CHEMISTRY (CODE – 043)

Chapter-wise Test: Solutions

(NCERT Class XII Chemistry, Unit 1: Solutions)

PRACTICE QUESTION PAPER

CLASS XII (2026-27)

Time: 1½ hours **Max. Marks: 35**

GENERAL INSTRUCTIONS: Read the following instructions carefully.

1. There are 17 questions in this question paper with internal choice. All questions are based on Unit 1: Solutions.
2. SECTION A consists of 8 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 3 very short answer questions carrying 2 marks each.
4. SECTION C consists of 4 short answer questions carrying 3 marks each.
5. SECTION D consists of 1 case-based question carrying 4 marks.
6. SECTION E consists of 1 long answer question carrying 5 marks.
7. All questions are compulsory. Internal choice is provided in Questions 9 to 15, 16(iii) and 17.
8. Questions 2, 3, 9, 12, 13, 14 and 16 are based on figures, structures or data tables given in the paper.
9. Use of log tables and calculators is not allowed.

SECTION A

Questions 1 to 8 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions. Each question carries 1 mark.

1 Which one of the following concentration terms is independent of temperature? — 1

A. Molarity
B. Normality
C. Molality
D. Volume percentage

2 Fig. 1 shows the variation of the partial pressure (p) of two gases X and Y with their mole fraction (x) in the solution, in the same solvent at the same temperature. — 1

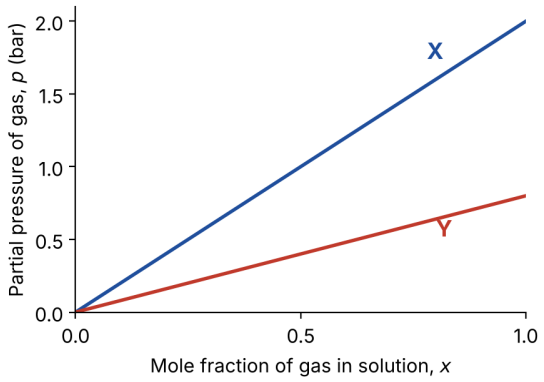


Fig. 1

Which of the following statements is correct?

A. Gas Y has a higher value of Henry's law constant than gas X.
B. Both gases have the same solubility at the same partial pressure.
C. At a given pressure, gas Y is less soluble than gas X.
D. Gas X has a higher value of K_H and is less soluble than gas Y at the same partial pressure.

3	The table gives the Henry's law constants (K_H) of some gases in water at 293 K. **Gas** | **He** | **H_2** | **N_2** | **O_2** K_H (kbar) | 144.97 | 69.16 | 76.48 | 34.86 Which of the following gases is the most soluble in water at 293 K when all of them are at the same partial pressure? A. He B. O_2 C. N_2 D. H_2	1
4	Which of the following pairs of liquids forms an (almost) ideal solution? A. Acetone and chloroform B. Ethanol and water C. Phenol and aniline D. Benzene and toluene	1
5	Which of the following forms a maximum boiling azeotrope? A. Ethanol and water B. Nitric acid and water C. Ethanol and acetone D. Carbon disulphide and acetone	1
6	Which of the following 0.1 M aqueous solutions will have the lowest freezing point? A. $Al_2(SO_4)_3$ B. $CaCl_2$ C. NaCl D. Glucose	1
7	The molality of a solution containing 4 g of NaOH (molar mass = 40 g mol^{-1}) in 250 g of water is: A. 0.1 m B. 0.2 m C. 0.4 m D. 1.0 m	1
8	**Assertion (A):** Aquatic species are more comfortable in cold water than in warm water. **Reason (R):** The solubility of oxygen in water increases with decrease in temperature. Select the most appropriate answer from the options given below: A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true.	1

SECTION B

Question Nos. 9 to 11 are very short answer questions carrying 2 marks each.

9 **Attempt either A or B.** 1+1

(A) Fig. 2 shows the vapour pressure–composition graphs of two binary solutions (a) and (b) of volatile liquids A and B.

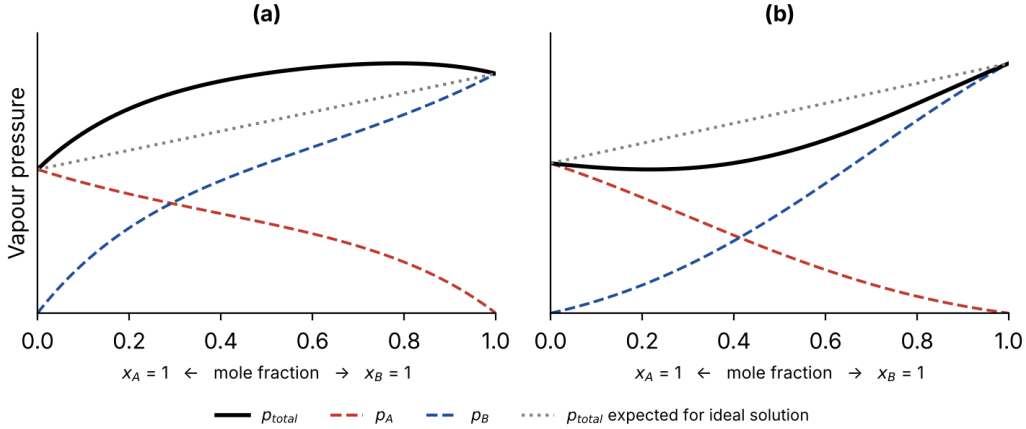


Fig. 2

(i) Name the type of deviation from Raoult's law shown by each solution.
(ii) Give one example of a pair of liquids for each type.

OR

(B) (i) What are ideal solutions? Write the values of $\Delta_{mix}H$ and $\Delta_{mix}V$ for them.
(ii) Give one example of an ideal solution.

10 **Attempt either A or B.** 1+1

(A) (i) State Henry's law.
(ii) Why do scuba divers suffer from a painful condition called 'bends' on coming rapidly to the surface?

OR

(B) (i) Why is a soda water bottle sealed under high pressure of CO_2?
(ii) Why do climbers at high altitudes become weak and unable to think clearly (anoxia)?

11 **Attempt either A or B.** 1+1

(A) Calculate the mole fraction of ethylene glycol ($C_2H_6O_2$) in a solution containing 30% of $C_2H_6O_2$ by mass. (Molar masses: $C_2H_6O_2$ = 62, H_2O = 18 g mol^{-1})

OR

(B) Calculate the molarity of a solution containing 10 g of NaOH in 250 mL of solution. (Molar mass of NaOH = 40 g mol^{-1})

SECTION C

Question Nos. 12 to 15 are short answer questions carrying 3 marks each.

12 **Attempt either A or B.** 1+2

Use the data given in the table for the molal boiling point elevation constant (K_b) and the molal freezing point depression constant (K_f) of some solvents.

Solvent	K_b (K kg mol^{-1})	K_f (K kg mol^{-1})
Water	0.52	1.86
Benzene	2.53	5.12
Cyclohexane	2.79	20.00
Carbon tetrachloride	5.03	31.8
Acetic acid	2.93	3.90

(A) (i) Which solvent in the table will show the largest depression in freezing point for the same molality of a solute?
(ii) 3.0 g of a non-volatile, non-electrolyte solute dissolved in 100 g of benzene lowers its freezing point by 0.64 K. Calculate the molar mass of the solute.

OR

(B) (i) 6.0 g of urea (molar mass = 60 g mol^{-1}) is dissolved in 200 g of water. Calculate the boiling point of the solution. (Boiling point of water = 373.15 K)
(ii) Which solvent in the table will show the largest elevation in boiling point for the same molality of a solute?

13 **Attempt either A or B.** 1+1+1

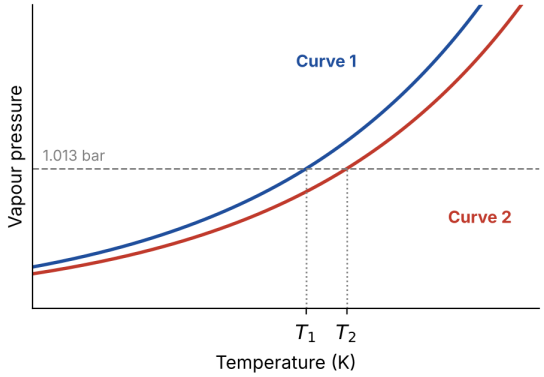
The table gives the van't Hoff factor (i) of some salts in aqueous solution at different concentrations.

Salt	0.1 m	0.01 m	0.001 m	i for complete dissociation
NaCl	1.87	1.94	1.97	2.00
KCl	1.85	1.94	1.98	2.00
$MgSO_4$	1.21	1.53	1.82	2.00
K_2SO_4	2.32	2.70	2.84	3.00

(A) (i) Why does the value of i approach the value for complete dissociation as the solution is made more dilute?
(ii) Why is the i value of $MgSO_4$ much lower than that of NaCl at the same molality?
(iii) Calculate the depression in freezing point of 0.01 m K_2SO_4 solution using the table. (K_f of water = 1.86 K kg mol^{-1})

OR

(B) (i) Define van't Hoff factor.
(ii) Using the table, calculate the degree of dissociation of K_2SO_4 in 0.01 m solution.

14	**Attempt either A or B.** **(A)** Fig. 3 shows the vapour pressure curves of a pure solvent and of a solution of a non-volatile solute in that solvent, plotted against temperature. The dashed line is at the atmospheric pressure of 1.013 bar.  **Fig. 3** (i) Which curve (1 or 2) represents the solution? Give a reason. (ii) What do T_1 and T_2 represent, and which is the boiling point of the solution? (iii) Write the relation between the elevation in boiling point (ΔT_b) and the molality of the solution. **OR** **(B)** The vapour pressures of pure liquids A and B are 300 and 500 mm Hg respectively at 350 K. Find the composition of the liquid mixture if the total vapour pressure is 400 mm Hg. Also find the composition of the vapour phase.	1+1+1
15	**Attempt either A or B.** **(A)** (i) What is osmosis? (ii) Calculate the osmotic pressure of a solution prepared by dissolving 9 g of glucose (molar mass = 180 g mol^{-1}) in 500 mL of solution at 300 K. (R = 0.083 L bar K^{-1} mol^{-1}) **OR** **(B)** (i) State Raoult's law for a solution containing a non-volatile solute. (ii) The vapour pressure of pure water at 298 K is 23.8 mm Hg. 12 g of urea (molar mass = 60 g mol^{-1}) is dissolved in 180 g of water. Calculate the vapour pressure of the solution.	1+2

SECTION D

Question No. 16 is a case-based/data-based question carrying 4 marks.

16 **Osmosis and red blood cells** 1+1+2

Red blood cells (RBCs) are surrounded by a semipermeable membrane. A laboratory technician placed samples of RBCs in three NaCl solutions P, Q and R and observed them under a microscope. The observations are recorded in the table.

Solution	NaCl (% w/v)	Observation of RBCs
P	0.9	No change in size
Q	0.3	Cells swell and finally burst
R	3.0	Cells shrink

Answer the following questions:

(i) Classify the solutions P, Q and R as isotonic, hypotonic or hypertonic with respect to the fluid inside the RBCs.
(ii) Name the phenomenon taking place in Q and state the direction of the flow of solvent.
(iii) **Attempt either A or B.**
(A) Why do the cells shrink in R? What would happen if a pressure larger than the osmotic pressure were applied on the solution side of a semipermeable membrane?
OR
(B) Why is a 0.9% NaCl solution used for intravenous injections? State one practical use of reverse osmosis.

SECTION E

Question No. 17 is a long answer question carrying 5 marks.

17 **Attempt either A or B.** 5

(A) (i) What are colligative properties? Name any two.
(ii) 5.0 g of a non-volatile non-electrolyte solute dissolved in 250 g of water depresses its freezing point by 0.372 K. Calculate the molar mass of the solute. (K_f of water = 1.86 K kg mol^{-1})
(iii) Calculate the boiling point of this solution. (K_b of water = 0.52 K kg mol^{-1}; boiling point of water = 373.15 K)
(iv) Why does 0.1 m NaCl solution show a greater depression in freezing point than 0.1 m glucose solution?

OR

(B) (i) Why is osmotic pressure preferred over other colligative properties for the determination of the molar mass of proteins and polymers?
(ii) Calculate the osmotic pressure at 300 K of a solution containing 5.85 g of NaCl in 1 litre of solution, assuming complete dissociation (i = 2). (R = 0.083 L bar K^{-1} mol^{-1}; molar mass of NaCl = 58.5 g mol^{-1})
(iii) Ethanoic acid (molar mass = 60 g mol^{-1}) dimerises in benzene. Calculate the van't Hoff factor if 80% of the acid is associated.
(iv) Calculate the molar mass of ethanoic acid that would be obtained experimentally in (iii).

— End of Question Paper —