

HINTS & SOLUTIONS (CHEMISTRY – Chapter-wise Tests)

Speed Test-29

- Each has three significant figures. When zero is used to locate the decimal point it is not considered as significant figure.
- Both Y and X are neither precise nor accurate as the two values in each of them are not close. With respect to X & Y, the values of Z are close & agree with the true value. Hence, both precise & accurate.
- M. Wt of $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ is 322 g which contains 224 g oxygen. \therefore 32.2 g will contain 22.4 g oxygen.
- $$\frac{\text{Wt. of metal oxide}}{\text{Wt. of metal chloride}} = \frac{\text{Eq. wt. of metal} + \text{Eq. wt. of oxygen}}{\text{Eq. wt. of metal} + \text{Eq. wt. of chlorine}}$$

$$\frac{3}{5} = \frac{E + 8}{E + 35.5} \quad \therefore E = 33.25$$
- At NTP $22400 \text{ cc of } \text{N}_2\text{O} = 6.02 \times 10^{23} \text{ molecules}$

$$\therefore 1 \text{ cc } \text{N}_2\text{O} = \frac{6.02 \times 10^{23}}{22400} \text{ molecules}$$

$$= \frac{3 \times 6.02 \times 10^{23}}{22400} \text{ atoms} = \frac{1.8}{224} \times 10^{22} \text{ atoms}$$

No. of electrons in a molecule of $\text{N}_2\text{O} = 7 + 7 + 8 = 22$

Hence no. of electrons

$$= \frac{6.02 \times 10^{23}}{22400} \times 22 \text{ electrons} = \frac{1.32 \times 10^{23}}{224}$$
- In law of reciprocal proportions, the two elements combining with the third element, must combine with each other in the same ratio or multiple of that ratio of S and O when combine with C is 2 : 1. Ratio of S and O in SO_2 is 1 : 1
- Normality of oxalic acid solution

$$= \frac{6.3 \times 1000}{63 \times 250} = 0.4 \text{ N}$$

Now from

$$\text{N}_1 \text{V}_1 = \text{N}_2 \text{V}_2$$

$$0.4 \times 10 = 0.1 \times \text{V}_2$$

$$\text{V}_2 = 40 \text{ mL}$$
- The relation between molarity (M) and molality (m) is

$$d = M \left(\frac{1}{m} + \frac{M_2}{1000} \right), \quad M_2 = \text{Mol. mass of solute}$$

On putting value

$$1.252 = 3 \left(\frac{1}{m} + \frac{58.5}{1000} \right)$$

on solving $m = 2.79 \text{ molal}$.
- The number of atoms in 0.1 mole of a triatomic gas

$$= 0.1 \times 3 \times 6.023 \times 10^{23}$$

$$= 1.806 \times 10^{23}$$
- (a)
- 50% of X (Atomic mass 10), 50% of Y (Atomic mass 20).

Relative number of atoms of X = $\frac{50}{10} = 5$ and then

$$Y = \frac{50}{20} = 2.5$$

Simple Ratio 2 : 1. Formula X_2Y
- (a) Weight of $\text{H}_2 = \text{mole} \times \text{molecular wt.}$

$$= 0.2 \times 2 = 0.4 \text{ g}$$

(b) $6.023 \times 10^{23} = 1 \text{ mole}$

Thus $6.023 \times 10^{22} = 0.1 \text{ mole}$

Weight of $\text{N}_2 = 0.1 \times 28 = 2.8 \text{ g}$

(c) Weight of silver = 0.1 g

(d) Weight of oxygen = $32 \times 0.1 = 3.2 \text{ g}$
- Moles of nitride ion

$$= \frac{4.2}{14} = 0.3 \text{ mole} = 0.3 \times \text{N}_A \text{ nitride ions.}$$

Valence electrons = $8 \times 0.3 \text{ N}_A = 2.4 \text{ N}_A$ ($5 + 3$ due to charge). One N^{3-} ion contains 8 valence electrons.
- $$2\text{K}_2\text{CrO}_4 + 2\text{HCl} \longrightarrow \text{K}_2\text{Cr}_2\text{O}_7 + 2\text{KCl} + \text{H}_2\text{O}$$

2 2 1 2 1
- Terminal zeros are not significant if there is no decimal i.e., 290 contains two significant figures whereas in 29900, there are 5 significant figures; $1.23 \times 1.331 = 1.63713$ but keeping the mind the 1.23 has only few significant figures i.e., only three significant figures, so result should also be reported in three significant figures only. Thus 1.6373 should be rounded off to 1.64. Value 1.783 is rounded off to 2, so has only one significant figure.
- (a) No. of molecules in different cases

(a) \therefore 22.4 litre at STP contains

$$= 6.023 \times 10^{23} \text{ molecules of } \text{H}_2$$

\therefore 15 litre at STP contains = $\frac{15}{22.4} \times 6.023 \times 10^{23}$

$$= 4.03 \times 10^{23} \text{ molecules of } \text{H}_2$$

(b) \therefore 22.4 litre at STP contains

$$= 6.023 \times 10^{23} \text{ molecules of } \text{N}_2$$

\therefore 5 litre at STP contains = $\frac{5}{22.4} \times 6.023 \times 10^{23}$

$$= 1.344 \times 10^{23} \text{ molecules of } \text{N}_2$$

(c) \therefore 2 gm of $\text{H}_2 = 6.023 \times 10^{23} \text{ molecules of } \text{H}_2$

$$\therefore 0.5 \text{ gm of } H_2 = \frac{0.5}{2} \times 6.023 \times 10^{23}$$

$$= 1.505 \times 10^{23} \text{ molecules of } H_2$$

(d) Similarly 10 g of O_2 gas

$$= \frac{10}{32} \times 6.023 \times 10^{23} \text{ molecules of } O_2$$

$$= 1.88 \times 10^{23} \text{ molecules of } O_2$$

Thus (a) will have maximum number of molecules.

17. (a) 21% of 1 litre is 0.21 litre.
22.4 litres = 1 mole at STP

$$\therefore 0.21 \text{ litre} = \frac{0.21}{22.4} = 0.0093 \text{ mole}$$

18. (a) $BaCO_3 \longrightarrow BaO + CO_2$
192 g of $BaCO_3$ 1 gives mole of CO_2 = 22.4 L
9.85 g of $BaCO_3$ will give 0.05 mole of CO_2 which is equal to 1.12 litre.

19. (b) Moles of Ca^{2+} to be precipitated = $\frac{20 \times 1}{1000} = 0.02$

$$\text{Moles of } Cu^{2+} \text{ to be precipitated} = \frac{20 \times 0.5}{1000} = 0.01$$

Hence molar amount of H_2S will be in the ratio 2 : 1

$$\left(\text{Remember Moles} = \frac{\text{Molarity} \times \text{volume in ml}}{1000} \right)$$

20. (c) For statement (i) : H, O, C, N = All have different chemical properties.
For statement (ii) : It is true as per Dalton's postulate.
For statement (iii) : N : O = 1 : 1 (NO)
For statement (iv) : Dalton's postulates says, atoms can neither be created nor destroyed.

21. (d) No. of moles = $\frac{\text{weight}}{\text{mol. wt.}} = \frac{50}{342} = 0.14 \text{ mole}$

22. (b) For one mole of the oxide

Moles of M = 0.98

Moles of O^{2-} = 1

Let moles of M^{3+} = x

$$\therefore \text{Moles of } M^{2+} = 0.98 - x$$

on balancing charge

$$(0.98 - x) \times 2 + 3x - 2 = 0$$

$$x = 0.04$$

$$\therefore \% \text{ of } M^{3+} = \frac{0.04}{0.98} \times 100 = 4.08\%$$

23. (d) $MgCO_3 \longrightarrow MgO + CO_2$

84 g of $MgCO_3$ form 40 g of MgO

$$\therefore 20 \text{ g of } MgCO_3 \text{ form } \frac{40 \times 20}{84} \text{ g of } MgO$$

$$= 9.52 \text{ g of } MgO$$

Since 8.0 g of MgO is formed

$$\text{Purity of sample} = \frac{8}{9.52} \times 100 = 84.0\%$$

24. (d) In AlF_3 the number of F is 3, for one AlF_3 molecule
 $3F^- \equiv 1$ formula unit of AlF_3

$$3.0 \times 10^{24} F^- = \frac{1}{3} \times 3.0 \times 10^{24} AlF_3 \text{ units}$$

25. (d) Mass of a substance is the amount of matter present in it while weight is the force exerted by gravity on an object.

Mass is constant while weight may vary from one place to another due to gravity.

SI unit of both mass and weight is kilogram.

26. (a) Fe (no. of moles) = $\frac{558.5}{55.85} = 10 \text{ moles} = 10 N_A \text{ atoms.}$

No. of moles in 60 g of C = $60/12 = 5 \text{ moles} = 5 N_A \text{ atoms.}$

27. (c) 50 mL of 16.9% solution of $AgNO_3$

$$\left(\frac{16.9}{100} \times 50 \right) = 8.45 \text{ g of } AgNO_3$$

$$n_{\text{mole}} = \frac{8.45 \text{ g}}{(107.8 + 14 + 16 \times 3) \text{ g/mol}}$$

$$= \left(\frac{8.45 \text{ g}}{169.8 \text{ g/mol}} \right) = 0.0497 \text{ moles}$$

50 mL of 5.8% solution of $NaCl$ contain

$$NaCl = \left(\frac{5.8}{100} \times 50 \right) = 2.9 \text{ g}$$

$$n_{NaCl} = \frac{2.9 \text{ g}}{(23 + 35.5) \text{ g/mol}} = 0.0495 \text{ moles}$$



1 mole 1 mole 1 mole

$$\therefore 0.049 \text{ mole } 0.049 \text{ mole } 0.049 \text{ mole of } AgCl$$

$$n = \frac{w}{M} \Rightarrow w = (n_{AgCl}) \times \text{Molecular Mass}$$

$$= (0.049) \times (107.8 + 35.5)$$

$$= 7.02 \text{ g}$$

28. (d) $n_C = \frac{26 \text{ g}}{12 \text{ g/mol}} = 2.16$

$$n_{O_2} = \frac{20 \text{ g}}{32 \text{ g/mol}} = 0.625$$

O₂ will be a limiting reagent in reaction (i)

$$n_{N_2} = \frac{60 \text{ g}}{28 \text{ g/mol}} = 2.14$$

$$n_{H_2} = 40$$

According to balanced equation,

1 mole of N₂ requires 3 mole of H₂

2.14 mole of N₂ require 6.42 mole of H₂

N₂ will be a limiting reagent in reaction (ii)

$$n_{P_4} = \frac{100 \text{ g}}{4 \times 31} = 0.86 \quad n_{O_2} = 6.25$$

According to balanced equation

1 mole of P₄ require 3 mole of O₂

0.86 mole of P₄ require 2.58 mole of O₂

So P₄ is a limiting reagent in reaction (iii)

29. (a) Proceed as follows :

Element	%	At.wt.	RNA	Simplest ratio
A	25	12.5	$\frac{25}{12.5} = 2$	1
B	75	37.5	$\frac{75}{37.5} = 2$	1

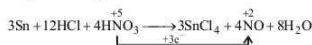
∴ The simplest formula of compound is AB

30. (d) Moles of Iodine present = $\frac{254}{127} = 2$

$$\text{Moles of oxygen} = \frac{80}{16} = 5$$

∴ The molecular formula is I₂O₅

31. (a) Change in O.N. of N in HNO₃ is 3, hence one formula weight has 3 equivalents.



Since change in O.N. = 3

32. (c) Ratio of no. of atoms in the molecule

$$= \frac{9}{12} : \frac{1}{1} : \frac{3.5}{14} = 0.75 : 1 : 0.25 = 3 : 4 : 1$$

Empirical formula = C₃H₄N;

$$\text{M.F.} = (\text{C}_3\text{H}_4\text{N})_n$$

n × Empirical formula mass = Molecular mass

$$n(3 \times 12 + 4 \times 1 + 14) = 108$$

$$n \times 54 = 108$$

$$n = 2$$

$$\text{M.F.} = \text{C}_6\text{H}_8\text{N}_2$$

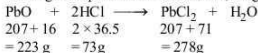
33. (a) 2.6 has two significant figures.

0.260 has three significant figures.

0.002600 has four significant figures.

2.6000 has five significant figures.

34. (d) Writing the equation for the reaction, we get



$$\text{No. of moles of PbO} = \frac{6.5}{223} = 0.029$$

$$\text{No. of moles of HCl} = \frac{3.2}{36.5} = 0.0877$$

Thus PbO is the limiting reactant 1 mole of PbO produce 1 mole PbCl₂.

0.029 mole PbO produces 0.029 mole PbCl₂.

35. (c) When the weight of different solutes are equal in equal volumes of solutions, the molarity is inversely related to molecular mass of the solute. Mol. mass of NaCl is less than KCl. Hence, molarity of NaCl solution will be more.

36. (b) $\text{geq of HCl} = \frac{3}{36.5} \times 2.5 = 0.20548 = \text{geq of Al(OH)}_3$

$$\begin{aligned} \text{Weight of Al(OH)}_3 &= \frac{0.20548 \times 78}{3} \\ &= 5.342 \text{ g} = 5342 \text{ mg} \end{aligned}$$

$$\therefore \text{No. of tablets} = \frac{5342}{400} = 13.35 \approx 14$$

37. (a) Let 100 g of compound be there.

$$\text{Number of moles of Nitrogen} = \frac{35}{14} = 2.5$$

$$\text{Number of moles of Hydrogen} = \frac{5}{1.008} = 4.9$$

$$\text{Number of moles of Carbon} = \frac{60}{12.01} = 4.9$$

Since 2.5 is the smallest value division by it give ratio

$$\text{N : H : C}$$

$$1 : 1.96 : 1.96$$

$$= 1 : 2 : 2$$

Empirical formula = C₂H₂N

Empirical formula weight = 2 × 12 + 2 + 14 = 40

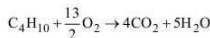
Molecular mass = 80

Molecular formulae = n (C₂H₂N)

$$\therefore 2 (\text{C}_2\text{H}_2\text{N}) \left(n = \frac{80}{40} \right) = \text{C}_4\text{H}_4\text{N}_2$$

38. (a) C₃H₈ + 5O₂ → 3CO₂ + 4H₂O

$$\quad \quad \quad a \quad \quad \quad 3a$$



$$(3-a) \quad \quad \quad 4(3-a)$$

$$\text{But } 3a + 4(3-a) = 10$$

$$\therefore a = 2 (\text{Propane}) \text{ and } 3-2 = 1 (\text{Butane})$$

39. (a) Mass of 6.023 × 10²³ atoms of oxygen = 16 g

Mass of one atom of oxygen

$$= \frac{16}{6.023 \times 10^{23}} = 2.66 \times 10^{-23} \text{ g}$$

Mass of 6.023×10^{23} atoms of nitrogen = 14 g

Mass of one atom of nitrogen

$$= \frac{14}{6.023 \times 10^{23}} = 2.32 \times 10^{-23} \text{ g}$$

Mass of 1×10^{-10} mole of oxygen = 16×10^{-10}

Mass of 1 mole of copper = 63 g

Mass of 1 mole of oxygen = 16 g

Mass of 1×10^{-10} mole of copper = $63 \times 1 \times 10^{-10}$
 $= 63 \times 10^{-10}$

So, the order of increasing mass is $\text{II} < \text{I} < \text{III} < \text{IV}$.

40. (d) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \longrightarrow 2\text{NH}_3(\text{g})$

N_2 is the limiting reagent in this reaction. 10 L N_2 will react with 30 L H_2 to produce 20 L of NH_3 . As the yield of reaction is 50% composition of resultant mixture will be 5 L of N_2 , 15 L of H_2 and 10 L of NH_3 .

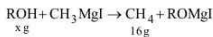
41. (d) 1 Mole of $\text{Mg}_3(\text{PO}_4)_2$ contains 8 mole of oxygen atoms
 \therefore 8 mole of oxygen atoms = 1 mole of $\text{Mg}_3(\text{PO}_4)_2$

0.25 mole of oxygen atom = $\frac{1}{8} \times 0.25$ mole of

$\text{Mg}_3(\text{PO}_4)_2$

$= 3.125 \times 10^{-2}$ mole of $\text{Mg}_3(\text{PO}_4)_2$

42. (c) Let the alcohol be ROH and x its molecular weight



$\frac{4.12}{1000}$ g of alcohol will produce $\frac{16 \times 4.12}{\text{x} \times 1000}$ g of methane

Methane actually obtained is = $\frac{16 \times 1.12}{22400}$ g

$$\text{equal} = \frac{16 \times 4.12}{\text{x} \times 1000} = \frac{16 \times 1.12}{22400} \therefore \text{x} = 82.4$$

43. (c) The conditions given are standard conditions

224 mL has mass = 1 g ;

22400 mL will have mass = 100 g. This is mol. wt of gas
 6.023×10^{23} molecules have $3 \times 6.023 \times 10^{23}$ atoms
 since gas is triatomic
 \therefore weight of one atom

$$= \frac{100}{3 \times 6.023 \times 10^{23}} = 5.5 \times 10^{-23} \text{ g}$$

44. (b) Sum of oxidation states must be equal to zero which is given by $\text{A}_3(\text{BC}_4)_2 = \text{A}_3\text{B}_2\text{C}_8$ ($6 + 10 - 16 = 0$)

45. (d)
- | | | | | | |
|---------|---------------|---|-------------------------|----------------------|---------------|
| | SO_2 | + | $\frac{1}{2}\text{O}_2$ | \rightleftharpoons | SO_3 |
| Initial | 5 mole | | 5 mole | | 0 mole |
| Final | 5 - 3 | | 5 - 1.5 mole | | 3 mole |
| | = 2 mole | | = 3.5 mole | | |
- Total number of moles = $2 + 3.5 + 3.0 = 8.5$