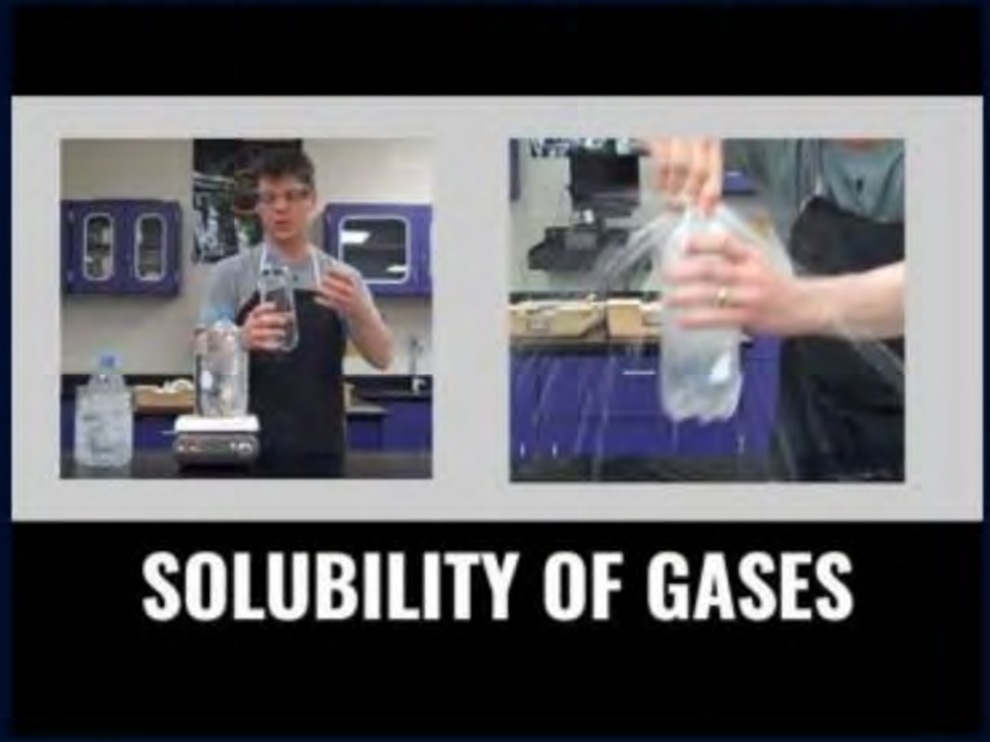
5. Try to make maximum notes during the class if something is left then u can use the notes pdf after the class to complete the remaining class.
6. Always ask your doubts in doubt section to get answer from faculty. Before asking any doubt please check whether same doubt has been asked by someone or not.


There is one big flaw in your Preparation that's name is Backlog ? What do we say to Backlog ?
NOT TODAY !!!

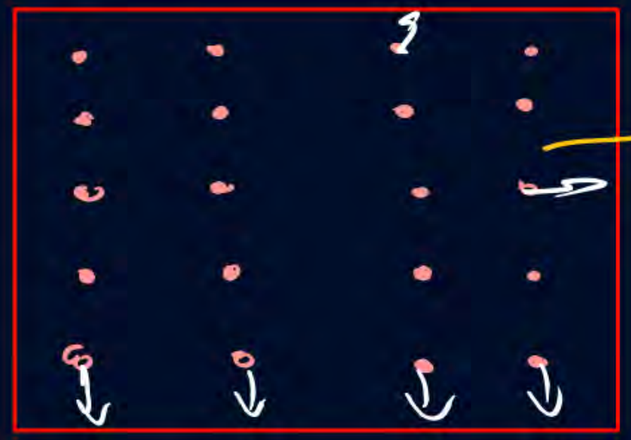
Revision of Last class

Solubility of Gas in a Liquid





Dalton's law of Partial Pressure



→ mixture of non-reacting gases (A & B)

↓

Total P = sum of partial pressure of each gas

$= P_A + P_B$

P_A : Partial P of A

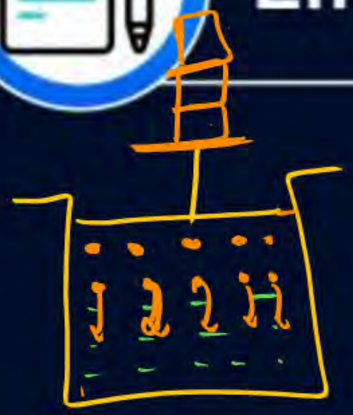
P_B : Partial P of B

$P_A = \chi'_A \times P_T$

mole fraction A in gaseous phase = $\chi'_A = Y_A$

$P_B = \chi'_B P_T$ $\quad \chi'_B = Y_B$

Effect of pressure (Henry's Law)



mass of gas dissolved in liquid (m) is proportional pressure above the liquid

$$m \propto P$$

$$m = \underline{K} P$$

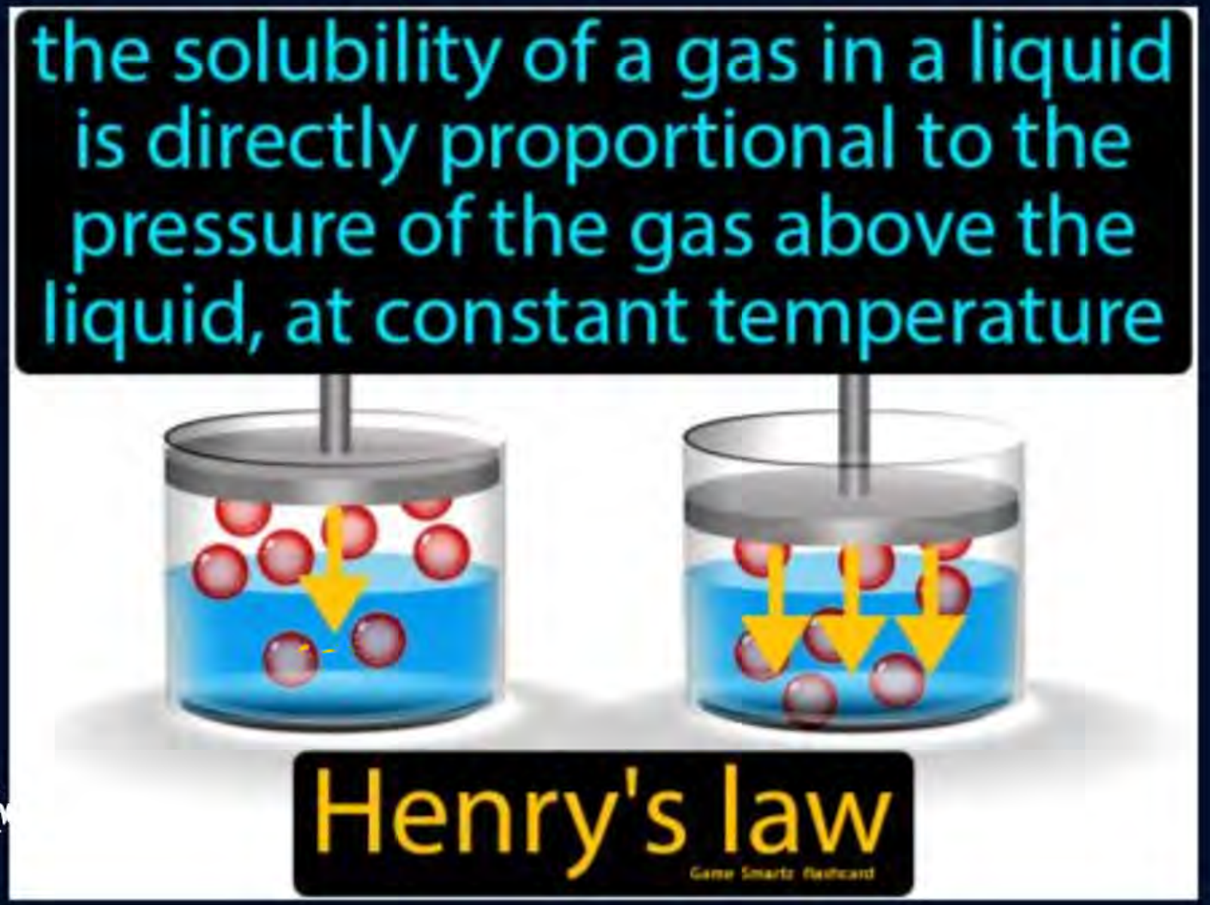
Henry's law :

A & B are non-reacting gases

→ Solubility of gas in liquid is proportional to partial pressure of gas

S_A = Solubility of gas

	m_A	Molarity	molality	mole fracti
Unit	g	mol/L	mol/kg.	no unit.



$$S_A \propto P_A$$

$$S_A = K P_A$$

$$P_A = \frac{1}{K} S_A$$

$$K_H = \left(\frac{1}{K}\right) = \text{Henry's Constt.}$$

$$P_A = K_H S_A$$

#MIT

Which formula used depend upon unit of K_H

① S_A = molarity

$$\underline{S_A = K_H P_A}$$

unit of K_H = $mol\ L^{-1} atm^{-1}$

② $m_A = K_H \underline{P_A}$

unit of K_H = $Kg/\underline{atm}$.

③ $\chi_A = K_H P_A$

Unit of K_H = atm^{-1} or bar^{-1} or Pa^{-1} or $mm\ of\ Hg$

① $\underline{P_A} = K_H S_A$

unit of K_H = atm L/mol.

② $P_A = K_H m_A$

unit of K_H = atm/Kg

③ $P_A = K_H \chi_A$

Unit of K_H = atm or bar or Pa or mm of Hg

Characteristics of Henry's constant (K_H)

P inc. ⇒ S ↑

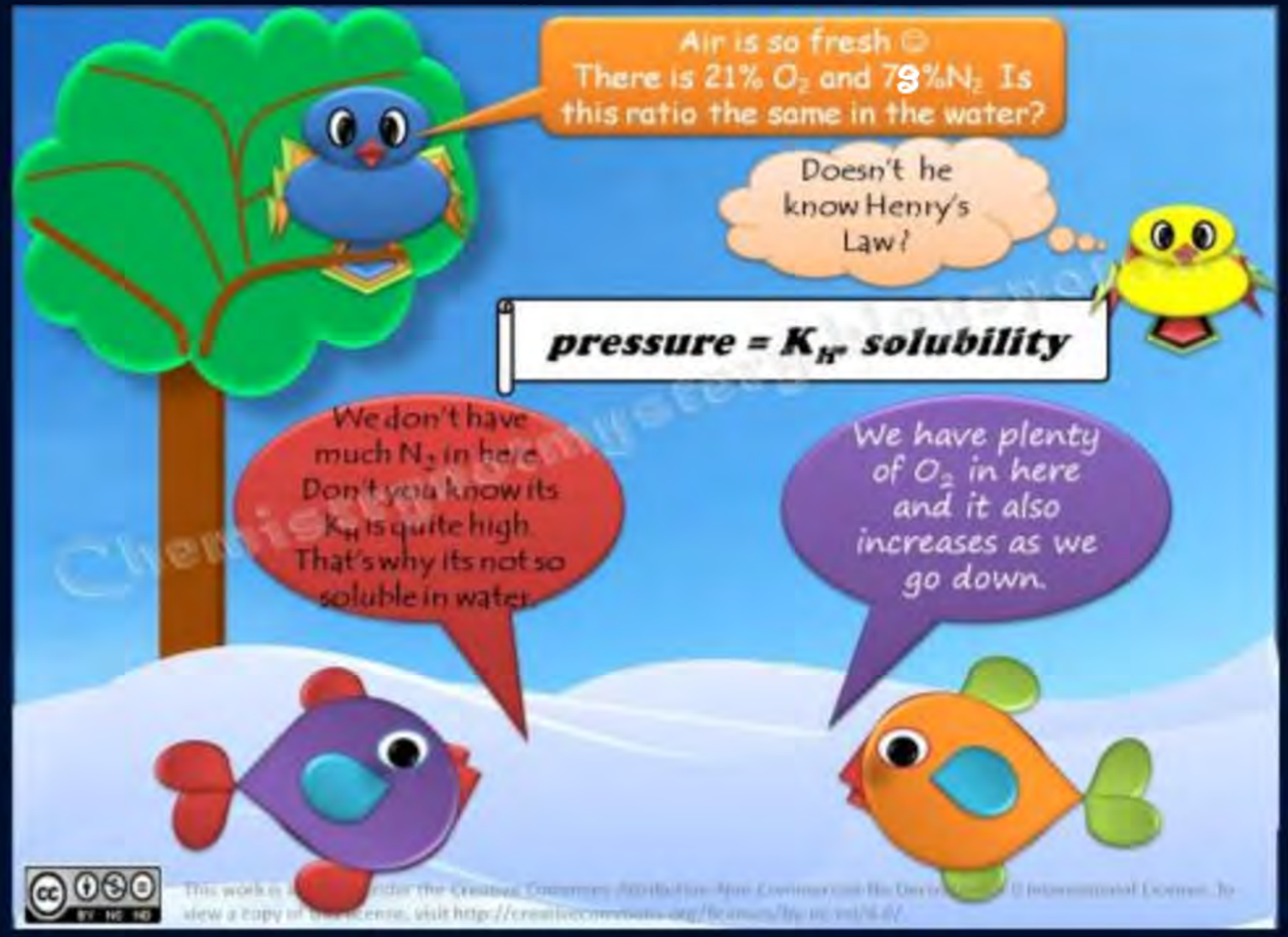
#MIT

1. K_H depends upon nature of gas

2. $K_H \propto$ Temperature

3. $K_H \propto \frac{1}{\text{Solubility of gas}}$

Temp $\propto \frac{1}{\text{Solubility of gas}}$



Limitations of Henry's Law

1. **Gas reacts with solvent**

Jaise ex : $NH_3 + H_2O \rightarrow NH_4OH \rightarrow NH_4^+ + OH^-$

2. **P is too high**

3. **Temperature is too low**

4. **When gases dissociate or associate in solvent**

Applications of Henry's Law

In deep sea Diving

He diluted.

20 l. 20 l. 60 l.

A	B	C
↓	↓	
40 Rs	40 Rs	120 Rs

50 l. 50 l.

Air Cylinders

O_2 + N_2 + He ✓

O_2 ═ N_2 ═

↓

P inc. Partial P dec.

S inc. Solubility dec.

O_2 blood dissolve

N_2 ,, ,,

P dec.

S dec.

O_2 used by blood

N_2 comes out from blood.

Cause pain.

On adding He, Partial P ↓

∴ Solubility dec.

Causes less pain.

Sickness decompression or Bends

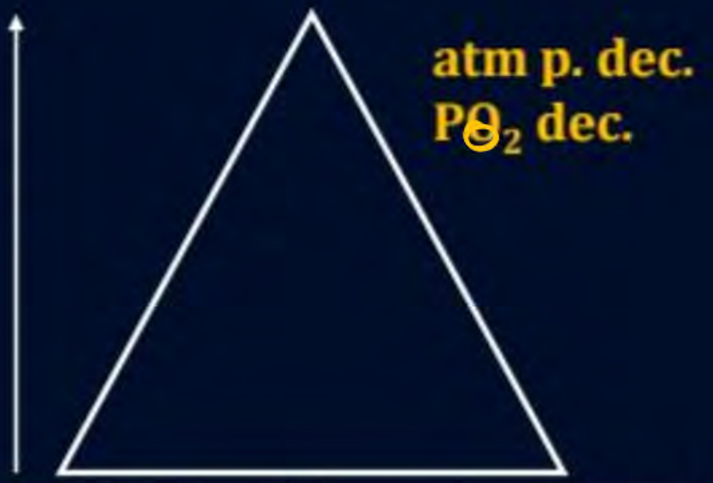
For people living at high altitudes

$\downarrow P_A = x_{oA}' \times P_T \downarrow$

At high attitudes atm P-dec. Po_2 dec.

Less O_2 is available for breathing which causes anoxia

$\therefore$ Mountains carry O_2 Cylinders with them



In function of Lungs

- In lungs PO_2 is very high it forms Oxyhaemoglobin but in Tissues PO_2 low

$\therefore$ O_2 is released

Chips packet gets swelled up at high altitudes, why?

Aeroplane → high altitudes PO_2 ↓

QUESTION

Low concentration of oxygen in blood and tissues of people living at high altitude is due to

A. Low temperature

B. Low atmospheric pressure

C. High atmospheric pressure

D. Both low temperature and high pressure

QUESTION – (NEET 2024)

The Henry's law constant (K_H) values of three gases (A, B, C) in water are 145, 2×10^{-5} and 35 kbar, respectively. The solubility of these gases in water follow the order:

$K_H \propto \frac{1}{\text{Solubility}}$

(A) B > A > C

(B) B > C > A ✓ B > C > A

(C) A > C > B

(D) A > B > C

QUESTION

P↑ T↓

The solubility of gases in liquids:

A. Increases with increase in pressure and temperature

B. Decreases with increase in pressure and temperature

C. Increases with increase in pressure and decrease in temperature

D. Decreases with increase in pressure and increase in temperature

QUESTION

Some of the following gases are soluble in water due to formation of their ions

I : SO_2; II: NH_3; III : HCl; IV : CH_4; V: H_2

Water insoluble gases can be:

(A) I, IV, V

(B) I, V

(C) I, II, III

(D) IV, V

$SO_2 + H_2O \rightarrow 2H^+ + SO_3^{2-}$

$NH_3 + H_2O \rightarrow NH_4^+ + OH^-$

$HCl + H_2O \rightarrow H^+ + Cl^-$

$CH_4 + H_2O \rightarrow$ No rxn

$H_2 + H_2O \rightarrow$ No rxn.

QUESTION

Molar solubility of helium, nitrogen and oxygen are plotted against partial pressure of the gas at constant temperature.
Henry's law constant for these gases will lie in following sequence?

A $O_2 > N_2 > He$

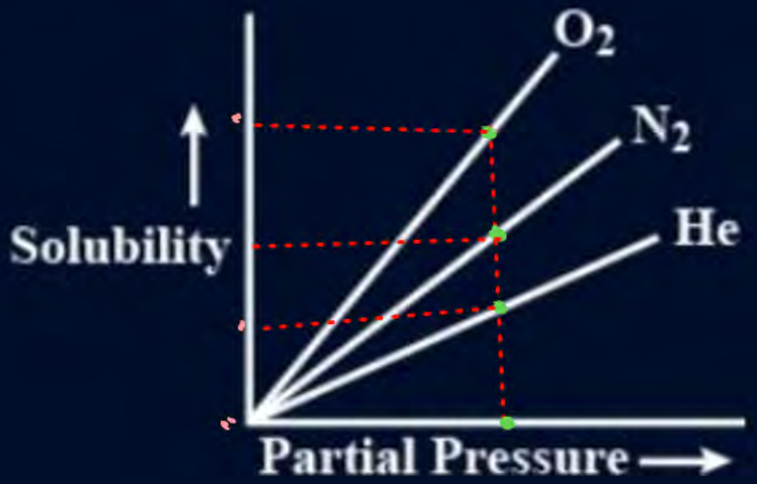
B $O_2 < N_2 < He$

C $O_2 = N_2 = He$

D $O_2 > N_2 < He$

$K_H \propto \frac{1}{\text{Solubility}}$

$O_2 < N_2 < He$



QUESTION

It is found that Henry's law constant (K_H) is the function of the nature of the gas, thus,

A. Higher the value of K_H at a given pressure, the lower is the solubility of the gas.

B. Higher the temperature of the gas, higher the vlaue of K_H, hence lower the solubility

C. Both of the above are correct

D. None of the above is correct

QUESTION

For O_2 and N_2, Henry's law constants are given at different temperature. Thus,

Gas	Temperature/K	K_H/kbar
N_2	293	76.5
N_2	303	88.5
O_2	293	35
O_2	303	47

T ↑ K_H ↑

A Solubility of gases decreases with increase in temperature

B When dissolved, the gas molecules are present in liquid phase and the process of dissolution can be considered similar to condensation in which heat is evolved ($\Delta H < 0$)

C Aquatic species are more comfortable in cold water rather than in warm water.

D All of the above are correct

QUESTION

C_2H_6

Partial pressure of ethane over sat, solution containing 6.56×10^{-2} g of ethane is 1 bar. If solution contains 5×10^{-2} g of ethane, then what shall be partial pressure of gas?

$P_{C_2H_6} = 1$ bar $\quad m_{C_2H_6} = 6.56 \times 10^{-2}$ g

$P'_{C_2H_6} = ?$ $\quad m'_{C_2H_6} = 5 \times 10^{-2}$ g

$$\frac{P_{C_2H_6}}{P'_{C_2H_6}} = \frac{K_H \, m_{C_2H_6}}{K_H \, m'_{C_2H_6}}$$

$$\frac{1}{P'_{C_2H_6}} = \frac{6.56 \times 10^{-2}}{5 \times 10^{-2}} \Rightarrow P'_{C_2H_6} = \frac{5}{6.56} = \frac{500}{656} \text{ bar}$$

$$m = \frac{n_B}{w_A(kg)}$$

$$\frac{\chi_B}{\chi_A} = \frac{n_B \times (n_A + n_B)}{(n_A + n_B)\, n_A}$$

$$= \frac{n_B \times 1000}{\frac{w_A}{M_A} \times M_A}$$

$$= \frac{n_B \times 1000}{n_A \times M_A}$$

$$m = \frac{\chi_B \times 1000}{\chi_A \times M_A}$$

$$m = \frac{\chi_B \times 1000}{(1-\chi_B) \times M_A}$$

QUESTION

$m = \frac{\chi_B \times 1000}{\chi_A \times M_A}$

$M_A = 18\ g$

H_2S, a toxic gas with rotten egg like smell, is used for the quantitative analysis. If the solubility of H_2S in water at STP is 0.2 m, then Henry's law constant for H_2S in water at 273 K is _____.

H_2S

(A) 3.6×10^8 Pa

(B) 5.0×10^8 Pa

(C) 5.0×10^5 Pa

(D) 2.78×10^7 Pa

$$m = 0.2\ m = \frac{\chi_{H_2S} \times 1000}{(1-\chi_{H_2S}) \times M_A} = 0.2 = \frac{1000\,\chi_{H_2S}}{18(1-\chi_{H_2S})}$$

STP

$P_{H_2S} = 1\ atm \approx 10^5\ Pa$

$P_{H_2S} = K_H \chi_{H_2S}$

$10^5 = K_H \times \frac{20}{5575}$

$K_H = \frac{5575 \times 10^5}{20} = \frac{2787.5 \times 10^4\ Pa}{1000} \times 1000 = 2.7875 \times 10^7\ Pa$

$0.2 - 0.2\,\chi_{H_2S} = 55.55\,\chi_{H_2O}$

$\chi_{H_2S} = \frac{0.20}{55.75}$

1 torr = 1 mm of Hg | 1 atm = 760 mm of Hg.

QUESTION (JEE MAINS -2016)

The solubility of N_2 in water at 300 K and 500 torr partial pressure is 0.01 g L^{-1}. The solubility (in g L^{-1}) at 750 torr partial pressure is:

A. 0.0075

B. 0.005

C. 0.02

D. 0.015 ✓

$S_{N_2} = 0.01\ g/L$

$P_{N_2} = 500\ torr$

$S'_{N_2} = ?$

$P'_{N_2} = 750\ torr$

$$\frac{P_{N_2}}{P'_{N_2}} = \frac{K_H S_{N_2}}{K_H S'_{N_2}}$$

$$\frac{500}{750} = \frac{0.01}{S'_{N_2}}$$

$$S'_{N_2} = \frac{0.01 \times 3}{2} = 0.015$$

QUESTION (JEE advance)

The Henry's law constant for the solubility of N_2 gas in water at 298 K is 1×10^5 atm. The mole fraction of N_2 in air 0.8. The number of mole of N_2 from air dissolved in 10 moles of water at 298 K at 5 atm pressure is:

(A) 4×10^{-4}

(B) 4×10^{-5}

(C) 5×10^{-4}

(D) 4×10^{-6}

$T = 298\ K$

$K_H(N_2) = 10^5$ atm

$\chi_{N_2} = Y_{N_2} = 0.8$

$n_{N_2} = ?$

$n_{H_2O} = 10$

$P_T = 5$ atm

$P_{N_2} = Y_{N_2} \times P_T$

$= 0.8 \times 5$

$= 4$ atm.

$P_{N_2} = K_H \times \chi_{N_2}$

$4 = K_H \times \dfrac{n_{N_2}}{n_{N_2} + n_{H_2O}}$

$4 = \dfrac{10^5 \times n_{N_2}}{n_{N_2} + 10}$

$40 \approx 10^5 n_{N_2}$

$4n_{N_2} + 40 = 10^5 n_{N_2}$

$n_{N_2} \approx \dfrac{40}{10^5} = 4 \times 10^{-4}$

QUESTION (JEE MAINS 9th Jan, 1st shift-2019)

Which one of the following statements regarding Henry's law is not correct?

(A) Different gases have different K_H (Henry's law constant) values at the same temperature

(B) The value of K_H increases with increase of temperature and K_H is function of the nature of the gas

(C) The partial pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution. $P_{N_2} = K_H \chi_{N_2}$

(D) Higher the value of K_H at a given pressure, higher is the solubility of the gas in the liquids

$K_H \propto \frac{1}{\text{Solubility}}$

QUESTION (JEE MAINS 3rd Sept, 1st shift-2020)

Henry's constants (in kbar) for four gases α, β, γ and δ in water at 298 K is given below:

Gas	α	β	γ	δ
K_H	50	2	2×10^{-5}	0.5

(Density of water = 10^3 kg m^{-3} at 298 K). This table implies that

A. α has the highest solubility in water at a given pressure

B. Solubility of γ at 308 K is lower than at 298 K

C. The pressure of a 55.5 molal solution of γ is 1 bar

D. The pressure of a 55.5 molal solution of δ is 250 bar

$P_T = 1$ bar

$P_r = K_H \chi_r$

$= 2 \times 10^{-5} \times \frac{1}{2}$

$= 10^{-5}$ K bar

$= 10^{-5} \times 100$ bar

$= 10^{-2}$ bar

$\chi_g = \frac{1}{2}$

$P_g = 0.5 \times 1000 \times \frac{1}{2}$

$= 250$ bar

$m = \frac{\chi_r \times 1000}{(1-\chi_r) \times M_A 18}$

$55.5 = \frac{\chi_r \times 55.5}{(1-\chi_r)}$

$1 - \chi_r = \chi_r$

$1 = 2\chi_r$

$\chi_r = \frac{1}{2}$

Home work from modules

Magarmach Practice Questions (MPQ)

QUESTION – (NCERT Exemplar)

On dissolving sugar in water at room temperature solution feels cool to touch. Under which of the following cases dissolution of sugar will be most rapid?

A. Sugar crystals in cold water.

B. Sugar crystals in hot water.

C. Powdered sugar in cold water.

D. Powdered sugar in hot water.

QUESTION – (NCERT Exemplar)

A beaker contains a solution of substance 'A'. Precipitation of substance 'A' takes place when small amount of 'A' is added to the solution. The solution is _____.

A. Saturated

B. Supersaturated

C. Unsaturated

D. Concentrated

QUESTION – (NCERT Exemplar)

Maximum amount of a solid solute that can be dissolved in a specified amount of a given liquid solvent does not depend upon _____.

A. Temperature

B. Nature of solute

C. Pressure

D. Nature of solvent

QUESTION* – (NCERT Exemplar)

Which of the following factor (s) affect the solubility of a gaseous solute in the fixed volume of liquid solvent?

(a) nature of solute (b) temperature (c) pressure

A (a) and (c) at constant T

B (a) and (b) at constant P

C (b) and (c) only

D (c) only

QUESTION – (NCERT Exemplar)

Match the items given in Column I with the type of solutions given in Column II.

Column I	Column II
(i) Soda water	(a) A solution of gas in solid
(ii) Sugar solution	(b) A solution of gas in gas
(iii) German silver	(c) A solution of solid in liquid
(iv) Air	(d) A solution of solid in solid
(v) Hydrogen gas in palladium	(e) A solution of gas in liquid
	(f) A solution of liquid in solid

THANK YOU