BYJU'S Home Learning Program

Topic covered:

- **Solutions (Session - 1) - NEET**

Worksheet

1. What will be the percentage concentration (w/v) of a solution containing 5 g of sodium hydroxide in 250 mL solution?
   a. 20% b. 2%
   c. 25% d. 5%

2. Find the weight percentage of methanol in a solution in which 15 g of it is dissolved in 35 g of water.
   a. 30% b. 50%
   c. 70% d. 75%

3. It is found that 5.8×10^{-3} g of oxygen per kilogram is dissolved in seawater. What is the concentration of oxygen in parts per million?
   a. 58.5 ppm b. 0.58 ppm
   c. 5.8 ppm d. 0.058 ppm

4. The fluoride ion concentration in a 500 g toothpaste is found to be 400 ppm. What will be the amount of fluoride present in the paste?
   a. 2 g b. 0.2 g
   c. 20 g d. 0.4 g

5. A solution is prepared by adding 540 g of glucose to 900 g of water. Calculate the mole fraction of glucose. (molar mass of glucose = 180 $gmol^{-1}$)
   a. 0.056 b. 0.94
   c. 0.56 d. 0.094

6. Find the mole fraction of ethylene glycol in its 25% (w/w) aqueous solution.
   a. 0.912 b. 0.097
   c. 0.088 d. 0.06

7. Calculate the mole fraction of benzene in a solution containing 40% (w/v) in CCl_4. (density of the solution = 1.59 g/cm^3)
   a. 0.042 b. 0.398
   c. 0.580 d. 0.568

8. 240 mL of a solution contains 0.02 moles of molar mass, 120g/mol. Find the strength of the solution in (w/v) percent.
   a. 5 % b. 10 %
   c. 1 % d. 2.5 %

9. The amount of anhydrous Na_2CO_3 present in 250 ml of 0.25 M solution is:
   a. 6.225 g b. 66.25 g
   c. 6.0 g d. 6.625 g

10. Molarity of pure water is:
    a. 1 M
    b. 55.56 M
    c. 20 M
    d. 10 M

11. Which of the following solutions has its normality equal to its molarity?
    a. H_2SO_4 aqueous solution
    b. H_3PO_4 aqueous solution
    c. HNO_3 aqueous solution
    d. $Al(OH)_3$ aqueous solution

12. How many grams of HCl are present in 250 cm^3 of 1.5 M HCl solution?
    a. 0.375 g
    b. 3.75 g
    c. 13.69 g
    d. 54.75 g

13. 0.2 N H_2SO_4 has the same molarity as:
    a. 0.1 M H_2SO_4
    b. 0.4 N HCl
    c. 0.4 M HNO_3
    d. 0.1 N H_3PO_4

14. The amount of $K_2Cr_2O_7$ (equivalent weight 49.04) needed to make 250 mL of a 0.5 N solution is:
    a. 2.452 g
    b. 6.13 g
    c. 0.613 g
    d. 24.52 g

15. Calculate the molality of KI if the density of 20% (mass/mass) aqueous KI is 1.202g mL^{-1}.
    a. 0.12 m
    b. 1.2 m
    c. 1.5 m
    d. 0.15 m

16. Calculate the molarity of 25% aqueous KI solution (w/w) if its density is 1.202g/mL.
    a. 0.145 M
    b. 1.45 M
    c. 0.15 M
    d. 1.80 M

17. A solution of $Al_2(SO_4)_3$ (density = 1.253 g/mL) contains 22% salt by weight. The molarity, normality and molality of the solution is:
    a. 0.805 M, 4.83 N, 0.825 m
    b. 0.825 M, 48.3 N, 0.805 m
    c. 4.83 M, 4.83 N, 4.83 m
    d. 0.8 M, 4.83 N, 4.83 m

18. Which of the following solutions has the largest value of normality?
    a. 8 g of KOH/litre
    b. 1 N phosphoric acid
    c. 6 g of NaOH/100 mL
    d. 0.5 M H_2SO_4

19. A solution of NH_4OH of density 0.6 g/mL contains 35% by mass of NH_4OH. What is the normality of the solution?
    a. 4.8 N
    b. 10 N
    c. 0.5 N
    d. 6 N

20. Which of the following is dependent on temperature?
    a. Molality
    b. Molarity
    c. Mole fraction
    d. Weight percentage

21. Calculate the mass percentage of carbon tetrachloride (CCl_4) if 22 g of benzene is dissolved in 122 g of carbon tetrachloride.
    a. 25.72 %
    b. 15.28 %
    c. 23.45 %
    d. 84.72 %

22. What weight of Na_2SO_4 (Molecular weight = 142) is needed to make 5 liters of 0.1 M solution?
    a. 105 g
    b. 88 g
    c. 142 g
    d. 71 g

23. Calculate the density in g/mL of a solution obtained by mixing 150 mL of NaOH (d = 1.70 g/mL) and 350 mL of distilled water (d = 1 g/mL).
    a. 1.85
    b. 1.21
    c. 2.58
    d. 0.62

24. An alcoholic iodine solution ("tincture" of iodine) is prepared by dissolving 5.15 g of iodine crystals in enough alcohol to make a volume of 225 mL. Calculate the molarity of iodine in the solution.
    a. 0.090 M
    b. 0.90 M
    c. 0.58 M
    d. 0.058 M

25. How many grams of NaCl are required to prepare 100 mL of 1 M solution?
    a. 58.5 g
    b. 585.5 g
    c. 5.85 g
    d. 10.5 g

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Answer Key

Question Number	1	2	3	4	5	6
Answer Key	(b)	(a)	(c)	(b)	(a)	(c)

Question Number	7	8	9	10	11	12
Answer Key	(b)	(c)	(d)	(b)	(c)	(c)

Question Number	13	14	15	16	17	18
Answer Key	(a)	(b)	(c)	(d)	(a)	(c)

Question Number	19	20	21	22	23	24
Answer Key	(d)	(b)	(d)	(d)	(b)	(a)

Question Number	25
Answer Key	(c)

Solutions

1. (b)

$$\% \text{ concentration of NaOH (w/v)} = \frac{\text{mass of NaOH in g}}{\text{volume of solution in mL}} \times 100 = \frac{5}{250} \times 100 = 2\%$$

2. (a)

$$\text{weight } \% = \frac{\text{mass of solute in g}}{\text{mass of solution in g}} \times 100 = \frac{15}{15+35} \times 100 = 30\%$$

3. (c)

$$\text{Concentration in ppm} = \frac{\text{mass of solute(in g)}}{\text{mass of solution(in g)}} \times 10^6 = \frac{5.8 \times 10^{-3}}{1000} \times 106 = 5.8 \text{ ppm}$$

4. (b)

$$\text{Concentration in ppm} = \frac{\text{mass of solute(in g)}}{\text{mass of solution(in g)}} \times 10^6$$

Mass of solution = 500g,
Concentration in ppm = 400 ppm; putting values in formula, we get

$$\text{mass of solute(in g)} = \frac{\text{Concentration in ppm} \times \text{mass of solution(in g)}}{10^6} = \frac{400 \times 500}{10^6} = 0.2\text{g}$$

5. (a)

Mass of solute (glucose) = 540 g

$$\text{Moles of solute} = \frac{\text{mass of solute}}{\text{molecular mass}} = \frac{540}{180} = 3$$

Mass of solvent (water) = 900g

$$\text{Moles of solvent} = \frac{\text{mass of solute}}{\text{molecular mass}} = \frac{900}{18} = 50$$

$$\text{We know, mole fraction} = \frac{\text{moles of solute}}{\text{moles of solute + moles of solvent}} = \frac{3}{50+3} = 0.056$$

6. (c)

Let the mass of solution be 100 g.
25% concentration of ethylene glycol = 25 g of ethylene glycol is present, and 75 g of water is present.

$$\text{Moles of ethylene glycol} = \frac{25}{62} = 0.403$$

$$\text{Moles of water} = \frac{75}{18} = 4.167$$

$$\text{Mole fraction of ethylene glycol} = \frac{\text{moles of ethylene glycol}}{\text{moles of ethylene glycol + moles of water}} = \frac{0.403}{0.403 + 4.167}$$

$$= 0.088$$

7. (b)

Let the volume of the solution be 100 cm^3

Density of the solution $= \frac{\text{mass of the solution}}{\text{volume of the solution}}$

Mass of the solution(g) $= 1.59 g/cm^3 \times 100\ cm^3 = 159 g$

40 %(w/v) = 40g of benzene(solute) is present in 100 $cm^3$of solution.

So, mass of the solvent (CCl_4) = 159 – 40 g = 119 g

So, mole fraction of benzene $= \frac{\text{moles of benzene}}{\text{moles of benzene } + \text{ moles of } CCl_4} = \frac{\frac{40}{78}}{\left(\frac{40}{78}\right) + \left(\frac{119}{154}\right)}$

$= \frac{0.512}{0.512+0.773} = 0.398$

8. (c)

Volume of solution = 240 mL

Weight of solution = number of moles × molecular weight

$= 0.02 \times 120 = 2.4$ g

So, 240 mL of solution has 2.4 g of solute

100 mL of solution will contain $\frac{2.4}{240} \times 100 = 1$ g solute

i.e. there is 1g solute in 100 mL of solution

Therefore, strength is 1% (w/v).

9. (d)

Molarity $= \frac{\text{moles of solute}}{\text{volume of solution(L)}}$

Molarity = 0.25 M, volume of solution = 0.25 L

So, moles of solute = 0.25 M × 0.25 L = 0.0625 moles

Number of moles= $\frac{\text{mass of } Na_2CO_3}{\text{molecular mass}}$; amount of $Na_2CO_3 = 0.0625 \times 106 = 6.562$ g

10. (b)

Let volume of water be 1 L.

Molarity $= \frac{\text{moles of solute}}{\text{volume of solution(L)}}$

Density of pure water = 1g/mL

density $= \frac{\text{mass}}{\text{volume}} \Rightarrow$ mass $= 1 \times 1000 = 1000$ g

So, moles of water $= \frac{1000}{18} = 55.561$ moles

Molarity = 55.561 = 55.56 M

11. (c)
Normality = Molarity × n
Where n is the n-factor
For HNO_3, n = 1
Therefore, Normality = Molarity

12. (c)
$$\text{Molarity} = \frac{\text{moles of solute}}{\text{volume of solution (L)}} = \frac{\text{moles of solute}}{\text{volume of solution (mL)}} \times 1000$$
$$\text{So, moles of solute} = \frac{1.5 \times 250}{1000} = 0.375$$
So, amount of HCl present = moles of HCl × molar mass of HCl = 0.375 × 36.5 = 13.69 g

13. (a)
Normality = Molarity × n-factor
As H_2SO_4 is dibasic so n-factor is 2.
Hence 0.2 N H_2SO_4 will have the same molarity as 0.1 M H_2SO_4.

14. (b)
$$\text{Normality} = \frac{\text{gram equivalent of solute}}{\text{volume of solution (L)}} = \frac{\text{gram equivalent solute}}{\text{volume of solution (mL)}} \times 1000$$
$$\text{Gram equivalents} = \text{Normality} \times \text{Volume of solution} = 0.5\ \text{N} \times \frac{250}{1000} = 0.125\ \text{geq}$$
$$\text{Now, gram equivalent} = \frac{\text{amount of } K_2Cr_2O_7 \text{ used}}{\text{equivalent weight}}$$
Amount of $K_2Cr_2O_7$ used = 0.125 × 49.04 = 6.13 g

15. (c)
Let the mass of the solution be 100 g.
20% (mass/mass) = 20g of KI in 80g of solvent
$$\text{Moles of KI (solute)} = \frac{\text{amount of KI}}{\text{molar mass}} = \frac{20}{166} = 0.12\ \text{mol}$$
$$\text{molality} = \frac{\text{moles of solute}}{\text{amount of solvent (kg)}} = \frac{\text{moles of solute}}{\text{amount of solvent (g)}} \times 1000$$
$$\text{Therefore, molality} = \frac{0.12}{80} \times 1000 = 1.50\ \text{mol/kg}.$$

16. (d)

Let the mass of the solution be 100g.

25% (mass/mass) = 25g of KI in 75g of solvent

$$\text{Moles of KI (solute)} = \frac{\text{amount of KI}}{\text{molar mass}} = \frac{25}{166} = 0.15$$

So, we can calculate the volume of solution when the density is given

$$\text{Volume of the solution} = \frac{100\text{ g}}{1.202\text{ g/mL}} = 83.19\text{ mL}$$

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{volume of solution (L)}} = \frac{\text{moles of solute}}{\text{volume of solution (mL)}} \times 1000$$

$$\text{Molarity} = \frac{0.15}{83.19} \times 1000 = 1.80\text{ mol/L}$$

17. (a)

Let the mass of solution be 100 g.

So, the amount of $Al_2(SO_4)_3$(solute) will be 22 g (% conc. (w/w) is given)

$$\text{Moles of } Al_2(SO_4)_3 = \frac{\text{weight of solute}}{\text{molar mass}} = \frac{22}{342} = 0.064$$

From density we can calculate volume of the solution

$$\text{Volume of solution} = \frac{100\text{ g}}{1.253\text{g/mL}} = 79.81\text{ mL}$$

$$\text{Now, Molarity} = \frac{(\text{moles of solute})}{\text{volume of solution (mL)}} \times 1000 = \frac{0.064}{79.81} \times 1000 = 0.802\text{ M}$$

$$\text{Molality} = \frac{\text{moles of solute}}{\text{mass of solvent(g)}} \times 1000 = \frac{0.064}{78} \times 1000 = 0.821\text{ M}$$

$$\text{Gram equivalent} = \frac{\text{molar mass}}{\text{n} - \text{factor}} = \frac{342}{6} = 57$$

$$\text{Normality} = \frac{\text{gram equivalent of solute}}{\text{volume of solution (mL)}} \times 1000 = \frac{57}{79.81} \times 1000 = 4.83\text{ N}$$

18. (c)

$$\text{a. Normality of KOH} = \frac{\text{gram equivalent of solute}}{\text{volume of solution (mL)}} \times 1000 = \frac{0.143}{1000} \times 1000$$

$$= 0.143\text{ N (moles of KOH} = \frac{8}{56} = 0.143)$$

b. Normality of $H_3PO_4 = 1$ N

$$\text{c. Normality of NaOH} = \frac{\text{gram equivalent of solute}}{\text{volume of solution (mL)}} \times 1000 = \frac{0.15}{100} \times 1000$$

$$= 1.5\text{ N (moles of NaOH} = \frac{6}{40} = 0.15)$$

$$\text{d. Normality} = \text{Molarity} \times \text{n} - \text{factor}$$

$$= 0.5 \times 2 = 1\text{ N (n} - \text{factor for } H_2SO_4 \text{ is 2)}$$

So, the largest value of normality is in c. which is 6 g of $\frac{\text{NaOH}}{100}$ mL

19. (d)

Let the volume of the solution be 1000 mL

So, the mass of the solution = 0.6g/mL × 1000 mL = 600g

Mass of NH_4OH = % of NH_4OH × mass of solution = 0.35 × 600 = 210g

Gram equivalent of $NH_4OH = \frac{\text{amount of } NH_4OH}{\text{equivalent weight}} = \frac{210}{35} = 6$ (n − factor for NH_4OH is 1.

Hence Normality $= \frac{\text{gram equivalent of solute}}{\text{volume of solution (L)}} = \frac{6}{1} = 6$ N

20. (b)

Molarity is temperature dependent as it depends on the volume of the solution and volume is directly related to temperature. As the temperature increases, so does the volume. Same goes for normality. Molality, mole fraction and weight percentage are independent of temperature as the mass and the number of moles are not dependent on temperature.

21. (d)

Mass % of benzene $= \frac{\text{mass of benzene}}{\text{mass of solution}} \times 100 = \frac{22}{122+22} \times 100 = 15.28\%$

Mass % of carbon tetrachloride = 100 − 15.28 = 84.72 %

22. (d)

Molarity $= \frac{\text{moles of solute}}{\text{volume of solution (mL)}} \times 1000 \Rightarrow 0.1 \text{ M} = \frac{\text{moles of solute}}{5 \text{ L}}$

So, moles of solute = 0.1 x 5 = 0.5 moles

Amount of Na_2SO_4 used = moles x Molar mass = 0.5 x 142 = 71 g

23. (b)

mass of NaOH = density × volume = 1.70 × 150 = 255 g

Mass of water used = 350 g

So, the total weight of the solution = 255 + 350 = 605 g

Total volume of the solution = 150 + 350 = 500 mL

So, density $= \frac{\text{mass}}{\text{volume}} = \frac{605}{500} = 1.21$ g/mL

24. (a)

Moles of iodine $= \frac{\text{Amount of iodine used}}{\text{molar mass}} = \frac{5.15}{254} = 0.0203$

Molarity of Iodine in solution $= \frac{\text{moles of solute}}{\text{volume of solution (mL)}} \times 1000$

$= \frac{0.0203}{225} \times 1000 = 0.0902$ M

25. (c)

Molarity $= \frac{\text{moles of NaCl}}{\text{volume of solution (mL)}} \times 1000$

moles of NaCl $= 1 \times \frac{100}{1000} = 0.1$ moles

So, amount of NaCl used = moles × molar mass = 0.1 × 58.5 = 5.85 g