Chapter 01 Some Basic Concepts of Chemistry

JEE-FLASHBACK

JEE MAINS QUESTION

Q.1 A gaseous hydrocarbon gives upon combustion 0.72 g of water and 3.08 g of CO_2. The empirical formula of the hydrocarbon is **[JEE(Main)-2013]**

(1) C_2H_4 (2) C_3H_4
(3) C_6H_5 (4) C_7H_8

Q.2 The ratio of masses of oxygen and nitrogen in a particular gaseous mixture is 1 : 4. The ratio of number of their molecule is: **[JEE(Main)-2014]**

(1) 1:8 (2) 3:16 (3) 1:4 (4) 7:32

Q.3 The molecular formula of a commercial resin used for exchanging ions in water softening is $C_8H_7SO_3Na$ (Mol. Wt. 206) What would be the maximum uptake of Ca^{2+} ions by the resin when expressed in mole per gram resin?

[JEE(Main)-2015]

(1) $\frac{1}{103}$ (2) $\frac{1}{106}$ (3) $\frac{2}{309}$ (4) $\frac{1}{412}$

Q.4 In Carius method of estimation of halogens, 250 mg of an organic compound give 141 mg of AgBr. The percentage of bromine in the compound is : (at. mass Ag = 108; Br = 80)

[JEE(Main)-2015]

(1) 24 (2) 36 (3) 48 (4) 60

Q.5 The most abundant elements by mass in the body of a healthy human adult are : Oxygen (61.4%) ; Carbon (22.9%), Hydrogen (10.0%) ; and Nitrogen (2.6%). The weight which a 75 kg person would gain if all 1H atoms are replaced by 2H atoms is **[JEE(Main)-2017]**

(1) 15 kg (2) 37.5 kg
(3) 7.5 kg (4)10 kg

Q.6 1 gram of a carbonate (M_2CO_3) on treatment with excess HCl produces 0.01186 mole of CO_2. The molar mass of M_2CO_3 in g mol^{-1} is : **[JEE(Main)-2017]**

(1) 1186 (2) 84.3 (3) 118.6 (4) 11.86

Q.7 The ratio of mass percent of C and H of an organic compound ($C_XH_YO_Z$) is 6:1, If one molecule of the above compound ($C_XH_YO_Z$) contains half as much oxygen as required to burn on molecule of compound C_XH_Y completely to CO_2 and H_2O. The empirical formula of compound $C_XH_YO_Z$ is : **[JEE(Main)-2018]**

(1) $C_2H_4O_3$ (2) $C_3H_6O_3$
(3) C_2H_4O (4) $C_3H_4O_2$

Q.8 For the following reaction, the mass of water produced from 445 g of $C_{57}H_{110}O_6$ is:

$2C_{57}H_{110}O_6(s) + 163\ O_2(g) \longrightarrow 114\ CO_2(g) + 110\ H_2O(l)$ **[JEE(Main)-2019]**

(1) 490g (2) 890g (3) 445g (4) 495g

Q.9 A 10 mg effervescent tablet containing sodium bicarbonate and oxalic acid releases 0.25 ml of CO_2 at T = 298.15 K and p = 1 bar. If molar volume of CO_2 is 25.0 L under such condition, what is the percentage of sodium bicarbonate in each tablet ? [Molar mass of $NaHCO_3$ = 84 g mol^{-1}] **[JEE(Main)-2019]**

(1) 0.84 (2) 8.4 (3) 16.8 (4) 33.6

Q.10 An organic compound is estimated through Duma's method and was found to evolve 6 moles of CO_2, 4 moles of H_2O and 1 mole of nitrogen gas. The formula of the compound is :

[JEE(Main)-2019]

(1) $C_6H_8N_2$ (2) C_6H_8N (3) $C_{12}H_8N_2$ (4) $C_{12}H_8N$

Q.11 The percentage composition of carbon by mole in methane is : **[JEE(Main)-2019]**

(1) 25% (2) 75% (3) 20% (4) 80%

Q.12 For a reaction,

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$; identify dihydrogen ($H_2$) as a limiting reagent in the following reaction mixtures. **[JEE(Main)-2019]**

(1) 28 g of N_2 + 6 g of H_2

(2) 56 g of N_2 + 10 g of H_2

(3) 14 g of N_2 + 4 g of H_2

(4) 35 g of N_2 + 8 g of H_2

Q.13 The minimum amount of $O_2(g)$ consumed per gram of reactant is for the reaction :(Given atomic mass : Fe = 56, O = 16, Mg = 24, P = 31, C = 12, H = 1) **[JEE(Main)-2019]**

(1) $4Fe(s)+3O_2(g) \rightarrow 2Fe_2O_3(s)$

(2) $C_3H_8(g)+ 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$

(3) $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

(4) $P_4(s)+ 5O_2(g) \rightarrow P_4O_{10}(s)$

Q.14 5 moles of AB_2 weigh 125×10^{-3} kg and 10 moles of A_2B_2 weigh 300×10^{-3} kg. The molar mass of A(MA) and molar mass of B (MB) in kg mol^{-1} are: **[JEE(Main)-2019]**

(1) MA = 5×10^{-3} and MB= 10×10^{-3}

(2) MA = 50×10^{-3} and MB = 25×10^{-3}

(3) MA = 25×10^{-3} and MB = 50×10^{-3}

(4) MA = 10×10^{-3} and MB = 5×10^{-3}

Q.15 25g of an unknown hydrocarbon upon burning produces 88g of CO_2 and 9g of H_2O. This unknown hydrocarbon contains: **[JEE(Main)-2019]**

(1) 18g of carbon and 7g of hydrogen

(2) 22g of carbon and 3g of hydrogen

(3) 24g of carbon and 1g of hydrogen

(4) 20g of carbon and 5g of hydrogen

Q.16 At 300 K and 1 atmospheric pressure, 10 mL of a hydrocarbon required 55 mL of O_2 for complete combustion, and 40 mL of CO_2 is formed. The formula of the hydrocarbon is: **[JEE(Main)-2019]**

(1) C_4H_7Cl (2) C_4H_{10} (3) C_4H_8 (4) C_4H_6

Q.17 How much mass of $NaNO_3$ is required to prepare 50 ml of aqueous solution to get 70 mg Na^+ per ml so solution **[JEE Main – 2020]**

Q.18 1.8 gram $C_xH_yO_z$ compound on combustion gives 2.64 gram $CO_{2(g)}$ and 1.08 gram of H_2O. find out mass % of oxygen in compound **[JEE Main – 2020]**

(1) 63.3% (2) 53.3%

(3) 51.3% (4) 55.33%

Q.19 1.86 gm of aniline is converted into acetanilide with 90% efficiency. Mass of acetanilide formed is [X] $\times 10^{-2}$gm **[JEE Main – 2020]**

Q.20 V ml of a hydrocarbon C_xH_y requires 6V ml of oxygen for complete combustion & forms 4Vml of CO_2 Determine y **[JEE Main – 2020]**

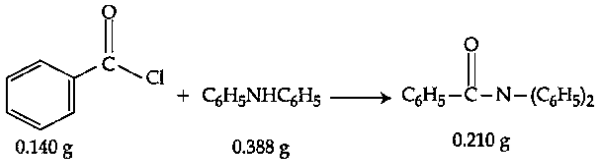
Q.21 Complete combustion of 3g of ethane gives x × 10^{22} molecules of water. The vale of x is. ___ (Round off to the Nearest integer) **[JEE Main – 2021]**

[use : $N_A = 6.023 \times 10^{23}$, Atomic masses in u : C 12 .0; O: 16.0; H: 1.0]

Q.22 _____ grams of 3- Hydroxy propanal (MW = 74) must be dehydrated to produce 7.8 g of acrolein (MW = 56) (C_3H_4O) if the percentage yield is 64. (Round off to the Nearest integer)

[given: Atomic masses : C : 12.0 u, H : 1.0 u, O: 16.0 u] **[JEE Main – 2021]**

Q.23



Consider the above reaction. The percentage yield of amide product is____. (Round off to the Nearest integer)

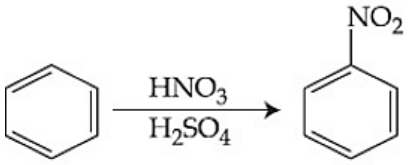
(Given : Atomic mass : C : 12.0 u, H : 1.0 u, N: 14.0 u, O : 16.0 : u, Cl : 35.5 u)

[JEE Main – 2021]

Q.24 The number of chlorine atoms in 20 mL of chlorine gas at STP is ____ 10^{21}. (Round off to the Nearest integer)

[Assume chlorine is an ideal gas at STP R = 0.083 L bar $mol^{-1}K^{-1}$, $N_A = 6.023 \times 10^{23}$] **[JEE Main – 2021]**

Q.25



In the above reaction, 3.9 g of benzene on nitration gives 4.92 g of nitrobenzene. The percentage yield of nitrobenzene in the above reaction is ____%
(Round off to the Nearest integer)
(given atomic mass : C : 12.0 u, H : 1.0 u, O : 16.0 : u, N: 14.0 u) **[JEE Main – 2021]**

Q.26 When 35 mL of 0.15 M lead nitrate solution is missed with 20 mL of 0.12 M chromic sulphate solution, _____ × 10^{-5} moles of lead sulphate precipitate out. (Round off to the Nearest Integer) **[JEE Main – 2021]**

Q.27 The exact volumes of 1m NaOH solution required to neutralise 50 mL of 1 M H_3PO_3 solution and 2M, H_3PO_2 solution respectively, are : **[JEE Main – 2021]**
(1) 100 mL and 100 mL
(2) 100 mL and 50 mL
(3) 100 mL and 200 mL
(4) 50 mL and 50 mL

Q.28 Complete combustion of 750 g of an organic compound provides 420 g of CO_2 and 210 g of H_2O. The percentage composition of carbon and hydrogen in organic compound is 15.3 and _____ respectively. (Round off to the Nearest Integer) **[JEE Main – 2021]**

Q.29 The number of significant figures in 0.00340 is___. **[JEE Main – 2021]**

Q.30 4g equimolar mixture of NaOH and Na_2CO_3 contains x g of NaOH and y g of Na_2CO_3. The value of x is ____g (Nearest integer) **[JEE Main – 2021]**

Q.31 250 mL of 0.5 M NaOH was added to 500 mL of 1 M HCl. The number of unreacted HCl molecules in the solution after complete reaction is ___ × 10^{21}
(NA = 6.022 × 10^{23}) **[JEE Main – 2021]**

Q.32 The number of moles of NH_3 that must be added to 2L of 0.80 M $AgNO_3$ in order to reduce the concentration of Ag^+ ions to 5.0 × 10^{-8} M ($K_{formation}$ for $[Ag(NH_3)_2]^+$ = 1.0 × 10^8) is _____. (Nearest integer)
[Assume no volume change on adding NH_3] **[JEE Main – 2021]**

Q.33 The number of atoms in 8 g of sodium is x × 10^{23}. The value of x is ____. (Nearest integer)
[given : N_A = 6.20 × 10^{23} mol^{-1} Atomic mass of Na = 23.0 u] **[JEE Main – 2021]**

Q.34 If a rocket runs on a fuel (C_{15} H_{30}) and liquid oxygen, the weight of oxygen required and CO_2 released for every litre of fuel respectively etc.
(Given : density of the fuel is 0.756 g/mL) **[JEE MAIN-2022]**
(1) 1188 g and 1296 g
(2) 2376 g and 2592 g
(3) 2592 g and 2376 g
(4) 3429 g and 3142 g

Q.35 116 g of a substance upon dissociation reaction. yields 7.5 g of hydrogen, 60 g of oxygen and 48.5 g of carbon. Given that the atomic masses of H, O and C 1, 16 and 12 respectively. The data agrees with how many formulae of the following ? **[JEE MAIN-2022]**
(1) CH_3COOH (2) HCHO
(3) CH_3OOCH_3 (4) CH_3CHO

Q.36 Haemoglobin contains 0.34% of iron by mass. The number of Fe atoms in 3.3 g of haemoglobin is
(Given : Atomic mass of Fe is 56 u, N_A in 6.022 ×10^{23} mol^{-1}) **[JEE MAIN-2022]**
(1) 1.21 × 10^5 (2) 12.z0 × 10^{16}
(3) 1.21 × 10^{20} (4) 3.4 × 10^{22}

Q.37

$$\underset{20\,g}{N_{2(g)}} + 3\underset{5\,g}{H_{2(g)}} \rightleftharpoons 2NH_{3(g)}$$

Consider the above reaction, the limiting reagent of the reaction and number of moles of NH_3 formed respectively are : **[JEE MAIN-2022]**
(1) H_2, 1.42 moles (2) H_2, 0.71 moles
(3) N_2, 1.42 moles (4) N_2, 0.71 moles

Q.38 The number of molecules and moles in 2.8375 litres of O_2 at STP are respectively

[JEE MAIN-2023]

(1) 7.527×10^{23} and 0.125 mol
(2) 7.527×10^{22} and 0.250 mol
(3) 1.505×10^{23} and 0.250 mol
(4) 7.527×10^{22} and 0.125 mol

Q.39 Match List-I with List-II. **[JEE MAIN-2023]**

List-I		List-II	
A.	16 g of CH_4 (g)	I	Weighs 28g
B.	1 g of H_2(g)	II	60.2×10^{23} electrons
C.	1 mole of N_2 (g)	III	Weighs 32 g
D.	0.5 mol of SO_2(g)	IV	Occupies 11.4 L volume at STP

Choose the correct answer from the options given below:
(1) A-II, B-III, C-IV, D-I
(2) A-II, B-IV, C-I, D-III
(3) A-I, B-III, C-II, D-IV
(4) A-II, B-IV, C-III, D-I

Q.40 Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: 3.1500 g of hydrated oxalic acid dissolved in water to make 250.0 mL solution will result in 0.1 M oxalic acid solution.

Reason R: Molar mass of hydrated oxalic acid is 126 g mol^{-1}. In the light of the above statements, choose the correct answer from the options given below: **[JEE MAIN-2023]**

(1) Both A and R are true but R is NOT the correct explanation of A
(2) A is true but R is false
(3) Both A and R are true and R is the correct explanation of A
(4) A is false but R is true

Q.41 Zinc reacts with hydrochloric acid to give hydrogen and zinc chloride. The volume of hydrogen gas produced at STP from the reaction of 11.5 g of zinc with excess HCl is _____ L (Nearest integer) **[JEE MAIN-2023]**

(Given: Molar mass of Zn is 65.4 g mol^{-1} and Molar volume of H_2 at STP = 22.7 L)

Q.42 When a hydrocarbon A undergoes combustion in the presence of air, it requires 9.5 equivalents of oxygen and produces 3 equivalents of water. What is the molecular formula of A?

[JEE MAIN-2023]

(1) C_8H_6 (2) C_9H_9 (3) C_6H_6 (4) C_9H_6

JEE ADVANCE QUESTION

Q.1 A student perform a titration with different burettes and finds titre values of 25.2 mL, 25.25 mL, 25.0 mL. The number of significant figures in the average titre value is:

[JEE Advance-2012]

Q.2 Reaction of Br_2 with Na_2CO_3 in aqueous solution gives sodium bromide and sodium bromate with evolution of CO_2 gas. The number of sodium bromide molecules involved in the balanced chemical equation is

[JEE Advance-2012]

Q.3 Dissolving 120 g of urea (mol. Wt 60) in 1000 g of water gave a solution of density 1.15 g/mL. The molarity of the solution is:

[JEE Advance-2012]

(1) 1.78 M (2) 2.00 M
(3) 2.05 M (4) 2.22 M

Q.4 29.2% (w/w) HCl stock solution has density of 1.25g mL^{-1}. The molecular weight of HCl is 36.5g mol^{-1}. The volume (mL) of stock solution required to prepare a 200 mL solution of 0.4M HCl is: **[JEE Advance-2012]**

Q.5 A compound H_2X with molar weight of 80g is dissolved in a solvent having density of 0.4g ml^{-1}. Assuming no change in volume upon dissolution, the molality of a 3.2 molar solution is **[JEE Advance 2014]**

Q.6 The mole fraction of a solute in a solution is 0.1. At 298K, molarity of this solution is the same as its molarity. Density of this solution at 298K is 2.0gcm^{-3}. The ratio of molecular weight of the solute and solvent, $\left(\frac{MW_{solute}}{MW_{solvent}}\right)$, is

[JEE Advance 2016]

Q.7 In neutral of faintly alkaline solution, 8 moles of permanganate anion quantitatively oxidize thiosulphate anion to produce X moles of a sulphur containing product. The magnitude of X is **[JEE Advance 2016]**

Q.8 The ammonia prepared by treating ammonium sulphate with calcium hydroxide is completely used by $NiCl_2.6H_2O$ to form a stable coordination compound. Assume that both the reactions are 100% complete. If 1584g of ammonium sulphate and 952 g of $NiCl_2.6H_2O$ are used in the preparation, the combined weight (in grams) of gypsum and the nickel-ammonia coordination compound thus produced is____.

(Atomic weights in g mol^{-1} : H = 1, N = 14, O = 16, S = 32, Cl = 35.5, Ca = 40, Ni = 59)

[JEE Advance 2018]

Q.9 The mole fraction of urea in an aqueous urea solution containing 900g of water is 0.05. If the density of the solution is 1.2g cm^{-3}, the molarity of urea solution is

(Given data : Molar masses of urea and water are 60g mol^{-1} and 18g mol, respectively)

[JEE Advance 2019]

Q.10 Aluminium reacts with sulfuric acid to form aluminium sulfate and hydrogen. What is the volume of hydrogen gas in litres (L) produced at 300K and 1.0 atm pressure, when 5.4g of aluminium and 50.0 mL of 5.0 M sulfuric acid are combined for the reaction?

(Use molar mass of aluminium as 27.0 g mol^{-1}, R = 0.082 atm L mol^{-1} K^{-1})

[JEE Advance 2020]

Question Statement for Question 11 and 12.

The reaction of x g of Sn with HCl quantitatively produced a salt. The entire amount of the salt reacted with y g of nitrobenzene in the presence of the require amount of HCl of produce 1.29 g of an organic salt (quantitatively).

(Use Molar masses (in g mol^{-1}) of H, C, N, O, Cl and Sn as 1, 12, 14, 16, 35 and 119, respectively).

[JEE Advance 2021]

Q.11 The value of x is _____.

Q.12 The value of y is _____.

Question Statement for Questions 13 and 14.

A sample (5.6 g) containing iron is completely dissolved in cold dilute HCl to prepare a 250 mL of solution. Titration of 25.0 mL of this solution requires 12.5 mL of 0.03 M $KMnO_4$ solution to reach the endpoint. Number of moles of Fe^{2+} present in 250 mL solution is $x \times 10^{-2}$ (consider complete dissolution of $FeCl_2$). The amount of iron present in the sample is y% by weight.

(Assume: $KMnO_4$ reacts only with Fe^{2+} in the solution

Use: Molar mass of iron as 56 g mol^{-1})

[JEE Advance 2021]

Q.13 The value of x is _____.

Q.14 The value of y is _____.

Q.15 The treatment of an aqueous solution of 3.74 g of $Cu(NO_3)_2$ with excess KI results in a brown solution along with the formation of a precipitate. Passing H_2S through this brown solution gives another precipitate X. The amount of X (in g) is _____.

[Given: Atomic mass of H =1, N = 14, O = 16, S = 32, K = 39, Cu = 63, I = 127]

[JEE Advance 2022]

Q.16 Dissolving 1.24 g of white phosphorus in boiling NaOH solution in an inert atmosphere gives a gas Q. The amount of $CuSO_4$ (in g) required to completely consume the gas Q is _____.

[JEE Advance 2022]

Q.17 The reaction of Xe and O_2F_2 gives a Xe compound P. The number of moles of HF produced by the complete hydrolysis of 1 mol of P is _____. **[JEE Advance 2022]**

Q.18 To check the principle of multiple proportions, a series of pure binary compounds (P_mQ_n) were analyzed and their composition is tabulated below. The correct option(s) is(are)

[JEE Advance 2022]

Compound	Weight % of P	Weight % of Q
1	50	50
2	44.4	55.6
3	40	60

(1) If empirical formula of compound 3 is P_3Q_4, then the empirical formula of compound 2 is P_3Q_5.

(2) If empirical formula of compound 3 is P_3Q_2 and atomic weight of element P is 20, then the atomic weight of Q is 45.

(3) If empirical formula of compound 2 is PQ, then the empirical formula of the compound 1 is P_3Q_4.

(4) If atomic weight of P and Q are 70 and 35, respectively, then the empirical formula of compound 1 is P_2Q.

Q.19 The stoichiometric reaction of 516 g of dimethyldichlorosilane with water results in a tetrameric cyclic product X in 75% yield. The weight (in g) of X obtained is___.

[Use, molar mass (g mol^{-1}): H = 1, C = 12, O = 16, Si = 28, Cl = 35.5] **[JEE Advance 2023]**

ANSWER KEY

JEE-FLASHBACK

JEE MAINS QUESTIONS

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	4	4	4	1	3	2	1	4	2	1	3	2	1	1	3
Que.	16	17	18	20	21	22	23	24	25	26	27	28	29	30	31
Ans.	4	129.3	2	8	18	16	77	1	80	525	3	3	3	1	226
Que.	32	33	34	35	36	37	38	39	40	41	42				
Ans.	4	2	3	2	4	3	4	2	3	4	1				

Q.19 (243×10^{-2})