Exercise-1

Marked Questions may have for Revision Questions.

OBJECTIVE QUESTIONS

Section (A) : Atoms, molecules, moles & avogadro's hypothesis

A-1. If the atomic mass of Sodium is 23, the number of moles in 46 g of sodium is :
(1) 1 (2) 2 (3) 2.3 (4) 4.6

A-2. Which of the following contains the greatest number of atoms ?
(1) 1.0 g of butane (C_4H_{10}) (2) 1.0 g of nitrogen (N_2)
(3) 1.0 g of silver (Ag) (4) 1.0 g of water (H_2O)

A-3. A sample of aluminium has a mass of 54.0 g. What is the mass of the same number of magnesium atoms? (At. wt. Al = 27, Mg=24)
(1) 12 g (2) 24 g (3) 48 g (4) 96 g.

A-4. The weight of a molecule of the compound $C_6H_{12}O_6$ is :
(1) 1.09×10^{-21} g (2) 2.988×10^{-22} g (3) 5.025×10^{-23} g (4) 16.023×10^{-23} g

A-5. Four 1-1 litre flasks are seperately filled with the gases N_2, Ne, N_2O and SO_3 at the same temperature and pressure. The ratio of total number of atoms of these gases present in different flask would be :
(1) 1 : 1 : 1 : 1 (2) 1 : 2 : 2 : 3 (3) 2 : 1 : 3 : 4 (4) 3 : 2 : 2 : 1

A-6. The total number of g-molecules of SO_2Cl_2 in 13.5 g of sulphuryl chloride is
(1) 0.1 (2) 0.2 (3) 0.3 (4) 0.4

A-7. The number of sodium atoms in 2 moles of sodium ferrocyanide $Na_4[Fe(CN)_6]$ is :
(1) 12 × 23 (2) 26×10^{23} (3) 34×10^{23} (4) 48×10^{23}

A-8. 4.4 g of an unknown gas occupies 2.24 litres of volume at STP, the gas may be :
(1) N_2O (2) CO (3) CO_2 (4) 1 & 3 Both

A-9. 5.6 litre of oxygen at STP contains :
(1) 6.02×10^{23} atoms (2) 3.01×10^{23} atoms (3) 1.505×10^{23} atoms (4) 0.7525×10^{23} atoms

A-10. If V ml of the vapours of substance at NTP weight W g. Then mol w. of substance is :
(1) (W/V) × 22400 (2) $\frac{V}{W} \times 22.4$ (3) (W–V) × 22400 (4) $\frac{W \times 1}{V \times 22400}$

A-11. If N_A is Avogadro's number then number of valence electrons in 4.2 *g* of nitride ions (N^{3-})
(1) 2.4 N_A (2) 4.2 N_A (3) 1.6 N_A (4) 3.2 N_A

A-12. The weight of 1×10^{22} molecules of $CuSO_4.5H_2O$ is :
(1) 41.59 *g* (2) 415.9 *g* (3) 4.159 *g* (4) None of these

A-13. Rearrange the following (I to IV) in the order of increasing masses and choose the correct answer from (a), (b), (c) and (d) (Atomic mass: *N*=14, *O*=16, *Cu*=63).
I. 1 molecule of oxygen
II. 1 atom of nitrogen
III. 1×10^{-10} g molecular weight of oxygen

IV. 1×10^{-10} g atomic weight of copper

(1) II<I<III<IV (2) IV<III<II<I (3) II<III<I<IV (4) III<IV<I<II

A-14. 1.520 *g* of the hydroxide of a metal on ignition gave 0.995 *gm* of oxide. The equivalent weight of metal is

(1) 1.520 (2) 0.995 (3) 19.00 (4) 9.00

A-15. How much coulomb charge is present on 1*g* ion of N^{-3}

(1) 5.2×10^6 Couloumb (2) 2.894×10^5 Couloumb

(3) 6.6×10^6 Couloumb (4) 8.2×10^6 Couloumb

A-16. Ratio of C_p and C_υ of a gas X is 1.4, the number of atom of the gas 'X' present in 11.2 litres of it at NTP will be

(1) 6.02×10^{23} (2) 1.2×10^{23} (3) 3.01×10^{23} (4) 2.01×10^{23}

Section (B) : Percentage composition and molecular formula

B-1. The number of atoms of Cr and O in a compound are 4.8×10^{10} & 9.6×10^{10} respectively. Its empirical formula is–

(1) Cr_2O_3 (2) CrO_2 (3) Cr_2O_4 (4) None

B-2. The empirical formula of a compound of molecular mass 120 is CH_2O. The molecular formula of the compound is :

(1) $C_2H_4O_2$ (2) $C_4H_8O_4$ (3) $C_3H_6O_3$ (4) all of these

B-3. A compound of X and Y has equal mass of them. If their atomic weights are 30 and 20 respectively. Molecular formula of that compound (its mol wt. is 120) could be :

(1) X_2Y_2 (2) X_3Y_3 (3) X_2Y_3 (4) X_3Y_2

B-4. 1 litre of a hydrocarbon weights as much as one litre of CO_2.Then the molecular formula of the hydrocarbon is :

(1) C_3H_8 (2) C_2H_6 (3) C_2H_4 (4) C_3H_6

B-5. Percentage of Se in peroxidase anhydrous enzyme is 0.5% by weight (at. wt. = 78.4) then min. mol. wt. of peroxidase anhydrous enzymes is :

(1) 1.568×10^4 (2) 1.568×10^3 (3) 15.68 (4) 2.136×10^4

B-6. Which of the following compounds has same empirical formula as that of glucose :

(1) CH_3CHO (2) CH_3COOH (3) CH_3OH (4) C_2H_6

B-7. Caffeine has a molecular weight of 194. It contains 28.9% by mass of nitrogen number of atoms of nitrogen in one molecule of it :

(1) 2 (2) 3 (3) 4 (4) 5

B-8. Insulin constans 3.4% sulphur. The minimum mol. wt. of insulin is –

(1) 941.176 (2) 944 (3) 945.27 (4) None

B-9. Vapour density of a metal chloride is 66. Its oxide contains 53% metal. The atomic weight of the metal is

(1) 21 (2) 54 (3) 27.06 (4) 2.086

B-10. The percentage of nitrogen in urea is about

(1) 46 (2) 85 (3) 18 (4) 28

Section (C) : Density and vapour density

C-1. 22.4 litre of water vapour at NTP, when condensed to water occupies an approximate volume of : (Given : density of water = 1 g/ml)
(1) 18 litre (2) 1 litre (3) 1 ml (4) 18 ml

C-2. Vapour density of a gas if its density is 0.178 g/L at NTP is :
(1) 0.178 (2) 2 (3) 4 (4) 0.089

C-3. Vapour density of a volatile substance w.r.t. CH_4 is 4 (CH_4 = 1). Its molecular weight would be –
(1) 8 (2) 32 (3) 64 (4) 128

C-4. A gas is found to have the formula $(CO)_x$. It's VD is 70 the value of x must be :
(1) 7 (2) 4 (3) 5 (4) 6

Section (D) : Balanced chemical equation analysis

D-1. The equation $2Al(S) + \frac{3}{2} O_2(g) \rightarrow Al_2O_3(S)$ show that :
(1) 2 mole of Al reacts with $\frac{3}{2}$ mole of O_2 to produce $\frac{7}{2}$ mole of Al_2O_3
(2) 2g of Al reacts with $\frac{3}{2}$ g of O_2 to produce one mole of Al_2O_3
(3) 2g mole of Al reacts with $\frac{3}{2}$ litre of O_2 to produce 1 mole of Al_2O_3
(4) 2 mole of Al reacts with $\frac{3}{2}$ mole of O_2 to produce 1 mole of Al_2O_3

D-2. Volume of CO_2 obtained at STP by the complete decomposition of 9.85 g $BaCO_3$ is :
(At. wt. of Ba = 137)
(1) 2.24 lit (2) 1.12 lit (3) 0.84 lit (4) 0.56 lit

D-3. 500 ml of a gaseous hydrocarbon when burnt in excess of O_2 gave 2.5 litre of CO_2 and 3.0 litre of water vapours under same conditions. Molecular formula of the hydrocarbon is :
(1) C_4H_8 (2) C_4H_{10} (3) C_5H_{10} (4) C_5H_{12}

D-4. The moles of O_2 required for reacting with 6.8 g of ammonia (....NH_3 + ... $O_2 \rightarrow$ ..... NO + ... H_2O) is
(1) 5 (2) 2.5 (3) 1 (4) 0.5

D-5. The volume of oxygen required for complete combustion of 20 ml of ethene is
(1) 30 ml (2) 60 ml (3) 40 ml (4) 50 ml

D-6. What weight of $CaCO_3$ must be decomposed to produce the sufficient quantity of carbon dioxide to convert 21.2 kg of Na_2CO_3 completely in to $NaHCO_3$. [Atomic mass Na = 23, Ca = 40]

$$CaCO_3 \longrightarrow CaO + CO_2$$

$$Na_2CO_3 + CO_2 + H_2O \longrightarrow 2NaHCO_3$$

(1) 100 Kg (2) 20 Kg (3) 120 Kg (4) 30 Kg

D-7. The volume of gas at NTP produced by 100g of CaC_2 with water :
(1) 70 litre (2) 35 litre (3) 17.5 litre (4) 22.4 litre

D-8. Sulphur trioxide is prepared by the following two reactions

$S_8(s) + 8O_2(g) \rightarrow 8SO_2(g)$

$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$

How many grams of SO_3 are produced from 1 mol of S_8 ?

(1) 1280.0 (2) 640.0 (3) 960.0 (4) 320.0

D-9. Butane C_4H_{10}, burns with the oxygen in air to give carbon dioxide and water.
What is the amount (in moles) of carbon dioxide produced from 0.15 mol C_4H_{10} ?

$C_4H_{10}(g) + O_2(g) \longrightarrow CO_2(g) + H_2O(g)$ (not balanced)

(1) 0.15 mol CO_2 (2) 0.30 mol CO_2 (3) 0.45 mol CO_2 (4) 0.60 mol CO_2

D-10. The mass of $BaCO_3$ produced when excess CO_2 is bubbled through a solution of 0.205 mol $Ba(OH)_2$ is

(1) 81 *g* (2) 40.5 *g* (3) 20.25 *g* (4) 162 *g*

D-11. When 100% pure sample of $CaCO_3$ was heated strongly 6.72 L of CO_2 was produced at STP. Find the weight of residual CaO left ?

(1) 30 g (2) 0.56 g (3) 16.8 g (4) None of these

D-12. When sodium bicarbonate is heated 3.6×10^{24} molecules of water are obtained. Find the moles of sodium bicarbonate heated.

$NaHCO_3 \longrightarrow Na_2CO_3 + CO_2 + H_2O$

(1) 6 (2) 12 (3) 9 (4) 8

Section (E) : Limiting reagent

E-1. If 0.5 mol of $BaCl_2$ is mixed with 0.1 mole of Na_3PO_4, the maximum number of mole of $Ba_3(PO_4)_2$ that can be formed is :

(1) 0.7 (2) 0.05 (3) 0.30 (4) 0.10

E-2. For the reaction $2P + Q \rightarrow R$, 8 mol of P and 5 mol of Q will produce

(1) 8 mol of R (2) 5 mol of R (3) 4 mol of R (4) 13 mol of R

E-3. 0.5 mole of H_2SO_4 is mixed with 0.2 mole of $Ca(OH)_2$. The maximum number of moles of $CaSO_4$ formed is:

(1) 0.2 (2) 0.5 (3) 0.4 (4) 1.5

E-4. For the reaction : $A + 2B \rightarrow C$

5 mole of A and 8 mole of B will produce :

(1) 5 mole of C (2) 4 mole of C (3) 8 mole of C (4) 12 mole of C

E-5 Calculate the amount of H_2 which is left unreacted in the given reaction :

$2H_2 + O_2 \longrightarrow 2H_2O$

If 8 g of H_2 is mixed with 16 g O_2 ?

(1) 3 g (2) 6 g (3) 1 g (4) 4 g

E-6. Zinc and hydrochloric acid react according to the reaction.

$Zn(s) + 2HCl(aq.) \longrightarrow ZnCl_2(aq.) + H_2(g)$

If 0.30 mole of Zn are added to hydrochloric acid containing 0.52 mole HCl, how many moles of H_2 are produced ?

(1) 0.26 (2) 1.04 (3) 0.52 (4) 0.13

E-7. A mixture of 1.0 mole of Al and 3.0 mole of Cl_2 are allowed to react as :

$$2Al\,(s) + 3Cl_2\,(g) \longrightarrow 2AlCl_3\,(s)$$

(a) Which is limiting reagent ?
(b) How many moles of $AlCl_3$ are formed
(c) Moles of excess reagent left unreacted is
(1) (a) Al, (b) 1.0 (c) 1.5 (2) (a) Cl_2, (b) 2.0 (c) 2.0
(3) (a) Al, (b) 0.5 (c) 1.5 (4) (a) Cl_2, (b) 1.0 (c) 1.5

Section (F) : Principle of Atom Conservation (POAC)

F-1. 25.4 g of iodine and 14.2g of chlorine are made to react completely to yield a mixture of ICl and ICl_3. Calculate the number of moles of ICl and ICl_3 formed.
(1) 0.1 mole, 0.1 mole (2) 0.1 mole, 0.2 mole (3) 0.5 mole, 0.5 mole (4) 0.2 mole, 0.2 mole

F-2. 21.6 g of silver coin is dissolved in HNO_3. When NaCl is added to this solution, all silver is precipitated as AgCl. The weight of AgCl is found to be 14.35 g then % of silver in coin is :
(1) 50% (2) 75% (3) 100% (4) 15%

F-3. Carbon and oxygen are taken in mass ratio 3 : 4. In the reaction $C(s) + O_2(g) \longrightarrow CO_2(g)$
(1) Carbon is limiting reagent. (2) Oxygen is limiting reagent.
(3) None is limiting reagent. (4) Both are limiting reagent.

F-4. An equimolar mixture of NaCl and KCl weigh 266 mg. Find mass of AgCl produced on adding excess $AgNO_3$ to above mixture.
(1) 143.5 mg (2) 574 mg (3) 287 mg (4) None of these

Section (G) : Concentration terms

G-1. If 500 ml of 1 M solution of glucose is mixed with 500 ml of 1 M solution of glucose final molarity of solution will be :
(1) 1 M (2) 0.5 M (3) 2 M (4) 1.5 M

G-2. What approximate volume of 0.40 M $Ba(OH)_2$ must be added to 50.0 mL of 0.30 M NaOH to get a solution in which the molarity of the OH^- ions is 0.50 M?
(1) 33 mL (2) 66 mL (3) 133 mL (4) 100 mL

G-3. 500 mL of a glucose solution contains 6.02×10^{22} molecules. The concentration of the solution is
(1) 0.1 M (2) 1.0 M (3) 0.2 M (4) 2.0 M

G-4. What is the concentration of nitrate ions if equal volumes of 0.1 M $AgNO_3$ and 0.1 M NaCl are mixed together :
(1) 0.1 M (2) 0.2 M (3) 0.05 M (4) 0.25 M

G-5. The volume of water that must be added to a mixture of 250 ml of 0.6 M HCl and 750 ml of 0.2 M HCl to obtain 0.25 M solution of HCl is :
(1) 750 ml (2) 100 ml (3) 200 ml (4) 300 ml

G-6. The molarity of the solution containing 2.8% mass-volume solution of KOH is
(1) M/10 (2) M/2 (3) M/5 (4) 1 M

G-7. The mole fraction of water in a solution containing 117 g sodium chloride and 900 g of water is ?
(1) 0.0632 (2) 0.038 (3) 0.9615 (4) 1.000

G-8. 300 ml of 3.0 M NaCl is added to 200 ml of 4.0 M $BaCl_2$ solution. The concentration of Cl^- ions in the resulting solution is
(1) 7 M (2) 1.6 M (3) 1.8 M (4) 5 M

G-9. The molality of a sulphuric acid solution is 0.2. Calculate the total weight of the solution having 1000 gm of solvent.
(1) 1000 g (2) 1098.6 g (3) 980.4 g (4) 1019.6g

G-10. 25 mL of 3.0 M HNO_3 are mixed with 75 mL of 4.0M HNO_3. If the volumes are additive, the molarity of the final mixture would be-
(1) 3.25 M (2) 4.0 M (3) 3.75 M (4) 3.50 M

G-11. 15 gram of methyl alcohol is dissolved in 35 gram of water. What is the mass percentage of methyl alcohol in solution ?
(1) 30% (2) 50% (3) 70% (4) 75%

G-12. Density of a 2.05 M solution of acetic acid in water is 1.02 g/mL. The molality of the solution is
(1) 3.28 mol Kg^{-1} (2) 2.28 mol Kg^{-1} (3) 0.44 mol Kg^{-1} (4) 1.14 mol Kg^{-1}

G-13. A 5.2 molal aqueous solution of CH_3OH is supplied. What is the mole fraction of methyl alcohol in the solution ?
(1) 0.050 (2) 0.100 (3) 0.190 (4) 0.086

G-14. The molality of 15% (wt./vol.) solution of H_2SO_4 of density 1.1 g/cm^3 is approximately-
(1) 1.2 (2) 1.4 (3) 1.8 (4) 1.6

G-15. The density of a solution containing 13% by mass of sulphuric acid is 1.09 g/mL. Calculate the molarity of the solution-
(1) 1.445 M (2) 14.45 M (3) 144.5 M (4) 0.1445 M

G-16. 250 *ml* of a sodium carbonate solution contains 2.65 grams of Na_2CO_3. If 10 *ml* of this solution is diluted to one litre, what is the concentration of the resultant solution (mol. wt. of Na_2CO_3=106)
(1) 0.1 M (2) 0.001 M (3) 0.01 M (4) 10^{-4} M

G-17. What is the concentration of nitrate ions if equal volumes of 0.1 M $AgNO_3$ and 0.1 M NaCl are mixed together :
(1) 0.1 M (2) 0.2 M (3) 0.05 M (4) 0.25 M

G-18. How much water should be added to 200 cc of semimolar solution of NaOH to make it exactly decimolar:
(1) 200 cc (2) 400 cc (3) 800 cc (4) 600 cc

G-19. A 300 g solution of density 1.5 g/ml is prepared by adding 90 g of glucose ($C_6H_{12}O_6$) in water. Find molarity of this solution.
(1) 5/3 (2) 5/2 (3) 2/5 (4) 3/5

Section (H) : Calculation of oxidation number

H-1. The oxidation number of Oxygen in Na_2O_2 is :
(1) + 1 (2) + 2 (3) – 2 (4) – 1

H-2. One of the following has both positive and negative oxidation states
(1) F (2) Cl (3) He (4) Na

H-3. The oxidation state of osmium (Os) in OsO_4 is
(1) + 7 (2) + 6 (3) + 4 (4) + 8

H-4. Oxidation number of nitrogen in $(NH_4)_2SO_4$ is
(1) $-\frac{1}{3}$ (2) – 1 (3) + 1 (4) – 3

H-5. In which of the following compounds, the oxidation number of iodine is fractional ?
(1) IF_7 (2) I_3^- (3) IF_5 (4) IF_3

H-6. The oxidation number of cobalt in $K_3[Co(NO_2)_6]$ is
(1) 0 (2) + 4 (3) + 3 (4) + 6

H-7. The oxidation number of Phosphorus in $Mg_2P_2O_7$ is :
(1) + 3 (2) + 2 (3) + 5 (4) – 3

H-8. In which of the following compounds, nitrogen has an oxidation state of –1 ?
(1) N_2O (2) NO_2^- (3) NH_2OH (4) N_2H_4

Section (I) : Balancing of redox reactions

I-1. A reducing agent is a substance :
(1) in which an element undergoes increase in oxidation number.
(2) in which an element undergoes decrease in oxidation number.
(3) which gains electron(s)
(4) which shares electron(s)

I-2. Consider the following reaction :

$3Br_2 + 6CO_3^{2-} + 3H_2O \longrightarrow 5Br^- + BrO_3^- + 6\,HCO_3^-$

Which of the following statements is true regarding this reaction:
(1) Bromine is oxidized and the carbonate radical is reduced.
(2) Bromine is reduced and the carbonate radical is oxidized.
(3) Bromine is neither reduced nor oxidized.
(4) Bromine is both reduced and oxidized.

I-3. Which of the following is a redox reaction:
(1) $2\,CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$ (2) $CuSO_4 + 4\,NH_3 \rightarrow [Cu(NH_3)_4]\,SO_4$
(3) $2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$ (4) $Cr_2O_7^{2-} + 2OH^- \rightarrow 2\,CrO_4^{2-} + H_2O$

I-4. Consider the reaction, $Zn + Cu^{2+} \longrightarrow Zn^{2+} + Cu$
(1) Zn is reduced to Zn^{2+} (2) Zn is oxidised to Zn^{2+}
(3) Zn^{2+} is oxidised to Zn (4) Cu^{2+} is oxidised to Cu.

I-5. Which reaction does not represent auto redox or disproportionation reaction :
(1) $Cl_2 + OH^- \longrightarrow Cl^- + ClO_3^- + H_2O$ (2) $2H_2O_2 \longrightarrow H_2O + O_2$
(3) $2Cu^+ \longrightarrow Cu^{2+} + Cu$ (4) $(NH_4)_2Cr_2O_7 \longrightarrow N_2 + Cr_2O_3 + 4H_2O$

I-6. In the reaction $X^- + XO_3^- + H^+ \longrightarrow X_2 + H_2O$, the molar ratio in which X^- and XO_3^- react is :
(1) 1 : 5 (2) 5 : 1 (3) 2 : 3 (4) 3 : 2

I-7. The compound that can work both as an oxidising as well as a reducing agent is :
(1) $KMnO_4$ (2) H_2O_2 (3) $Fe_2(SO_4)_3$ (4) $K_2Cr_2O_7$

Exercise-2

Marked Questions may have for Revision Questions.

OBJECTIVE QUESTIONS

1. How many moles of electron weigh one kilogram :
(1) 6.023×10^{23} (2) $\frac{1}{9.108} \times 10^{31}$ (3) $\frac{6.023}{9.108} \times 10^{54}$ (4) $\frac{1}{9.108 \times 6.023} \times 10^{8}$

2. The molar ratio of Fe^{2+} to Fe^{3+} in a mixture of $FeSO_4$ and $Fe_2(SO_4)_3$ having equal number of sulphate ion in both ferrous and ferric sulphate is
(1) 1 : 2 (2) 3 : 2 (3) 2 : 3 (4) can't be determined

3. Molarity of H_2SO_4 is 18 M. Its density is 1.8 g/cm^3, hence molality is
(1) 18 (2) 100 (3) 36 (4) 500

4. A sample of ammonium phosphate $(NH_4)_3PO_4$ contains 3.18 mol of H atoms. The number of mol of O atoms in the sample is :
(1) 0.265 (2) 0.795 (3) 1.06 (4) 3.18

5. The mass of carbon anode consumed (giving only carbon dioxide) in the production of 270 Kg of aluminium metal from bauxite by the Hall process is :
(1) 180 kg (2) 270 kg (3) 240 kg (4) 90 kg

6. Two elements X (at-mass 16) and Y (at-mass 14) combine to form compounds A, B and C. The ratio of different masses of Y which combines with a fixed mass of X in A,B and C is 1 : 3 : 5. If 32 parts by mass of X combines with 84 parts by mass of Y in B, then in C 16 parts by mass of X will combine with :
(1) 14 parts by mass of Y (2) 42 parts by mass of Y
(3) 70 parts by mass of Y (4) 84 parts by mass of Y

7. If LPG cylinder contains mixture of butane and isobutane, then the amount of oxygen that would be required for combustion of 1 kg of it will be :
(1) 1.8 kg (2) 2.7 kg (3) 4.5 kg (4) 3.58 kg

8. X g of Ag was dissolved in HNO_3 and the solution was treated with excess of NaCl. When 2.87 g of AgCl was precipitated the value of X is
(1) 1.08 g (2) 2.16 g (3) 2.70 g (4) 1.62 g

9. Calculate the weight of FeO produced from 6.7 g VO & 4.8 g Fe_2O_3
$VO + Fe_2O_3 \longrightarrow FeO + V_2O_5$ (At. wt. of V = 51, At. wt. of Fe = 56)
(1) 4.32 (2) 7.755 (3) 2.585 (4) 0.0718

10. Calculate the wt. of CaO required to remove the hardness of 10^6 litre of water containing 1.62 g of calcium bicarbonate per litre.

$Ca(HCO_3)_2 + CaO \longrightarrow 2CaCO_3 + 2H_2O$

(1) 5.6×10^3 g (2) 5.6×10^4 g (3) 5.6×10^5 g (4) 5.6×10^6 g

11. How many mole of $Zn(FeS_2)$ can be made from 2 mole zinc, 3 mole iron and 5 mole sulphur.
(1) 2 mole (2) 3 mole (3) 4 mole (4) 5 mole

12. Equal moles of H_2O and NaCl are present in a solution. Hence, molality of NaCl solution is :
(1) 0.55 (2) 55.5 (3) 1.00 (4) 0.18

13. Decreasing order of mass of pure NaOH in each of the aqueous solution.
(I) 50 g of 40% (W/W) NaOH
(II) 50 ml of 50% (W/V) NaOH (d_{sol} = 1.2 g/ml).
(III) 50 g of 15 M NaOH (d_{sol} = 1 g/ml).
(1) I, II, III (2) III, II, I (3) II, III, I (4) III = II = I.

14. Mole fraction of A in H_2O is 0.2. The molality of A in H_2O is :
(1) 13.9 (2) 15.5 (3) 14.5 (4) 16.8

15. A solution of glucose received from some research laboratory has been marked mole fraction x and molality (m) at 10ºC. When you will calculate its molality and mole fraction in your laboratory at 24ºC you will find
(1) mole fraction (x) and molality (m) (2) mole fraction (2x) and molality (2m)
(3) mole fraction (x/2) and molality (m/2) (4) mole fraction (x) and (m ± dm) molality

16. 2M of 100 ml Na_2SO_4 is mixed with 3M of 100 ml NaCl solution and 1M of 200 ml $CaCl_2$ solution. Then the ratio of the concentration of cation and anion.
(1) 1/2 (2) 2 (3) 1.5 (4) 1

17. What is the quantity of water that should be added to 16 g. methanol to make the mole fraction of methanol as 0.25 :
(1) 27 g. (2) 12 g. (3) 18 g. (4) 36 g.

18. Assuming that petrol is iso-octane (C_8H_{18}) and has a density 0.8 g ml^{-1}, 1.425 litre of petrol on complete combustion will consume oxygen ?
(1) 50 L (2) 125 L (3) 125 mol (4) 50 mol

19. In which of the following reactions is there a change in the oxidation number of nitrogen atom:
(1) $2NO_2 \longrightarrow N_2O_4$ (2) $NH_3 + H_2O \longrightarrow NH_4^+ + OH^-$
(3) $N_2O_5 + H_2O \longrightarrow 2HNO_3$ (4) None of these

20. For the redox reaction $MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$,
the correct stoichiometric coefficients of MnO_4^-, $C_2O_4^{2-}$ and H^+ are respectively:
(1) 2, 5, 16 (2) 16, 5, 2 (3) 5, 16, 2 (4) 2, 16, 5

21. When SO_2 is passed through a solution of potassium iodate, the oxidation state of iodine changes from:
(1) + 5 to 0 (2) + 5 to – 1 (3) – 5 to 0 (4) – 7 to – 1

22. The number of electrons required to balance the following equation,

$NO_3^- + 4H^+ + e^- \longrightarrow 2H_2O + NO$ is

(1) 5 (2) 4 (3) 3 (4) 2

23. One mole of calcium phosphide on reaction with excess of water gives
(1) One mole of phosphine
(2) Two moles of phosphoric acid
(3) Two moles of phosphine
(4) One mole of phosphorus pentoxide

Exercise-3

PART - I : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

OFFLINE JEE-MAIN

1. In an organic compound of molar mass 108 g mol^{-1} C, H and N atoms are present in 9 : 1 : 3.5 by weight. Molecular formula can be : **[AIEEE 2002, 3/225]**
(1) $C_6H_8N_2$ (2) $C_7H_{10}N$ (3) $C_5H_6N_3$ (4) $C_4H_{18}N_3$

2. When $KMnO_4$ acts as an oxidising agent and ultimately forms MnO_4^{2-}, MnO_2, Mn_2O_3 and Mn^{2+}, then the number of electrons transferred in each case is : **[AIEEE 2002, 3/225]**
(1) 4, 3, 1, 5 (2) 1, 5, 3, 7 (3) 1, 3, 4, 5 (4) 3, 5, 7, 1

3. Which of the following is a redox reaction? **[AIEEE 2002, 3/225]**
(1) $NaCl + KNO_3 \longrightarrow NaNO_3 + KCl$ (2) $CaC_2O_4 + 2\,HCl \longrightarrow CaCl_2 + H_2C_2O_4$
(3) $Mg(OH)_2 + 2\,NH_4Cl \longrightarrow MgCl_2 + 2\,NH_4OH$ (4) $Zn + 2\,AgCN \longrightarrow 2\,Ag + Zn(CN)_2$

4. Which of the following concentration factor is affected by change in temperature ? **[AIEEE 2002, 3/225]**
(1) Molarity (2) Molality (3) Mole fraction (4) Weight fraction

5. What volume of hydrogen gas at 273 K and 1 atm pressure will be consumed in obtaining 21.6 g of elemental boron (atomic mass = 10.8) from the reduction of boron trichloride by hydrogen- **[AIEEE 2003, 3/225]**
(1) 44.8 lit. (2) 22.4 lit. (3) 89.6 lit. (4) 67.2 lit.

6. 6.02×10^{20} molecules of urea are present in 100 ml of its solution. The concentration of urea solution is- **[AIEEE 2004, 3/225]**
(1) 0.001 M (2) 0.01 M (3) 0.02 M (4) 0.1 M

7. The oxidation state of Cr in $[Cr(NH_3)_4Cl_2]^+$ is : **[AIEEE 2005, 1½/225]**
(1) + 3 (2) + 2 (3) + 1 (4) 0

8. Two solution of a substance (non electrolyte) are mixed in the following manner. 480 ml of 1.5M first solution + 520 ml of 1.2M second solution. What is the molarity of the final mixture ? **[AIEEE 2005, 3/225]**
(1) 2.70M (2) 1.344M (3) 1.50M (4) 1.20M

9. Which of the following chemical reactions depicts the oxidizing behaviour of H_2SO_4? **[AIEEE-2006, 3/165]**
(1) $2HI + H_2SO_4 \rightarrow I_2 + SO_2 + 2H_2O$ (2) $Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + 2H_2O$
(3) $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$ (4) $2PCl_5 + H_2SO_4 \rightarrow 2POCl_3 + 2HCl + SO_2Cl_2$

10. How many moles of magnesium phosphate, $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms ? **[AIEEE-2006, 3/165]**

(1) 0.02 (2) 3.125×10^{-2} (3) 1.25×10^{-2} (4) 2.5×10^{-2}

11. Density of a 2.05M solution of acetic acid in water is 1.02 g/ml. The molality of the solution is : **[AIEEE-2006, 3/165]**

(1) 1.14 mol kg^{-1} (2) 3.28 mol kg^{-1} (3) 2.28 mol kg^{-1} (4) 0.44 mol kg^{-1}

12. In the reaction **[AIEEE-2007, 3/120]**

$2Al_{(s)} + 6HCl_{(aq)} \rightarrow 2Al^{3+}_{(aq)} + 6Cl^{-}_{(aq)} + 3H_2\,(g)$

(1) 6L $HCl_{(aq)}$ is consumed for every 3L H_2 produced.

(2) 33.6 L $H_{2(g)}$ is produced regardless temperature and pressure for every moles that reacts.

(3) 67.2 L $H_{2(g)}$ at STP is produced for every mole of Al that reacts .

(4) 11.2 L $H_{2(g)}$ at STP is produced for every mole of $HCl_{(aq)}$ consumed.

13. The density (in g mL^{-1}) of a 3.60 M sulphuric acid solution that is 29% (H_2SO_4 molar mass = 98 g mol^{-1}) by mass will be : **[AIEEE-2007, 3/120]**

(1) 1.22 (2) 1.45 (3) 1.64 (4) 1.88

14. A 5.2 molal aqueous solution of methyl alcohol, (CH_3OH), is supplied. What is the mole fraction of methyl alcohol in the solution? **[AIEEE-2011, 3/120]**

(1) 0.100 (2) 0.190 (3) 0.086 (4) 0.050

15. The molality of a urea solution in which 0.0100 g of urea, $[(NH_2)_2CO]$ is added to 0.3000 dm^3 of water at STP is: **[AIEEE-2011, 3/120]**

(1) 5.55×10^{-4} (2) 33.3 m (3) 3.33×10^{-2} m (4) 0.555 m

16. The density of a solution prepared by dissolving 120 g of urea (mol. mass = 60 u) in 1000 g of water is 1.15 g/mL. The molarity of this solution is : **[AIEEE-2012, 4/120]**

(1) 0.50 M (2) 1.78 M (3) 1.02 M (4) 2.05 M

17. The molarity of a solution obtained by mixing 750 mL of 0.5 M HCl with 250 mL of 2 M HCl will be : **[JEE(Main)-2013, 4/120]**

(1) 0.875 M (2) 1.00 M (3) 1.75 M (4) 0.975 M

18. Consider the following reaction :

$$xMnO_4^- + yC_2O_4^{2-} + zH^+ \rightarrow xMn^{2+} + 2yCO_2 + \frac{z}{2}H_2O$$

The values of x, y and z in the reaction are, respectively : **[JEE(Main)-2013, 4/120]**

(1) 5, 2 and 16 (2) 2, 5 and 8 (3) 2, 5 and 16 (4) 5, 2 and 8

19. In which of the following reactions H_2O_2 acts as a reducing agent ? **[JEE(Main)-2014, 4/120]**

(a) $H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$

(b) $H_2O_2 - 2e^- \rightarrow O_2 + 2H^+$

(c) $H_2O_2 + 2e^- \rightarrow 2OH^-$

(d) $H_2O_2 + 2OH^- - 2e^- \rightarrow O_2 + 2H_2O$

(1) (a), (b) (2) (c), (d) (3) (a), (c) (4) (b), (d)

20. 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, 4/120]**

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

21. 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, 4/120]**

(1) $\frac{1}{103}$ (2) $\frac{1}{206}$ (3) $\frac{2}{309}$ (4) $\frac{1}{412}$

22. 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, 4/120]**

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

23. 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, 4/120]**

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

24. Which of the following reactions is an example of a redox reaction ? **[JEE(Main)-2017, 4/120]**

(1) $XeF_2 + PF_5 \longrightarrow [XeF]^+ PF_6^-$ (2) $XeF_6 + H_2O \longrightarrow XeOF_4 + 2HF$

(3) $XeF_6 + 2H_2O \longrightarrow XeO_2F_2 + 4HF$ (4) $XeF_4 + O_2F_2 \longrightarrow XeF_6 + O_2$

ONLINE JEE-MAIN

1. Dissolving 120 g of a compound of (mol. wt. 60) in 1000 g of water gave a solution of density 1.12 g/mL. The molarity of the solution is : **[JEE(Main) 2014 Online (09-04-14), 4/120]**

(1) 1.00 M (2) 2.00 M (3) 2.50 M (4) 4.00 M

2. The amount of oxygen in 3.6 moles of water is : **[JEE(Main) 2014 Online (09-04-14), 4/120]**

(1) 115.2 g (2) 57.6 g (3) 28.8 g (4) 18.4 g

3. A gaseous compound of nitrogen and hydrogen contains 12.5% (by mass) of hydrogen. The density of the compound relative to hydrogen is 16. The molecular formula of the compound is : **[JEE(Main) 2014 Online (11-04-14), 4/120]**

(1) NH_2 (2) N_3H (3) NH_3 (4) N_2H_4

4. The amout of $BaSO_4$ formed upon mixing 100 mL of 20.8% $BaCl_2$ solution with 50 mL of 9.8% H_2SO_4 solution will be : (Ba = 137, Cl = 35.5, S = 32, H = 1 and O = 16) : **[JEE(Main) 2014 Online (12-04-14), 4/120]**

(1) 23.3 g (2) 11.65 g (3) 30.6 g (4) 33.2 g

5. How many electrons are involved in the following redox reaction ? **[JEE(Main) 2014 Online (19-04-14), 4/120]**

$Cr_2O_7^{2-} + Fe^{2+} + C_2O_4^{2-} \rightarrow Cr^{3+} + Fe^{3+} + CO_2$ (unblanced)

(1) 3 (2) 4 (3) 6 (4) 5

6. Amongst the following, identify the species with an atom in +6 oxidation state : **[JEE(Main) 2014 Online (19-04-14), 4/120]**

(1) $[MnO_4]^-$ (2) $[Cr(CN)_6]^{3-}$ (3) Cr_2O_3 (4) CrO_2Cl_2

7. A sample of a hydrate of barium chloride weighing 61 g was heated until all the water of hydration is removed. The dried sample weighed 52 g. The formula of the hydrated salt is: (atomic mass, Ba = 137 amu, Cl = 35.5 amu) **[JEE(Main) 2015 Online (10-04-15), 4/120]**

(1) $BaCl_2 + H_2O$ (2) $BaCl_2 + 4H_2O$ (3) $BaCl_2 + 3H_2O$ (4) $BaCl_2 + 2H_2O$

8. $A + 3B + 3C \rightleftharpoons AB_2C_3$

Reaction of 6.0 g of A, 6.0×10^{23} atoms of B, and 0.036 mol of C yields 4.8 g of compound AB_2C_3. If the atomic mass of A and C are 60 and 80 amu, respectively, the atomic mass of B is (Avogadro no. = 6×10^{23}) : **[JEE(Main) 2015 Online (11-04-15), 4/120]**

(1) 50 amu (2) 60 amu (3) 70 amu (4) 40 amu

9. The non-metal that does not exhibit positive oxidation state is : **[JEE(Main) 2016 Online (09-04-16), 4/120]**

(1) Fluorine (2) Oxygen (3) Chlorine (4) Iodine

10. 5 L of an alkane requires 25 L of oxygen for its complete combustion. If all volumes are measured at constant temperature and pressure, the alkane is ; **[JEE(Main) 2016 Online (09-04-16), 4/120]**

(1) Butane (2) Isobutane (3) Ethane (4) Propane

11. An organic compound contains C, H and S. The minimum molecular weight of the compound containing 8% sulphur is: (atomic weight of S = 32 amu) **[JEE(Main) 2016 Online (09-04-16), 4/120]**

(1) 300 g mol^{-1} (2) 400 g mol^{-1} (3) 200 g mol^{-1} (4) 600 g mol^{-1}

12. The amount of arsenic pentasulphide that can be obtained when 35.5 g arsenic acid is treated with excess H_2S in the presence of conc. HCl (assuming 100% conversion) **[JEE(Main) 2016 Online (09-04-16), 4/120]**

(1) 0.25 mol (2) 0.125 mol (3) 0.333 mol (4) 0.50 mol

13. Excess of NaOH (aq) was added to 100 mL of $FeCl_3$(aq) resulting into 2.14 g of $Fe(OH)_3$. The molarity of $FeCl_3$(aq) is : **[JEE(Main) 2017 Online (08-04-17), 4/120]**

(Given molar mass of Fe = 56 g mol^{-1} and molar mass of Cl = 35.5 g mol^{-1})

(1) 1.8 M (2) 0.2 M (3) 0.6 M (4) 0.3 M

14. The pair of compounds having metals in their highest oxidation state is : **[JEE(Main) 2017 Online (08-04-17), 4/120]**

(1) MnO_2 and CrO_2Cl_2 (2) $[FeCl_4]^-$ and Co_2O_3

(3) $[Fe(CN)_6]^{3-}$ and $[Cu(CN)_4]^{2-}$ (4) $[NiCl_4]^{2-}$ and $[CoCl_4]^{2-}$

PART - II : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

1. An aqueous solution of 6.3 g oxalic acid dihydrate is made up to 250 mL. The volume of 0.1 N NaOH required to completely neutralise 10 mL of this solution is : **[JEE-2001(S), 1/35]**

(A) 40 mL (B) 20 mL (C) 10 mL (D) 4 mL

2. The reaction, $3ClO^-$ (aq) $\rightarrow$ ClO_3^- (aq) + $2Cl^-$ (aq) is an example of : **[JEE-2001(S), 1/35]**

(A) oxidation reaction (B) reduction reaction

(C) disproportionation reaction (D) decomposition reaction

3. How many moles of electron weigh one kilogram : **[JEE-2002(S), 3/90]**

(A) 6.023×10^{23} (B) $\frac{1}{9.108} \times 10^{31}$ (C) $\frac{6.023}{9.108} \times 10^{54}$ (D) $\frac{1}{9.108 \times 6.023} \times 10^{8}$

4. Which has maximum number of atoms : **[JEE-2003(S), 3/84]**

(A) 24 g of C (12) (B) 56 g of Fe (56) (C) 27 g of Al (27) (D) 108 g Ag (108)

5. Amongst the following, the pair having both the metals in their highest oxidation state is : **[JEE-2004(S), 3/84]**

(A) $[Fe(CN)_6]^{3-}$ and $[Co(CN)_6]^{3-}$ (B) CrO_2Cl_2 and MnO_4^-
(C) TiO_2 and MnO_2 (D) $[MnCl_4]^{2-}$ and $[NiF_6]^{2-}$

6. Given that the abundances of isotopes ^{54}Fe, ^{56}Fe and ^{57}Fe are 5%, 90% and 5%, respectively, the atomic mass of Fe is : **[JEE-2009, 3/160]**

(A) 55.85 (B) 55.95 (C) 55.75 (D) 56.05

7. 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 2011, 3/160]**

(A) 1.78 M (B) 2.00 M (C) 2.05 M (D) 2.22 M

8. The order of the oxidation state of the phosphorus atom in H_3PO_2, H_3PO_4, H_3PO_3, and $H_4P_2O_6$ is **[JEE 2017, 3/160]**

(A) $H_3PO_4 > H_3PO_2 > H_3PO_3 > H_4P_2O_6$ (B) $H_3PO_4 > H_4P_2O_6 > H_3PO_3 > H_3PO_2$
(C) $H_3PO_2 > H_3PO_3 > H_4P_2O_6 > H_3PO_4$ (D) $H_3PO_3 > H_3PO_2 > H_3PO_4 > H_4P_2O_6$

Answers

EXERCISE - 1

A-1.	(2)	**A-2.**	(1)	**A-3.**	(3)	**A-4.**	(2)	**A-5.**	(3)
A-6.	(1)	**A-7.**	(4)	**A-8.**	(4)	**A-9.**	(2)	**A-10.**	(1)
A-11.	(1)	**A-12.**	(3)	**A-13.**	(1)	**A-14.**	(4)	**A-15.**	(2)
A-16.	(1)	**B-1.**	(2)	**B-2.**	(2)	**B-3.**	(3)	**B-4.**	(1)
B-5.	(1)	**B-6.**	(2)	**B-7.**	(3)	**B-8.**	(1)	**B-9.**	(3)
B-10.	(1)	**C-1.**	(4)	**C-2.**	(2)	**C-3.**	(3)	**C-4.**	(3)
D-1.	(4)	**D-2.**	(2)	**D-3.**	(4)	**D-4.**	(4)	**D-5.**	(2)
D-6.	(2)	**D-7.**	(2)	**D-8.**	(2)	**D-9.**	(4)	**D-10.**	(2)
D-11.	(3)	**D-12.**	(2)	**E-1.**	(2)	**E-2.**	(3)	**E-3.**	(1)
E-4.	(2)	**E-5**	(2)	**E-6.**	(1)	**E-7.**	(1)	**F-1.**	(1)
F-2.	(1)	**F-3.**	(2)	**F-4.**	(2)	**G-1.**	(1)	**G-2.**	(1)
G-3.	(3)	**G-4.**	(3)	**G-5.**	(3)	**G-6.**	(2)	**G-7.**	(3)
G-8.	(4)	**G-9.**	(4)	**G-10.**	(3)	**G-11.**	(1)	**G-12.**	(2)
G-13.	(4)	**G-14.**	(4)	**G-15.**	(1)	**G-16.**	(2)	**G-17.**	(3)
G-18.	(3)	**G-19.**	(2)	**H-1.**	(4)	**H-2.**	(2)	**H-3.**	(4)
H-4.	(4)	**H-5.**	(2)	**H-6.**	(3)	**H-7.**	(3)	**H-8.**	(3)
I-1.	(1)	**I-2.**	(4)	**I-3.**	(3)	**I-4.**	(2)	**I-5.**	(4)
I-6.	(2)	**I-7.**	(2)						

EXERCISE - 2

1.	(4)	**2.**	(2)	**3.**	(4)	**4.**	(3)	**5.**	(4)
6.	(3)	**7.**	(4)	**8.**	(2)	**9.**	(1)	**10.**	(3)
11.	(1)	**12.**	(2)	**13.**	(2)	**14.**	(1)	**15.**	(1)
16.	(4)	**17.**	(1)	**18.**	(3)	**19.**	(4)	**20.**	(1)
21.	(2)	**22.**	(3)	**23.**	(3)				

EXERCISE - 3

PART - I

OFFLINE JEE-MAIN

1.	(1)	**2.**	(3)	**3.**	(4)	**4.**	(1)	**5.**	(4)
6.	(2)	**7.**	(1)	**8.**	(2)	**9.**	(1)	**10.**	(2)
11.	(3)	**12.**	(4)	**13.**	(1)	**14.**	(3)	**15.**	(1)
16.	(4)	**17.**	(1)	**18.**	(3)	**19.**	(4)	**20.**	(2)
21.	(4)	**22.**	(1)	**23.**	(2)	**24.**	(4)		

ONLINE JEE-MAIN

1.	(2)	**2.**	(2)	**3.**	(4)	**4.**	(2)	**5.**	(3)
6.	(4)	**7.**	(4)	**8.**	(1)	**9.**	(1)	**10.**	(4)
11.	(2)	**12.**	(2)	**13.**	(2)	**14.**	(3)		

PART - II

1.	(A)	**2.**	(C)	**3.**	(D)	**4.**	(A)	**5.**	(B)
6.	(B)	**7.**	(C)	**8.**	(B)				