DPP - Daily Practice Problems

Name : _____ Date : _____

Start Time : _____ End Time : _____

CHEMISTRY 31

SYLLABUS : Solution I : Solubility, Method of Expressing Concentration of Solutions, Colligative Properties, Relative Lowering of Vapour Pressure, Ideal and Non-ideal solutions.

Max. Marks : 120 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

DIRECTIONS (Q.1-Q.21) : There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE choice is correct.

Q.1 The statement "If 0.003 moles of a gas are dissolved in 900 g of water under a pressure of 1 atmosphere; 0.006 moles will be dissolved under a pressure of 2 atmospheres", illustrates

(a) Dalton's law of partial pressure
(b) Graham's law
(c) Raoult's law
(d) Henry's law

Q.2 Dilute one litre 1 molar H_2SO_4 solution by 5 litre water, the normality of that solution is

(a) 0.2 N (b) 5 N (c) 10 N (d) 0.33 N

Q.3 9.8g of H_2SO_4 is present in 2 litres of a solution. The molarity of the solution is

(a) 0.1 M (b) 0.05 M (c) 0.2 M (d) 0.01 M

Q.4 The normality of 0.3 M phosphorous acid (H_3PO_3) is

(a) 0.1 (b) 0.9 (c) 0.3 (d) 0.6

Q.5 20 ml of HCl solution requires 19.85 ml of 0.01 M NaOH solution for complete neutralization. The molarity of HCl solution is

(a) 0.0099 (b) 0.099 (c) 0.99 (d) 9.9

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ

Space for Rough Work

Q.6 Equimolar solutions in the same solvent have
(a) Same boiling point but different freezing point
(b) Same freezing point but different boiling point
(c) Same boiling and same freezing points
(d) Different boiling and different freezing points

Q.7 Which of the following is not a colligative property?
(a) Osmotic pressure
(b) Elevation in B.P
(c) Vapour pressure
(d) Depression in freezing point

Q.8 Colligative properties of a solution depend upon
(a) Nature of both solvent and solute
(b) The relative number of solute particles
(c) Nature of solute only
(d) Nature of solvent only

Q.9 Vapour pressure of CCl_4 at 25° C is 143 mm of Hg. 0.5 gm of a non-volatile solute (mol. wt. = 65) is dissolved in 100 ml CCl_4. Find the vapour pressure of the solution (Density of $CCl_4 = 1.58\ g/cm^3$)
(a) 141.93 mm (b) 94.39 mm
(c) 199.34 mm (d) 143.99 mm

Q.10 If p^o and p are the vapour pressure of a solvent and its solution respectively and N_1 and N_2 are the mole fractions of the solvent and solute respectively, then correct relation is
(a) $p = p^oN_1$ (b) $p = p^oN_2$
(c) $p^o = pN_2$ (d) $p = p^o(N_1/N_2)$

Q.11 At 300 K, when a solute is added to a solvent its vapour pressure over the mercury reduces from 50 mm to 45 mm. The value of mole fraction of solute will be
(a) 0.005 (b) 0.010 (c) 0.100 (d) 0.900

Q.12 A solution has a 1 : 4 mole ratio of pentane to hexane. The vapour pressure of the pure hydrocarbons at 20° C are 440 mmHg for pentane and 120 mmHg for hexane. The mole fraction of pentane in the vapour phase would be
(a) 0.549 (b) 0.200 (c) 0.786 (d) 0.478

Q.13 Which one of the statements given below concerning properties of solutions, describes a colligative effect ?
(a) Boiling point of pure water decreases by the addition of ethanol
(b) Vapour pressure of pure water decreases by the addition of nitric acid
(c) Vapour pressure of pure benzene decreases by the addition of naphthalene
(d) Boiling point of pure benzene increases by the addition of toluene

Q.14 An ideal solution was obtained by mixing methanol and ethanol. If the partial vapour pressure of methanol and ethanol are 2.619kPa and 4.556kPa respectively, the composition of the vapour (in terms of mole fraction) will be
(a) 0.635 methanol, 0.365 ethanol
(b) 0.365 methanol, 0.635 ethanol
(c) 0.574 methanol, 0.326 ethanol
(d) 0.173 methanol, 0.827 ethanol

Q.15 Which one of the following is the expression of Raoult's law?
(a) $\frac{p-p_s}{p} = \frac{n}{n+N}$ (b) $\frac{p_s-p}{p} = \frac{N}{N+n}$
(c) $\frac{p-p_s}{p_s} = \frac{N}{N-n}$ (d) $\frac{p_s-p}{p_s} = \frac{N-n}{N}$
p = vapour pressure of pure solvent
p_s = vapour pressure of the solution
n = number of moles of the solute
N = number of moles of the solvent

Q.16 In an experiment, 1g of a non-volatile solute was dissolved in 100g of acetone (mol. mass = 58) at 298 K. The vapour pressure of the solution was found to be 192.5 mm Hg. The molecular weight of the solute is (vapour pressure of acetone = 195 mm Hg)
(a) 25.24 (b) 35.24
(c) 45.24 (d) 55.24

Q.17 Which of the following liquid pairs shows a positive deviation from Raoult's law ?
(a) Water-nitric acid (b) Benzene-methanol
(c) Water-hydrochloric acid (d) Acetone-chloroform

RESPONSE GRID					
	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ	10. ⓐⓑⓒⓓ
	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ	15. ⓐⓑⓒⓓ
	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ			

Space for Rough Work

Q.18 Formation of a solution from two components can be considered as
(i) Pure solvent → separated solvent molecules, ΔH_1
(ii) Pure solute → separated solute molecules, ΔH_2
(iii) Separated solvent & solute molecules → Solution, ΔH_3
Solution so formed will be ideal, if
(a) $\cdot H_{soln} \cdot \cdot H_3 \cdot \cdot H_1 \cdot \cdot H_2$
(b) $\cdot H_{soln} \cdot \cdot H_1 \cdot \cdot H_2 \cdot \cdot H_3$
(c) $\cdot H_{soln} \cdot \cdot H_1 \cdot \cdot H_2 \cdot \cdot H_3$
(d) $\cdot H_{soln} \cdot \cdot H_1 \cdot \cdot H_2 \cdot \cdot H_3$

Q.19 Which of the following is true, when components form an ideal solution ?
(a) $\Delta H_m = \Delta V_m = 0$ (b) $\Delta H_m > \Delta V_m$
(c) $\Delta H_m < \Delta V_m$ (d) $\Delta H_m = \Delta V_m = 1$

Q.20 Which of the following mixture shows positive deviation by ideal behaviour?
(a) $CHCl_3 + (CH_3)_2CO$ (b) $C_6H_6 + C_6H_5CH_3$
(c) $H_2O + HCl$ (d) $CCl_4 + CHCl_3$

Q.21 When ethanol mixes in cyclohexane; cyclohexane reduces the intermolecular forces between ethanol molecules. In this, liquid pair shows
(a) positive deviation by Raoult's law
(b) negative deviation by Raoult's law
(c) no deviation by Raoult's law
(d) decrease in volume

DIRECTIONS (Q.22-Q.24) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

Codes :
(a) 1, 2 and 3 are correct **(b)** 1 and 2 are correct
(c) 2 and 4 are correct **(d)** 1 and 3 are correct

Q.22 In which case Raoult's law is applicable ?
(1) 1 M urea (2) 1 M glucose
(3) 1 M sucrose (4) 1 M NaCl

Q.23 Which one of the following are ideal solutions?
(1) Benzene + toluene
(2) *n*-Hexane + *n*-heptane
(3) Ethyl bromide + ethyl iodide
(4) $CCl_4 + CHCl_3$

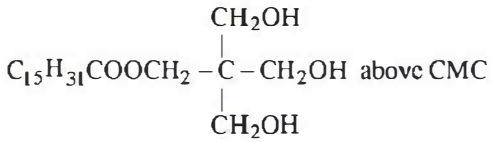
Q.24 Which of the following statements are correct?
(1) Relative lowering of vapour pressure is independent of the nature of solute
(2) The vapour pressure is a colligative property
(3) Vapour pressure of a solution is lower than the vapour pressure of the solvent
(4) The relative lowering of vapour pressure is directly proportional to the original pressure

DIRECTIONS (Q.25-Q.27) : Read the passage given below and answer the questions that follows :

Measurement of colligative properties of dilute solutions of many of substances may be used to determine their molecular masses. However, in some cases the calculated values differ considerably from the normal values. Their departure from the normal values is owing to the change of molecular state of the solute in the solution. The ratio of normal molecular mass to the observed value called Van't Hoff factor, *i*, reflects the kind of change of molecular state of the dissolved substance.

Q.25 Which of the following structural changes will not be reflected by the Van't Hoff factor of a dissolved solute?
(a) Association (b) Ionization
(c) Micellization (d) Isomerization

Q.26 Which of the following substances will not show the abnormal colligative properties in solutions ?
(a) Aqueous solution of sodium oleate
(b) Aqueous solution of



(c) Phenol in benzene
(d) Aqueous solution of thiourea

Q.27 For 0.1 M solution, the colligative property will follow the order
(a) $NaCl > Na_2SO_4 > Na_3PO_4$
(b) $NaCl < Na_2SO_4 < Na_3PO_4$
(c) $NaCl > Na_2SO_4 \approx Na_3PO_4$
(d) $NaCl < Na_2SO_4 = Na_3PO_4$

RESPONSE GRID					
	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ	20. ⓐⓑⓒⓓ	21. ⓐⓑⓒⓓ	22. ⓐⓑⓒⓓ
	23. ⓐⓑⓒⓓ	24. ⓐⓑⓒⓓ	25. ⓐⓑⓒⓓ	26. ⓐⓑⓒⓓ	27. ⓐⓑⓒⓓ

Space for Rough Work

DIRECTIONS (Q.28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(c) Statement-1 is False, Statement-2 is True.

(d) Statement-1 is True, Statement-2 is False.

28. **Statement-1 :** If 100 cc of 0.1 N HCl is mixed with 100 cc of 0.2 N HCl, the normality of the final solution will be 0.30.

Statement-2 : Normalities of similar solutions like HCl can be added.

29. **Statement-1 :** If a liquid solute is more volatile than the solvent added to the solvent, the vapour pressure of the solution may increase i.e., $p_s > p^o$.

Statement-2 : In the presence of a more volatile liquid solute, only the solute will form the vapours and solvent will not.

30. **Statement-1:** Azeotropic mixtures are formed only by non-ideal solutions and they may have boiling points either greater or lesser than both the components.

Statement-2 : The composition of the vapour phase is same as that of the liquid phase of an azeotropic mixutre.

RESPONSE GRID	28.ⓐⓑⓒⓓ	29.ⓐⓑⓒⓓ	30.ⓐⓑⓒⓓ

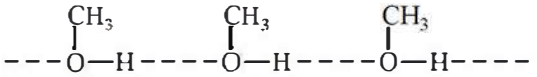
DAILY PRACTICE PROBLEM SHEET 31 - CHEMISTRY			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	36	Qualifying Score	52
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

DAILY PRACTICE PROBLEMS

CHEMISTRY SOLUTIONS (31)

1. (d) Mole fraction ∝ partial pressure of the gas
2. (d) $N_1V_1 = N_2V_2$ $[V_2 = (1+5=6)]$
$\Rightarrow 2\times1 = N_2\times6 \Rightarrow N_2 = 0.33$
3. (b) $M = \frac{W\times1000}{\text{mol.mass}\times\text{Volume in ml.}} = \frac{9.8\times1000}{98\times2000} = 0.05M$
4. (d) Basicity of H_3PO_3 is 2.
Hence Normality $0.3\,M\ H_3PO_3 = 0.6\,N$.
5. (a) $M_1V_1 = M_2V_2$, $0.01\times19.85 = M_2\times20$, $M_2 = 0.009925$;
$M_2 = 0.0099$
6. (c) Due to same conc. and same nature of solvent.
7. (c) Vapour pressure is not colligative property.
8. (b) Colligative properties depend upon no. of solute particles only.
9. (a) $\frac{p^o - p_s}{p^o} = \frac{w\times M}{m\times W} \Rightarrow p_s = p^o - p^o\left(\frac{w\times M}{m\times W}\right)$
$= 143 - \frac{0.5\times154}{65\times158}\times143$
$= 143 - 1.07 = 141.93$mm.
10. (a) Partial pressure of any volatile constituent of a solution is equal to the vapour pressure of any constituent multiplied by mole fraction of that constituent.
11. (c) $\frac{p^o - p_s}{p^o} = X_{solute} \Rightarrow \frac{50-45}{50} = X_{solute} = 0.1$
12. (d) $P_T = P_p^oX_p + P_h^oX_h = 440\times\frac{1}{5} + 120\times\frac{4}{5}$
$= 88+96 = 184$;
$P_p^oX_p = Y_pP_T \Rightarrow \frac{88}{184} = Y_p = 0.478$
13. (c) The decrease in vapour pressure of benzene by addition of naphthalene is an example of colligative property.
Change in vapour pressure of solvent or change in boiling point of solvent may also be due to formation of hydrogen bond and or interaction between solvent molecules and solute molecules.
14. (b) Composition of methanol in vapour $= \frac{2.619}{2.619+4.556}$
$= 0.365$
Thus composition of ethanol in vapour
$= 1 - 0.365 = 0.635$
15. (a) Only (a) describes the Raoult's law correctly among the given choices.
16. (c) $\frac{p^o - p_s}{p^o} = \frac{n}{n+N} \Rightarrow \frac{195-192.5}{195} = \frac{1/M}{100/58 + 1/M}$
$\Rightarrow M = 45.24$
17. (b) In solution showing positive type of deviation the partial pressure of each component of solution is greater than the vapour pressure as expected according to Raoult's law.
In solution of methanol & benzene methanol molecules are held together due to hydrogen bonding as shown below.



On adding benzene, the benzene molecules get in between the molecules of methanol thus breaking the hydrogen bonds. As the resulting solution has weak intermolecular attraction, the escaping tendency of alcohol & benzene molecules from the solution increases. Consequently, the vapour pressure of the solution is greater than the vapour pressure as expected from Raoult's law.
18. (b) For an ideal solution, $\Delta H_{mixing} = 0$
$\Delta H = \Delta H_1 + \Delta H_2 + \Delta H_3$ (According to Hess's law)
i.e., for ideal solutions there is no change in magnitude of the attractive forces in the two components present.
19. (a) For the ideal solution, ΔH_{mix} and $\Delta V_{mix} = 0$
20. (d) The mixture of $CCl_4 + CHCl_3$ shows positive deviation ideal behaviour.
21. (a) In this case liquid pair shows positive deviation and the reason is same as in Q.17.
22. (a) Raoult's law is not applicable to solutes which dissociate or associate in the particular solution.
23. (a) $CCl_4 + CHCl_3$ is the only example of non-ideal solution.
24. (d) According to Raoult's law, the relative lowering in vapour pressure of a dilute solution is equal to mole fraction of the solute present in the solution, vapour pressure is not a colligative property.
Thus, statements (1), and (3) are correct.
25. (d) Isomerization does not lead to change of concentration of mole particles in the solution.
26. (d) In (a) and (b) the solutes undergo micellization in solution, and in (c) the solute undergoes dimerization. As a result the observed colligative properties will be different than the normal values and in thiourea i = 1.
27. (b) Colligative property in decreasing order
$Na_3PO_4 > Na_2SO_4 > NaCl$
$Na_3PO_4 \rightarrow 3Na^+ + PO_4^{3-} = 4$
$Na_2SO_4 \rightarrow 2Na^+ + SO_4^{2-} = 3$
$NaCl \rightarrow Na^+ + Cl^- = 2$
28. (c) If 100 cc of 0.1 N HCl is mixed with 100 cc of 0.2 N HCl, the normality of the final solution will be 0.15
$N_1V_1 + N_2V_2 = N_3V_3$ i.e.,
$0.1\times100 + 0.2\times100 = N_3\times200$
or $N_3 = \frac{0.3\times100}{200} = 0.15$
29. (d) Both the solute and solvent will form the vapour but vapour phase will become richer in the more volatile component.
30. (b) Non-ideal solutions with positive deviation i.e., having more vapour pressure than expected, boil at lower temperature while those with negative deviation boil at higher temperature than those of the components.