HOLIDAY HOME WORK FOR SUMMER VACATION 2022-23

CLASS XII A

1. **INVESTIGATORY PROJECT:** All the students are required to conduct a scientific investigation involving laboratory testing and collecting information from other sources. This project is assessed as a part of practical examination at the end of year. A project should ideally arise out of the need felt by the student. Students explore their areas of interest and narrow down their ideas to a testable hypothesis or problem question. There are many issues in our immediate surroundings which need to be addressed. Keen observation will help identify the problem.

A project could have the following outline:

1. **Statement of Problem-**A clear statement of the problem/need that has given rise to the project

2. **Objectives**-General and specific objectives of topic

3. **Introduction**-The introduction should describe the relevance of problem or why the problem is the most appropriate for your inquiry. It should also describe previously known facts about your problem question with proper bibliography. Introduction towards end briefly includes hypothesis your hypothesis and the method to test it.

4. **Problem question** (specific, concrete questions to which concrete answers can be given) and/ or hypotheses

5.**Methods/Procedures Methodology** (will your research be based on survey, an experimental investigation, historical study, ethnographic study or content analysis).Methods describe the experiments proposed or the observations planned to make and the detailed process of analysis of data/observations. Methods proposed should be feasible and be able to adequately answer problem question.

6. **Materials/Resources required**

7. **Observations/Data** gathered Using the procedures mentioned in introduction, experiments should be conducted and data should be recorded. Interesting things that happened during the conduct of experiments should also be recorded.

8. **Analysis of data and discussion of result** Data should be interpreted in terms of proposed hypothesis. Data should be tabulated and interpreted with the help of graphs if possible. The interpretation should be done in an honest manner even if it does not support proposed hypothesis. 9. Conclusion Reporting and writing up the report Discussion of new learning from the study may be covered under conclusion. This may have possible suggestions for future studies.

10. **Limitation of the study** The limitations of the study are those features of design or procedure that might have affected the interpretation of the results of study. The limitations are alternatively interpreted as flaws or shortcomings due to flawed methodology, observations, small number of experiments or non-peer reviewed nature of study etc.

11. **Bibliography**

II. Write in your Notebook:

UNIT - SOLUTIONS

1. The system that forms maximum boiling azeotrope is
(a) Carbon disulphide – acetone (b) Benzene – toluene
(c) Acetone – chloroform (d) n-Hexane – n-Heptane

2. In osmosis
(a) Solvent molecules move from higher concentration to lower concentration
(b) Solvent molecules move from lower concentration to higher concentration
(c) Solute molecules move from higher concentration to lower concentration
(d) Solute molecules move from lower concentration to higher concentration

3. Two solutions A and B are separated by semi-permeable membrane. If the liquid flows from A to B then
(a) A is less concentrated than B (b) A is more concentrated than B
(c) Both have the same concentration (d) None of these

4. A liquid mixture boils without changing constituent is called
(a) Binary liquid mixture (b) Zeotropic mixture
(c) Azeotropic mixture (d) Stable structure complex

5. Osmotic pressure is measured quickly and accurately by
(a) Berkeley and Hatley's method (b) Morse's method
(c) Pleffer's method (d) De Vries method

6. A solution of acetone in ethanol
(a) behaves like a near ideal solution
(b) Obeys Raoult's law
(c) Shows a negative deviation from Raoult's Law
(d) Shows a positive deviation from Raoult's Law

7. Liquids A and B form an ideal solution
(a) The enthalpy of mixing is zero
(b) The entropy of mixing is zero
(c) The free energy of mixing is zero
(d) The free energy as well as the entropy of mixing is zero

8. When a substance is dissolved in a solvent, the vapour pressure of the solvent is decreased. This result in
(a) An increase in the boiling point of the solution
(b) A decrease in the boiling point of the solvent
(c) The solution having a higher freezing point than the solvent
(d) The solution having a lower osmotic pressure than the solvent

9. The density of 3 M solution of NaCl is 1.25 g L^{-1}. The molality of the solution is
(a) 1.79 (b) 2.79
(c) 0.79 (d) 2.98

10. Which colligative property is more useful to determine the molecular mass of the proteins and polymers?
(a) Lowering in vapour pressure (b) Elevation in boiling point
(c) Depression in freezing point (d) Osmotic pressure

11. Value of Henry's constant K_H is
(a) Increases with increase in temperature
(b) Decreases with increase in temperature
(c) Remains constant
(d) First increases then decreases

12. If two liquids A and B form minimum boiling azeotrope at some specific composition then
(a) A – B interactions are stronger than those between A – A or B – B
(b) Vapour pressure of solution increase because more number of molecules of liquids A and B can escape
(c) Vapour pressure of solution decreases because less number of molecules of only one of the liquids escapes from the solution
(d) A – B interactions are weaker than those between A – A or B – B.

13. Molal depression constant depends upon:
(a) nature of the solute (b) nature of the solvent
(c) vapour pressure of the solution (d) heat of solution

14. Ethylene glycol is used as antifreeze in a cold climate. Mass of ethylene glycol which should be added to 4 kg of water to prevent it from freezing at – 6 ^{0}C will be: (K_f for water = 1.86 K kg mol^{-1} and molar mass of ethylene glycol = 62 g mol^{-1})
(a) 204.30 g (b) 804.32 g
(c) 400.00 g (d) 304.60 g

15. Normal human blood sugar range from 65 – 105 mg / dL.
Considering density of human blood is 1.06 kg/ L, if a patient's sugar level reads 720 ppm, his/her blood sugar at that time is
(a) Low (b) High
(c) Normal (d) Cannot say

16. When a particular solution has a higher osmotic pressure than the given standard solution, it is most appropriately called as …… with respect to the standard solution.
(a) Hypotonic (b) Hypertonic
(c) Isotonic (d) Pertonic

17. Which of the following statements is correct?
(a) Solutes that dissociates in water experience a decrease in colligative properties
(b) Colligative properties are independent of the number of particles of the solute in the solution
(c) Solutes that dissociate in water have molar mass higher than the molar mass of the solute calculated theoretically
(d) Solutes that associate in water have molar mass higher than the molar mass of the solute calculated theoretically.

18. Which relationship is not correct?

(a) $\Delta T_b = \frac{K_{b}.1000.W_2}{M_2.W_1}$ (b) $M_2 = \frac{K_{f}.W_1.1000}{W_2.\Delta T_b}$

(c) $\pi = \frac{n_2}{V}RT$ (d) $\frac{p^0 - p_s}{p^0} = \frac{W_2}{M_2} \times \frac{M_1}{W_1}$

19. Water – HCl mixture
I. shows positive deviations II. Forms minimum boiling azeotrope
III. shows negative deviations IV. Forms maximum boiling azeotrope
(a) I and II (b) II and III
(c) I and IV (d) III and IV

20. Which of the following is true for an aqueous solution of the solute in terms of concentration?
(a) 1 M = 1 m (b) 1 M > 1 m
(c) 1 M < 1 m (d) cannot be predicted

21. Two liquids P and Q have vapour pressures 450 and 200 torr respectively at certain temperature. In an ideal solution of the two, the mole fraction of P at which two liquids have equal partial pressures is
(a) 0.80 (b) 0.308
(c) 0.444 (d) 0.154

22. When 1 mole of benzene is mixed with 1 mole of toluene, the vapour will contain:
(Given: vapour pressure of benzene = 12.8 kPa and vapour pressure of toluene = 3.85 kPa)
(a) equal amount of benzene and toluene as it forms an ideal solution.
(b) unequal amount of benzene and toluene as it forms a non ideal solution
(c) higher percentage of benzene
(d) higher percentage of toluene

23. A set of solutions is prepared using 180 g of water as a solvent and 10 g of different non-electrolyte and non-volatile solutes A, B and C. The relative lowering of vapour pressure in the presence of these solutes are in the order (given: Molar mass of A = 100 g mol^{-1}, B = 200 g mol^{-1}, C = 10,000 g mol^{-1})
(a) A > B> C (b) B > C > A

(c) C > B > A (d) A > C > B

24. The osmotic pressure of 5 % aqueous solution of glucose (π_1) is related to that of 5 % aqueous solution of urea (π_2) as
(a) $\pi_1 = \pi_2$ (b) $\pi_1 < \pi_2$
(c) $\pi_1 > \pi_2$ (d) $\pi_1 = {}^{\pi_2}/_2$

25. Which of the following units is useful in relating concentration of solution with its vapour pressure?
(a) mole fraction (b) Parts per million
(c) mass percentage (d) molality

26. On dissolving sugar in water at room temperature solution feels cool top 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

27. Osmotic pressure of urea solution at 10 ^{0}C is 500 mm. Osmotic pressure of the solution becomes 105.3 mm. When it is diluted and temperature raised to 25 ^{0}C. The extent of dilution is:
(a) 6 times (b) 5 times
(c) 7 times (d) 4 times

28. A pressure cooker reduces cooking time because:
(a) heat is more evenly distributed
(b) the high pressure tenderises the food
(c) the boiling point of water inside the cooker is elevated
(d) the boiling point of water inside the cooker is depressed

29. Azeotropic mixture of HCl and Water has
(a) 84 % HCl (b) 22.2 % HCl
(c) 63 % HCl (d) 20.2 % HCl

30. For which of the following solutions ΔH_{mix} and ΔV_{mix} is negative?
(a) Acetone and aniline (b) Ethyl alcohol and cyclohexane
(c) Acetone and CS_2 (d) Benzene and toluene

31. The empirical formula of a non-electrolyte is CH_2O. A solution containing 6 g of the compound exerts the same osmotic pressure as that of 0.05 M glucose solution at the same temperature. The molecular formula of the compound is:
(a) $C_2H_4O_2$ (b) $C_3H_6O_3$
(c) $C_5H_{10}O_5$ (d) $C_4H_8O_4$

32. 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 1 atmospheres”, illustrates:

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

33. Which of the following characteristics is not possessed by an ideal solution?
(a) Obeys Raoult's law
(b) Volume change on mixing is not equal to zero
(c) There should be no chemical reaction between solute and solvent
(d) Only very dilute solutions behave as ideal solutions

34. The phenomenon of lowering of vapour pressure is defined as:
(a) Decrease in vapour pressure of a solvent on addition of a volatile non electrolyte solute in it.
(b) Decrease in vapour pressure of a solvent on addition of a non-volatile non electrolyte solute in it.
(c) Decrease in vapour pressure of a solvent on addition of a volatile electrolyte solute in it.
(d) Decrease in vapour pressure of a solvent on addition of a non-volatile solute in it.

35. During depression of freezing point in a solution the following are in equilibrium
(a) liquid solvent, solid solvent (b) liquid solvent, solid solute
(c) liquid solute, solid solute (d) liquid solute, solid solvent

36. 1 molar aqueous solution is more concentrated than 1 molal aqueous solution of the same solute because:
(a) mass of the solute present in 1 molar solution is more
(b) volume of solvent in 1 molar aqueous solution is less
(c) volume of solvent in 1 molar aqueous solution is more
(d) All the above statements are correct

37. 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) Higher the value of K_H at a given pressure, higher is the solubility of the gas in the liquids
(c) The value of K_H increases with increase of temperature and K_H is function of the nature of the gas
(d) The partial pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution.

38. 1 g of a non-volatile, non-electrolyte solute is dissolved in 100 g of two different solvents A and B, whose ebullioscopic constants are in the ratio of 1: 5. The ratio of the elevation in their boiling points, $\frac{\Delta T_{b\ (A)}}{\Delta T_{b\ (B)}}$, is
(a) 5 : 1 (b) 10 : 1
(c) 1 : 5 (d) 1 : 0.2

ASSERTION REASONING TYPE QUESTIONS

In these questions (Q.No. 39 – 48), a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(a) Assertion and reason both are correct statements and reason is the correct explanation for assertion.

(b) Assertion and reason both are correct statements but reason is not the correct explanation for assertion.

(c) Assertion is correct statement but reason is wrong statement.

(d) Assertion is wrong statement but reason is correct statement.

39. Assertion : Reverse osmosis is used in the desalination of sea water.
Reason: When pressure more than osmotic pressure is applied, pure water is squeezed out of the sea water through the membrane.

40. Asssertion: The freezing point is the temperature at which solid crystallizes from solution.
Reason: The freezing point depression is the difference between that temperature freezing point of pure solvent.

41. Assertion: Isotonic solution does not show the phenomenon of osmosis.
Reason: Isotonic solutions have equal osmotic pressure.

42. Assertion: Molecular mass of polymers cannot be calculated using boiling point or freezing point method.

Reason: Polymer solutions do not possess a constant boiling point or freezing point.

43. Assertion: On placing RBC's in 0.5 % NaCl solution, they will shrink due to plasmolysis.
Reason: RBC's are isotonic with 0.91 % NaCl solution.

44. Assertion: Azeotropic mixtures are formed only by non –ideal solutions and they may have boiling points either greater than both the components or lesser than both the components.
Reason: The composition of the vapour phase is same as that of the liquid phase of an azeotropic mixture.

45. Assertion: ΔH_{mix} and ΔV_{mix} are positive for an ideal solution.
Reason: The interactions between the particles of the components of an ideal solution almost identical as between particles in the liquids.

46. Assertion: The pressure exerted by the vapour in equilibrium with a liquid at a given temperature is called its vapour pressure.
Reason: If a non-volatile solute is added to a solvent to give a solution, the vapour pressure of the solution is found to be greater than the vapour pressure of the pure solvent.

47. Assertion: One molal aqueous solution of urea contains 60 g of urea in 1 kg of water.
Reason: Solution containing one mole of solute in 1000 g solvent is called one molal solution.

48. Assertion: If a liquid solute, more volatile than the solvent, is added to the solvent, the vapour pressure of the solution may increase i.e. $p_s > p^o$.
Reason: In the presence of a more volatile liquid solute, only the solute will form the vapours and solvent will not.

COMPREHENSION BASED QUESTIONS

49. Read the passage below and answer the following questions :
The solubility of gases increases with increase of pressure. William Henry made a systematic investigation of the solubility of a gas in a liquid. According to Henry's law "the mass of a gas dissolved per unit volume of the solvent at constant temperature is directly proportional to the pressure of the gas in equilibrium with the solution."
Dalton during the same period also concluded independently that the solubility of a gas in a liquid solution depends upon the partial pressure of a gas. If we use the mole fraction of gas in the solution as a measure of its solubility, then Henry's law can be modified as "the partial pressure of the gas in the vapour phase is directly proportional to the mole fraction of the gas in the solution."

(i) Henry's law constant for the solubility of methane in benzene at 298 K is 4.27×10^5 mm Hg. The solubility of methane in benzene at 298 K under 760 mm Hg is
(a) 4.27×10^{-5} (b) 1.78×10^{-3}
(c) 4.27×10^{-3} (d) 1.78×10^{-5}

(ii) The partial pressure of ethane over a saturated solution containing 6.56×10^{-2} g of ethane is 1 bar. If the solution contains 5.00×10^{-2} g of ethane then what will be the partial pressure (in bar) of the gas?
(a) 0.762 (b) 1.312
(c) 3.81 (d) 5.0

(iii) K_H (kbar) values for Ar (*g*), CO_2 (*g*), HCHO (*g*) and CH_4 (*g*) are 40.39, 1.67, 1.83×10^{-5} and 0.413 respectively. Arrange these gases in the order of their increasing solubility.
(a) HCHO < CH_4 < CO_2 < Ar
(b) HCHO < CO_2 < CH_4 < Ar
(c) Ar < CO_2 < CH_4 < HCHO
(d) Ar < CH_4 < CO_2 < HCHO

(iv) When a gas is bubbled through water at 298 K, a very dilute solution of the gas is obtained. Henry's law constant for the gas at 298 K is 150 kbar. If the gas exerts a partial pressure of 2 bar, the number of millimoles of the gas dissolved in 1 L of water is
(a) 0.55 (b) 0.87
(c) 0.37 (d) 0.66

50. Read the passage given below and answer the questions:

At the freezing point of a solvent, the solid and the liquid are in equilibrium. Therefore, a solution will freeze when its vapour pressure becomes equal to the vapour pressure of the pure solid solvent. It has been observed that when a non- volatile solute is added too the solvent, the freezing point of the solution is always lower than that of the pure solvent. Depression in freezing point can be given as, $\Delta T_f = K_f m$

Where, K_f = Molal freezing point depression constant

or we can write, $\Delta T_f = \frac{K_f \, X \, 1000 \, X \, W_B}{M_B \, X \, W_A}$

In these questions (Q.No. i – iv), a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(a) Assertion and reason both are correct statements and reason is the correct explanation for assertion.

(b) Assertion and reason both are correct statements but reason is not the correct explanation for assertion.

(c) Assertion is correct statement but reason is wrong statement.

(d) Assertion is wrong statement but reason is correct statement.

(i) Assertion: 0.1 M solution of glucose has same depression in the freezing point as 0.1 M solution of urea.

Reason: K_f for both has same value.

(ii) Assertion: Larger the value of cryoscopic constant of the solvent, lesser will be the freezing point of the solution.

Reason: Extent of depression in the freezing point depends on the nature of the solvent.

(iii) Assertion: The water pouch of instant cold pack for treating athletic injuries breaks when squeezed and NH_4NO_3 dissolves thus lowering the temperature.

Reason: Addition of non-volatile solute into solvent results into depression if freezing point of solvent.

(iv) Assertion: If a non-volatile solute is mixed in a solution then elevation in boiling point and depression in freezing point both will be same.

Reason: Elevation in boiling point and depression in freezing point both depend on number of particles of solute.

51. (i) State Henry's law. Give the mathematical expression for the law.

(ii) Define the term: azeotrope.

(iii) State Raoult's law for a solution containing two volatile solvents. Give the mathematical expression for the law.

(iv) Vapour pressure of two liquid A & B are 120 and 180mm Hg at a given temp. If 2 mole of A and 3 mole of B are mixed to form an ideal solution, calculate the vapour pressure of solution at same temperature.

52. (i) Water boils at a lower temperature in hills than in plains. Why?

(ii) 18 g of glucose, $C_6H_{12}O_6$ (Molar mass = 180 g $mole^{-1}$) is dissolved in 1 Kg of water in a sauce pan. At what temperature will this solution boil?

53. (i) Why is osmotic pressure considered to be a colligative property?
    (ii) What happens when a plant cell is placed in (a). Hypertonic solution (b). Hypotonic solution
    (iii) Equimolar solutions of NaCl and glucose are not isotonic. Why?
54. (i) Give the points of differences between ideal and non-ideal solution.
    (ii) Why is an increase in temperature observed on mixing chloroform with acetone?
    (iii) On mixing equal volumes of water and ethanol, what type of deviation would you expect from Raoult's law? Why?
55. (i) State the condition resulting in reverse osmosis.
    (ii) A person suffering from high blood pressure should take less common salt, why?
    (iii) At 300K 36 g of glucose in 1 liter solution exerted an osmotic pressure of 4.98 bars. What would be the concentration of the solution at 300K if it exerts a pressure of 1.52 bars?
56. (i)What is the mole fraction of the solute in 2.5 m aqueous solution?
    (ii)What is the sum of the mole fractions of all the components in a three component system?
    (iii)The vapour pressures of pure liquids A and B are 450 and 700 mm Hg respectively at 350K. Find the composition of liquid mixture if the total pressure is 600 mm Hg. Also find the composition in vapour phase.
57. (i) What is van't hoff factor?
    (ii) What is expected value of van't Hoff factor for $K_3[Fe(CN)_6]$ in dilute solution?
    (iii) When is the value of van't Hoff factor more than one?
    (iv) Determine the amount of CaCl2 (i = 2.47) dissolved in 2.5 litres of water such that its osmotic pressure is 0.75 atm at 300K.
58. (i) What is anti-freeze?
    (ii) Why should the solution of non-volatile solute freezes at a lower temperature?
    (iii) Will the depression in freezing point be same or different if 0.1 mole of s ugar, 0.1 mole of glucose is dissolved in one litre of water?
    (iv) Why it is advised to add ethylene glycol to water in car radiator while driving in a hill station?
    (v) A solution containing 18 g of non-volatile solute in 200 g water freezes at 272.07 K. calculate the molar mass of solute. (Given K_f = 1.86 K/m).

UNIT: ELECTROCHEMISTRY

Q.1 Can you store copper sulphate solution in a Zinc pot? Give reason.

Q.2 Define limiting molar conductivity.

Q.3 How much electricity is required for the following reductions

(i) One mole of Al^{3+} to Al

(ii) One mole MnO_4^- to Mn^{2+}

Q.4 Arrange the following metals in order of their increasing reducing power.
K^+/K = - 2.93V, Ag^+/Ag = 0.80V, Hg^{2+}/Hg = 0.79 V, Mg^{2+}/Mg = - 2.37 V
Cr^{3+}/Cr = - 0.74V.

Q.5 (a) Following reactions occur at cathode during the electrolysis aqueous sodium chloride solution

$Na^+(aq) + e^-$ ----------→ $Na(s)$ E^0 = -2.71V

$H^+(aq) + e^-$ ----------→ ½ $H_2(g)$ E^0 = - 0.00V

On the basis of their standard reduction electrode potential(E^0) values, which reaction is feasible at the cathode and Why?

(b) Why does the cell potential of mercury cell remain constant throughout its life?

Q.6 Write the Nernst equation for the cell and find the emf of the cell at 298K

$Mg(s)/Mg^{2+}(0.001M)llCu^{2+}(0.0001M)/cu(s)$

Given that $E^0_{Mg2+/Mg}$ = -2.36V

$E^0_{Cu2+/Cu}$ = +0.34V

Q.7 Define molar conductivity of a substance and describe how for weak and strong electrolytes, molar conductivity change with concentration. How can you explain such a change?

Q.8 (a) Conductivity of 0.00241M acetic acid is $7.896X10^{-5}$ Scm^{-1}. Calculate its molar conductivity and it the limiting molar conductivity of acetic acid is 390.5 Scm^2 mol^{-1}. What is its dissociation constant?

(b) Why does the conductivity of a solution decrease with dilution?

Q.9 (a) Write the chemistry of recharging and discharging the lead storage battery, highlighting all the materials that are involved during recharging and discharging.

(b) What is Kohlrausch law of independent migration of ions.

Q.10 (a) A solution of $Ni(NO_3)_2$ is electrolyzed between platinum electrode using a current of 5 Ampere for 20 min. what mass of Ni is deposited at the cathode ?

(b) A voltaic cell is set up at 25^0C with the following half cell:

$Al/Al^{3+}(0.001M)$ and $Ni/Ni^{2+}(0.50M)$

Write an equation for the reaction that occur when the cell generates an electric current and determine the cell potential

$E^0_{Ni/Ni\,2+}$ = -0.25 V and $E^0_{Al/Al\,3+}$= -1.66 V. (log 8 $X10^{-5}$ =-0.54)