DPP SOLUTION

- Subject – Physical Chemistry

- Chapter – Solutions

DPP No.- 01

By – Amit Mahajan Sir

Question

Homogeneous mixture of two or more than two components is called

Sugar + water

↓

Homogeneous

1. **Solute** ✗
2. **Solvent** ✗
3. **Both (A) & (B)**
4. **Solution**

Ans (D)

Question

Which of the following is an example of gaseous solution?

1. **Camphor in nitrogen gas**

   solid $N_2(g)$

2. **Solution of hydrogen in palladium** x

   solute solvent

3. **Chloroform mixed with nitrogen gas**

   solute solvent

4. **Both (A) & (C)**

Ans (D)

Question

In amalgam of mercury with sodium, solvent is

1. **Mercury**
2. **Sodium**
3. **Amalgam**
4. **None of these**

Na(Hg)
↓
Sodium alloy with Hg(l)
↓ ↓
Solvent Solute

Ans (B)

Question

The unit of molality is

1. **mol L^{-1}**
2. **mol kg^{-1}**
3. **mol^{-1} L^{-1}**
4. **mol L**

$$m = \frac{n_B \Rightarrow mol}{w_A (in\ kg) \rightarrow kg}$$

Ans (B)

Question

The partial pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution is given by

1. **Raoult's law**
2. **Ostwald's law**
3. **Distribution law**
4. **Henry's law**

$P_A \propto x_A$

$P_A = K_H x_A$

Ans (4)

Question

Four gases like H_2, He, CH_4 and CO_2 has Henry's constant values (K_H) are 69.16, 144.979, 0.413 and 1. 67. The gas which is more soluble in liquid is

	H_2	He	CH_4	CO_2
K_H	69.16	144.979	0.413	1.67

(1) He

(2) CH_4

(3) H_2

(4) CO_2

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

Ans (2)

Question

The solubility of gas in a liquid increase with

1. **Increase of temperature**
2. **Amount of liquid taken** ×
3. **Decreases in temperature**
4. **Reduction of gas pressure**

T↑ solubility dec

T↓ solubility inc

Ans (3)

Question

solid or gas

Solubility of a substance is its maximum amount that can be dissolved in a specified amount of solvent. It depends upon

(i) Nature of solute

(ii) Nature of solvent

(iii) Temperature

(iv) Pressure

1. **Only (i), (ii) and (iii)**
2. **Only (i), (iii) and (iv)**
3. **Only (i) and (iv)**
4. **(i), (ii), (iii) and (iv)**

Ans (4)

Question

During dissolution when solute is a added to the solvent, some solute particles separate out from the solution as a result of crystallization. At the stage of equilibrium, the concentration of solute in the solution at given temperature and pressure.

Solute + Solvent $\underset{\text{Crystallisation}}{\overset{\text{Dissolution}}{\rightleftharpoons}}$ Solution.

P, T, Conc, density Constt.

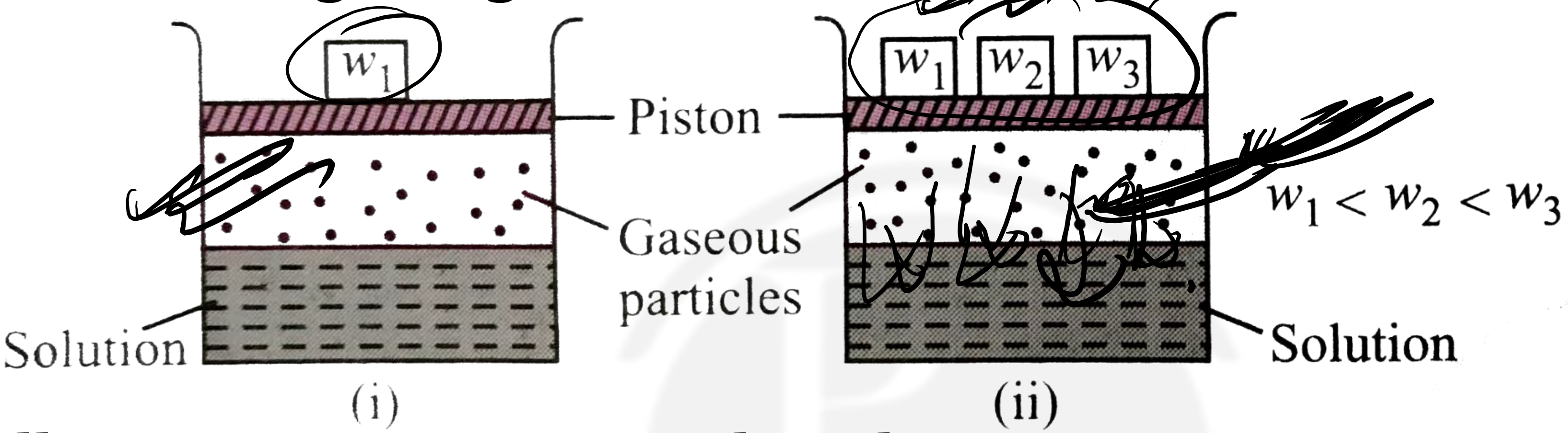
1. **Increases**
2. **Decreases**
3. **Remains constant**
4. **Keeps changing**

Ans (3)

Question

Consider the two figures given below.

Pressure high



of the following statements regarding the experiment is true?

1. **The solubility of a gas in liquid in beaker (i) is greater than that in beaker (ii).**
2. **The solubility of gas in beaker (i) is less than that in beaker (ii)**
3. **The solubility of gas is equal in both beakers.**
4. **The solubility of gas remains unaffected by change in weights.**

Ans (2)

Question

According to Henry's law the partial pressure of the gas in vapour phase (p) is proportional to the mole fraction of the gas (x) in the solution. For different gases the correct statements about Henry's constant is

$P \propto x$

1. **Higher the value of K_H at a given pressure, higher is the solubility of the gas.**
2. **Higher in the value of K_H at a given pressure, lower the solubility of the gas**
3. **K_H is not a function of nature of gas**
4. **K_H value for all gases is same at a given pressure.**

Ans (2)

Question

The value of Henry's law constant for some gases at 293 K is given below. Arrange the gases in the increasing order of their solubility.

He : 144.97 kbar, H_2 : 69.16 kbar

N_2 : 76.48 kbar, O_2 : 34.86 kbar

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

1. He < N_2 < H_2 < O_2
2. O_2 < H_2 < N_2 < He
3. H_2 < N_2 < O_2 < He
4. He < O_2 < N_2 < H_2

He < N_2 < H_2 < O_2

Ans (1)

Question

$\chi_B = \chi_{H_2S}$

$M_A = 18g$

H_2S is a toxic gas used in qualitative analysis. If solubility of H_2S in water at STP is 0.195 m, what is the value of K_H ?

$P = 1\,bar$

1. **0.0263 bar**
2. **69.16 bar**
3. **192 bar**
4. **282 bar**

$m = 0.195\,m$

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

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

$0.195 = \dfrac{\chi_B \times 1000}{(1-\chi_B)18}$

$0.195 = \dfrac{1000\chi_B}{18 - 18\chi_B}$

$3.51 - 3.51\chi_B = 1000\chi_B$

$\chi_B = \dfrac{3.51}{1003.51}$

$1 = K_H \times \dfrac{3.51}{1003.51}$

$K_H = \dfrac{1003.51}{3.51} = 282\,bar$

$\dfrac{1000}{4} \approx 250$

Ans (4)

Question

Henry's law constant for molality of methane in benzene at 298 K is 4.27×10^5 mm Hg. The mole fraction of methane in benzene at 298 K under 760 mm Hg is

1. 1.78×10^{-3}
2. 17.43
3. 0.114
4. 2.814

$K_H = 4.27 \times 10^5$ mm of Hg

$P_{CH_4} = 760$ mm of Hg

$\chi_{CH_4} = ?$

$P_{CH_4} = K_H \chi_{CH_4}$

$760 = 4.27 \times 10^{5} \chi_{CH_4}$

$\frac{760}{427} \times 10^{-3} = \chi_{CH_4}$

$\chi_{CH_4} = 1.748 \times 10^{-3}$

Ans (1)

Question

When a gas is bubbled through water at 298 K, a very dilute solution of gas is obtained. Henry's law constant for the gas is 100 k bar. If gas exerts a pressure of 1 bar, the number of moles of gas dissolved in 1 litre of water is

1. 0.555
2. 55.55×10^{-5}
3. 55.55×10^{-3}
4. 5.55×10^{-5}

$K_H = 100$ Kbar
$= 100000$ bar

$P_{gas} = 1$ bar

$n_{gas} = ?$

1 Litre of water → solvent

1000 ml of H_2O = V
1 g/ml of H_2O = d
$W_A = 1000 \times 1 = 1000$ g

$n_A = \frac{1000}{18} = 55.55$

Ans (2)

$$P_{gas} = K_{H(gas)} \; \chi_{gas}$$

$$1 = \frac{10^5 \; n_{gas}}{n_{gas} + 55.55}$$

$$n_{gas} + 55.55 = 10^5 \; n_{gas}$$

$$55.55 = 10^5 \; n_{gas} - n_{gas} \approx 10^5 \; n_{gas}$$

$$n_{gas} = \frac{55.55}{10^5} = 55.55 \times 10^{-5}$$

Question

How much oxygen is dissolved in 100 mL water at 298 K if partial pressure of oxygen is 0.5 atm and $K_H = 1.4 \times 10^{-3}$ mol/L/atm ?

1. 22.4mg
2. 22.4 g
3. 2.24 g
4. 2.24mg

$P_{O_2} = K_H \, x_{O_2}$

$w_{O_2} = ?$

V of H_2O = 100ml

$T = 298K$

$P_{O_2} = 0.5$ atm

$K_H = 1.4 \times 10^{-3}$ mol L^{-1} atm^{-1}

$$S_{O_2} = K_H P_{O_2}$$

$$K = \frac{S_{O_2} \rightarrow \frac{mol}{L}}{P_{O_2} \rightarrow atm}$$

Ans (4)

$S_{O_2} = K_H P_{O_2}$

$= 1.4 \times 10^{-3} \times 0.5 = 0.7 \times 10^{-3} = 7 \times 10^{-4}$ mol/L

1000 ml has moles of O_2 = 7×10^{-4} mol

100 ml ~~~~~~ $= \frac{7 \times 10^{-4}}{10\cancel{00}} \times 1\cancel{00} = 7 \times 10^{-5}$ mol

$M_{O_2} = 32g$

Mass of $O_2 = 7 \times 10^{-5} \times 32 = 224 \times 10^{-5}$ g

$= 2.24 \times 10^{-3}$ g

$= 2.24$ mg

Question

Henry's law is not applicable for aqueous solution of

1. O_2
2. N_2
3. SO_3
4. He

$SO_3 + H_2O \rightarrow H_2SO_4$

Ans (3)

Question

On increasing temperature, the solubility of $NaNO_3$ in water

endothermic

$T \uparrow$ solubility $\uparrow$

1. **Increases**
2. **Decreases**
3. **Remains unaffected**
4. **Cannot be determined**

Ans (1)

Question

O_2 is bubbled through water at 293 K. Assume that O_2 exerts a partial pressure of 0.98 bar, find the solubility of O_2 in g L^{-1}. The value of Henry's Law constant KH for O_2 is 34.84 k bar.

(1) 0.05

(2) 0.08

(3) 0.07

(4) 0.01

$P_{O_2} = 0.98$ bar

$K_H = 34.84$ K bar

$= 34840$ bar

$P_{O_2} = K_H \, x_{O_2}$

$0.98 = 34840 \dfrac{n_{O_2}}{n_{O_2} + n_{H_2O}}$

volume water$^{(A)}$ = 1 L = 1000 ml

$w_A = 1000g$, $M_A = 18g$

$n_{H_2O} = n_A = \dfrac{1000}{18} = 55.55$

$\dfrac{0.98}{1} = \dfrac{34840 n_{O_2}}{n_{O_2} + 55.55}$

$0.98 n_{O_2} + 54.439 = 34840 n_{O_2}$

Ans (1)

$$3484\,0\,n_{O_2} - 0.98\,n_{O_2} = 54.43\,g$$

$$34839\,n_{O_2} = 54.43\,g$$

$$n_{O_2} = \frac{54.43\,g}{34839} = 0.0015\ \text{mol}$$

$$n_{O_2} = 0.0015 \times 32\ g$$

$$= 0.048\,g$$

Thank You...