HINTS & SOLUTIONS (CHEMISTRY – Chapter-wise Tests)

Speed Test-29

1. **(c)** Each has three significant figures. When zero is used to locate the decimal point it is not considered as significant figure.

2. **(d)** 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.

3. **(c)** M. Wt of $Na_2SO_4.10\,H_2O$ is 322 g which contains 224 g oxygen. $\therefore$ 32.2 g will contain 22.4 g oxygen.

4. **(b)** $\frac{\text{Wt. of metal oxide}}{\text{Wt. of metal chloride}}$

$$= \frac{\text{Eq. wt of metal} + \text{Eq. wt of oxygen}}{\text{Eq. wt of metal} + \text{Eq. wt of chlorine}}$$

$$\frac{3}{5} = \frac{E+8}{E+35.5} \qquad \therefore E = 33.25$$

5. **(d)** At NTP 22400 cc of $N_2O = 6.02 \times 10^{23}$ molecules

$$\therefore 1 \text{ cc } N_2O = \frac{6.02 \times 10^{23}}{22400} \text{ molecules}$$

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

No. of electrons in a molecule of $N_2O = 7 + 7 + 8 = 22$

Hence no. of electrons

$$= \frac{6.02 \times 10^{23}}{22400} \times 22 \text{ electrons } = \frac{1.32 \times 10^{23}}{224}$$

6. **(c)** 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

7. **(d)** Normality of oxalic acid solution

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

Now from

$N_1V_1 = N_2V_2$

$0.4 \times 10 = 0.1 \times V_2$

$V_2 = 40$ mL

8. **(c)** The relation between molarity (M) and molality (m) is

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

On putting value

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

on solving m = 2.79 molal.

9. **(b)** The number of atoms in 0.1 mole of a triatomic gas

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

$= 1.806 \times 10^{23}$

10. **(a)**

11. **(c)** 50% of X (Atomic mass 10), 50% of Y (Atomic mass 20).

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

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

Simple Ratio 2 : 1. Formula X_2Y

12. **(c)** (a) Weight of H_2 = mole × molecular wt.

$= 0.2 \times 2 = 0.4$ g

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

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

Weight of $N_2 = 0.1 \times 28 = 2.8$ g

(c) Weight of silver = 0.1 g

(d) Weight of oxygen = $32 \times 0.1 = 3.2$ g

13. **(b)** Moles of nitride ion

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

Valence electrons $= 8 \times 0.3\, N_A = 2.4\, N_A$ (5 + 3 due to charge). One N^{3-} ion contains 8 valence electrons.

14. **(a)** $\underset{2}{2K_2CrO_4} + \underset{2}{2HCl} \longrightarrow \underset{1}{K_2Cr_2O_7} + \underset{2}{2KCl} + \underset{1}{H_2O}$

15. **(b)** 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.

16. **(a)** No. of molecules in different cases

(a) $\because$ 22.4 litre at STP contains

$= 6.023 \times 10^{23}$ molecules of H_2

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

$= 4.03 \times 10^{23}$ molecules of H_2

(b) $\because$ 22.4 litre at STP contains

$= 6.023 \times 10^{23}$ molecules of N_2

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

$= 1.344 \times 10^{23}$ molecules of N_2

(c) $\because$ 2 gm of $H_2 = 6.023 \times 10^{23}$ molecules of H_2

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

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

(d) Similarly 10 g of O_2 gas

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

$= 1.88 \times 10^{23}$ 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 litre $= \frac{0.21}{22.4} = 0.0093$ 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 $= \frac{20 \times 1}{1000} = 0.02$

Moles of Cu^{2+} 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 $= \frac{\text{weight}}{\text{mol. wt.}} = \frac{50}{342} = 0.14$ mole

22. (b) For one mole of the oxide
Moles of M = 0.98
Moles of $O^{2-} = 1$
Let moles of $M^{3+} = x$
$\therefore$ Moles of $M^{2+} = 0.98 - x$

on balancing charge
$(0.98 - x) \times 2 + 3x - 2 = 0$
$x = 0.04$

$\therefore$ % 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

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

= 9.52 g of MgO
Since 8.0 g of MgO is formed

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

$3.0 \times 10^{24}\ F^- \equiv \frac{1}{3} \times 3.0 \times 10^{24}\ AlF_3$ 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) $= \frac{558.5}{55.85} = 10$ moles $= 10N_A$ atoms.
No. of moles in 60 g of C = 60/12 = 5 moles = $5N_A$ atoms.

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

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

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

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

50 mL of 5.8% solution of NaCl contain

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

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

$AgNO_3 + NaCl \rightarrow AgCl\downarrow + \overset{\oplus}{Na} + \overset{\ominus}{Cl}$

1 mole 1 mole 1 mole

$\therefore$ 0.049 mole 0.049 mole 0.049 mole of AgCl

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

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

$= 7.02$ g

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

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

O_2 will be a limiting reagent in reaction (i)

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

$$n_{H_2} = 40$$

According to balanced equation,
1 mole of N_2 requires 3 mole of H_2
2.14 mole of N_2 require 6.42 mole of H_2
N_2 will be a limiting reagent in reaction (ii)

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

According to balanced equation
1 mole of P_4 require 3 mole of O_2
0.86 mole of P_4 require 2.58 mole of O_2
So P_4 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

$\therefore$ The simplest formula of compound is AB

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

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

$\therefore$ The molecular formula is $= I_2O_5$

31. (a) Change in O.N. of N in HNO_3 is 3, hence one formula weight has 3 equivalents.

$$3Sn + 12HCl + 4H\overset{+5}{N}O_3 \longrightarrow 3SnCl_4 + 4\overset{+2}{N}O + 8H_2O \quad (+3e^-)$$

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 $= C_3H_4N$;
M.F. $= (C_3H_4N)_n$
n × Empirical formula mass = Molecular mass
n (3 × 12 + 4 + 14) = 108
n × 54 = 108
n = 2
M.F. $= C_6H_8N_2$

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

PbO	+	$2HCl$	$\longrightarrow$	$PbCl_2$	+	H_2O
207 + 16		2 × 36.5		207 + 71		
= 223 g		= 73g		= 278g		

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

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 $PbCl_2$.
0.029 mole PbO produces 0.029 mole $PbCl_2$.

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

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

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

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

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

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

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

Since 2.5 is the smallest value division by it give ratio
N : H : C
1 : 1.96 : 1.96
= 1 : 2 : 2
Empirical formula $= C_2H_2N$
Empirical formula weight = 2 × 12 + 2 + 14 = 40
Molecular mass = 80
Molecular formulae $= n\,(C_2H_2N)$

$$\because = 2\,(C_2H_2N)\left(n = \frac{80}{40}\right) = C_4H_4N_2$$

38. (a) $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
a   3a

$C_4H_{10} + \frac{13}{2}O_2 \rightarrow 4CO_2 + 5H_2O$

(3 – a)   4 (3 – a)
But 3a + 4 (3 – a) = 10
$\therefore$ a = 2 (Propane) and 3 – 2 = 1 (Butane)

39. (a) Mass of 6.023×10^{23} atoms of oxygen = 16 g
Mass of one atom of oxygen

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

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

Mass of one atom of nitrogen

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

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 II < I < III < IV.

40. **(d)** $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$;

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 $Mg_3(PO_4)_2$ contains 8 mole of oxygen atoms

$\therefore$ 8 mole of oxygen atoms $\equiv$ 1 mole of $Mg_3(PO_4)_2$

0.25 mole of oxygen atom $\equiv \frac{1}{8} \times 0.25$ mole of $Mg_3(PO_4)_2$

$= 3.125 \times 10^{-2}$ mole of $Mg_3(PO_4)_2$

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

$$\underset{x\,g}{ROH} + CH_3MgI \rightarrow \underset{16\,g}{CH_4} + ROMgI$$

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

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

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

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

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

44. **(b)** Sum of oxidation states must be equal to zero which is given by $A_3(BC_4)_2 = A_3B_2C_8$ $(6 + 10 - 16 = 0)$

45. **(d)**

	SO_2 +	$\frac{1}{2}O_2$ $\rightleftharpoons$	SO_3
Initial	5 mole	5 mole	0 mole
Final	5 – 3 = 2 mole	5 – 1.5 mole = 3.5 mole	3 mole

Total number of moles = 2 + 3.5 + 3.0 = 8.5