Mole Concept
DPP-3

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1. How much 83.4% pure salt cake (Na_2SO_4) could be produced from 250 kg of 94.5% pure salt in the reaction $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$?

2. Carbon disulfide, CS_2 can be made from by-product SO_2. The overall reaction is $5C + 2SO_2 \rightarrow CS_2 + 4CO$. How much CS_2 can be produced from 540 kg of waste SO_2 with excess coke, if the SO_2 conversion is 82.0% ?

3. (i) A solution of lead nitrate prepared by dissolving 2.07 g of pure lead in nitric acid was treated with HCl, Cl_2 gas and NH_4Cl. What will be the maximum weight of $(NH_4)_2$ $PbCl_6$ so produced ? (N = 14, H = 1, Pb = 207, Cl = 35.5)

   (ii) if on performing the experiment, 2.28 g of $(NH_4)_2$ $PbCl_6$ was produced, calculate the percentage yield of $(NH_4)_2$ $PbCl_6$.

4. What is the molar concentration of a solution containing 16.0 g CH_3OH in 200 cm^3 solution?

5. The concentration of glucose ($C_6H_{12}O_6$) is normal blood is approximately 90 mg per 100 mL. What is the molarity of the glucose ?

6. Calculate the volume occupied by 100 g of sodium hydroxide solution of density 1.20 g/mL.

7. How much NH_4Cl is required to prepare 100 mL of a solution containing 70 mg NH_4Cl per mL ?

8. Determine the molar concentration of each of the following solutions :

   (a) 166 g KI per L solution

   (b) 33.0 g $(NH_4)_2SO_4$ in 200 mL solution

   (c) 12.5 g $CuSO_4$.$5H_2O$ in 100 mL solution

   (d) 10.0 mg Al^{3+} per mL solution.

9. A litre of milk weighs 1.032 kg. The butterfat it contains to the extent of 4.0% by volume has a density of 865 kg/m^3. What is the density of the fat-free "skimmed" milk ?

10. Anmonia gas is passed into water, yielding a solution of density of 0.93 g/cm^3 and containing 18.6% NH_3 by weight. What is the mass of NH_3 per cm^3 of solution ?

11. What is the concentration of sugar ($C_{12}H_{22}O_{11}$) in mol L^{-1} if its 20 g are dissolved in enough water to make a final volume up to 2L ? **(NCERT Problem)**

12. Calculate the mass of sodium acetate (CH_3COONa) required to make 500 mL of 0.375 molar aqueous solution. Molar mass of sodium acetate is 82.0245 g mol^{-1}.

   (NCERT Problem)

13. Calculate the concentration of nitric acid in moles per litre in a sample which has a density, 1.41 g mL^{-1} and the mass percent of nitric acid in it being 69%.

   (NCERT Problem)

14. If the density of methanol is 0.793 kg L^{-1}, what is its volume needed for making 2.5 L of its 0.25 M solution ? **(NCERT Problem)**

15. A sample of drinking water was found to be severely contaminated with chloroform, $CHCl_3$, supposed to be carcinogenic in nature. The level of contamination was 15 ppm (by mass). **(NCERT Problem)**

   (i) Express this in percent by mass.

   (ii) Determine the molality of chloroform in the water sample.

16. Calculate the molarity of a solution of ethanol in water in which the mole fraction of ethanol is 0.040 (assume the density of solution to be 1g/mL). **(NCERT Problem)**

17. The number of water molecules present in a drop of water (volume = 0.0018 ml) at room temperature is (density of H_2O = 1 g/mL)

   (a) 6.023×10^{19}
   (b) 1.084×10^{18}
   (c) 4.84×10^{17}
   (d) 6.023×10^{23}

18. The number of water molecules in 1 litre of water is (density of H_2O = 1 g/mL)

   (a) 18
   (b) 18×1000
   (c) N_A
   (d) $55.55 N_A$

19. How many moles of potassium chlorate to be heated to produce 11.2 litre oxygen at STP ?

$$\left[KClO_3 \rightarrow KCl + \frac{3}{2}O_2 \right]$$

    (a) 1/2 mol   (b) 1/3 mol   (c) 1/4 mol   (d) 2/3 mol

20. The number of atoms present in 0.5 mole of nitrogen is same as the atoms in

    (a) 12 g of C   (b) 64 g of S   (c) 8 g of O   (d) 48 g of Mg

21. One mole of a mixture of CO and CO_2 requires exactly 20 gram of NaOH in solution for complete conversion of all the CO_2 into Na_2CO_3. How many moles more of NaOH would it require for conversion into Na_2CO_3 if the mixture (one mole) is completely oxidised to CO_2.

    (a) 0.2   (b) 0.5   (c) 0.4   (d) 1.5

22. The mole fraction of a given sample of I_2 in C_6H_6 is 0.2. The molality of I_2 in C_6H_6 is

    (a) 0.32   (b) 3.2   (c) 0.032   (d) 0.48

23. The number of atoms in 558.5 g Fe (At. wt. of Fe = 55.85 g mol^{-1}) is

    (a) 558.5 × 6.023 × 10^{23} (b) Half that in 8 g of He

    (c) twice in 60 g of C   (d) 6.02 × 10^{22}

24. What volume of 0.4 M $FeCl_3 . 6H_2O$ will contain 600 mg of Fe^{3+} ?

    (a) 49.85 mL   (b) 26.78 mL   (c) 147.55 mL   (d) 87.65 mL

25. A solution contain 50% NaCl mass by volume, hence the strength of NaCl in the given solution is (Given density of the solution is 1.25g/cc)

    (a) 50% by strength   (b) 40% by mass   (c) 6.25 M   (d) 8.547 m

ANSWERS

1. 343.93 Kg   **2.** 262.91kg   **3. (a)** 4.56g, **(b)** 50%   **4.** 2.5M   **5.** 5 × 10^{-3} M

6. 83.33 mL   **7.** 7g   **8. (a)** 1M, **(b)** 1.25M, **(c)** 0.5M, **(d)** 0.37M

9. 1039 kg/m³   **10.** 0.173g/mL   **11.** 0.029M   **12.** 15.379 g

13. 15.44M   **14.** 25.22 mL   **15. (i)** 15 × 10^{-4}% **(ii)** 1.2577 × 10^{-4} m

16. 2.09M   **17.** (a)   **18.** (d)   **19.** (b)   **20.** (a)   **21.** (d)

22. (b)   **23.** (c)   **24.** (b)   **25.** (b)