Q1 - 24 January - Shift 1

When $Fe_{0.93}O$ is heated in presence of oxygen, it converts to Fe_2O_3. The number of correct statement/s from the following is _____.

A. The equivalent weight of $Fe_{0.93}O$ is $\frac{\text{Molecular weight}}{0.79}$.

B. The number of moles of Fe^{2+} and Fe^{3+} in 1 mole of $Fe_{0.93}O$ is 0.79 and 0.14 respectively.

C. $Fe_{0.93}O$ is metal deficient with lattice comprising of cubic closed packed arrangement of O^{2-} ions.

D. The % composition of Fe^{2+} and Fe^{3+} in $Fe_{0.93}O$ is 85% and 15% respectively.

Space for your notes:

Q2 - 24 January - Shift 2

The number of units, which are used to express concentration of solutions from the following is _____.

Mass percent, Mole, Mole fraction, Molarity, ppm, Molality.

Space for your notes:

Q3 - 25 January - Shift 2

What is the mass ratio of ethylene glycol ($C_2H_6O_2$, molar mass = 62 g/mol) required for making 500 g of 0.25 molal aqueous solution and 250 mL of 0.25 molar aqueous solution ?

(1) 1 : 1 (2) 3 : 1

(3) 2 : 1 (4) 1 : 2

Space for your notes:

Q4 - 25 January - Shift 2

Number of hydrogen atoms per molecule of a hydrocarbon A having 85.8% carbon is _____

(Given : Molar mass of A = 84 g mol^{-1})

Space for your notes:

Q5 - 29 January - Shift 2

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?

(1) C_8H_6 (2) C_9H_9

(3) C_6H_6 (4) C_9H_6

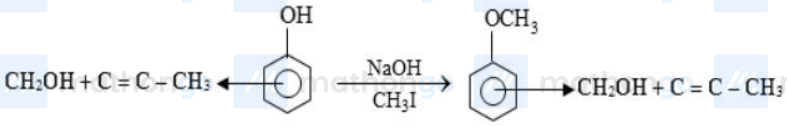
Space for your notes:

Q6 - 29 January - Shift 2

When 0.01 mol of an organic compound containing 60% carbon was burnt completely, 4.4 g of CO_2 was produced. The molar mass of compound is _____ $g\ mol^{-1}$ (Nearest integer)

Space for your notes:

Q7 - 30 January - Shift 1



Some amount of dichloromethane (CH_2Cl_2) is added to 671.141 mL of chloroform $(CHCl_3)$ to prepare 2.6×10^{-3} M solution of CH_2Cl_2 (DCM). The concentration of DCM is _____ ppm (by mass).

Given: Atomic mass : C = 12; H : 1; Cl = 35.5

density of $CHCl_3 = 1.49\,g\,cm^{-3}$

Space for your notes:

Q8 - 30 January - Shift 2

Match List I with List II:

	List I (Mixture)		List II (Separation Technique)
(A)	$CHCl_3 + C_6H_5NH_2$	I	Steam distillation
(B)	$C_6H_{14} + C_5H_{12}$	II	Differential extraction
(C)	$C_6H_5NH_2 + H_2O$	III	Distillation
(D)	Organic compound in H_2O	IV	Fractional distillation

(1) A-IV, B-I, C-III, D-II

(2) A-III, B-IV, C-I, D-II

(3) A-II, B-I, C-III, D-IV

(4) A-III, B-I, C-IV, D-II

Space for your notes:

Q9 - 31 January - Shift 1

On complete combustion, 0.492 g of an organic compound gave 0.792 g of CO_2.

The % of carbon in the organic compound is _____ (Nearest integer)

Space for your notes:

Q10 - 31 January - Shift 1

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)

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

Space for your notes:

Q11 - 31 January - Shift 2

When a hydrocarbon A undergoes complete combustion it requires 11 equivalents of oxygen and produces 4 equivalents of water. What is the molecular formula of A ?

(1) C_9H_8

(2) $C_{11}H_4$

(3) C_5H_8

(4) $C_{11}H_8$

Space for your notes:

Q12 - 31 January - Shift 2

Assume carbon burns according to following equation :

$$2C_{(s)} + O_{2(g)} \rightarrow 2CO(g)$$

When 12 g carbon is burnt in 48 g of oxygen, the volume of carbon monoxide produced is _____ $\times 10^{-1}$ L at STP [nearest integer]

[Given : Assume CO as ideal gas, Mass of C is 12 g mol^{-1}, Mass of O is 16 g mol^{-1} and molar volume of an ideal gas at STP is 22.7 L mol^{-1}]

Space for your notes:

Q13 - 01 February - Shift 1

The density of 3 M solution of NaCl is 1.0 g mL^{-1}. Molality of the solution is _____ $\times 10^{-2}$ m.

(Nearest integer).

Given: Molar mass of Na and Cl is 23 and 35.5 g mol^{-1} respectively.

Space for your notes:

Q14 - 01 February - Shift 2

The molality of a 10% (v/v) solution of di-bromine solution in CCl_4 (carbon tetrachloride) is 'x'. x = _____ $\times 10^{-2}$ M. (Nearest integer)

[Given : molar mass of Br_2 = 160 g mol^{-1}

atomic mass of C = 12 g mol^{-1}

atomic mass of Cl = 35.5 g mol^{-1}

density of dibromine = 3.2 g cm^{-3}

density of CCl_4 = 1.6 g cm^{-3}]

Space for your notes:

Answer Key

(As per Official NTA Key released on 2 Feb)

Q1 (4)	**Q2** (5)	**Q3** (3)	**Q4** (12)
Q5 (1)	**Q6** (200)	**Q7** (221)	**Q8** (2)
Q9 (44)	**Q10** (4)	**Q11** (1)	**Q12** (227)
Q13 (364)	**Q14** (139)		

Q1 (4)

$A : Fe_{0.93}O \rightarrow Fe_2O_3$

$$nf = \left(3 - \frac{200}{93}\right) \times 0.93$$

$nf = 0.79$

$B : 2x + (0.93 - x) \times 3 = 2$

$x = 0.79$

$Fe^{2+} = 0.79, Fe^{3+} = 0.21$

$C :$ Fact

$$D : \%Fe^{2+} = \frac{0.79}{0.93} \times 100 = 85\%; Fe^{3+} = 15\%$$

Q2 (5)

Mass percent, mole fraction, molarity, ppm, molality are used for measuring concentration terms.

Q3 (3)

Assume : Mass of solvent ≈ Mass of solution

Case I :-

$$0.25 = \frac{W_1}{62} \times \frac{1000}{500}$$

Case II :-

$$0.25 = \frac{W_2}{62} \times \frac{1000}{250}$$

$$\frac{W_1}{} = \frac{2}{}$$

Q4 (12)

Element	Percentage	Mole	Mole ratio
C	85.8	$\frac{85.8}{12}=7.15$	1
H	14.2	$\frac{14.2}{1}=14.2$	2

Empirical formula (CH_2)

$$14 \times n = 84$$
$$n = 6$$

$\therefore$ Molecular formula C_6H_{12}

Q5 (1)

$$C_xH_y + \left(x + \frac{y}{4}\right) O_2 \rightarrow xCO_2 + \frac{y}{2} H_2O$$

$$x + \frac{y}{4} = 9.5$$
$$\frac{y}{2} = 3$$
$$\Rightarrow x = 8, y = 6$$

Q6 (200)

Let M is the molar mass of the compound (g/mol)

mass of compound = 0.01 M gm

$$\text{mass of carbon} = 0.01\ M \times \frac{60}{100}$$

$$\text{moles of carbon} = \frac{0.01M}{12} \times \frac{60}{100}$$

$$\text{moles of } CO_2 \text{ from combustion} = \frac{4.4}{44} = \text{moles of carbon}$$

$$\frac{0.01M}{12} \times \frac{60}{100} = \frac{4.4}{44}$$

$$M = \frac{4.4}{44} \times \frac{100}{60} \times \frac{12}{0.01} = 200 gm/mol$$

Q7 (221)

$$\text{Molarity} = \frac{\text{mole}}{\text{volume}}$$

$$2.6 \times 10^{-3} = \frac{x/85}{0.67141}$$

$$x = 0.148\ g$$

$$\text{conc. Fo DCM in ppm} = \frac{0.148}{1.49 \times 671.141} \times 10^6$$

$$= 148\ ppm$$

Q8 (2)

List I (Mixture)	List II (Separation Technique)
$CHCl_3 + C_6H_5NH_2$	Distillation
$C_6H_{14} + C_5H_{12}$	Fractional distillation
$C_6H_5NH_2 + H_2O$	Steam distillation
Organic compound in H_2O	Differential extraction

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Q9 (44)

$$\text{weight of C in 0.792 gm } CO_2$$

$$= \frac{12}{44} \times 0.792 = 0.216$$

$$\% \text{ of C in compound} = \frac{0.216}{0.492} \times 100$$

$$= 43.90\%$$

Ans : 44

Q10 (4)

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2\uparrow$$

$$\text{Moles of Zn used} = \frac{11.5}{65.4} = \text{Moles of } H_2 \text{ evolved}$$

$$\text{Volume of } H_2 = \frac{11.5}{65.4} \times 22.7L = 3.99L$$

Ans : 4

Q11 (1)

$$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$$

$$\frac{y}{2} = 4 \therefore y = 8$$

$$x + \frac{8}{4} = 11$$

$$\therefore x = 9$$

$$\therefore \text{ Hydrocarbon will be} = C_9H_8$$

Q12 (227)

$$2C(s) + O_2(g) \rightarrow 2CO(g)$$

1mol 1.5 mol

Limiting reagent is carbon. One mole carbon produces one mole CO. Hence, volume at STP is 227×10^{-1} litre

Q13 (364)

$$m = \frac{1000 \times M}{1000 \times d - M \times \text{M.W of solute}}$$

$$= \frac{1000 \times 3}{1000 \times 1 - (3 \times 58.5)} = 3.64$$

$$= 364 \times 10^{-2}$$

Q14 (139)

(10 ml solute in 90 ml solvent

mass of solute $= 10 \times 3.2 = 32g$

mass of solvent $= 90 \times 1.6g$

$$m = \frac{32 \times 1000}{160 \times 90 \times 1.6} = 1.388$$

$$m = 138.8 \times 10^{-2} = 139$$