EXERCISES

1. Calculate the molar mass of the following: (i) H2O (ii) CO2 (iii) CH4

2. Calculate the mass per cent of different elements present in sodium sulphate (Na2SO4).

3. Determine the empirical formula of an oxide of iron, which has 69.9% iron and 30.1% dioxygen by mass.

4. Calculate the amount of carbon dioxide that could be produced when (i) 1 mole of carbon is burnt in air. (ii) 1 mole of carbon is burnt in 16 g of dioxygen. (iii) 2 moles of carbon are burnt in 16 g of dioxygen.

5. Calculate the mass of sodium acetate (CH3COONa) required to make 500 mL of 0.375 molar aqueous solution. Molar mass of sodium acetate is 82.0245 g mol–1. 2022-23 26 CHEMISTRY

6. 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 per cent of nitric acid in it being 69%.

7. How much copper can be obtained from 100 g of copper sulphate (CuSO4)? 1.8 Determine the molecular formula of an oxide of iron, in which the mass per cent of iron and oxygen are 69.9 and 30.1, respectively.

9. Calculate the atomic mass (average) of chlorine using the following data: % Natural Abundance Molar Mass 35Cl 75.77 34.9689 37Cl 24.23 36.9659

10. In three moles of ethane (C2 H6), calculate the following: (i) Number of moles of carbon atoms. (ii) Number of moles of hydrogen atoms. (iii) Number of molecules of ethane.

11. What is the concentration of sugar (C12H22O11) in mol L–1 if its 20 g are dissolved in enough water to make a final volume up to 2L?

12. 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?

13. Pressure is determined as force per unit area of the surface. The SI unit of pressure, pascal is as shown below: 1Pa = 1N m–2 If mass of air at sea level is 1034 g cm–2, calculate the pressure in pascal.

14. What is the SI unit of mass? How is it defined?

15. Match the following prefixes with their multiples: Prefixes Multiples (i) micro 106 (ii) deca 109 (iii) mega 10–6 (iv) giga 10–15 (v) femto 10

16. What do you mean by significant figures?

17. 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). (i) Express this in per cent by mass. (ii) Determine the molality of chloroform in the water sample.

18. Express the following in the scientific notation: (i) 0.0048 (ii) 234,000 (iii) 8008 (iv) 500.0 (v) 6.0012

19. How many significant figures are present in the following? (i) 0.0025 (ii) 208 (iii) 5005 2022-23 SOME BASIC CONCEPTS OF CHEMISTRY 27 (iv) 126,000 (v) 500.0 (vi) 2.0034

20. Round up the following upto three significant figures: (i) 34.216 (ii) 10.4107 (iii) 0.04597 (iv) 2808

21. The following data are obtained when dinitrogen and dioxygen react together to form different compounds: Mass of dinitrogen Mass of dioxygen (i) 14 g 16 g (ii) 14 g 32 g (iii) 28 g 32 g (iv) 28 g 80 g (a) Which law of chemical combination is obeyed by the above experimental data? Give its statement. (b) Fill in the blanks in the following conversions: (i) 1 km = ... mm = ... pm (ii) 1 mg = ... kg = ... ng (iii) 1 mL = ... L = ... dm3

22. If the speed of light is 3.0 × 108 m s–1, calculate the distance covered by light in 2.00 ns.

23. In a reaction A + B2 AB2 Identify the limiting reagent, if any, in the following reaction mixtures. (i) 300 atoms of A + 200 molecules of B (ii) 2 mol A + 3 mol B (iii) 100 atoms of A + 100 molecules of B (iv) 5 mol A + 2.5 mol B (v) 2.5 mol A + 5 mol B

24. Dinitrogen and dihydrogen react with each other to produce ammonia according to the following chemical equation: N2 (g) + H2 (g) 2NH3 (g) (i) Calculate the mass of ammonia produced if 2.00 × 103 g dinitrogen reacts with 1.00 ×103 g of dihydrogen. (ii) Will any of the two reactants remain unreacted? (iii) If yes, which one and what would be its mass?

25. How are 0.50 mol Na2CO3 and 0.50 M Na2CO3 different?

26. If 10 volumes of dihydrogen gas react with five volumes of dioxygen gas, how many volumes of water vapour would be produced?

27. Convert the following into basic units: (i) 28.7 pm (ii) 15.15 pm (iii) 25365 mg
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28. Which one of the following will have the largest number of atoms? (i) 1 g Au (s) (ii) 1 g Na (s) (iii) 1 g Li (s) (iv) 1 g of Cl2(g)

29. Calculate the molarity of a solution of ethanol in water, in which the mole fraction of ethanol is 0.040 (assume the density of water to be one).

30. What will be the mass of one 12C atom in g?

31. How many significant figures should be present in the answer to the following calculations? (i) 0.02856 298.15 0.112 × × 0 5785. (ii) 5 × 5.364 (iii) 0.0125 + 0.7864 + 0.0215

32. Use the data given in the following table to calculate the molar mass of naturally occuring argon isotopes: Isotope Isotopic molar mass Abundance 36Ar 35.96755 g mol–1 0.337% 38Ar 37.96272 g mol–1 0.063% 40Ar 39.9624 g mol–1 99.600%

33. Calculate the number of atoms in each of the following (i) 52 moles of Ar (ii) 52 u of He (iii) 52 g of He.

34. A welding fuel gas contains carbon and hydrogen only. Burning a small sample of it in oxygen gives 3.38 g carbon dioxide, 0.690 g of water and no other products. A volume of 10.0 L (measured at STP) of this welding gas is found to weigh 11.6 g. Calculate (i) empirical formula, (ii) molar mass of the gas, and (iii) the molecular formula.

35. Calcium carbonate reacts with aqueous HCl to give CaCl2 and CO2 according to the reaction, CaCO3 (s) + 2 HCl (aq) → CaCl2 (aq) + CO2(g) + H2O(l) What mass of CaCO3 is required to react completely with 25 mL of 0.75 M HCl?

36. Chlorine is prepared in the laboratory by treating manganese dioxide (MnO2) with aqueous hydrochloric acid according to the reaction 4 HCl (aq) + MnO2(s) → 2H2O (l) + MnCl2(aq) + Cl2 (g) How many grams of HCl react with 5.0 g of manganese dioxide? 2022-23