**XII STD - QUESTION BANK**

**CHEMISTRY**

**CHAPTER. 1**

**1.1 EXPRESSING CONCENTRATION OF SOLUTIONS**

**LEVEL-0**

1. For a solution of density, d in g/ml containing solute of molecular weight W the molarity and molality are related by

a) 

b) 

c) 

d) 

**Key: a**

**Hint:**



2. Example for solid in gas type of solution

a) O2 in H2O

b) Camphor in N2

c) CHCl3 in N2

d) Cu in gold

**Key: b**

**Hint:** Solid in gas type,

Solid – solute

Gas – solvent

Camphor in N2,

Camphor – solute

(S)

Nitrogen – solvent

(g)

3. A molal solution is one that contains one mole of a solute in

a) 1000 g of the solvent

b) one litre of the solvent

c) one litre of the solution

d) 22.4 litres of the solution

**Key: a**

**Hint:** A 1 molal solution is one defined as a solution that contains one mole of solute dissolved in 1 kg of solvent.

4. Two bottles A and B contain 2M and 2m aqueous solutions of sulphuric acid respectively, then

a) A is more concentrated than B

b) B is more concentrated than A

c) Conc. of A and B are equal

d) It is impossible to compare the concentrations

**Key: a**

**Hint:** In aqueous solution 2M is more concentrated.

5. Which of the following is a quantitative description of the solution?

a) Dilute

b) Concentrated

c) Saturated

d) Molar

**Key: d**

**Hint:** Dilute, concentrated and saturated terms are qualitative methods of description of concentration of solution whereas molar or molarity is quantitative method.

6. When a solute is present in trace quantities the following expression is used.

a) Gram per million

b) Milligram percent

c) Microgram percent

d) Nano gram percent

e) Parts per million

**Key: e**

**Hint:** Conceptual

**LEVEL-1**

7. If 25 ml of 0.25 M NaCl solution is diluted with water to a volume of 500 ml the new concentration of the solution is

a) 0.0125 M

b) 0.167 M

c) 0.833 M

d) 0.0167 M

**Key: a**

**Hint:** 

8. Mole fraction of C3H5(OH)3 in a solution of 36 g of water and 46 of glycerine is:

a) 0.46

b) 0.36

c) 0.20

d) 0.40

**Key: c**

**Hint:** Mole of H2O 

Mole of glycerine 

Total mole = 2 + 0.5 = 2.5

Mole fractions of glycerine 

9. Calculate molality of 1 litre solution of 93% H2SO4 by volume. The density of solution is 1.84 g ml-1

a) 9.42

b) 10.42

c) 11.42

d) 12.42

**Key: b**

**Hint:** Given H2SO4 is 93 % volume

Wt. of H2SO4 = 93 g

Volume of solution = 100 ml

Weight of solution = 100 × 1.84 gm = 184 g

Wt. of water = 184 – 93 = 91 g

Molality =  =

10. A solution is prepared by adding 2g of glucose into 18 g of water. Calculate the mass percent of the glucose.

a) 20 %

b) 10 %

c) 12.5 %

d) 10.5 %

**Key: b**

**Hint:**



11. The molarity of pure water is 

a) 50 M

b) 18 M

c) 55.6 M

d) 100 M

**Key: c**

**Hint:**



12. Regarding molality, which of the following statements are correct  
A) Units of molarity gm-moles kg-1

B) Molarity of dibasic acid is half of its normality

C) 

D) Molarity always equals to its molality

a) A, B

b) D, B

c) B, C

d) A, C

**Key:** c

**Hint:** In case of molarity   
(a) units: g moles lit−1  
(b) For Dibasic acid, or *N* = *M* ×2  
(c) N = M × n-factor 



(d) Molarity always is not equal to molality

13. If a substance ‘A’ dissolves in solution of a mixture of ‘B’ and ‘C’ with their respective number of moles as nA, nB and nC, Mole fraction of C in the solution is:

a) 

b) 

c) 

d) 

**Key: b**

**Hint:** Mole fraction of ‘C’ **=** =

14. The molarity of the solution containing 7.1 g of Na2SO4 in 100 ml of aqueous solution is   
a) 2 M

b) 0.5 M

c) 1 M

d) 0.05 M

**Key: b**

**Hint:** 

15. Three statements are given about mole fraction

i) Mole fraction of a solute + mole fraction of solvent = 1

ii) Equal weights of Helium and methane are present in a gaseous mixture. The mole fraction of He is 4/5

iii) The mole fraction of water in the aqueous solution of NaOH is 0.8. The molality of the solution is nearly 14 moles kg-1

a) i and ii are correct

b) ii and iii are correct

c) i and iii are correct

d) All are correct

**Key: a**

**Hint:** Conceptual

16. A gaseous mixture contains four gases A, B, C and D. The mole fraction of B is 0.5. The mole fraction of A is

a) 0.525

b) 0.375

c) 0.625

d) 0.732

**Key: b**

**Hint:** χA + χB + χC + χD = 1

χB = 0.5

χA should be less (or) Than 0.5

17. The number of moles of a solute in its solution is 20 and total number of moles are 80. The mole fraction of solute is

a) 2.5

b) 0.25

c) 1

d) 0.75

**Key: b**

**Hint:** Moles fraction of solute = 

**LEVEL - 2**

18. Hardness of a water sample is 100 ppm CaCO3. Thus, molarity of CaCO3 is   
a) 2 × 10−3 M

b) 1 × 10−3 M

c) 2 × 10−2 M

d) 2 × 10−4 M

**Key: b**

**Hint:** Hard water has hardness = 100 ppm

Thus, 106 mL (= 103) water has CaCO3 = 100 g = 1 mol

Thus, 

19. Molarity and molality of a solution of caustic soda are respectively 11.12 M and 94.12. The density of the solution is   
a) 0.556 g mL-1

b) 5.56 g mL-1

c) 55.6 g mL-1

d) None of these

**Key: a**

**Hint:**



20. At 25°C, the density of 15 M H2SO4 is 1.8 g cm-3. Thus, mass percentage of H2SO4 in aqueous solution is   
a) 2%

b) 81.6%

c) 18%

d) 1.8%

**Key: b**

**Hint:** 18 M H2SO4 means 18 mol L-1

1000 mL of H2SO4 solution has H2SO4 = 18 mol = 15 × 98 g

Also, 1000 mL = 1000 × 1.8 g H2SO4 = 15 × 98 g

100 g H2SO4 solution has

H2SO4 = 

Thus, mass percentage of H2SO4 = 81.6%

21. The molality of a urea solution in which 0.0100 g of urea [(NH2)2CO] is added to 0.3000 dm3 of water at STP is

a) 0.555 m

b) 5.55 × 10−4 m

c) 3.33 m

d) 3.33 × 10−2 m

**Key: b**

**Hint:** 



Water at STP (d = 1 g/cm3 = 1 kg/dm3) = 0.3 dm3 = 0.3 kg



22. The density of ‘x’ M solution (‘x’ molar) of NaOH is 1.12 g mL-1. While in molality, the concentration of the solution is 3m (3 molal). Then x is

(Given : Molar mass of NaOH is 40 g/mol)  
a) 3.5

b) 3.0

c) 3.8

d) 2.8

**Key: b**

**Hint:**



23. Molality (m) of 3M aqueous solution of NaCl is:   
(Given: Density of solution = 1.25 g mL-1, Molar mass in g mol-1 (Na -23, Cl-35.50   
a) 2.90 m

b) 2.79 m

c) 1.90 m

d) 3.85 m

**Key: b**

**Hint:**



24. The concentration of a 100 ml solution containing x grams of Na2CO3 is yM. The values of x and y are

a) 2.12, 0.05

b) 1.06, 0.2

c) 1.06, 0.1

d) 2.12, 0.1

**Key: c**

**Hint:**



25. Which of the following statements, regarding the mole fraction (x) of a component in solution, is incorrect?

a) 0 ≤ x ≤ 1

b) x ≤ 1

c) x is always non-negative

d) None of these

**Key: a**

**Hint:** Mole fraction of any component A in solution



As total no. of moles of solution > No. of moles of A

Thus x can never be equal to one or zero.

26. 9 of H2SO4 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) 0.1 M

**Key: b**

**Hint:** 

27. 2.0 molar solution is obtained, when 0.5 mole solute is dissolved in

a) 250 ml solvent

b) 250 g solvent

c) 250 ml solution

d) 1000 ml solvent

**Key: c**

**Hint:** We know that





Volume of solution in litre



28. Molarity and molarity of an aqueous solution of a liquid (Mol. Wt = 50) are 9 and 10 respectively. What is the density of the solution?

a) 1 g/cc

b) 0.95 g/cc

c) 1.05 g/cc

d) 1.35 g/cc

**Key: d**

**Hint:**



**LEVEL - 3**

29. Which of the following aqueous solutions has the highest concentration of Na+?  
a) 0.304 M Na2SO4

b) A solution containing 2.06 g NaCl/100 mL

c) A solution having 15.4 mg Na+/mL

d) All have equal [Na+]

**Key: c**

**Hint:** (a) 

[Na+] = 0.208 × 2 = 0.416 M

(b) 2.07 g NaCl/100 mL = 10.5 g NaCl/L = 

= 0.353 M

[Na+] = 0.353 M

(c) = 15.4 mg Na+ = 15.4 × 10-3 g Na+ mL-1



30. Calculate the molality and mole fraction of the solute in aqueous solution containing 3.0 g of urea per 250 gm of water (Mol.wt.urea = 60).  
a) 0.2 m, 0.00357

b) 0.4 m, 0.00357

c) 0.5 m, 0.00357

d) 0.7 m, 0.00357

**Key: a**

**Hint:** Wt. of solute (urea) dissolved = 3.0 g

Wt. of the solvent (water) = 250 g

Mol. Wt. of the solute = 60

3.0 gm of the solute = 

= 0.05 moles

Thus 250 g of the solvent contain = 0.05 moles of solute

∴1000 g of the solvent contain 

Hence molality of the solution = 0.2 m

In short,

Molality = No. of moles of solute/100g of solvent

Molality 

Calculation of mole fraction

3.0 g of solute = 3/60 moles = 0.05 mole

250 g of water = = 13.94 moles

∴ Mole fraction of the solute = 

31. A solution has 25% of water, 25% ethanol and 50% acetic acid by mass. Calculate the mole fraction of each component.

a) 0.50, 0.3, 0.19

b) 0.19, 0.3, 0.50

c) 0.3, 0.19, 0.50

d) 0.50, 0.19, 0.3

**Key: d**

**Hint:** Since 18 g of water = 1 mole

25 g of water = =1.38 mole

Similarly, 46 g of ethanol = 1 mole

25 g of ethanol = =0.55 moles

Again, 60 g of acetic acid = 1 mole

50 g of acetic acid = =0.83 mole

∴ Mole fraction of water = =0.50

Similarly, Mole fraction of ethanol = =0.19

Mole fraction of acetic acid = =0.3

32. Molality of a solution in aqueous medium is 0.8. Calculate its mole fraction fan the percentage by mass of solute if molar mass of solute is 60

a) 4.5 %

b) 4.6 %

c) 4.7 %

d) 4.8 %

**Key: a**

**Hint:** We know that,



Where, xB = mole fraction of solute

mA = molar fraction of solvent



xB = 0.014

Let wB = x g, wA = 100 g



X = 4.8 %

33. Find the molality of H2SO4 solution whose specific gravity is 1.98 g ml-1 and 95% by volume H2SO4

a) 7.412

b) 8.412

c) 9.412

d) 10.412

**Key: c**

**Hint:** H2SO4 is 95% by volume

Wt. of H2SO4 = 95 g

Vol of solution = 100 ml

Moles of H2SO4 = , and weight of solution

= 100 × 1.98 = 198 g

Weight of water = 198 – 95 = 198 g

Molality = 

Hence molality of H2SO4 solution is 9.412

**MATCH TYPE**

34. Match the following

|  |  |  |  |
| --- | --- | --- | --- |
|  | **List I** |  | **List II** |
| A | Gaseous solution | 1 | German silver |
| B | Liquid solution | 2 | Milk |
| C | Solid solution | 3 | Sand in water |
| D | Colloidal solution | 4 | Aqueous Alcoholic solution |
|  |  | 5 | Air |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | A | B | C | D |
| a) | 5 | 4 | 1 | 2 |
| b) | 1 | 3 | 2 | 5 |
| c) | 4 | 2 | 5 | 1 |
| d) | 2 | 3 | 1 | 4 |

**Key: a**

**Hint:** Based on physical state of solute and solvent.

**35.** Match the following

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Column I** |  | **Column II** |
| A | Mass percentage | 1 | Medicine and pharmacy |
| B | Mass by volume | 2 | Concentration of pollutants in water |
| C | ppm | 3 | Industrial chemical application |
| D | Volume percentage | 4 | Liquid solutions |

a) A – (q), B – (p), C – (s), D – (r)

b) A – (s), B – (r), C – (p), D – (q)

c) A – (r), B – (q), C – (s), D – (p)

d) A – (r), B – (p), C – (q), D – (s)

**Key: d**

**Hint:** Conceptual

36. Match the following

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Column I** |  | **Column II** |
| A | Na-Hg Amalgam | 1 | gas - solid |
| B | H2 in Pd | 2 | gas - liquid |
| C | Camphor in nitrogen gas | 3 | liquid - solid |
| D | Oxygen dissolved in water | 4 | solid - gas |

a) A – (q), B – (s), C – (r), D – (p)

b) A – (t), B – (p), C – (q), D – (s)

c) A – (r), B – (p), C – (s), D – (q)

d) A – (s), B – (q), C – (p), D – (p)

**Key: c**

**Hint:** Conceptual

**PYQ QUESTIONS**

**37.** Sea water, which can be considered as a 6 molar (6M) solution of NaCl, has a density of 2 g mL-1. The concentration of dissolved oxygen (O2) in sea water is 5.8 ppm. Then the concentration of dissolved oxygen (O2) in sea water, is x **×** 10-4 m. x = \_\_\_\_\_\_\_\_\_\_\_\_.(Nearest integer)   
Given: Molar mass of NaCl is 58.5 g mol-1  
 Molar mass of O2 is 32 g mol-1

a) 1

b) 2

c) 3

d) 4

**Key: b**

**Hint:** Sea water is 6 Molar in NaCl, So 1000 ml of sea water contains 6 mol of NaCl.

Mass of solution = Volume × density = 1000 × 2

Mass of solution = 2000 g

Ppm = 

Mass of O2 = 5.8 × 2 × 10-3

= 1.16 × 10-2 g

Molality for O2 ,



Correct answer = 2

**38.** Given below are two statements: One is labelled as Assertion and the other one is labelled as Reason.  
**Assertion:** undergoes SN2 reaction faster than.

**Reason:** Iodine is a better leaving group because of its large size.  
In the light of the above statements, choose the correct answer from the options given below.

a) Both assertion and reason are true and reason is the correct explanation of assertion.

b) Both assertion and reason are true but reason is not the correct explanation of assertion.

c) Assertion is true but reason is false.

d) Assertion is false but reason is true.

**Key: a**

**Hint:** Rate ofundergoes SN2 reaction  faster than

Because iodine is a good leaving group due to large size of iodine. Which stabilizes the I- ion**.**

**ASSERTION AND REASON**

**39. Assertion:** Molarity of a solution in liquid state changes with temperature.

**Reason:** The volume of a solution changes with change in temperature.

a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.

b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

c) Assertion is correct, reason is incorrect

d) Assertion is incorrect, reason is correct.

**Key: a**

**Hint:** Conceptual

**40.** Given below are two statements: One is labelled as Assertion and the other one is labelled as Reason.  
**Assertion:** At 10° C, the density of a 5M solution of KCl [atomic masses of K and Cl are 39 & 35.5 g mol-1] is x g mL-1. The solution is cooled to -21° C. The molality of the solution will remain unchanged.

**Reason:** The molality of a solution does not change with temperature as mass remains unaffected with temperature.

a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.

b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

c) Assertion is correct, reason is incorrect

d) Assertion is incorrect, reason is correct.

**Key: a**

**Hint:** Molality of solution does not depend on the temperature as it depends on the moles of solute and mass of solvent. Hence, both assertion and reason are true.

**STATEMENT TYPE**

**41.** Molarity and molality of a solution of NaOH is calculated. If now temperature of the solution is increased then which of the following statement(s) is/are correct?

(i) Molarity of solution decreases

(ii) Molality of the solution increases

a) Both statements are correct

b) Statement (i) is correct only

c) Statement (ii) is correct only

d) Both statements are incorrect.

**Key: b**

**Hint:** Molarity include volume thus with increase intemperature increases’ volume increases, hence molarity decreases while in case of molality mass of solvent is taken, which is not effected by temperature.

**42.** Study the given statements and choose the correct option.

(i) 3.62 mass percentage of sodium hypochlorite in water is used as commercial bleaching solution.

(ii) 35% volume percentage of ethylene glycol is used as an antifreeze (as coolent in car engines).

(iii) Concentration of dissolved oxygen in a litre of sea water is 5.8 ppm.

a) Statements (i) and (ii) are correct

b) Statements (i) and (iii) are correct

c) Statements (ii) and (iii) are correct

d) Statements (i),(ii) and (iii) are correct

**Key: d**

**Hint:** Conceptual