PREVIOUS HSE QUESTIONS FROM THE CHAPTER "SOME BASIC CONCEPTS"

1. State and illustrate law of multiple proportions.   (3)
2. (i) Calculate the mass of $CO_2(g)$ in gram produced by the reaction between 3 mol of $CH_4(g)$ and 2 mol of $O_2(g)$ according to the equation : $CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(g)$ (2)
   (ii) Identify the limiting reagent in this reaction.   (1)   [December 2021]
3. (i) Write Avogadro number.   (1)
   (ii) How many moles of water molecules are present in 180 g of water?
       (Molecular mass of water = 18 g).   (2)
4. (i) Define Molarity.   (1)
   (ii) State law of multiple proportions.   (2)   [September 2021]
5. (a) Who proposed the law of conservation of mass?   (1)
   (b) Illustrate the above law by using a chemical reaction.   (1)
6. Determine the empirical formula of an oxide of iron which has 69.9% iron (Fe) and 30.1% oxygen (O) by mass. [Hint: Atomic mass of Fe = 55.85].   (3)   [December 2020]
7. (a) Classify the following matter as homogeneous mixture, heterogeneous mixture, element and compounds.   gold, air, muddy water, water   (1)
    (b) Define limiting reagent of a reaction.   (1)
8. (a) Hydrogen and oxygen combines to form H_2O and H_2O_2. Which law of chemical combination is illustrated here?   (1)
   (b) The balanced chemical equation for combustion of CH_4 is $CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$.
   Calculate the amount of water formed by the combustion of 32g of CH_4.   (2)   [March 2020]
9. Which of the following contains the maximum number of molecules?
         a)   1g N_2 (a) 1g CO_2 c) 1g H_2 d) 1g NH_3 (1)
10. Calculate the mass of SO_3 (g) produced, if 500 g SO_2 (g) reacts with 200 g O_2 (g) according to the equation:
         $2SO_2(g) + O_2(g) \longrightarrow 2SO_3(S)$. Identify the limiting reagent.   (3)   [July 2019]
11. Round off 0.0525 to a number with two significant figures.   (1)
12. A reaction mixture for the production of NH_3 gas contains 250 g of N_2 gas and 50 g of H_2 gas under suitable conditions. Identify the limiting reactant if any and calculate the mass of NH_3 gas produced. (3)
                                                                 [March 2019]
13. Which among the following measurements contains the highest number of significant figures?
   a)   1.123 x 10^{-3} kg   b) 1.2 x 10^{-3} kg   c) 0.123 x 10^3 kg   d) 2 x 10^5 kg   (1)
14. State and illustrate the law of multiple proportions. (2)
15. Calculate the amount of $CO_2(g)$ produced by the reaction of 32g of CH_4 (g) and 32g of O_2 (g). (3)
                                                                 [August 2018]
16. The number of oxygen atoms present in 5 moles of glucose ($C_6H_{12}O_6$) is .... (1)
17. Find the molecular formula of the compound with molar mass 78 g mol^{-1} and empirical formula CH. (2)
18. Calculate the mass of oxalic acid dihydrate ($H_2C_2O_4.2H_2O$) required to prepare 0.1M, 250 ml of its aqueous solution.   (3)   [March 2018]
19. a) NO and NO_2 are two oxides of nitrogen.
   i)   Which law of chemical combination is illustrated by these compounds?   (1)
   ii)   State the law. (1)
   b) Calculate the mass of a magnesium atom in grams.   (1)
   c) What is molality?   (1)   [July 2017]
20. a) Determine the number of moles present in 0.55 mg of electrons.

   i)   1 mole   ii) 2 moles   iii) 1.5 moles   iv) 0.5 mole   (1)

   b) Give the empirical formula of the following.

        $C_6H_{12}O_6$, C_6H_6, CH_3COOH, $C_6H_6Cl_6$ (2)

   c) Two elements, carbon and hydrogen combine to form C_2H_6, C_2H_4 and C_2H_2. Identify the law illustrated
      here. (1)   [March 2017]

21. Empirical formula represents the simplest whole number ratio of various atoms present in a compound.
    a) Give the relation between empirical formula and molecular formula.   (1)
    b) An organic compound has the following percentage composition C = 12.36%, H = 2.13%, Br = 85%. Its
        vapour density is 94. Find its molecular formula.   (2)
    c) What is mole fraction?   (1)   [September 2016]

22. a) When nitrogen and hydrogen combines to form ammonia, the ratio between the volumes of gaseous
       reactants and products is 1: 3: 2. Name the law of chemical combination illustrated here.   (1)
    b) A compound is made up of two elements A and B, has A = 70% and B = 30%. The relative number of
       moles of A and B in the compound are 1.25 and 1.88 respectively. If the molar mass of the compound is
       160, find the molecular formula of the compound. (3)   [March 2016]

23. 12 g of ^{12}C contains Avogadro's number of carbon atoms.
    a) Give the Avogadro's number.   (1)
    b) The mass of 2 moles of ammonia gas is ....
        (i)   2 g   (ii) 1.2 x 10^{22}g   (iii) 17 g   (iv) 34g   (1)
    c) Calculate the volume of ammonia gas produced at STP when 140 g of nitrogen gas reacts with 30 g of
        hydrogen gas. (Atomic mass: N = 14u, H = 1 u) (2)   [October 2015]

24. 'A given compound always contains exactly the same proportion of elements by weight.'
    a) (i)   Name the above law.   (1)
        (ii)   Write the name of the Scientist who proposed this law. (1)
    b) Calculate the number of molecules in each of the following:
        i) 1 g N_2 ii) 1 g CO_2 (Given that N_A is 6.022 x 10^{23}, molecular mass of N_2 = 28 and CO_2 = 44)   (2)
                                                                   [March 2015]

25. Hydrogen combines with oxygen to form two different compounds, namely water (H_2O) and hydrogen
    peroxide (H_2O_2).
    a) Which law is obeyed by this combination?   (1)
    b) State the law.   (2)
    c) How many significant figures are present in the following?
        I)   0.0025   ii) 285 (1)   [August 2014]

26. a) How many moles of dioxygen are present in 64g of dioxygen? (Molar mass of dioxygen is 32). (1)
    b) The following data were obtained when dinitrogen (N_2) and dioxygen (O_2) react together to form
    different compounds.

Mass of N_2	Mass of O_2
14 g	16 g
14 g	32 g
28 g	32 g
28 g	80 g

Name the law of chemical combination obeyed by the above experimental data. (1)

c) Define empirical formula. How is it related to the molecular formula of a compound? (2)

[March 2014]

27. a) Atoms have very small mass and so usually the mass of atoms are given relative to a standard called atomic mass unit. What is atomic mass unit (amu)? (1)

b) In a reaction $A + B_2 \rightarrow AB_2$, identify the limiting reagent in the reaction mixture containing 5mol A and 2.5mol B.   (1)

c) Calculate the mass of NaOH required to make 500 ml of 0.5M aqueous solution. (Molar mass of NaOH = 40)   (2)   [October 2013]

28. The mole concept helps in handling a large number of atoms and molecules in stoichiometric calculations.
   a) Define 1 mol.   (1)
   b) What is the number of hydrogen atoms in 1 mole of methane (CH_4)?   (1)
   c) Calculate the amount of carbon dioxide formed by the complete combustion of 80g of methane as per the reaction:

   $$CH_4\ (g) + 2O_2\ (g) \longrightarrow CO_2\ (g) + 2\ H_2O\ (g)$$

   (Atomic mass of C = 12.01u, H = 1.008u, O = 16u)   (2)   [March 2013]

29. a) Mole is a very large number to indicate the number of atoms, molecules etc. Write another name for one mole.   (1)

b) i) How the molecular formula is different from that of empirical formula?   (1)

   ii) An organic compound on analysis gave the following composition. Carbon = 40%, Hydrogen = 6.66% and oxygen = 53.34%. Calculate its molecular formula if its molecular mass is 90. (2)   [September 2012]

30. The combination of elements to form compounds is governed by the laws of chemical combination.
   a. Hydrogen combines with oxygen to form compounds, namely water and hydrogen peroxide. State and illustrate the related law of chemical combination.   (2)
   b. What is mean by limiting reagent in a chemical reaction?   (1)
   c. 28 g of nitrogen is mixed with 12 g of hydrogen to form ammonia as per the reaction, $N_2 + 3\ H_2 \longrightarrow 2NH_3$. Which is the limiting reagent in this reaction?   (1)   [March 2012]

31. The laws of chemical combination govern the formation of compounds from elements.
   a) State the law of conservation of mass. Who put forward this law?   (1½)
   b) The following data are obtained when dinitrogen and dioxygen react together to form different compounds.

Sl. No.	Mass of dinitrogen (in g)	Mass of dioxygen (in g)
1	14	16
2	14	32
3	28	48
4	28	80

Which law of chemical combination is illustrated by the above experimental data? Explain? (2½)

[October 2011]

32. The laws of chemical combination are the basis of the atomic theory.
   a) Name the law of chemical combination illustrated by the pair of compounds, CO and CO_2.   (1)
   b) State and explain the law of conservation of mass.   (1½)
   c) Calculate the molarity of a solution containing 8 g of NaOH in 500 mL of water. (1½)   [March 2011]

33. One mole is the amount of substance that contains as many particles as 12 g of C^{12} isotope of carbon.
   a) What do you mean by molar mass of a compound?   (1)
   b) Calculate the number of moles in 1 L of water (Density of water 1 g/mL). Also calculate the number of water molecules in 1 L water. (3)   [September 2010]

34. If the mass percent of various elements of a compound is known, its empirical formula can be calculated.
   a) What is mass percent?   (1)
   b) A compound contains 4.07% hydrogen, 24.27% carbon and 71.65% chlorine. Its molecular mass is 98.96. What are the empirical and molecular formulae?   (3)   [March 2010]

35. Calculate the number of moles of oxygen required to produce 240 g of MgO by burning Mg metal. (Atomic mass Mg = 24, O = 16)   (4)   [March 2009]

36. One gram atom of an element contains 6.02×10^{23} atoms.
    a) Find the number of oxygen atoms in 4 g of O_2.   (1)
    b) Which is heavier, one oxygen atom or 10 hydrogen atoms?   (1)   [February 2008]
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