

## CHEMISTRY

### BOOKS - NARENDER AVASTHI CHEMISTRY (HINGLISH)

## STOICHIOMETRY

### Exercise

1. Calculate number of neutrons present in  $12 \times 10^{25}$  atoms of oxygen ( $^{17}\text{O}$ ): (Given :  $N_A = 6 \times 10^{23}$ )

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2. If mass of one atom is  $3.32 \times 10^{-23} \text{g}$ , then calculate number of nucleons (neutrons and protons) present in 2 atoms of the element:

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3. Calculate number of electron present in 9.5 g of  $PO_4^{3-}$ :

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4. What is the number of moles of O-atoms in 126 amu of  $HNO_3$  ?

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5. What is the charge of 96 amu of  $S^{2-}$  ?

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6. A sample of sodium has a mass of 46g. What is the mass of the same number of calcium atoms as sodium atoms present in given sample ?

A. 20gm

B. 40gm

C. 60gm

D. 80gm

**Answer: D**

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7. The total number of neutrons present in  $54\text{mLH}_2\text{O}(l)$  are :

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8. Total number of electrons present in  $48\text{gmG}^{2+}$  are :

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9. The number of neutrons in  $5\text{g}$  of  $\text{D}_2\text{O}$  ( $\text{D}$  is  $2\text{H}$ ) are:

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10. Cisplatin, an anticancer drug, has the molecular formula  $Pt(NH_3)_2Cl_2$ . What is the mass (in gram) of one molecule ? (Atomic masses :  $Pt = 195$ ,  $H = 14$ ,  $Cl = 35.5$ )

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11. Aspirin has the formula  $C_9H_8O_4$ . How many atoms of oxygen are there in a tablet weighing  $360mg$  ?

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12.  $20g$  of ideal gas contains only atoms of  $S$  and  $O$  occupies  $5.6L$  at  $1$  atm and  $273K$ . what is the molecular mass of gas ?

A. 20AMU

B. 40AMU

C. 80AMU

D. 120AMU

**Answer: C**

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13. A sample of ammonium phosphate,  $(NH_4)_3PO_4$ , contains 6 moles of hydrogen atoms. The number of moles of oxygen atoms in the sample is :

A. 1

B. 2

C. 4

D. 6

**Answer: B**

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14. Total number of moles of oxygen atoms in 3 litre  $O_3(g)$  at  $27^\circ C$  and 8.21 atm are :

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15.  $3.011 \times 10^{22}$  atoms of an element weighs 1.15gm. The atomic mass of the element is :

A. 23AMU

B. 230AMU

C. 2.3AMU

D. 1.15AMU

**Answer: A**

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16. One atom of an element  $x$  weighs  $6.643 \times 10^{-23}g$ . Number of moles of atoms in its  $20kg$  is :

- A. 4
- B. 40
- C. 100
- D. 500

**Answer: D**



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17. Mass of one atom of the element  $A$  is  $3.9854 \times 10^{-23}g$ . How many atoms are contained in  $1g$  of the element  $A$  ?



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18. Which of the following contains the largest mass of hydrogen atoms ?



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19. Which has minimum number of oxygen atom ?



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20. Rearrange the following (I to IV) in the order of increasing masses :



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21. If the volume of a drop of water is  $0.0018\text{mL}$  then the number of water molecules present in two drop of water at room temperature is :

A.  $6.022 \times 10^{23}$

B.  $6.022 \times 10^{21}$

C.  $6.022 \times 10^{19}$

D. NONE OF THESE



**Answer: D**

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**22.** It is known that atom contain protons, neutrons and electrons. If the mass of neutron is assumed to half of its original value whereas that of proton is assumed to be twice of its original value then the atomic mass of  $^{146}\text{C}$  will be :

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**23.** Common salt obtained from sea-water contains 8.775%  $\text{NaCl}$  by mass. The number of formula units of  $\text{NaCl}$  present in 25g of this salt is :

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**24.** The number of hydrogen atoms present in 25.6g of sucrose ( $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ ) which has a molar mass of 342.3g is :



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25. Caffeine has a molecular mass of 194. If it contains 28.9 % by mass of nitrogen, number of atoms of nitrogen in one molecule of caffeine is :



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26. The density of water is 1g/mL. Water is the volume occupied by 1 molecule of water ?



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27. A  $25.0\text{mm} \times 40.0\text{mm}$  piece of gold foil is  $0.25\text{mm}$  thick. The density of gold is  $19.32 \frac{\text{g}}{\text{cm}^3}$ . How many gold atoms are in the sheet ? (Atomic weight :  $A_u = 197.0$ )



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28. If average molecular mass of air is 29, then assuming  $N_2$  and  $O_2$  gases are there, which option are correct regarding composition of air?

(i)

75 % by mass of  $N_2$

(ii) 75 % by moles  $N_2$

A. only i) is correct

B. only ii) is correct

C. both ii) and iii) are correct

D. both i) and ii) are correct

**Answer: C**



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29. Density of dry air containing only  $N_2$  and  $O_2$  is  $1.15 \frac{g}{L}$  at  $740mm$  of  $Hg$  and  $300K$ . What is % composition of  $N_2$  by mass in the air ?



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30. A gaseous mixture of  $H_2$  and  $CO_2$  gases contains 66 mass % of  $CO_2$ .

The vapour density of the mixture is :

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31. The vapour density of a mixture containing  $NO_2$  and  $N_2O_4$  is 27.6.

The mole fraction of  $N_2O_4$  in the mixture is :

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32. Density of ideal gas at 2 atm and 600K is 2g/L. Calculate relative density of this with respect to Ne(g) under similar conditions : (given :

$$R = \frac{1}{12} \text{ atm} \frac{\text{L}}{\text{m}} \text{ol. K}$$

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33. Average atomic mass of magnesium is 24.31amu. This magnesium is composed of 79 mole % of  $24m\text{g}$  and remaining 21 mole % of

25mg and 25mg. Calculate mole % of 26mg.

A. 10

B. 11

C. 15

D. 16

**Answer: A**



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**34.** Indium (atomic mass = 114.82) has two naturally occurring isotopes, the predominant one from has isotopic mass 114.9041 and abundance of 95.72%. Which of the following isotopic mass is the most likely for the other isotope ?



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35. Calculate density of a gaseous mixture which consist of  $3.01 \times 10^{24}$  molecules of  $N_2$  and  $32g$  of  $O_2$  gas at 3 atm pressure and  $860K$  temperature (Given :  $R = \frac{1}{12} \text{ atm } \frac{L}{m} o \leq . K$ )

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36. A mixture of  $O_2$  and gas Y (*mol. wt.* 80) in the mole ratio  $a : b$  has a mean molecular weight 40. What would be mean molecular weight, if the gases are mixed in the ratio  $b : a$  under identical conditions ? ( gases are )

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37. If water sample are taken from sea, rivers or lake, they will be found to contain hydrogen and oxygen in the approximate ratio of 1:8. This indicates the law of :

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38. Carbon and oxygen combine to form two oxides, carbon is respectively 12:16 and 12:32. These figures illustrate the :

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39. A sample of calcium carbonate ( $CaCO_3$ ) has the following percentage composition:  $Ca = 40\%$ ,  $C = 12\%$ ,  $O = 48\%$ . If the law of constant proportions is true. Then the weight of calcium in 4g of a sample of calcium carbonate obtained from another source will be

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40. All the substances listed below are fertilizers that contribute nitrogen to the soil. Which of these is the richest source of nitrogen on a mass percentage basis ?

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41. One mole of element X has 0.444 times the mass of one mole of element Y. One atom of element X has 2.96 times the mass of one atom of  $^{12}\text{C}$ . What is the atomic mass of X ?

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42. A given sample of pure compound contains 9.81g of Zn,  $1.8 \times 10^{23}$  atoms of chromium, and 0.60 mol of oxygen atoms. What is the simplest formula?

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43. The formula of an acid is  $\text{HXO}_2$ . The mass of 0.0242 g of the acid is 1.657g. What is the atomic mass of X ?

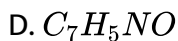
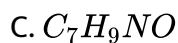
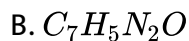
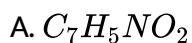
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44. What is the empirical formula of vanadium oxide, if 2.74g of the metal oxide contains 1.53g of metal?

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45. Determine the empirical formula of kelvar, used in making bullet proof vests, is 70.6% C, 4.2% H, 11.8% N and 13.4% O:



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46. The hydrate salt  $Na_2CO_3 \cdot xH_2O$  undergoes 63% loss in mass on heating and becomes anhydrous. The value of  $x$  is :

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47. A 6.85g sample of the hydrated  $Sr(OH)_2 \cdot xH_2O$  is dried in an oven to give 3.13g of anhydrous  $Sr(OH)_2$ . What is the value of  $x$ ? (Atomic masses :  $Sr = 87.60$ ,  $O = 16.0$ ,  $H = 1.0$ )

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48. What percentage of oxygen is present in the compound  $CaCO_3 \cdot 3Ca_3(PO_4)_2$ ?

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49. Dieldrin, an insecticide, contains  $C$ ,  $H$ ,  $Cl$  and  $O$ . Combustion of  $29.72\text{mg}$  of dieldrin gave  $41.21\text{mgCO}_2$  and  $5.63\text{mg}$  of  $H_2O$ . In a separate analysis  $25.31\text{mg}$  of dieldrin was converted into  $57.13\text{mg}$   $AgCl$ . What is the empirical formula of dieldrin?

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50. A gaseous compound is composed of  $85.7\%$  by mass carbon and  $14.3\%$  by mass hydrogen. Its density is  $2.28\text{ g/litre}$  at  $300\text{K}$  and  $1.0\text{ atm}$  pressure. Determine the molecular formula of the compound.

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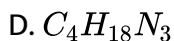
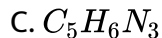
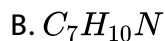
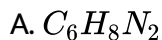
51. Complete combustion of  $0.858\text{g}$  of compound  $X$  given  $2.64\text{g}$  of  $CO_2$  and  $1.26\text{g}$  of  $H_2O$ . The lowest molar mass of  $X$  can have:

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52. The sulphate of a metal  $M$  contains 9.87% of  $M$ , This sulphate is isomorphous with  $ZnSO_4 \cdot 7H_2O$ . The atomic weight of  $M$  is

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53. In an organic compound of molar mass  $108 \text{ g mol}^{-1}$ ,  $C$ ,  $H$  and  $N$  atoms are presents in 9 : 1 : 3.5 by mass. Molecular formula can be



**Answer: A**

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54. On analysis, a certain compound was found to contain 524g of iodine (at.mass 127) and 80g oxygen (at.mass 16). What is the formula of the compound ?

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55. An element A is tervalent and another element B is divalent. The formula of the compound formed from these elements will be :

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56. A compound used in making nylon, contains 43.8 % oxygen. There are four oxygen atoms per molecule. What is the molecular mass of compound ?

A. 36

B. 116

C. 292

Answer: D

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57. Suppose two elements X and Y combine to form two compound  $XY_2$  and  $X_2Y_3$  weigh 85g. The atomic masses of X and Y are respectively :

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58. 44g of a sample on complete combustion given 88g  $CO_2$  and 36g of  $H_2O$ . The molecular formula of the compound may be :

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59. 40 miligram diatomic volatile substance ( $X_2$ ) is converted to vapour that displaced  $4.92\text{mL}$  of air at  $1\text{atm}$  and  $300\text{k}$ . Atomic mass of element X is nearly :

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60. Two elemets  $X$ ( atomic weight = 75) and  $Y$ ( atomic weight = 16) combine to give a compound having  $75.8\%$   $X$ . The formula of the compound is

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61. A sample of phosphorus that weighs  $12.4\text{g}$  exerts a pressure  $8\text{atm}$  in a  $0.821$  litre closed vesel at  $527^\circ\text{C}$ . The molecular formula of the phosphorus vapour is :

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62. Manganese forms non-stoichiometric oxides having the general formula  $MnO_x$ . The value of  $x$  for the compound that analyzed 64 % by mass Mn :

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63. 1.44 gram of titanium ( $Ti$ ) reacted with excess of  $O_2$  and produce  $x$  gram of non – stoichiometric compound  $Ti_{1.44}O$ . The value of  $x$  is :

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64. Which statement is false for the balanced equation given below ?

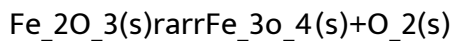
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65. Which of the following setups is correct to calculate the mass (in g) of  $KClO_3$  produced from the reacting of 0.150 moles of  $Cl_2$  ?

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66. 2.0g of a sample contains mixture of  $SiO_2$  and  $Fe_2O_3$ . On very strong heating, it leaves a residue weighing 1.96g. The reaction responsible for loss of mass is given below.



, (unbalanced equation)  $\hat{w}$ isthepercenta  $\geq$  bymass of  $SiO_2$  in original sample ?

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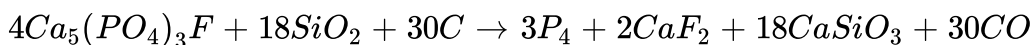
67. What volume of air at 1 atm and 273K containing 21 % of oxygen by volume is required to completely burn sulphur ( $S_8$ ) present in 200g of sample , which contains 20 % inert material which does not burn. Sulphur burns according to the reaction  $\frac{1}{8}S_8(s) + O_2(g) \rightarrow SO_2(g)$

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68. For the reaction,  $2Fe(NO_3)_3 + 3Na_2CO_3 \rightarrow Fe_2(CO_3)_3 + 6NaNO_3$  initially 2.5 mole of  $Fe(NO_3)_3$  and 3.6 mole of  $Na_2CO_3$  are taken. If 6.3 mole of  $NaNO_3$  is obtained then % yield of given reaction is :

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69. How many of  $P_4$  can be produced by reaction of 0.10 moles  $Ca_5(PO_4)_3F$ , 0.36 moles  $SiO_2$  and 0.90 moles  $C$  according to the following reaction ?



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70. Some older emergency oxygen masks contains potassium superoxide  $KO_2$  which reacts with  $CO_2$  and water present in exhaled air to produce oxygen according to the given equation. If a person exhales 0.667g of  $CO_2$  per minute, how many gram of  $KO_2$  are consumed in 5.0 minutes ?

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71. The mass of  $N_2F_2$  produced by the reaction of 2.0g of  $NH_3$  and 8.0g of  $F_2$  is 3.56g. What is the per cent yield ?

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72. Calculate the mass of lime ( $CaO$ ) obtained by heating 200kg of 95 % pure lime stone ( $CaCO_3$ ):

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73. Phosphoric acid ( $H_3PO_4$ ) prepared in a two step process. (1)  $P_4 + 5O_2 \rightarrow P_4O_{10}$  (2)  $P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$  We allow 62g of phosphorus to react with excess oxygen which form  $P_4O_{10}$  in 85 % yield. In the step (2) reaction 90 % yield of  $H_3PO_4$  is obtained. The mass of  $H_3PO_4$  produced is :

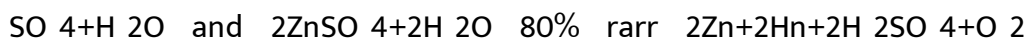
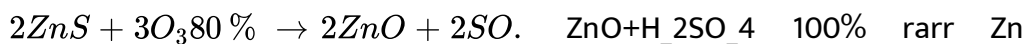
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74. 9 moles of "D" and 14 moles of E are allowed to react in a closed vessel according to given reactions. Calculate number of moles of B formed in the end of reaction, if 4 moles of G are present in reaction vessel. (percentage yield of reaction is mentioned in the reaction) Step -1



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75. The chief ore of Zn is the sulphide ZnS. The ore is concentrated by froth floatation process and then heated in air to convert ZnS to ZnO.



. The number of moles of Zn required for or  $\prod_{uc} \in g 2mo \leq sofZn`$  will

be :

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76. 0.8 moles of a mixture of  $CO$  and  $CO_2$  requires exactly 40 gram of  $NaOH$  in solution for complete conversion of all the  $CO_2$  into  $Na_2CO_3$ . How many more of  $NaOH$  would be required for conversion into  $Na_2CO_3$  if the mixture (0.8 mole) is completely oxidised to  $CO_2$  ?

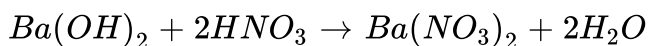
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77. Silver oxide ( $Ag_2O$ ) decomposes at temperature  $300^\circ C$  yielding metallic silver and oxygen gas. A 1.60g sample of impure silver oxide yields 0.104g of oxygen gas. What is the per cent by mass of the silver oxide in the sample ?

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78. Comprehension # 5

342g of 20 % by mass of  $Ba(OH)_2$  solution (*sp. gr.* 0.57) is reacted with 200mL of 2M  $HNO_3$  according to given balanced reaction :



Find the molarity of the ion in resulting solution by which nature of the above solution is identified, is

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79.  $100\text{mL}$  of  $\text{H}_2\text{SO}_4$  solution having molarity  $1\text{M}$  and density  $1.5\text{g/mL}$  is mixed with  $400\text{mL}$  of water. Calculate final molarity of  $\text{H}_2\text{SO}_4$  solution, if final density is  $1.25\text{g/mL}$ ?

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80. What volume of  $\text{HCl}$  solution of density  $1.2\frac{\text{g}}{\text{cm}^3}$  and containing  $36.5\%$  by mass  $\text{HCl}$ , must be allowed to react with zinc ( $\text{Zn}$ ) in order to liberate  $4.0\text{g}$  of hydrogen ?

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81. An ideal gaseous mixture of ethane ( $C_2H_6$ ) and ethene ( $C_2H_4$ ) occupies 28 litre at  $1\text{atm } 0^\circ C$ . The mixture reacts completely with  $128\text{gm}O_2$  to produce  $CO_2$  and  $H_2O$ . Mole of fraction at  $C_2H_6$  in the mixture is-

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82. Wood's metal contains 50.0 % bismuth, 25.0 % lead, 12.5 % tin and 12.5 % cadmium by mass. What is the mole fraction of tin ? (Atomic mass :  $Bi = 209$ ,  $Pb = 207$ ,  $Sn = 119$ ,  $Cd = 112$ )

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83. The density of a 56.0 % by mass aqueous solution of 1-propanol ( $CH_3CH_2CH_2OH$ ) is  $0.8975\frac{g}{c}m^3$ . What is the mole fraction of the 1-propanol ?

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84. What is the molarity of  $SO_4^{2-}$  ion in aqueous solution that contain 34.2 ppm of  $Al_2(SO_4)_3$ ? (Assume complete dissociation and density of solution  $1 \frac{g}{mL}$ )

A.  $3 \times 10^{-4}$

B.  $2 \times 10^{-4}$

C.  $10^{-4}$

D. None

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85. The relation between molarity (M) and molality (m) is given by :  
( $\rho$ =density of solution (g/mL),  $M_1$ = molecular mass of solute)

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86. Molarity and molality of a solution of a liquid (mol.mass = 50) in aqueous solution is 9 and 10 respectively. What is the density of solution ? (Round of the answer to nearest whole number)

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87. An aqueous solution of ethanol has density 1.025 g/mL and it is 2 M. What is the molality of this solution ?

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88. 0.2 mole of  $HCl$  and 0.2 mole of barium chloride were dissolved in water to produce a 500mL solution. The molarity of the  $Cl^-$  ions is :

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89. Calculate the mass of anhydrous  $HCl$  in  $10mL$  of concentrated  $HCl$  (density =  $1.2\frac{g}{mL}$ ) solution having 37 %  $HCl$  by mass is :

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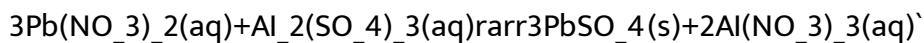
90. Calculate the molality of 1L solution of 80 %  $H_2SO_4$  ( $\frac{w}{V}$ ) given that the density of the solution is  $1.80gmL^{-1}$ . ( round of the answer to nearest whole number )

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91. Fluoxymesterone,  $C_{10}H_{29}FO_3$ , is an anabolic steroid. A 500 mL solution is prepared by dissolving  $10.0mg$  of the steroid in water.  $10.0mL$  portion of this solution is diluted to a final volume of  $1.00L$ . what is the resulting molarity ?

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92. The 25 mL of a 0.15 M solution of lead nitrate,  $Pb(NO_3)_2$  reacts with all of the aluminium sulphate,  $Al_2(SO_4)_3$ , present in 20 mL of a solution. What is the molar concentration of the  $Al_2(SO_4)_3$ ?



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93. 

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94. 50 mL of 20.8% (w/v)  $BaCl_2$  and (aq) and 100 mL of 9.8% (w/v)  $H_2SO_4$  (aq) solutions are mixed. Molarity of  $Cl^-$  ion in the resulting solution is : (At mass of  $Ba = 137$ )

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95.  $100\text{mL}$  of  $10\%$   $\text{NaOH}\left(\frac{w}{V}\right)$  is added to  $100\text{mL}$  of  $10\%$   $\text{HCl}\left(\frac{w}{V}\right)$ .

The nature of resultant solution is :

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96. How many millilitres of  $0.1\text{M}\text{H}_2\text{SO}_4$  must be added to  $50\text{mL}$  of  $0.1\text{M}\text{NaOH}$  to give a solution that has a concentration of  $0.05\text{M}$  in  $\text{H}_2\text{SO}_4$  ?

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97.  $1\text{M}\text{HCl}$  and  $2\text{M}\text{HCl}$  are mixed in volume ratio 4:1. What is the final molarity of  $\text{HCl}$  solution?

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98. Three solutions X,Y,Z of HCl are mixed to produce 100mL of 0.1M solution . The molarities of X,Y and Z are 0.7M, 0.12M and 0.15M respectively. What respective volumes of X,Y and Z should be mixed?

A. 50 ml, 25 ml, 25ml

B. 20 ml, 60 ml, 20ml

C. 40 ml, 30 ml, 30 ml

D. 55 ml , 20 ml, 25 ml

**Answer: d**



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99. The impure 6g of  $NaCl$  is dissolved in water and then treated with excess of silver nitrate solution. The mass of precipitate of silver chloride is found to be 14g. The % purity of  $NaCl$  solution would be:

A. 95%

B. 85%

C. 75%

D. 65%

**Answer: A**

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**100.** Decreasing order (first having highest and then other following it) of mass of pure NaOH in each of the aqueous solution

(P) 50 gm of 40 % ( $w/w$ ) NaOH

(Q) 50 gm of 50 % ( $w/w$ ) NaOH [ $d_{\text{soln.}} = 1.2\text{gm/ml}$ ]

(R) 50 gm of 20 M NaOH [ $d_{\text{soln.}} = 1\text{gm/ml}$ ]

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**101.** 0.607g of silver salt of tribasic organic acid was quantitatively reduced to 0.37g of pure Ag. What is the mol. Wt. of the acid ?

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**102.** A sample of peanut oil weighing 2g is added to 25mL of 0.40M  $KOH$ . After saponification is complete, 8.5mL of 0.28M  $H_2SO_4$  is needed to neutralize excess of  $KOH$ . The saponification number of peanut oil is : (saponification number is defined as the milligrams of  $KOH$  consumed by 1g of oil)

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**103.** 20mL of a mixture of  $CO$  and  $H_2$  were mixed excess of  $O_2$  and exploded & cooled. There was a volume contraction of 23mL. All volume measurements corresponds to room temperature ( $27^\circ C$ ) and one atmospheric pressure. Determine the volume ratio ( $V_1 : V_2$  of  $CO$  and  $H_2$  in the original mixture .

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104. In the reaction  $2Al(s) + 6HCl(aq) \rightarrow 6Cl^-(aq) + 3H_2$

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105. Oxidation state(s) of chlorine in  $CaOCl_2$  (bleaching powder)

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106. The oxidation number of sulphur in  $S_8$ ,  $S_2F_2$ ,  $H_2S$  and  $H_2SO_4$  respectively are :

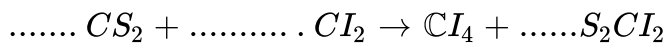
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107. In the chemical reaction,  
 $K_2Cr_2O_7 + xH_2SO_4 + ySO_2 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + zH_2O$ , the  
value of  $x$ ,  $y$  and  $z$  respectively are :

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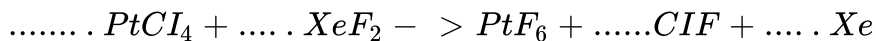


108. Balance the followings equations and choose the quantity which is the sum of the coefficients of reactants and products :



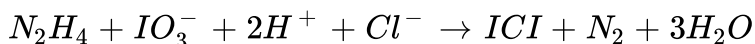
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109. Balance the followings equations and choose the quantity which is the sum of the coefficients of reactants and products :



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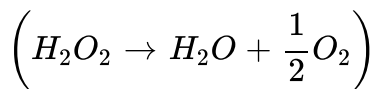
110. Hydrazine reacts with  $KIO_3$  in presence of  $HCl$  as :



The equivalent masses of  $N_2H_4$  and  $KIO_3$  respectively are :

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111.  $H_2O_2$  is used as bleaching reagent because on dissociation it gives oxygen



"Chachi420" used  $H_2O_2$  solution to bleach her hair and she required 2.24L  $O_2$  gas at 1atm and 273K. She has a  $H_2O_2$  solution labelled '5.6V' then what volume of such solution must she required to bleach her hair?

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112. A sample of 1.0g of solid  $Fe_2O_3$  of 80% purity is dissolved in a moderately concentrated HCl solution which is reduced by zinc dust. The resulting solution required 16.7mL of a 0.1M solution of the oxidant. Calculate the number of electrons taken up by the oxidant.

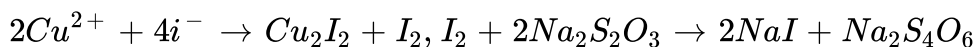
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113. Stannous sulphate ( $SnSO_4$ ) and potassium permanganate are used as oxidising agents in acidic medium for oxidation of ferrous ammonium

sulphate to ferric sulphate. The ration of number of moles of stannous sulphate required per mole of ferrous ammonium sulphate to the number of moles of  $KMnO_4$  required per mole of ferrous ammonium sulphate, is:

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**114.** In a iodometric estimation, the following reactions occur



0.12 mole of  $CuSO_4$  was added to excess of KI solution and the liberated iodine required 120mL of hypo. The molarity of hypo solution was:

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**115.** 32g of a sample of  $FeSO_4 \cdot 7H_2O$  were dissolved in dilute sulphuric acid and water and its volume was made up to 1 litre. 25mL of this solution required 20mL of 0.02M  $KMnO_4$  solution for complete oxidation. Calculate the mass% of  $FeSO_4 \cdot 7H_2O$  in the sample.

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116. A mixture  $NaOH + Na_2CO_3$  required 25mL of 0.1 M HCl using phenolphthalein as the indicator. However, the same amount of the mixture required 30mL of 0.1M HCl when methyl orange was used as the indicator. The molar ration of  $NaOH$  and  $Na_2CO_3$  in the mixture was:

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117. When 100mL solution of  $NaOH$  and  $NaCO_3$  was first titrated with N/10 HCl in presence of HPh, 17.5mL were used till end point is obtained. After this end point MeOH was added and 2.5mL of same HCl were required to attain new end point. The amount NaOH in mixture is:

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118. 1gram of a sample of  $CaCO_3$  was strongly heated and the  $CO_2$  liberated was absorbed in 100mL of 0.5 M NaOH solution. Assuming 90%

purity for the sample, how many mL of 0.5M HCl would be required to react with the resulting solution to reach the end point in presence of phenolphthalein?

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**119.** Calculate the number of millilitre of  $NH_3(aq)$  solution ( $d = 0.986 \frac{g}{mL}$ ) contain 2.5 % by mass  $NH_3$ , which will be required to precipitate iron as  $Fe(OH)_3$  in a 0.8g sample that contains 50 %  $Fe_2O_3$ .

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**120.** In the preparation of iron from haematite ( $Fe_2O_3$ ) by the reduction with carbon  $Fe_2O_3 + C \rightarrow Fe + CO_2$  how much 80 % pure iron may be produced from 120kg of 90 % pure  $Fe_2O_3$  ?

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**121.** A mineral consists of an equimolar mixture of the carbonates of two bivalent metals. One metal is present to the extent of 12.5 % by mass. 2.8g of the mineral on heating lost 1.32g of  $CO_2$ . What is the % by mass of the other metal ?

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**122.** A 1.0g sample of pure organic compound containing chlorine is fused with  $Na_2O_2$  to convert chlorine to  $NaCl$ . The sample is then dissolved in water and the chloride precipitated as  $AgCl$ . If the mass of  $AgCl$  is 1.96g, how many chlorine atoms does each molecule contain ?

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**123.** A metal M forms the sulphate  $M_2(SO_4)_3$ . A 0.596 gram sample of the sulphate reacts with excess  $BaCl_2$  to give 1.220g  $BaSO_4$ . What is the

atomic mass of M? (Atomic mass :  $S = 32$ ,  $Ba = 137.3$ )

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**124.** A silver coin weighing  $11.34g$  was dissolved in nitric acid. When sodium chloride was added to the solution all the silver (present as  $AgNO_3$ ) was precipitated as silver chloride. The mass of the precipitated silver chloride was  $14.35g$ . Calculate the percentage of silver in the coin.

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**125.**  $100cm^3$  of a solution of an acid (Molar mass = 98) containing  $29.4g$  of the acid per litre were completely neutralized by  $90.0cm^3$  of aq.  $NaOH$  containing  $20g$  of  $NaOH$  per  $500cm^3$ . The basicity of the acid is :

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126. The concentration of an oxalic acid solution is  $x \text{ mol litre}^{-1}$ .  $40 \text{ mL}$  of this solution reacts with  $16 \text{ mL}$  of  $0.05 \text{ M}$  acidified  $\text{KMnO}_4$ . What is the  $\text{pH}$  of ' $x$ ' M oxalic acid solution ? (Assume that oxalic acid dissociates completely.)

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### Level 1 (Q.1 To Q.30)

1. Calculate number of neutrons present in  $12 \times 10^{25}$

$a \rightarrow m \text{ sof } \otimes y \geq n(80^{17})$ : (Given:  $N_A = 6 \times 10^{23}$ )

A. 1800

B. 1600

C.  $1800N_A$

D.  $3200N_A$





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2. If mass of one atom is  $3.32 \times 10^{-23} g$ , then calculate number of nucleons (neutrons and protons) present in 2 atoms of the element:

A. 40

B. 20

C. 10

D.  $40N_4$



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3. Calculate number of electron present in 9.5 g of  $PO_4^{3-}$ :

A. 6

B.  $5N_A$

C.  $0.1N_A$

D.  $4.7N_A$



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4. What is the number of moles of O-atoms in 126 amu of  $HNO_3$  ?

A. 2

B.  $\frac{2}{N_A}$

C.  $0.1N_A$

D.  $\frac{6}{N_A}$



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5. what is the charge of 96 amu of  $S^{2-}$  ?

A. 2C

B.  $3.2 \times 10^{-19} C$

C.  $9.6 \times 10^{-19} C$

D. 6 C



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6. A sample of sodium has a mass of  $46g$ . What is the mass of the same number of calcium atoms as sodium atoms present in given sample ?

A.  $46 g$

B.  $20 g$

C.  $40 g$

D.  $80 g$



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7. The total number of neutrons present in  $54\text{mLH}_2\text{O}(l)$  are :

A.  $3N_A$

B.  $30N_A$

C.  $24N_A$

D. None of these



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8. Total number of electrons present in  $48\text{gmG}^{2+}$  are :

A.  $24N_A$

B.  $2N_A$

C.  $20N_A$

D. None of these



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9. The number of neutrons in 5g of  $D_2O$  (D is  ${}^2_1H$ )

A.  $0.25N_A$

B.  $2.5N_A$

C.  $1.1N_A$

D. None of these



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10. Cisplatin, an anticancer drug, has the molecular formula  $Pt(NH_3)_2Cl_2$ . What is the mass (in gram) of one molecule ? (Atomic masses :  $Pt = 195$ ,  $H = 1$ ,  $Cl = 35.5$ )

A.  $4.98 \times 10^{23}$

B.  $1.08 \times 10^{-22}$

C.  $6.55 \times 10^{-21}$

D.  $3.85 \times 10^{-22}$

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11. Aspirin has the formula  $C_9H_8O_4$ . How many atoms of oxygen are there in a tablet weighing  $360\text{mg}$ ?

A.  $1.204 \times 10^{23}$

B.  $1.08 \times 10^{22}$

C.  $1.204 \times 10^{24}$

D.  $4.81 \times 10^{24}$

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12. 20g of ideal gas contains only atoms of  $S$  and  $O$  occupies 5.6L at 1 atm and 273K. what is the molecular mass of gas ?

A. 64

B. 80

C. 96

D. None of these



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13. A sample of ammonium phosphate,  $(NH_4)_3PO_4$ , contains 6 moles of hydrogen atom, The no. of moles of oxygen atom are:

A. 1

B. 2

C. 4

D. 6



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14. Total number of moles of oxygen atoms in 3 litre  $O_3(g)$  at  $27^\circ C$  and 8.21 atm are :

A. 3

B. 1

C. 1

D. None of these



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15.  $3.011 \times 10^{22}$  atoms of an element weighs 1.15gm. The atomic mass of the element is :



A.  $10a\mu$

B.  $2.3a\mu$

C.  $35.5a\mu$

D.  $23a\mu$

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16. One atom of an element  $x$  weight  $6.643 \times 10^{-232}g$ . Number of moles of atom in 20 kg is :

A. 4

B. 40

C. 100

D. 500

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17. Mass of one atom of the element  $A$  is  $3.9854 \times 10^{-23} g$ . How many atoms are contained in 1g of the element  $A$  ?

A.  $2.509 \times 10^{23}$

B.  $6.022 \times 10^{23}$

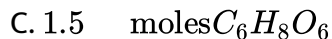
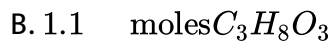
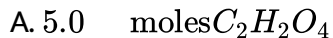
C.  $12.044 \times 10^{23}$

D. None of these



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18. Which of the following contains the largest mass of hydrogen atoms?



D. 4.0 moles  $C_2H_4O_2$

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19. Which has minimum number of oxygen atom ?

A. 10 mL  $H_2O(l)$

B. 0.1 mole  $V_2O_5(s)$

C. 12 gm  $O_3(g)$

D.  $12.044 \times 10^{22}$  molecules of  $CO_2$

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20. Rearrange the following (*I* to *IV*) in the order of increasing masses :

(I) 0.5 mole of  $O_3$                       (II) 0.5 gm atom of oxygen

(III)  $3.011 \times 10^{23}$  molecules of  $O_2$                       (IV) 5.6 litre of  $CO_2$  at *STP*

A.  $II < IV < III < I$

B.  $II < I < IV < III$

C.  $IV < II < III < I$

D.  $I < II < III < IV$

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21. If the volume of a drop of water is  $0.0018\text{mL}$  then the number of water molecules present in two drop of water at room temperature is :

A.  $12.046 \times 10^{19}$

B.  $1.084 \times 10^{18}$

C.  $4.48 \times 10^{17}$

D.  $6.023 \times 10^{23}$

**Answer: A**

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22. It is known that atoms contain protons, neutrons and electrons. If the mass of a neutron is assumed to be half of its original value whereas that of a proton is assumed to be twice of its original value then the atomic mass of  ${}^{14}_6\text{C}$  will be :-

- A. same
- B. 14.28 % less
- C. 14.28 % more
- D. 28.56 % less

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23. Common salt obtained from sea-water contains 8.775 %  $\text{NaCl}$  by mass. The number of formula units of  $\text{NaCl}$  present in 25g of this salt is :

- A.  $3.367 \times 10^{23}$  formula units

B.  $2.258 \times 10^{22}$  formula units

C.  $3.176 \times 10^{23}$  formula units

D.  $4.73 \times 10^{25}$  formula units

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**24.** The number of hydrogen atoms present in 25.6g of sucrose ( $C_{12}H_{22}O_{11}$ ) which has a molar mass of 342.3g is :

A.  $22 \times 10^{23}$

B.  $9.91 \times 10^{23}$

C.  $11 \times 10^{23}$

D.  $44 \times 10^{23}$

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25. Caffeine has a molecular mass of 194. If it contains 28.9 % by mass of nitrogen, number of atoms of nitrogen in one molecule of caffeine is :

A. 4

B. 6

C. 2

D. 3



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26. The density of water is 1g/mL. Water is the volume occupied by 1 molecule of water ?

A.  $1.44 \times 10^{-23} mL$

B.  $1 mL$

C.  $18 mL$

D.  $2.88 \times 10^{-23} mL$



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27. A  $25.0\text{mm} \times 40.0\text{mm}$  piece of gold foil is  $0.25\text{mm}$  thick. The density of gold is  $19.32 \frac{\text{g}}{\text{cm}^3}$ . How many gold atoms are in the sheet ? (Atomic weight :  $Au = 197.0$ )

A.  $7.7 \times 10^{23}$

B.  $1.5 \times 10^{23}$

C.  $4.3 \times 10^{21}$

D.  $1.47 \times 10^{22}$



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28. If average molecular mass of air is 29, then assuming  $N_2$  and  $O_2$  gases are there, which option are correct regarding composition of are?



(i)

75 % by mass of  $N_2$

(ii) 75 % by moles  $N_2$

- A. only (i) is are correct
- B. Only (ii) is correct
- C. both (ii) and (iii) are correct
- D. both (i) and (ii) are correct



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29. Density of dry air containing only  $N_2$  and  $O_2$  is  $1.15 \frac{g}{L}$  at  $740mm$  of  $Hg$  and  $300K$ . What is % composition of  $N_2$  by mass in the air ?

- A. 78 %
- B. 85.5 %
- C. 70.02 %
- D. 62.75 %

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30. A gaseous mixture of  $H_2$  and  $CO_2$  gas contains 66 mass % of  $CO_2$  .

The vapour density of the mixture is :

A. 6.1

B. 5.4

C. 2.7

D. 10.8

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1. A mixture contains  $N_2O_4$  and  $NO_2$  in the ratio 2:1 by volume. The vapour density of the mixture is:

A. 0.1

B. 0.2

C. 0.5

D. 0.8



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2. Density of ideal gas at 2 atm and 600K is 2g/L. Calculate relative density of this with respect to Ne(g) under similar conditions : (given :

$$R = \frac{1}{12} \text{ atm} \frac{\text{L}}{\text{m}} \text{ol. K}$$

A. 2.5

B. 2

C. 3

D. 5

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3. Average atomic mass of magnesium is 24.31 amu. This magnesium is composed of 79 mole % of  $^{24}\text{Mg}$  and remaining 21 mol % of  $^{25}\text{Mg}$  and  $^{26}\text{Mg}$ . Calculate mole % of  $^{26}\text{Mg}$ .

A. 10

B. 11

C. 15

D. 16

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4. Indium (atomic mass = 114.82) has two naturally occurring isotopes, the predominant one from has isotopic mass 114.9041 and abundance of 95.72%. Which of the following isotopic mass is the most likely for the other isotope ?

A. 112.94

B. 115.9

C. 113.9

D. 114.9

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5. Calculate density of a gaseous mixture which consist of  $3.01 \times 10^{24}$  molecules of  $N_2$  and 32g of  $O_2$  gas at 3 atm pressure and 860K temperature (Given :  $R = \frac{1}{12} \text{ atm } \frac{L}{m} o \leq . K$ )

A. 0.6g/L

B.  $1.2g/L$

C.  $0.3g/L$

D.  $12g/L$

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6. A mixture of  $O_2$  and gas Y (*mol. wt.* 80) in the mole ratio  $a:b$  has a mean molecular weight 40. What would be mean molecular weight, if the gases are mixed in the ratio  $b:a$  under identical conditions ? ( gases are )

A. 40

B. 48

C. 62

D. 72

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7. If water samples are taken from sea, rivers or lake, they will be found to contain hydrogen and oxygen in the approximate ratio of 1:8. This indicates the law of :

- A. Law of conservation of mass
- B. Definite proportion
- C. Reciprocal proportions
- D. None of these

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8. Hydrogen and oxygen combine to form  $H_2O_2$  and  $H_2O$  containing 5.93% and 11.2% hydrogen respectively. The data illustrates :

- A. Law of conservation of mass
- B. Law of constant proportion

C. law of reciparocal proporation

D. law of multiple proporetion

**Answer: 4**

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9. Which one the following combinations illustrate law of reciprocal proportions ?

A.  $N_2O_3$ ,  $N_2O_4$ ,  $N_2O_5$

B.  $NaCl$ ,  $NaBr$ ,  $NaI$

C.  $CS_2$ ,  $CO_2$ ,  $SO_2$

D.  $PH_3$ ,  $P_2O_3$ ,  $P_2O_5$

**Answer: 3**

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10. Carbon and oxygen combine to form two oxides, carbon is respectively 12: 16 and 12: 32. These figures illustrate the :

- A. law of multiple proportions
- B. law of reciprocal proportions
- C. law of conservation of mass
- D. law of constant proportions



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11. A sample of calcium carbonate ( $CaCO_3$ ) has the following percentage composition:  $Ca = 40\%$ ,  $C = 12\%$ ,  $O = 48\%$ . If the law of constant proportions is true. Then the weight of calcium in 4g of a sample of calcium carbonate obtained from another source will be

- A. 0.016g
- B. 0.16g

C. 1.6g

D. 16g



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12. The law of multiple proportion is illustrated by the two compounds :

A. Sodium chloride and sodium bromide

B. Ordinary water and heavy water

C. Caustic soda caustic potash

D. Sulphur dioxide and sulphur trioxide

**Answer: 4**



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13. All the substance listed below are fertilizers that contribute nitrogen to the soil. Which of these is the richest source of nitrogen on a mass percentage basis ?

A. Urea ,  $(NH_2)_2CO$

B. Ammonium nitrate ,  $NH_4NO_3$

C. Nitric oxide , NO

D. Ammonia ,  $NH_3$

**Answer: D**



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14. One mole of element X has 0.444 times the mass of one mole of element Y. One atom of element X has  $2.96 \times$  the mass of one atom of  $^{12}C$ . What is the atomic mass of Y ?

A. 80

B. 15.77

C. 46.67

D. 40

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15. A given sample of pure compound contains 9.81g of Zn,  $1.8 \times 10^{23}$  atoms of chromium, and 0.60 mol of oxygen atoms. What is the simplest formula?

A.  $ZnCr_2O_7$

B.  $ZnCr_2O_4$

C.  $ZnCrO_4$

D.  $ZnCrO_6$

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16. The formula of an acid is  $HXO_2$ . The mass of 0.0242 moles of the acid is 1.657g. What is the atomic mass of X ?

- A. 35.5
- B. 28.1
- C. 128
- D. 19

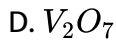
**Answer: A**



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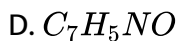
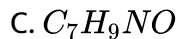
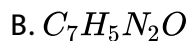
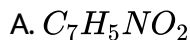
17. What is the empirical formula of vanadium oxide, if 2.74g of the metal oxide contains 1.53g of metal ?

- A.  $V_2O_3$
- B. VO
- C.  $V_2O_5$



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18. Determine the empirical formula of kelvar, used in making bullet proof vests, is 70.6 % *C*, 4.2 % *H*, 11.8 % *N* and 13.4 % *O*:



Answer: D



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19. The hydrated salt  $Na_2CO_3 \cdot xH_2O$  undergoes 63% loss in mass on heating and becomes anhydrous. The value  $x$  is :

- A. 10
- B. 12
- C. 8
- D. 18



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20. A 6.85g sample of the hydrated  $Sr(OH)_2 \cdot xH_2O$  is dried in an oven to give 3.13g of anhydrous  $Sr(OH)_2$ . What is the value of  $x$ ? (Atomic masses :  $Sr = 87.60$ ,  $O = 16.0$ ,  $H = 1.0$ )

- A. 8
- B. 12

C. 10

D. 6

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21. What percentage of oxygen is present in the compound  $CaCO_3 \cdot 3Ca_3(PO_4)_2$ ?

A. 23.3 %

B. 45.36 %

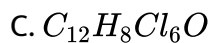
C. 41.94 %

D. 17.08 %

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22. Dieldrin, an insecticide, contains  $C$ ,  $H$ ,  $Cl$  and  $O$ . Combustion of  $29.72\text{mg}$  of dieldrin gave  $41.21\text{mgCO}_2$  and  $5.63\text{mg}$  of  $H_2O$ . In a separate analysis  $25.31\text{mg}$  of Dieldrin was converted into  $57.13\text{mg}$   $Ag\ Cl$ . What is the empirical formula of Dieldrin ?

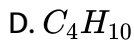
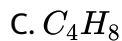
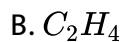
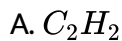


**Answer: C**



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23. A gaseous compound is composed of  $85.7\%$  by mass carbon and  $14.3\%$  by mass hydrogen. Its density is  $2.28\text{ g/litre}$  at  $300\text{K}$  and  $1.0\text{ atm}$  pressure. Determine the molecular formula of the compound.



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24. Complete combustion of 0.858 g of compound X gives 2.63 g of  $CO_2$  and 1.28 g of  $H_2O$ . The lowest molecular mass X can have

A. 47 g

B. 86 g

C. 129 g

D. 172 g

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25. The sulphate of a metal  $M$  contains 9.87% of  $M$ , This sulphate is isomorphous with  $ZnSO_4 \cdot 7H_2O$ . The atomic weight of  $M$  is

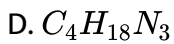
- A. 40.3
- B. 36.3
- C. 24.3
- D. 11.3



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26. In an organic compound of molar mass  $108 \text{ gmmol}^{-1}$   $C$ ,  $H$  and  $N$  atoms are presents in 9: 1: 3.5 by mass. Molecular can be

- A.  $C_6H_8N_2$
- B.  $C_7H_{10}N$
- C.  $C_5H_6N_3$



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27. On analysis, a certain compound was found to contain 524g of iodine (at.mass 127) and 80g oxygen (at.mass 16). What is the formula of the compound ?

A. IO

B.  $I_2O$

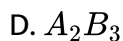
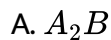
C.  $I_5O_3$

D.  $I_{(2)}O_{(5)}$



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28. An element A is trivalent and another element B is divalent. The formula of the compound formed from these elements will be :



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29. A compound used in making nylon, contains 43.8 % oxygen. There are four oxygen atoms per molecule. What is the molecular mass of compound ?

A. 36

B. 116

C. 292

D. 146

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**30.** Suppose two elements  $X$  and  $Y$  combine to form two compounds  $XY_2$  and  $X_2Y_3$  when 0.05 mole of  $XY_2$  weight  $5g$  while  $3.011 \times 10^{23}$  molecules of  $X_2Y_3$  weight  $85g$ . The atomic masses of  $X$  and  $Y$  are respectively.

A. 23,30

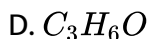
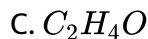
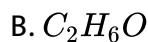
B. 30,40

C. 40,30

D. 80,60

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1. 44g of a sample on complete combustion given 88g $CO_2$  and 36g of  $H_2O$ . The molecular formula of the compound may be :



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2. 40 miligram diatomic volatile substance ( $X_2$ ) is converted to vapour that displaced 4.92mL of air at 1atm and 300k. Atomic mass of element X is nearly :

A. 400

B. 240

C. 200

D. 100

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3. Two elements  $X$  (atomic weight = 75) and  $Y$  (atomic weight = 16) combine to give a compound having 75.8%  $X$ . The formula of the compound is

A.  $XY$

B.  $X_2Y$

C.  $X_2Y_2$

D.  $X_2Y_3$

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4. A sample of phosphorus that weighs  $12.4\text{g}$  exerts a pressure  $8\text{ atm}$  in a  $0.821\text{ litre}$  closed vessel at  $527^\circ\text{C}$ . The molecular formula of the phosphorus vapour is :



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5. Manganese forms non-stoichiometric oxides having the general formula  $MnO_x$ . The value of  $x$  for the compound that analyzed  $64\%$  by mass mn :

A. 1.16

B. 1.83

C. 2

D. 1.93

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6. 1, 44 gram of titanium ( $Ti$ ) reacted with excess of  $O_2$  and produce  $x$  gram of non-stoichiometric compound  $Ti_{1.44}O$ . The value of  $x$  is :

A. 2

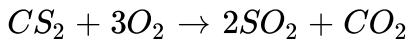
B. 1.77

C. 1.44

D. None of these

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7. Which statement is false for the balanced equation given below ?



- A. One mole of  $CS_2$  will produce one mole of  $CO_2$
- B. The reaction of 16 g of oxygen produces 7.33g of  $CO_2$
- C. The reaction of one mole of  $O_2$  will produce  $2/3$  "mole of"  $SO_2$
- D. Six molecules of oxygen requires three molecular of  $CS_2$



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8. Which of the following setups is correct to calculate the mass (in g) of  $KClO_3$  produced from the reacting of 0.150 moles of  $Cl_2$  ?

A.

$$0.150 \quad \text{moles} \quad Cl_2 \times 1 \text{mole} \quad KClO_3 / 3 \text{moles} Cl_2 \times 122.5g / 1$$

B.

$$0.150 \text{ moles } Cl_2 \times 1 \text{ mole } KClO_3 / 3 \text{ moles } Cl_2 \times 1 \text{ mole}$$

C.

$$0.150 \text{ moles } Cl_2 \times 3 \text{ moles } Cl_2 / 1 \text{ mole } KClO_3 \times 122.5 \text{ g} / 1 \text{ mole}$$

D.

$$0.150 \text{ moles } Cl_2 \times 3 \text{ moles } Cl_2 / 1 \text{ mole } KClO_3 \times 1 \text{ mole } K$$



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9. 2.0 g of a sample contains mixture of  $SiO_2$  and  $Fe_2O_3$ . On very strong heating, it leaves a residue weighing 1.96g. The reaction responsible for loss of mass is given below.

$Fe_2O_3(s) \rightarrow Fe_3O_4(s) + O_2(g)$ , (unbalance equation) It brgt What is the percentage by mass of  $SiO_2$  in original sample ?

A. 10 %

B. 20 %

C. 40 %

D. 60 %

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10. What volume of air at 1 atm and  $273K$  containing 21 % of oxygen by volume is required to completely burn sulphur ( $S_8$ ) present in 200g of sample , which contains 20 % inert material which does not burn.

Sulphur burns according to the reaction  $\frac{1}{8}S_8(s) + O_2(g) \rightarrow SO_2(g)$

A. 23.52 litre

B. 320 litre

C. 112 litre

D. 533.33 litre

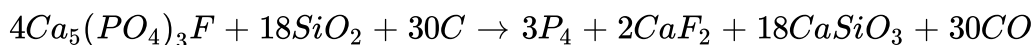
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11. For the reaction,  $2Fe(NO_3)_3 + 3Na_2CO_3 \rightarrow Fe_2(CO_3)_3 + 6NaNO_3$  initially 2.5 mole of  $Fe(NO_3)_3$  and 3.6 mole of  $Na_2CO_3$  are taken. If 6.3 mole of  $NaNO_3$  is obtained then % yield of given reaction is :

- A. 50
- B. 84
- C. 87.5
- D. 100

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12. How many of  $P_4$  can be produced by reaction of 0.10 moles  $Ca_5(PO_4)_3F$ , 0.36 moles  $SiO_2$  and 0.90 moles  $C$  according to the following reaction ?



A. 0.060

B. 0.030

C. 0.045

D. 0.075



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13. Some older emergency oxygen masks contains potassium superoxide  $KO_2$  which reacts with  $CO_2$  and water present in exhaled air to produce oxygen according to the given equation. If a person exhales  $0.667g$  of  $CO_2$  per minute, how many gram of  $KO_2$  are consumed in 5.0 minutes ?

A. 10.7

B. 0.0757

C. 1.07

D. 5.38



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14. The mass of  $N_2F_4$  produced by the reaction of 2.0 g of  $NH_3$  and 8.0 g  $F_2$  is 3.56 g. What is the per cent yield ?

- A. 79
- B. 71.2
- C. 84.6
- D. None of these



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15. Calculate the weight of lime (CaO) obtained by heating 200 kg of 95% pure lime stone ( $CaCO_3$ ).

- A. 104.4kg



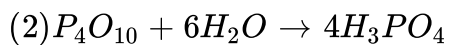
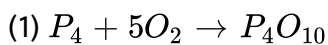
B.  $105.4\text{kg}$

C.  $212.8\text{kg}$

D.  $106.4\text{kg}$

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16. Phosphoric acid ( $H_3PO_4$ ) prepared in two step process .



Well allow 62 g of phosphorous to react with excess oxygen which form  $P_4O_{10}$  in 85 % yield . In the step (2) reaction 90 % yield of  $H_3PO_4$  is obtained . Mass of  $H_3PO_4$  produced is :

A.  $37.485\text{g}$

B.  $149.949\text{g}$

C.  $125.47\text{g}$

D.  $564.48\text{g}$



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17. 9 moles of "D" and 14 moles of E are allowed to react in a closed vessel according to given reactions. Calculate number of moles of B formed in the end of reaction, if 4 moles of G are present in reaction vessel. (percentage yield of reaction is mentioned in the reaction) Step -1



A. 2.4

B. 30

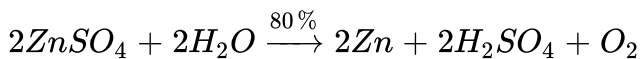
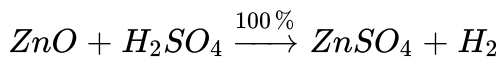
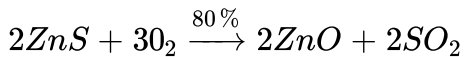
C. 4.8

D. 1



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18. The chief ore of Zn is the sulphide, ZnS. The ore is concentrated by froth floatation process and then heated in air to convert ZnS to ZnO.



The number of moles of ZnS required for producing 2 moles of Zn will be:

A. 3.125

B. 2

C. 2.125

D. 4



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19. 0.8 moles of a mixture of  $CO$  and  $CO_2$  requires exactly 40 gram of  $NaOH$  in solution for complete conversion of all the  $CO_2$  into  $Na_2CO_3$ .

How many more of  $NaOH$  would be required for conversion into  $Na_2CO_3$  if the mixture (0.8 mole) is completely oxidised to  $CO_2$  ?

- A. 0.2
- B. 0.6
- C. 1
- D. 1.5



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20. Silver oxide ( $Ag_2O$ ) decomposes at temperature  $300^\circ C$  yielding metallic silver and oxygen gas. A 1.60g sample of impure silver oxide yields 0.104g of oxygen gas. What is the per cent by mass of the silver oxide in the sample ?

- A. 5.9
- B. 47.125

C. 94.25

D. 88.2

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21. 342 g of 20% by mass of  $\text{Ba}(\text{OH})_2$  solution (sp.gr.0.57) is reacted with 1200 mL of 2M  $\text{HNO}_3$ . If the final density of solution is same as pure water then molarity of the iron in resulting solution which decides the nature of the above solution is :

A. 0.25

B. 0.5M

C. 0.888M

D. None of these

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22.  $100\text{mL}$  of  $\text{H}_2\text{SO}_4$  solution having molarity  $1\text{M}$  and density  $1.5\text{g/mL}$  is mixed with  $400\text{mL}$  of water. Calculate final molarity of  $\text{H}_2\text{SO}_4$  solution, if final density is  $1.25\text{g/mL}$ ?

- A.  $4.4\text{M}$
- B.  $0.145\text{M}$
- C.  $0.52\text{M}$
- D.  $0.227\text{M}$

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23. What volume of  $\text{HCl}$  solution of density  $1.2\frac{\text{g}}{\text{cm}^3}$  and containing  $36.5\%$  by mass  $\text{HCl}$ , must be allowed to react with zinc ( $\text{Zn}$ ) in order to liberate  $4.0\text{g}$  of hydrogen ?

- A.  $333.33\text{mL}$
- B.  $500\text{mL}$

C.  $614.66\text{mL}$

D. None of these

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24. An ideal gaseous mixture of ethane ( $C_2H_6$ ) and ethene ( $C_2H_4$ ) occupies 28 litre at  $1\text{atm}$   $0^\circ\text{C}$ . The mixture reacts completely with  $128\text{gmO}_2$  to produce  $CO_2$  and  $H_2O$ . Mole of fraction at  $C_2H_6$  in the mixture is-

A. 0.6

B. 0.4

C. 0.5

D. 0.8

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25. Wood's metal contains 50.0 % bismuth, 25.0 % lead, 12.5 % tin and 12.5 % cadmium by mass. What is the mole fraction of tin ? (Atomic mass :  $Bi = 209$ ,  $Pb = 207$ ,  $Sn = 119$ ,  $Cd = 112$ )

A. 0.202

B. 0.158

C. 0.176

D. 0.221

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26. The density of a 56.0 % by mass aqueous solution of 1-propanol ( $CH_3CH_2CH_2OH$ ) is  $0.8975 \frac{g}{cm^3}$ . What is the mole fraction of the 1-propanol ?

A. 0.292

B. 0.227



C. 0.241

D. 0.276

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27. What is the molartiy of  $SO_4^{2-}$  ion in aqueous solution that contain  $34.2p \pm$  of  $Al_2(SO_4)_3$ ? (Assume complete dissociation and density of solution  $1 \frac{g}{m} L$ )

A.  $3 \times 10^{-4} M$

B.  $2 \times 10^{-4}$

C.  $10^{-4} M$

D. None of these

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28. The relation between molarity (M) and molality (m) is given by :

( $\rho$ =density of solution (g/mL),  $M_1$ = molecular mass of solute)

$$\text{A. } m = \frac{1000M}{1000\rho - M_1}$$

$$\text{B. } m = \frac{1000\rho M}{1000\rho - MM_1}$$

$$\text{C. } m = \frac{1000MM}{1000\rho - MM_1}$$

$$\text{D. } m = \frac{1000M}{1000\rho - MM_1}$$



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29. Molarity and molality of a solution of an liquid (mol.mass = 50) in aqueous solution is 9 and 10 respectively. what is the density of solution ?

A.  $1g/cc$

B.  $0.95g/cc$

C.  $1.05g/cc$

D.  $1.35g/cc$



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30. An aqueous solution of ethanol has density  $1.025 \frac{g}{mL}$  and it is 2 M.

What is the molality of this solution ?

A. 1.79

B. 2.143

C. 1.951

D. None of these



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Level 1 (Q.91 To Q.120)

1. 0.2 mole of  $HCl$  and 0.2 mole of barium chloride were dissolved in water to produce a  $500mL$  solution. The molarity of the  $Cl^-$  ions is :

- A.  $0.06M$
- B.  $0.09M$
- C.  $1.2M$
- D.  $0.80M$



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2. Calculate the mass of anhydrous  $HCl$  in  $10mL$  of concentrated  $HCl$  (density =  $1.2\frac{g}{mL}$ ) solution having 37%  $HCl$  by mass is :

- A.  $4.44g$
- B.  $4.44mg$
- C.  $4.44 \times 10^{-3}$

D.  $0.444\mu\text{g}$



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3. Calculate the molality of 1L solution of 80 %  $H_2SO_4$   $\left(\frac{w}{V}\right)$  given that the density of the solution is  $1.80\text{gmL}^{-1}$ .

A. 8.16

B. 8.6

C. 1.02

D. 10.8



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4. Fluoxymestrone ,  $C_{20}H_{29}FO_3$ , is an anabolic steroid . A 500 ml solution is diluted to final volume of 1.00 L. What is the resulting molarity ?

A.  $1.19 \times 10^{-10}$

B.  $1.19 \times 10^{-7}$

C.  $5.95 \times 10^{-8}$

D.  $2.38 \times 10^{-11}$

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5. The 25 mL of a 0.15 M solution of lead nitrate,  $Pb(NO_3)_2$  react with all of the aluminium sulphate,  $Al_2(SO_4)_3$ , present in 200 mL of a solution. What is the molar concentration of the  $Al_2(SO_4)_3$ , present in 20 mL of a solution. What is the molar concentration of the  $Al_2(SO_4)_3$  ?

A.  $6.25 \times 10^{-2} M$

B.  $2.421 \times 10^{-2} M$

C.  $0.1875 M$

D. None of these



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6. Concentrated  $HNO_3$  is 63%  $HNO_3$  by mass and has a density of  $1.4g/mL$ . How many millilitres of this solution are required to prepare  $250mL$  of a  $1.20MHNO_3$  solution ?

- A. 18.0
- B. 21.42
- C. 20.0
- D. 14.21



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7.  $50mL$  of 20.8% (w/V)  $BaCl_2$  (aq) and  $100mL$  of 9.8% (w/V)  $H_2SO_4$  (aq) solutions are mixed. Molarity of  $Cl^-$  in the resulting

solution is : (At mass of  $Ba = 137$ )

A. 0.333M

B. 0.666M

C. 0.1M

D. 1.33M

**Answer: B**



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8.  $100\text{mL}$  of  $10\%$   $\text{NaOH}\left(\frac{w}{V}\right)$  is added to  $100\text{mL}$  of  $10\%$   $\text{HCl}\left(\frac{w}{V}\right)$ .

The nature of resultant solution is :

A. alkaline

B. strongly alkaline

C. acidic

D. neutral



**Answer: C**



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9. What volume of 0.10 M  $H_2SO_4$  must be added to 50 mL of a 0.10 NaOH solution to make a solution in which molarity of the  $H_2SO_4$  is 0.050M?

A. 400mL

B. 200mL

C. 100mL

D. none of these

**Answer: C**



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10. 1M HCl and 2M HCl are mixed in volume ratio 4:1. What is the final molarity of HCl solution?

A. 1.5

B. 1

C. 1.2

D. 1.8

**Answer: C**



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**11.** Three solutions X,Y,Z of HCl are mixed to produce 100mL of 0.1M solution . The milarities of X,Y and Z are 0.7M, 0.12M and 0.15M respectively. What respective volumes of X,Y and Z should be mixed?

A.  $50mL, 25mL, 25mL$

B.  $20mL, 60mL, 20mL$

C.  $40mL, 30mL, 30mL$

D.  $55mL, 20mL, 25mL$

**Answer: D**

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12. A bottle of an aqueous  $H_2O_2$  solution is labelled as '28V'  $H_2O_2$  and the density of the solution ( $in\ g/mL$ ) is 1.25. Choose the correct

- A. Molarity of  $H_2O_2$  solution is 2
- B. Molarity of  $H_2O_2$  solution is 5
- C. Molarity of  $H_2O_2$  solution is 2.15
- D. none of these

**Answer: C**

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13. The impure 6g of NaCl is dissolved in water and then treated with excess of silver nitrate solution. The mass of precipitate of silver chloride

is found to be 14g. The % purity of NaCl solution would be:

A. 0.95

B. 0.85

C. 0.75

D. 0.65

**Answer: A**



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14.  $Al(SO_4)_3$  solution of 1 molal concentration is present in 1 litre solution of density 2.684 g/cc. How many moles  $BaSO_4$  would be precipitated on adding excess  $BaCl_2$  in it?

A. 2 moles

B. 3 moles

C. 6 moles

D. 12 moles

**Answer: C**

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15. A certain public water supply contains 0.10PPB (part per billion) of chloroform ( $CHCl_3$ ). How many molecules of  $CHCl_3$  would be obtained in 0.478mL drop of this water? (Assuming  $d=1g//ml$ )

A.  $4 \times 10^{-13} \times N_A$

B.  $10^{-3} \times N_A$

C.  $4 \times 10^{-10} \times N_A$

D. None of these

**Answer: A**

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16. Decreasing order (first having highest and then other following it) of mass of pure NaOH in each of the aqueous solution

(P) 50 gm of 40 % ( $w/w$ ) NaOH

(Q) 50 gm of 50 % ( $w/w$ ) NaOH [ $d_{\text{soln.}} = 1.2\text{gm/ml}$ ]

(R) 50 gm of 20 M NaOH [ $d_{\text{soln.}} = 1\text{gm/ml}$ ]

A. I,ii,iii

B. iii,ii,i

C. ii,iii,i

D. ii,i,iii

**Answer: B**



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17. What is the molar mass of diacidic organic Lewis base (B), if 12g of its chloroplatinate salt ( $BH_2PtCl_6$ ) on ignition produced 5g residue of Pt?

A. 52

B. 58

C. 88

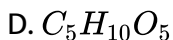
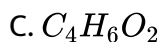
D. none of these

**Answer: B**



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**18.** On strong heating, one gram of the silver salt of an organic dibasic acid yields 0.5934g of silver. If the mass percentage of carbon in it 8 times the mass percentage of hydrogen and one-half the mass percentage of oxygen, determine the molecular formula of the acid.



**Answer: B**

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19. 0.607g of silver salt of tribasic organic acid was quantitatively reduced to 0.37g of pure  $Ag$ . What is the mol. Wt. of the acid ?

A. 207

B. 210

C. 531

D. 324

**Answer: B**

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20. A sample of peanut oil weighing 1.5763g is added to 25mL of 0.4210MKOH. After saponification is complete 8.46mL of



$0.2732M H_2SO_4$  is needed to neutralize excess  $KOH$ . The saponification number of peanut oil is:

A. 146.72

B. 223.44

C. 98.44

D. 98.9

**Answer: A**



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21.  $20mL$  of a mixture of  $CO$  and  $H_2$  were mixed excess of  $O_2$  and exploded & cooled. There was a volume contraction of  $23mL$ . All volume measurements corresponds to room temperature ( $27^\circ C$ ) and one atmospheric pressure. Determine the volume ratio ( $V_1 : V_2$  of  $CO$  and  $H_2$  in the original mixture .

A. 6.5: 13.5

B. 5: 15

C. 9: 11

D. 7: 13

**Answer: D**

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22. In the reaction  $2Al(s) + 6HCl(aq) \rightarrow 6Cl^-(aq) + 3H_2$

A.  $6LHCl(aq)$  is consumed for every  $3LH_2(g)$  produced

B.  $33.6L H_2(g)$  is produced regardless of temperature and pressure  
for every mole Al that reacts

C.

$67.2LH_2$  at  $1atm$  and  $273K$  is produced for every mole Al that reacts

D.  $11.2L H_2(g)$  at  $1atm$  and  $273K$  is produced for every mole  $HCl(aq)$   
consumed

**Answer: D**

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23. The percentage by volume of  $C_3H_8$  in a gaseous mixture of  $C_3H_8$ ,  $CH_4$  and  $CO$  is 20. When  $100\text{mL}$  of the mixture is burnt in excess of  $O_2$  the volume of  $CO_2$  produced is :

A. 90mL

B. 160mL

C. 140mL

D. none of these

**Answer: C**

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24. 40mL gaseous mixture of  $CO$ ,  $CH_4$  and Ne was exploded with 10mL of oxygen. After treatment with KOH the volume reduced by 9mL and again on treatment with alkaline progallol the volume further reduced by 1.5mL. Percentage of  $CH_4$  in the original mixture is:

- A. 22.5
- B. 77.5
- C. 7.5
- D. 15

**Answer: D**



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25. A gaseous mixture of propane and butane of volume 3 litre on complete combustion produces 11.0 litre  $CO_2$  under standard conditions of temperature and pressure. The ration of volume of butane to propane is:

A. 1:2

B. 2:1

C. 3:2

D. 3:1

**Answer: B**

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**26.** Phosphorous has the oxidation state of +1 in:

A. Orthophosphoric acid

B. Phosphorous acid

C. Hypophosphoric acid

D. Metaphosphoric acid

**Answer: C**

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27. Oxidation numbers of two *Cl* atoms in bleaching powder,  $CaOCl_2$ , are

A. +1 only

B. -1 only

C. +1 and -1

D. none of these

**Answer: C**



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28. The oxidation number of sulphur in  $S_8$ ,  $S_2F_2$ ,  $H_2S$  and  $H_2SO_4$  respectively are:

A. 0, +1, -2 and 6

B. +2, 0, +2 and 6

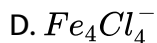
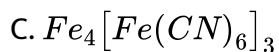
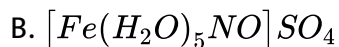
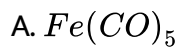
C. 0, + 1, + 2 and 6

D. - 2, 0, + 2 and 6

**Answer: A**

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**29.** Fe show on oxidation state of +1 in:



**Answer: B**

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30. When  $SO_2$  is passed into an acidified potassium dichromate solution, the oxidation number of sulphur and chromium in the final products respectively are:

A. +6, +6

B. +6, +3

C. +0, +3

D. +2, +3

**Answer: B**



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Level 1 (Q.121 To Q.150)

1. The oxidation number of nitrogen atoms in  $NH_4NO_3$  are:

A. +3, +3



B. +3, - 3

C. - 3, - 5

D. - 5, + 3

**Answer: C**

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2. The oxidation state of S-atoms in Caro's and Marshall's acids are:

A. +6, + 6

B. +6, + 4

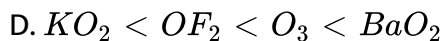
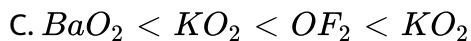
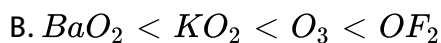
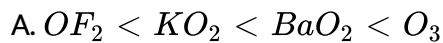
C. +6, - 6

D. +4, + 6

**Answer: A**

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3. In which of the following has the oxidation number of oxygen been arranged in increasing order ?



**Answer: B**



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4. The oxidation number of oxygen in  $KO_3$ ,  $Na_2O_2$  respectively are:

A. 3,2

B. 1,0

C. 0,1

D.  $-0.33$ ,  $-1$

**Answer: D**

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5. Oxidation number of  $P$  in  $Ba(H_2PO_2)_2$  is

A.  $-1$

B.  $+1$

C.  $+2$

D.  $+3$

**Answer: B**

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6. If it is known that in  $Fe_{0.96}O$ , Fe is present in  $+2$  and  $+3$  oxidation state, what is the mole fraction of  $Fe^{2+}$  in the compound?

A.  $\frac{12}{25}$

B.  $\frac{25}{12}$

C.  $\frac{1}{12}$

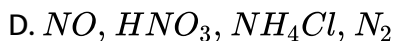
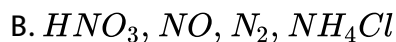
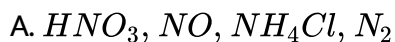
D.  $\frac{11}{12}$

**Answer: D**



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7. Which ordering of compounds is according to the decreasing order of the oxidation state of nitrogen ?



**Answer: B**

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8. 2 mole of  $N_2H_4$  loses 16 mole of electron is being converted to a new compound  $X$ . Assuming that all of the  $N$  appears in the new compound.

What is the oxidation state of ' $N$ ' in  $X$  ?

A.  $-1$

B.  $-2$

C.  $+2$

D.  $+4$

**Answer: C**

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9. When  $K_2Cr_2O_7$  is converted to  $K_2CrO_4$ , the change in the oxidation state of chromium is

A. 0

B. 6

C. 4

D. 3

**Answer: A**



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**10.** When a mananous salt is fused with a mixture of  $KNO_3$  and and solid NaOH, the oxidation number of Mn change from +2 to:

A. +4

B. +3

C. +6

D. +7

**Answer: C**

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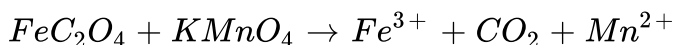
11. In Fe(II) -  $MnO_4^-$  titration  $HNO_3$  is not used because:

- A. it oxidises  $Mn^{2+}$
- B. it reduces  $MnO_4^-$
- C. it oxidise  $Fe^{2+}$
- D. it reduces  $Fe^{3+}$  formed

Answer: C

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12. Which species are oxidised and reduced in the reaction?



- A. Oxidised: Fe, C, Reduced: Mn
- B. Oxidised: Fe, Reduced: Mn

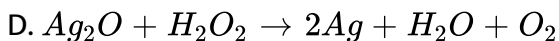
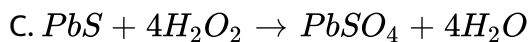
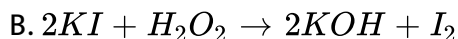
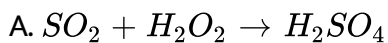
C. Reduced:Fe,Mn,Oxidised:C

D. Reduced:C,Oxidised:Mn,Fe

**Answer: A**

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13. In which of the following reactions,  $H_2O_2$  is acting as a reducing agent?

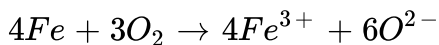


**Answer: D**

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14. Following reaction describes the rusting of iron



Which one of the following statements is incorrect?

A. This is an example of a redox reaction

B. Metallic iron is reduced to  $Fe^{2+}$

C.  $Fe^{3+}$  is an oxidising agent

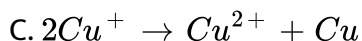
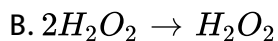
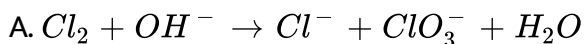
D. Metallic iron is a redoxing agent

**Answer: B**



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15. Which reaction does not represent auto redox or disproportionation?





**Answer: D**

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**16.** Which of the following is redox reaction ?

A.  $H_2SO_4$  react with NaOH

B. In atmosphere,  $O_3$  is formed from  $O_2$  by lightning

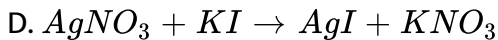
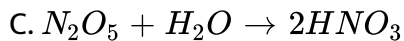
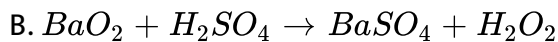
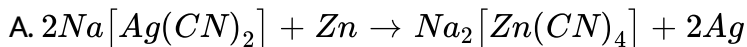
C. Evaporation of  $H_2O$

D. Oxides of nitrogen are formed from nitrogen & oxygen by lightning

**Answer: D**

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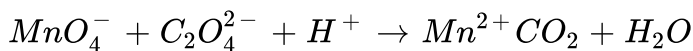
**17.** Which of the following is redox reaction?



**Answer: A**

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**18.** For the redox reaction



The correct stoichiometric coefficients of  $\text{MnO}_4^-$ ,  $\text{C}_2\text{O}_4^{2-}$  and  $\text{H}^+$  respectively:

A. 2,5,16

B. 16,3,12

C. 15,16,12

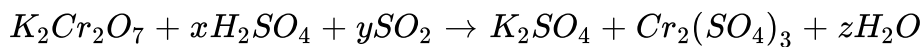
D. 2,16,5

**Answer: A**



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**19.** In the chemical reaction,



$x$ ,  $y$ , and  $z$  are

A.  $x=1, y=3, z=1$

B.  $x=4, y=1, z=4$

C.  $x=3, y=2, z=1$

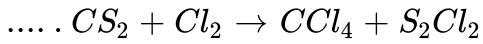
D.  $x=2, y=2, z=1$

**Answer: A**



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20. Balance the following equation and choose the quantity which is the sum of the coefficients of reactants and products:



A. 5

B. 3

C. 6

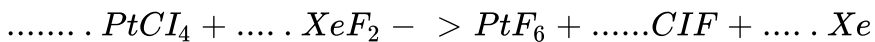
D. 2

**Answer: D**



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21. Balance the following equations and choose the quantity which is the sum of the coefficients of reactants and products :



A. 16

B. 13

C. 18

D. 12

**Answer: A**



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22. If 0.1 mole  $H_3PO_x$  is completely neutralised by 5.6g KOH then select the true statement.

A.  $x=3$  and given acid is dibasic

B.  $x=4$  and given acid has no P=H linkage

C.  $x=2$  and given acid does not form acid salt

D. all of these

**Answer: C**



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23. When potassium permanganate is titrated against ferrous ammonium sulphate, the equivalent weight of potassium permanganate is

- A.  $\frac{\text{molecular mass}}{3}$
- B.  $\frac{\text{molecular mass}}{5}$
- C.  $\frac{\text{molecular mass}}{2}$
- D.  $\frac{\text{molecular mass}}{10}$

**Answer: B**

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24. Equivalent weight of  $FeS_2$  in the half reaction

$FeS \rightarrow Fe_2O_3 + SO_2$  is :

- A.  $\frac{M}{10}$

B.  $\frac{M}{11}$

C.  $\frac{M}{6}$

D.  $\frac{M}{1}$

**Answer: B**



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25. The equivalent mass of HCl in the given reaction is:

A. 16.25

B. 36.5

C. 73

D. 85.1

**Answer: D**



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26. Equivalent weight of  $H_3PO_2$  when it disproportionates into  $PH_3$  and  $H_3PO_3$  is (mol.wt. of  $H_3PO_2 = M$ )

A.  $M$

B.  $\frac{M}{2}$

C.  $\frac{M}{4}$

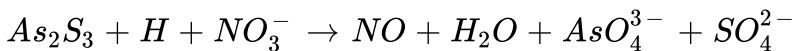
D.  $\frac{3M}{4}$

**Answer: D**



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27. In the following reaction (unbalanced), equivalent weight of  $As_2S_3$  is related to molecular weight  $M$  by



A.  $\frac{M}{2}$

B.  $\frac{M}{4}$

C.  $\frac{M}{24}$

D.  $\frac{M}{28}$

**Answer: D**



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28. Sulphur forms the chlorides  $S_2Cl_2$  and  $SCl_2$ . The equivalent mass of sulphur in  $SCl_2$  is

A. 8g/mol

B. 16g/mol

C. 64.8g/mol

D. 3g/mol

**Answer: B**



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29. The equivalent weight of an element is 4. Its chloride has a vapour density 59.25. Find the valency of element.

A. 4

B. 3

C. 2

D. 1

**Answer: B**



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30.  $6 \times 10^{-3}$  mole  $K_2Cr_2O_7$  reacts completely with  $9 \times 10^{-3}$  mole  $X^{n+}$  to give  $XO_3^-$  and  $Cr^{3+}$ . The value of  $n$  is :

A. 1

B. 2

C. 3

D. none of these

**Answer: A**

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### Level 1 (Q.151 To Q.180)

1. What mass of  $H_2C_2O_4 \cdot 2H_2O$  (*mol. mass* = 126) should be dissolved in water to prepare 250mL of centinormal solution which act as a reducing agent?

A. 0.63g

B. 0.1575g

C. 0.126g

D. 0.875g

**Answer: B**

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2. The equivalent weight of salt

$KHC_2O_4 \cdot H_2C_2O_4 \cdot 4H_2O$  when used as reducing agent : —

A.  $\frac{\text{Mol.mass}}{1}$

B.  $\frac{\text{Mol.mass}}{2}$

C.  $\frac{\text{Mol.mass}}{3}$

D.  $\frac{\text{Mol.mass}}{4}$

**Answer: D**



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3. The equivalent mass of divalent metal is W. The molecular mass of its chloride is:

A.  $W+35.6$

B.  $W+72$

C.  $2W+72$

D.  $2W+35.6$

**Answer: C**

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4. When

$BrO_3^-$  ions reacts with  $Br_2$  is liberated. The equivalent mass of  $Br_2$  in this re

:

A.  $\frac{5M}{8}$

B.  $\frac{5M}{3}$

C.  $\frac{3M}{5}$

D.  $\frac{4M}{6}$

**Answer: C**

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5. If  $m_A$  gram of a metal A displaces  $m_B$  gram of another metal B from its salt solution and if the equivalent mass are  $E_A$  and  $E_B$  respectively then equivalent mass of A can be expressed as:

A.  $E_A = \frac{m_A}{m_B} \times E_B$

B.  $E_A = \frac{m_A \times m_B}{E_B}$

C.  $E_A = \frac{m_B}{E_A} \times E_B$

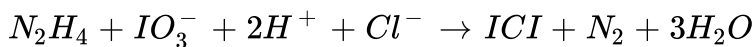
D.  $E_A = \sqrt{\frac{m_A}{m_B}} \times E_B$

**Answer: A**



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6. Hydrazine reacts with  $KIO_3$  in presence of  $HCl$  as :



The equivalent masses of  $N_2H_4$  and  $KIO_3$  respectively are :

A. 8 and 53.5

B. 16 and 53.5

C. 8 and 35.6

D. 8 and 87

**Answer: A**



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7. What will be the normality of a solution obtained by mixing 0.45N and 0.60N NaOH in the ratio 2:1 by volume?

A. 0.4N

B. 0.5N

C. 1.05N

D. 0.15N

**Answer: B**



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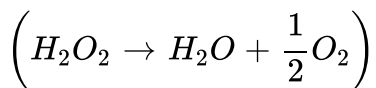
8. A solution containing  $2.7 \times 10^{-3}$  mol of  $A^{2+}$  ion required  $1.6 \times 10^{-3}$  mol of  $MnO_4^{2-}$  for the oxidation of  $A^{2+}$  to  $AO_3^-$  the medium is:

- A. neutral
- B. acidic
- C. strong basic
- D. none of these

**Answer: B**

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9.  $H_2O_2$  is used as bleaching reagent because on dissociation it gives oxygen



"Chachi420" used  $H_2O_2$  solution to bleach her hair and she required

2.24L  $O_2$  gas at 1atm and 273K. She has a  $H_2O_2$  solution labelled '5.6V'

then what volume of such solution must she required to bleach her hair?

A. 200mL

B. 300mL

C. 400mL

D. 500mL

**Answer: C**



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10. 1.25g of a solid dibasic acid is completely neutralised by 25mL of 0.25 molar  $Ba(OH_2)$  solution. Molecular mass of the acid is:

A. 100

B. 150

C. 120

D. 200

**Answer: D**

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11. 10mL of  $N\text{-HCl}$ , 20mL of  $N/2\text{H}_2\text{SO}_4$  and  $30\text{mLN}/3\text{HNO}_3$  are mixed together and volume made to one litre. The normally of  $\text{H}^+$  in the resulting solution is:

A.  $3\text{N}/100$

B.  $\text{N}/10$

C.  $\text{N}/20$

D.  $\text{N}/40$

**Answer: A**

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12.  $0.45\text{g}$  of acid (mol. Wt. = 90) was exactly neutralized by  $20\text{ml}$  of  $0.5\text{(M)}\text{NaOH}$ .

The basicity of the given acid is

A. 1

B. 2

C. 3

D. 4

**Answer: B**



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13. A  $3.4\text{g}$  sample of  $\text{H}_2\text{O}_2$  solution containing  $x\%$   $\text{H}_2\text{O}$  by mass requires  $x\text{mL}$  of a  $\text{KMnO}_4$  solution for complete oxidation under acidic conditions. The molarity of  $\text{KMnO}_4$  solution is :

A. 1

B. 0.5

C. 0.4

D. 0.2

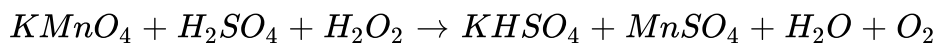
**Answer: C**



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**14.** What volume of  $O_2$  measured at standard condition will be formed by the action of  $100\text{mL}$  of  $0.5\text{NKMnO}_4$  on hydrogen peroxide in an acid solution?

The skeleton equation for the reaction is,



A. 0.12litre

B. 0.028 litre

C. 0.56 litre

D. 1.12 litre

**Answer: C**



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15. A sample of 1.0g of solid  $Fe_2O_3$  of 80% purity is dissolved in a moderately concentrated HCl solution which is reduced by zinc dust. The resulting solution required 16.7mL of a 0.1M solution of the oxidant. Calculate the number of electrons taken up by the oxidant.

A. 2

B. 4

C. 6

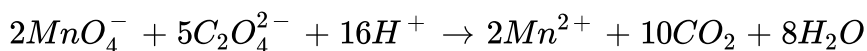
D. 5

Answer: C



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16.  $KMnO_4$  reacts with oxalic acid according to the equation



Here, 20mL of 1.0M  $KMnO_4$  is equivalent to:

A. 120mL of 0.25M  $H_2C_2O_4$

B. 150mL of 0.10M  $H_2C_2O_4$

C. 25mL of 0.20M  $H_2C_2O_4$

D. 50mL of 0.20M  $H_2C_2O_4$

**Answer: C**



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17. Ratio of moles of Fe (II) oxidised by equal volumes of equimolar  $KMnO_4$  and  $K_2Cr_2O_7$  solutions in acidic medium will be:

A. 5 : 3

B. 1 : 1

C. 1 : 2

D. 5 : 6

**Answer: D**



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**18.** The mass of a mixture containing HCl and  $H_2SO_4$  is 0.1g. On treatment with an excess of an  $AgNO_3$  solution, reacted with this acid mixture gives 0.1435g of AgCl. Mass % of the  $H_2SO_4$  mixture is:

A. 36.5

B. 63.5

C. 50

D. none of these

**Answer: B**



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19. A solution of  $Na_2S_2O_3$  is standardized iodometrically against 0.167g of  $KBrO_3$ . The process requires 50mL of the  $Na_2S_2O_4$  solution. What is the normality of the  $Na_2S_3O_3$ ?

- A. 0.2N
- B. 0.12N
- C. 0.72N
- D. 0.02N

**Answer: B**



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20. 0.80g of impure  $(NH_4)_2SO_4$  was boiled with 100mL of a 0.2N NaOH solution was neutralized using 5mL of a 0.2N  $NH_2SO_4$  solution. The percentage purity of the  $(NH_4)_2SO_4$  sample is:

- A. 82.5

B. 72.5

C. 62.5

D. 17.5

**Answer: A**



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21. The  $NH_3$  evolved due to complete conversion of N from 1.12g sample of protein was absorbed in 45ml of  $0.4N HNO_3$ . The excess acid required 20ml of  $0.1N NaOH$ . The % N in the sample is:

A. 8

B. 16

C. 20

D. 25

**Answer: A::C**



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22. Find out % of oxalate ion in a given sample of an alkali metal oxalate salt, 0.30g of it is dissolved in 100mL water and it required 90mL of 0.1M  $KMnO_4$  solution in acidic medium:

- A. 0.66
- B. 0.55
- C. 0.44
- D. 0.066

**Answer: A**



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23. 320mg of a sample of magnesium having a coating of its oxide required 20mL of 0.1M hydrochloric acid for the complete neutralisation of the latter. The composition of the sample is:

A. 87% Mg and 12.5%MgO

B. 12.5% Mg and 87.5 %MgO

C. 80% Mg and 20%MgO

D. 20% Mg and 80%MgO

**Answer: C**

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**24.** The concentration of bivalent lead ions in a sample of polluted of polluted water that aslo contains nitrate ions is determined by adding solid sodium sulphate ( $M=142$ ) to exactly 500mL water. Calculate the molarity of lead ions if 0.355g is sodium sulphate was nedded for complete precipitation of lead ions as sulphate.

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25. What volume of  $HNO_3$  (sp. gravity  $1.05 mL^{-1}$  containing 12.6(w/W) of  $HNO_3$ ) that reduce into NO is required to oxidise iron 1g  $FeSO_4 \cdot 7H_2O$  in acid medium is:

- A. 70mL
- B. 0.57mL
- C. 80mL
- D. 0.65mL

**Answer: C**

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26. The total volume of  $0.1M KMnO_4$  solution that are needed to oxidize 100mg each of ferric oxalate and ferrous sulphate in a mixture in acidic medium is:

A. 1.096mL

B. 1.32mL

C. 5.48mL

D. none of these

**Answer: A**



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27. When 2.5g of a sample of Mohr's salt reacts completely with 50mL of

$\frac{N}{10}$   $KMnO_4$  solution. The % purity of the sample of Mohr's salt is:

A. 78.4

B. 70

C. 37

D. 40

**Answer: A**

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28. 4 mole of a mixture of Mohr's salt and  $Fe_2(SO_4)_3$  requires 500mL of  $1MK_2Cr_2O_7$  for complete oxidation in acidic medium. The mole % of the Mohr's salt in the mixture is:

- A. 25
- B. 50
- C. 60
- D. 75

**Answer: D**

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29. The equivalent mass of a metal is twice to that of oxygen. How many times in the equivalent mass of its oxide than the equivalent mass of metal?

A. 1:5

B. 2

C. 3

D. 4

**Answer: A**



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**30.** A metal oxide has the formula  $M_2O_3$ . It can be reduced by hydrogen to give free metal and water. 0.1596 g of the metal oxide required 6 mg hydrogen for complete reduction. The atomic weight of the metal is:

A. 15.58

B. 155.8

C. 5.58

D. 55.8



**Answer: D**

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### Level 1 (Q.181 To Q.200)

1. Calculate the mass of oxalic acid ( $H_2C_2O_4$ ) which can be oxidised to  $CO_2$  by  $100.0\text{mL}$  of  $MnO_4^-$  solution,  $10\text{mL}$  of which is capable of oxidising  $50.0\text{mL}$  of  $1.0\text{NI}^-$  to  $I_2$ ?

- A. 45g
- B. 22.5g
- C. 30g
- D. 12.25g

**Answer: B**

 [Watch Video Solution](#)

2. A mixture of  $NaHC_2O_4$  and  $KHC_2O_4 \cdot H_2C_2O_4$  required equal volumess of  $0.2NKMnO_4$  and  $0.12NNaOH$  separately. What is the molar ration  $NaHC_2O_4$  and  $KHC_2O_4 \cdot H_2O_4$  in the mixture?

A. 6:1

B. 1:6

C. 1:3

D. 3:1

**Answer: D**



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3. Stannous sulphate ( $SnSO_4$ ) and potassium permanganate are used as oxidising agents in acidic medium for oxidation of ferrous ammnum sulphate to ferric sulphate. The ration of number of moles of stannous sulphate required per mole of ferrous ammonium sulphate to the

number of moles of  $KMnO_4$  required per mole of ferrous ammonium sulphate, is:

- A. 2.5
- B. 0.2
- C. 0.4
- D. 2

**Answer: A**



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4. If a g is the mass of  $NaHC_2O_4$  required to neutralize 100mL of 0.2M NaOH and b g that required to reduce 100mL of 0.02mLK $MnO_4$  in acidic medium then:

- A. a=b
- B. 2a=b
- C. a=2b

D. none of these

**Answer: D**

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5. 2 mole, equimolar mixture of  $Na_2C_2O_4$  and  $H_2C_2O_4$  required  $V_1$  L of  $0.1M KMnO_4$  in acidic medium for complete oxidation. The same amount of the mixture required  $V_2$  L of  $0.2M NaOH$  for neutralisation. The ratio of  $V_1$  and  $V_2$  is:

A. 1:2

B. 2:1

C. 4:5

D. 5:4

**Answer: C**

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6. A mixture containing 0.05 mole of  $K_2Cr_2O_7$  and 0.02 mole of  $KMnO_4$  was treated with excess of KI in acidic medium. The liberated iodine required 1.0 L of  $Na_2S_2O_3$  solution for titration. Concentration of  $Na_2S_2O_3$  solution was:

- A.  $0.4 \text{ mol L}^{-1}$
- B.  $0.20 \text{ mol L}^{-1}$
- C.  $0.25 \text{ mol L}^{-1}$
- D.  $0.30 \text{ mol L}^{-1}$

**Answer: A**

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7. 25 mL of  $2N HCl$ , 50 mL of  $4N HNO_3$  and  $x \text{ mL } H_2SO_4$  are mixed together and the total volume is made up to 1 L after dilution. 50 mL of this acid mixture completely reacted with 25 mL of a  $1N Na_2CO_3$  solution. The value of x is:

A. 250mL

B. 62.5mL

C. 100mL

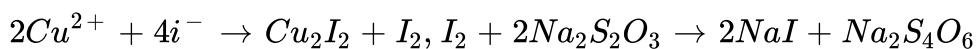
D. none of these

**Answer: B**



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8. In a iodometric estimation, the following reactions occur



0.12 mole of  $CuSO_4$  was added to excess of KI solution and the liberated iodine required 120mL of hypo. The molarity of hypo solution was:

A. 2

B. 0.2

C. 0.1

D. 1

**Answer: D**

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9. 1g mixture of equal number of mole of  $Li_2CO_3$  and other metal carbonate ( $M_2CO_3$ ) required 21.6mL of 0.5 N HCl for complete neutralisation reaction. What is the approximate atomic mass of the other metal?

A. 25

B. 23

C. 51

D. 118

**Answer: D**

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10. 32g of a sample of  $FeSO_4 \cdot 7H_2O$  were dissolved in dilute sulphuric acid and water and its volume was made up to 1 litre. 25 mL of this solution required 20 mL of 0.02 M  $KMnO_4$  solution for complete oxidation. Calculate the mass% of  $FeSO_4 \cdot 7H_2O$  in the sample.

A. 34.75

B. 69.5

C. 89.5

D. none of these

**Answer: A**



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11. In the mixture of  $(NaHCO_3 + Na_2CO_3)$  volume of HCl required is x mL with phenolphthalein indicator and then y mL with methyl orange indicator in same titration Hence, volume of HCl for complete reaction of  $Na_2CO_3$  is



A.  $2x$

B.  $y$

C.  $x/2$

D.  $(y-x)$

**Answer: D**



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12. 0.1g of a solution containing  $Na_2CO_3$  and  $NaHCO_3$  requires 10mL of 0.01 N HCl for neutralization using phenolphthalein as an indicator, mass% of  $Na_2CO_3$  in solution is:

A. 25

B. 32

C. 50

D. none of these

**Answer: C**



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13. A mixture  $NaOH + Na_2CO_3$  required 25mL of 0.1 M HCl using phenolphthalein as the indicator. However, the same amount of the mixture required 30mL of 0.1M HCl when methyl orange was used as the indicator. The molar ration of  $NaOH$  and  $Na_2CO_3$  in the mixture was:

A. 2 : 1

B. 1 : 2

C. 4 : 1

D. 1 : 4

**Answer: A**



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14. When 100mL solution of  $NaOH$  and  $NaCO_3$  was first titrated with N/10 HCl in presence of HPh, 17.5mL were used till end point is obtained. After this end point MeOH was added and 2.5mL of same HCl were required to attain new end point. The amount NaOH in mixture is:

- A. 0.06g per 100mL
- B. 0.06g per 200mL
- C. 0.05 g per 100mL
- D. 0.012 g per 200mL

**Answer: A**



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15. 1gram of a sample of  $CaCO_3$  was strongly heated and the  $CO_2$  liberated was absorbed in 100mL of 0.5 M NaOH solution. Assuming 90% purity for the sample, how many mL of 0.5M HCl would be required to

react with the resulting solution to reach the end point in presence of phenolphthalein?

A. 73mL

B. 41mL

C. 82mL

D. 100mL

**Answer: C**



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**16.** A sample of pure sodium chloride 0.318g is dissolved in water and titrated with HCl solution. A volume of 60mL is required to reach the methyl orange end point. Calculate the molarity of the acid.

A. 0.1M

B. 0.2M

C. 0.4M

D. none of these

**Answer: A**



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17. 10L of hard water required 5.6g of lime for removing hardness. Hence temporary hardness in ppm of  $CaCO_3$  is:

A. 1000

B. 2000

C. 100

D. 1

**Answer: A**



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18. 1L of pond water contains  $20\text{mg}$  of  $\text{Ca}^{2+}$  and  $12\text{mg}$  of  $\text{Mg}^{2+}$  ions. What is the volume of a  $2\text{N}$   $\text{Na}_2\text{CO}_3$  solution required to soften 5000L of pond water?

- A. 500L
- B. 50L
- C. 5L
- D. none of these

**Answer: C**



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19. One litre of a sample of hard water contain  $4.44\text{mg}$   $\text{CaCl}_2$  and  $1.9\text{mg}$  of  $\text{MgCl}_2$ . What is the total hardness in terms of ppm of  $\text{CaCO}_3$ ?

- A. 2ppm

B. 3ppm

C. 4ppm

D. 6ppm

**Answer: D**

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20. If hardness of water sample is 200ppm, then select the incorrect statement:

A. Mass ratio of  $CaCO_3$  to  $H_2O$  is  $\frac{0.02}{100}$

B. Mole ratio of  $CaCO_3$  to  $H_2O$  is  $3.6 \times 10^{-5}$

C. Mass of  $CaCO_3$  present in hard water is  $0.2g/L$

D. 1 miliequivalent of  $CaCO_3$  present in 1kg of hard water

**Answer: D**

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## Level 2 (Q.1 To Q.30)

1. A mixture of  $NH_4NO_3$  and  $(NH_4)_2HP_4$  contain 30.40% mass per cent of nitrogen. What is the mass ratio of the two components in the mixture ?

A. 2 : 1

B. 1 : 2

C. 3 : 4

D. 4 : 1

**Answer: A**



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2. What volume of 75% alcohol by weight ( $d = 0.80g/cm^3$ ) must be used to prepare  $150\text{ cm}^3$  of 30 % alcohol by mass ( $d = 0.90g/cm^3$ ) ?



- A. 67.5 mL
- B. 56.25 mL
- C. 44.44 mL
- D. None of these

**Answer: A**

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3. Calculate the number of millilitre of  $NH_3(aq)$  solution ( $d = 0.986 \frac{g}{mL}$ ) contain 2.5 % by mass  $NH_3$ , which will be required to precipitate iron as  $Fe(OH)_3$  in a 0.8g sample that contains 50 %  $Fe_2O_3$ .

- A. 0.344 mL
- B. 3.44 mL
- C. 17.24 mL
- D. 10.34 mL

**Answer: D**

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4. In the preparation of iron from haematite ( $Fe_2O_3$ ) by the reduction with carbon  $Fe_2O_3 + C \rightarrow Fe + CO_2$  how much 80% pure iron may be produced from 120kg of 90% pure  $Fe_2O_3$  ?

A. 94.5 kg

B. 60.48 kg

C. 116.66 kg

D. 120 kg

**Answer: A**

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5. A mineral consists of an equimolar mixture of the carbonates of two bivalent metals. One metal is present to the extent of 12.5% by mass. 2.8 g of the mineral on heating loses 1.32 g of  $CO_2$ . What is the % by mass of the other metal ?

A. 87.5

B. 35.71

C. 65.11

D. 23.21

**Answer: D**

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6. 6.2 g of a sample containing  $NaHCO_3$ ,  $NaHCO_3$  and non-volatile inert impurity on gentle heating loses 5% of its mass due to reaction  $2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$ . Residue is dissolved in water and formed 100 mL solution and its 10 mL portion requires 7.5 mL of 0.2

M aqueous solution of  $BaCl_2$  for complete precipitation of carbonates.

Determine mass (in gram) of  $Na_2CO_3$  in the original sample .

A. 1.59

B. 1.06

C. 0.53

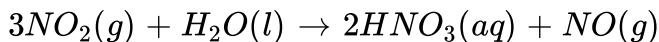
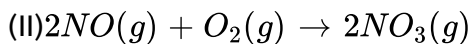
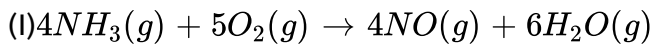
D. None of these

**Answer: B**



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7. Nitric acid can be produced from  $NH_3$  in three steps process given below



percent yield of 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> steps are respectively 50%, 60% and 80%

respectively then what volume of  $NH_3(g)$  at 1 atm and  $0^\circ$  required to produced 1575 g of  $HNO_3$  .

- A. 156.25
- B. 350 L
- C. 3500 L
- D. None of these

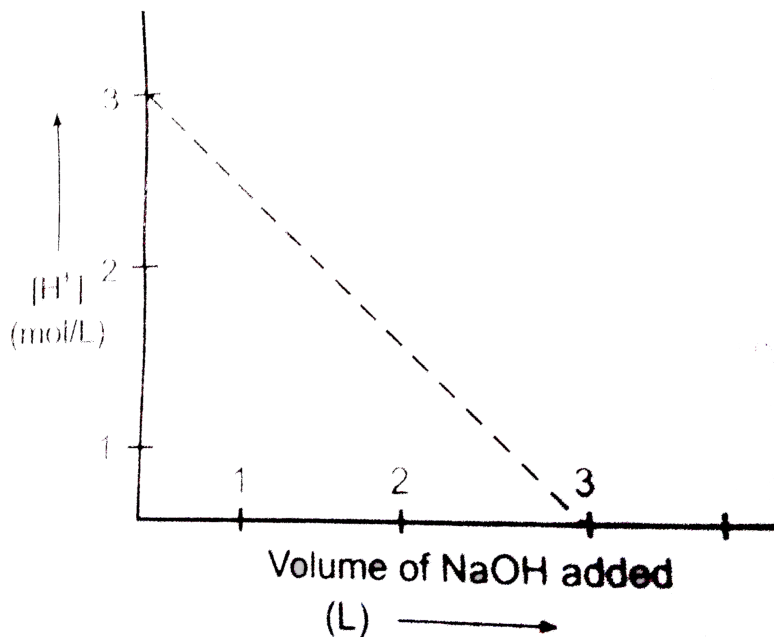
**Answer: C**



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8. 1 M NaOH solution was slowly added in to 1000 mL of 183.75 g impure  $H_2SO_4$  solution and the following plot was obtained. The percentage

purity of  $H_2SO_4$  sample and slope of the curve respectively are:



A. 75%,  $-\frac{1}{3}$

B. 80%,  $-\frac{1}{2}$

C. 80%, -1

D. None of these

Answer: C



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9.  $MnO_2$  on ignition converts into  $Mn_3O_4$ . A sample of pyrolusite having 75%  $MnO_2$ , 20% inert impurities and rest water is ignited in air to constant mass. What is the percentage of Mn in the ignited sample ?

A. 0.246

B. 0.37

C. 0.5524

D. 0.7405

**Answer: C**



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10. A 1.0g sample of a pure organic compound containing chlorine is fused with  $Na_2O_2$  to convert chlorine to NaCl. The sample is then dissolved in water, and the chloride precipitated with  $AgNO_3$ , giving 1.96 g of AgCl. If the molecular mass of organic compound is 147, how many chlorine does each molecule contain ?

A. 1

B. 2

C. 3

D. 4

**Answer: B**



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11. A 0.6gm sample consisting of only  $CaC_2O_4$  and  $MgC_2O_4$  is heated at  $500^\circ C$  gets converted into  $CaCO_3$  and  $MgCO_3$ . The sample then weighed 0.465gm. If the sample had been heated to  $900^\circ C$  where the products are CaO and MgO, then what would the mixture of oxides weigh?

A. 0.12 g

B. 0.21 g

C. 0.252 g



D. 0.3 g

**Answer: C**



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12. A metal M forms the sulphate  $M_2(SO_4)_3$ . A 0.596 gram sample of the sulphate reacts with excess  $BaCl_2$  to give 1.220 g  $BaSO_4$ . What is the atomic mass of M ?

A. 26.9

B. 69.7

C. 55.8

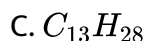
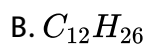
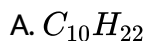
D. 23

**Answer: A**



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13. Urea ( $H_2NCONH_2$ ) is manufactured by passing  $CO_2(g)$  through ammonia solution followed by crystallization. For the above reaction is prepared by combustion of hydrocarbons. If combustion of 236 kg of a saturated hydrocarbon ( $C_nH_{2n+2}$ ) produces as much  $CO_2$  as required for production of 999.6 kg urea then molecular formula of hydrocarbon is:

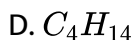
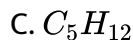
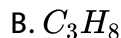


**Answer: B**

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14. 11.6 g of an organic compound having formula ( $C_nH_{2n+2}$ ) is burnt in excess of  $O_2(g)$  initially taken in a 22.41 litre steel vessel. Reaction the gaseous mixture was at 273 K with pressure reading 2 atm. After complete complete combustion and loss of considerable amount of heat,

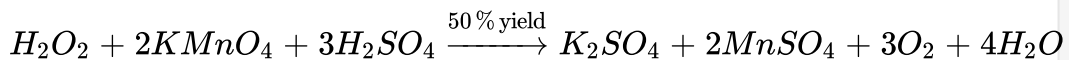
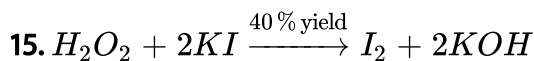
the mixture of product and excess of  $O_2$  had a temperature of 546 K and 4.6 atm pressure. The formula of organic compound is :



**Answer: D**



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150 mL of  $H_2O_2$  sample was divided into two parts. First part was treated with KI and formed KOH required 200 mL of  $M/2H_2SO_4$  for neutralisation. Other part was treated with  $KMnO_4$  yielding 6.74 litre of  $O_2$  at 1 atm. and 273 K. Using % yield indicated find volume strength of  $H_2O_2$  sample used.

A. 5.04

B. 10.08

C. 3.36

D. 33.6

**Answer: D**



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16.  $SO_2Cl_2$  (sulphuryl chloride ) reacts with water to give a mixture of  $H_2SO_4$  and HCL. What volume of 0.2 M  $Ba(OH)_2$  is needed to completely neutralize 25 mL of 0.2 M  $SO_2Cl_2$  solution:

A. 25 mL

B. 50 mL

C. 100 mL

D. 200 mL

**Answer: B**

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17. 5 g sample contain only  $Na_2CO_3$  and  $Na_2SO_4$  . This sample is dissolved and the volume made up to 250 mL. 25 mL of this solution neutralizes 20 mL of 0.1 M  $H_2SO_4$ .

Calcalute the % of  $Na_2SO_4$  in the sample .

A. 42.4

B. 57.6

C. 36.2

D. None of these

**Answer: B**

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18. 20 mL of 0.2 M NaOH(aq) solution is mixed with 35 mL of this 0.1 M NaOH (aq) solution and the resultant solution is diluted to 100 mL. 40 mL of this diluted solution reacted with 10% impure sample of oxalic acid ( $H_2C_2O_4$ ) The mass of impure is:

- A. 0.15 gram
- B. 0.135 gram
- C. 0.59 gram
- D. None of these

**Answer: A**



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19. A silver coin weighing 11.34 g was dissolved in nitric acid. When sodium chloride was added to the solution all the silver (present as  $AgNO_3$ ) precipitated as silver chloride. The mass of the precipitated silver chloride was 14.35 g. Calculate the percentage of silver in the coin.

A. 0.048

B. 0.952

C. 0.9

D. 0.8

**Answer: B**

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20. Two elements  $A$  and  $B$  combine chemically to form compounds combining with a fixed mass of  $A$  in I, II and III is 1 : 3 : 5, if 32 parts by mass of  $A$  combine with 84 parts by mass of  $B$  in II, then III, 16 parts of  $A$  will combine with..... by mass of  $B$ .

A. 14 parts by mass of  $B$

B. 42 parts by mass of  $B$

C. 70 parts by mass of  $B$

D. 84 parts by mass of  $B$

**Answer: C**

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**21.** The conversion of oxygen to ozone occurs to the extent of 15% only.

The mass of ozone that can be prepared from 67.2 L of oxygen at 1 atm and 273 K will be :

A. 14.4 g

B. 96 g

C. 640 g

D. 64 g

**Answer: A**

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22.  $RH_2$  (ion exchange resin) can replace  $Ca^{2+}$  ions in hard water as  $RH_2 + Ca^{2+} \rightarrow R_2Ca + 2H^+$ . If L of hard water after passing through  $RH_2$  has pH=3 then hardness in parts per million of  $Ca^{2+}$  is :

- A. 20
- B. 10
- C. 40
- D. 100

**Answer: A**



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23.  $100\text{cm}^3$  of a solution of an acid (Molar mass =98) containing 29.4 g of the acid per litre were completely neutralized by  $90.0\text{cm}^3$  of aq. NaOH containing 20 g of NaOH per  $500\text{cm}^3$ . The basicity of the acid is

- A. 3

B. 2

C. 1

D. data insufficient

**Answer: A**



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**24.** 20 mL of 0.1 M solution of compound  $NaCO_3 \cdot NaHCO_3 \cdot 2H_2O$  is titrated against 0.05 M HCL. X mL of HCL is used when phenolphthalein is used as an indicator and y mL of HCL is used when methly orange is the indicator in two separate titrations. Hence (y-x) is:

A. 40 mL

B. 80 mL

C. 120 mL

D. None of these

**Answer: B**

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25. A sample containing  $HA\bar{s}O_2$  (mol. Mass=108) and weighing 3.78 g is dissolved and diluted to 250 mL in a volumetric flask. A 50 mL sample (aliquot) is withdrawn with a pipet and titrated with 25 mL of 0.05 M solution of  $I_2$ . Calculate the percentage  $HA\bar{s}O_2$  in the sample :

A. 0.25

B. 0.2

C. 0.1

D. None of these

**Answer: A**

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26. A mixture of  $\text{FeO}$  and  $\text{Fe}_2\text{O}_3$  is completely reacted with 100 mL of 0.25 M acidified  $\text{KMnO}_4$  solution. The resultant solution was then treated with Zn dust which converted  $\text{Fe}^{3+}$  of the solution to  $\text{Fe}^{2+}$ . The  $\text{Fe}^{2+}$  required 1000 mL of 0.10  $\text{MK}_2\text{Cr}_2\text{O}_7$  solution. Find out the weight %  $\text{Fe}_2\text{O}_3$  in the mixture.

A. 80.85

B. 19.15

C. 50

D. 89.41

**Answer: A**



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27. To a 10mL, 1M aqueous solution of  $\text{Br}_2$ , excess of  $\text{NaOH}$  is added so that all  $\text{Br}_2$  is disproportionated to  $\text{Br}^-$  and  $\text{BrO}_3^-$ . The resulting solution is free from  $\text{Br}^-$ , by extraction and excess of  $\text{OH}^-$  neutralised

by acidifying the solution. The resulting solution is sufficient to react with 2 g of impure  $CaC_2O_4$  (M= 128g/mol) sample. The % purity of oxalate sample is :

A. 0.853

B. 0.125

C. 0.9

D. 0.64

**Answer: B**



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**28.** 0.10 g of a sample containing  $CuCO_3$  and some inert impurity was dissolved in dilute sulphuric acid and volume made up to 520 mL. This solution was added into 50mL of 0.04 M KI solution where copper precipitates as  $CuI$  and  $I^-$  is oxidized into  $I_3^-$ . A 10 mL portion of this solution is taken for analysis, filtered and made up free  $I_3^-$  and then treated with excess of acidic permanganate solution. Liberated iodine

required 20 mL of 2.5 mM sodium thiosulphate solution to reach the end point.

Determine mass percentage of  $CuCO_3$  in the original sample.

A. 7.41

B. 74.1

C. 61.75

D. None of these

**Answer: B**



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**29.** 1 mole of equimolar mixture of ferric oxalate and ferrous oxalate requires x mole of  $KMnO_4$  in acidic medium for complete oxidation. X is:

A. 0.5 mole

B. 0.9 mole

C. 1.2 mole

D. 4.5 mole

**Answer: B**

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30. An impure sample of sodium oxalate ( $Na_2C_2O_4$  weighing 0.20 g is dissolved in aqueous solution of  $H_2SO_4$ ) and solution is titrated at  $70^\circ C$ , requiring 45 mL of 0.02 M  $KMnO_4$  solution. The end point is overrun, and back titration is carried out with 10 mL of 0.1 M oxalic acid solution. Find the purity of  $Na_2C_2O_4$  in sample:

A. 75

B. 83.75

C. 90.25

D. None of these

**Answer: B**

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## Level 2 (Q.31 To Q.35)

1. 0.5 gmixture of  $K_2Cr_2O_7$  and  $KMnO_4$  was treated with excess of KI in acidic medium. Iodine liberated required  $150cm^3$  of 0.10 N solution of thiosulphate solution for titration.

Find trhe percentage of  $K_2Cr_2O_7$  in the mixture :

A. 14.64

B. 34.2

C. 65.69

D. 50

**Answer: A**



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2. A 150 mL of solution of  $I_2$  is divided into two unequal parts. I part reacts with hypo solution solution in acidic medium. 15 mL of 0.4 M hypo was consumed. II part was added with 100 mL of 0.3 M NaOH solution. What was the initial concentration of  $I_2$  ?

- A. 0.08 M
- B. 0.1 M
- C. 0.2 M
- D. None of these

**Answer: B**

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3. A mixture of  $H_2SO_4$  and  $H_2C_2O_4$  (oxalic acid ) and some inert impurity weighing 3.185 g was dissolved in water and the solution made up to 1litre. 10 mL of this solution required 3 mL of 0.1 N NaOH for complete neutralization. In another experiment 100 mL of the same solution in hot

condition required 4 mL of 0.02 M  $KMnO_4$  solution for complete reaction. The mass % of  $H_2SO_4$  in the mixture was:

A. 40

B. 50

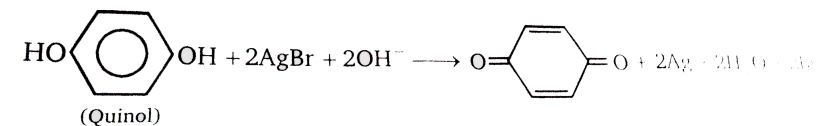
C. 60

D. 80

**Answer: A**

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4. During developing of an exposed camera film, one step involves in the following reaction :



A. It acts as an acid

B. It acts as reducing agent

C. It acts as oxidant

D. It acts as a base

**Answer: B**

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5. The concentration of an oxalic acid solution is  $x \text{ mol litre}^{-1}$ . 40mL of this solution reacts with 16 mL of 0.05 M acidified  $KMnO_4$ . What is the pH  $x$  M oxalic acid solution ? (Assume that oxalic acid dissociates completely.)

A. 1.3

B. 1.699

C. 1

D. 2

**Answer: C**

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## Level 3 - Passage

1. Oleum is considered as a solution of  $SO_3$  in  $H_2SO_4$ , which is obtained by passing  $SO_3$  in solution of  $H_2SO_4$ . When 100 g sample of oleum is diluted with desired mass of  $H_2O$  then the total mass of  $H_2SO_4$  obtained after dilution is known as % labelling in oleum.

For example, a oleum bottle labelled as '109 %  $H_2SO_4$ ' means the 109 g total mass of pure  $H_2SO_4$  will be formed when 100 g of oleum is diluted by 9 g of  $H_2O$  which combines with all the free  $SO_3$  present in oleum to form  $H_2SO_4$  as  $SO_3 + H_2O \rightarrow H_2SO_4$

What is the % of free  $SO_3$  in an oleum that is labelled as '104.5 %  $H_2SO_4$ ' ?

- A. 10
- B. 20
- C. 40

D. None of these

**Answer: B**

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2. Oleum is considered as a solution of  $SO_3$  in  $H_2SO_4$ , which is obtained by passing  $SO_3$  in solution of  $H_2SO_4$ . When 100 g sample of oleum is diluted with desired mass of  $H_2O$  then the total mass of  $H_2SO_4$  obtained after dilution is known as % labelling in oleum.

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9.0 g water is added into oleum sample labelled as "112%"  $H_2SO_4$  then the amount of free  $SO_3$  remaining in the solution is : (STP=1 atm and 273 K)

A. 14.93 Lit at STP

B. 7.46 L at STP

C. 3.73 L at STP

D. 11.2 L at STP

**Answer: C**

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3. Oleum is considered as a solution of  $SO_3$  in  $H_2SO_4$ , which is obtained by passing  $SO_3$  in solution of  $H_2SO_4$ . When 100 g sample of oleum is diluted with desired mass of  $H_2O$  then the total mass of  $H_2SO_4$  obtained after dilution is known as % labelling in oleum.

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If excess water is added into a bottle sample labelled as "112% $H_2SO_4$ " and is reacted with 5.3 g  $NaCO_3$  then find the volume of  $CO_2$  evolved at 1 atm pressure and 300 K temperature after the completion of the reaction :

A. 2.46 L

B. 24.6 L

C. 1.23 L

D. 12.3 L

**Answer: C**

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4. Oleum is considered as a solution of  $SO_3$  in  $H_2SO_4$ , which is obtained by passing  $SO_3$  in solution of  $H_2SO_4$ . When 100 g sample of oleum is diluted with desired mass of  $H_2O$  then the total mass of  $H_2SO_4$  obtained after dilution is known as % labelling in oleum.

For example, a oleum bottle labelled as '109 %  $H_2SO_4$ ' means the 109 g total mass of pure  $H_2SO_4$  will be formed when 100 g of oleum is diluted by 9 g of  $H_2O$  which combines with all the free  $SO_3$  present in oleum to form  $H_2SO_4$  as  $SO_3 + H_2O \rightarrow H_2SO_4$

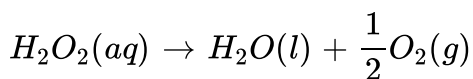
1 g of oleum sample is diluted with water. The solution required 54 mL of 0.4 N NaOH for complete neutralization. The % free  $SO_3$  in the sample is :

- A. 74
- B. 26
- C. 20
- D. None of these

**Answer: B**

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5. The strength of  $H_2O_2$  is expressed in several ways like molarity, normality, % (w/V), volume strength, etc. The strength of "10 V" means 1 volume of  $H_2O_2$  on decomposition gives 10 volumes of oxygen at 1 atm and 273 K or 1 litre of  $H_2O_2$  gives 10 litre of  $O_2$  at 1 atm and 273 K The decomposition of  $H_2O_2$  is shown as under :



$H_2O_2$  can act as oxidising as well as reducing agent. As oxidizing agent



$H_2O_2$  is converted into  $H_2O$  and as reducing agent  $H_2O_2$  is converted into  $O_2$ . For both cases its n-factor is 2.  $\therefore$  Normality of  $H_2O_2$  " solution " =  $2 \times$  molarity of  $H_2O_2$  solution

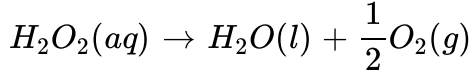
What is the molarity of "11.2 V"  $H_2O_2$  ?

- A. 1 M
- B. 2 M
- C. 5.6 M
- D. 11.2 M

**Answer: A**

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6. The strength of  $H_2O_2$  is expressed in several ways like molarity, normality, % (w/V), volume strength, etc. The strength of "10 V" means 1 volume of  $H_2O_2$  on decomposition gives 10 volumes of oxygen at 1 atm and 273 K or 1 litre of  $H_2O_2$  gives 10 litre of  $O_2$  at 1 atm and 273 K The decomposition of  $H_2O_2$  is shown as under :



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into  $O_2$ . For both cases its n-factor is 2.  $\therefore$  Normality of  $H_2O_2$

solution =  $2 \times$  molarity of  $H_2O_2$  solution

What is the percentage strength (%w/V) of "11.2 V"  $H_2O_2$

A. 1.7

B. 3.4

C. 34

D. None of these

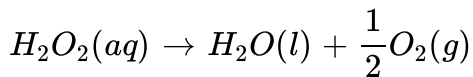
**Answer: B**



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7. The strength of  $H_2O_2$  is expressed in several ways like molarity, normality, % (w/V), volume strength, etc. The strength of "10 V" means 1 volume of  $H_2O_2$  on decomposition gives 10 volumes of oxygen at 1 atm

and 273 K or 1 litre of  $H_2O_2$  gives 10 litre of  $O_2$  at 1 atm and 273 K The decomposition of  $H_2O_2$  is shown as under :



$H_2O_2$  can act as oxidising as well as reducing agent. As oxidizing agent  $H_2O_2$  is converted into  $H_2O$  and as reducing agent  $H_2O_2$  is converted into  $O_2$ . For both cases its n-factor is 2.  $\therefore$  Normality of  $H_2O_2$  "solution" =  $2 \times$  molarity of  $H_2O_2$  solution

20 mL of  $H_2O_2$  solution is reacted with 80 mL of 0.05  $M KMnO_4$  "in acidic medium then what is the volume strength of"  $H_2O_2$  ?

A. 2.8

B. 5.6

C. 11.2

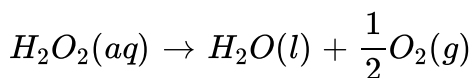
D. None of these

**Answer: B**



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8. The strength of  $H_2O_2$  is expressed in several ways like molarity, normality, % (w/V), volume strength, etc. The strength of "10 V" means 1 volume of  $H_2O_2$  on decomposition gives 10 volumes of oxygen at 1 atm and 273 K or 1 litre of  $H_2O_2$  gives 10 litre of  $O_2$  at 1 atm and 273 K. The decomposition of  $H_2O_2$  is shown as under :



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" =  $2 \times$  molarity of  $H_2O_2$  solution

40 g  $Ba(MnO_4)_2$  (mol.mass=375) sample containing some inert impurities in acidic medium completely reacts with 125 mL of "33.6 V" of  $H_2O_2$ . What is the percentage purity of the sample ?

A. 0.2812

B. 0.7031

C. 0.85

D. None of these

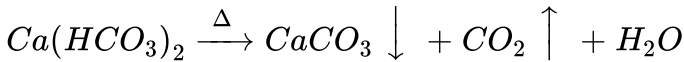
**Answer: B**



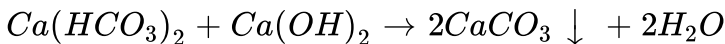
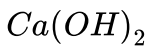
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9. A water is said to be soft water if it produces sufficient foam with the soap and water that does not produce foam with soap is known as hard water. Hardness has been classified into two types (i) Temporary hardness (ii) Permanent hardness.

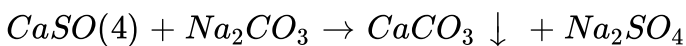
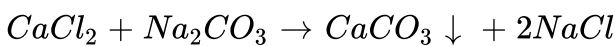
Temporary hardness is due to presence of calcium and magnesium bicarbonate. It is simply removed by boiling as



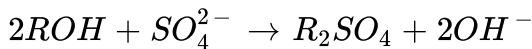
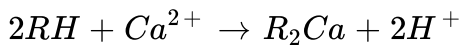
temporary hardness can also be removed by addition of slaked lime,



permanent hardness is due to presence of sulphates and chlorides of Ca, Mg, etc. It is removed by washing soda as



Permanent hardness also removed by ion exchange resin process as



The degree of hardness of water is measured in terms of PPM of  $CaCO_3$

100 PPM means 100 g of  $CaCO_3$  is present in  $10^6$  g of  $H_2O$ . If any other

water sample which contain 120 PPM of  $MgSO_4$ , hardness in terms of

$CaCO_3$  is equal to =100 PPM.

One litre of a sample of hard water ( $d=1$  g/mL) contains 136 mg of  $CaSO_4$

and 190 mg of  $MgCl_2$ . What is the total hardness of water in terms of

$CaCO_3$  ?

- A. 100 ppm
- B. 200 ppm
- C. 300 ppm
- D. None of these

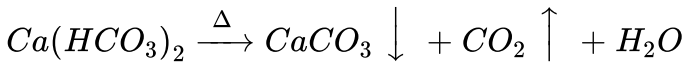
**Answer: C**



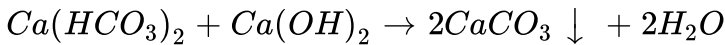
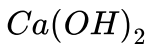
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**10.** A water is said to be soft water if it produces sufficient foam with the soap and water that does not produce foam with soap is known as hard water. Hardness has been classified into two types (i) Temporary hardness (ii) Permanent hardness.

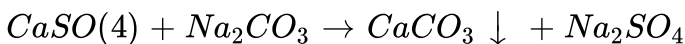
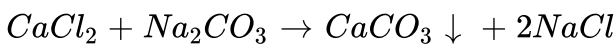
Temporary hardness is due to presence of calcium and magnesium bicarbonate. It is simply removed by boiling as



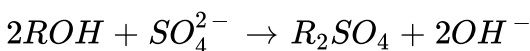
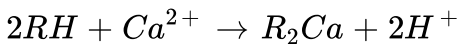
temporary hardness can also be removed by addition of slaked lime,



permanent hardness is due to presence of sulphates and chlorides of Ca, Mg, etc. It is removed by washing soda as



Permanent hardness also removed by ion exchange resin process as



The degree of hardness of water is measured in terms of PPM of  $CaCO_3$

100 PPM means 100 g of  $CaCO_3$  is present in  $10^6$  g of  $H_2O$ . If any other water sample which contain 120 PPM of  $MgSO_4$ , hardness in terms of  $CaCO_3$  is equal to =100 PPM.

What is the mass of  $Ca(OH)_2$  required for 10 litre of water remove temporary hardness of 100 PPM due to  $Ca(HCO_3)_2$  ?

A. 1.62 g

B. 0.74 g

C. 7.4 g

D. None of these

**Answer: B**

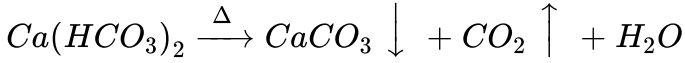


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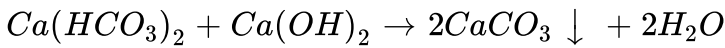
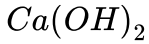
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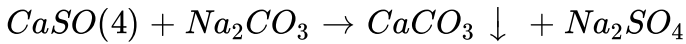
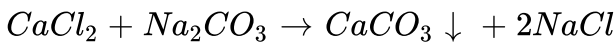
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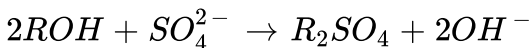
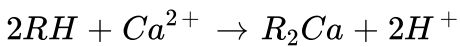
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100 PPM means 100 g of  $CaCO_3$  is present in  $10^6$  g of  $H_2O$ . If any other water sample which contain 120 PPM of  $MgSO_4$ , hardness in terms of  $CaCO_3$  is equal to =100 PPM.

A 200 g sample of hard water is passed through the column of cation

exchange resin, in which  $H^+$  is exchanged by  $Ca^{2+}$ . The outlet water of column required 50mL of 0.1 M NaOH for complete neutralization. What is the hardness of  $Ca^{2+}$  ion in PPM?

A. 250 ppm

B. 500 ppm

C. 750 ppm

D. 1000 ppm

**Answer: B**



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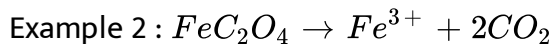
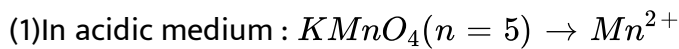
12. "Equivalent mass" = ("Molecular mass/Atomic mass" )/("n-factor")

n-factor is very important in redox as well as non-redox reactions. With the help of n-factor we can predict the molar ratio of the reactant species taking part in reactions. The reciprocal of n-factor's ratio of the reactions is the molar ratio of the reactants.

In general n-factor of acid/base is number of moles of  $H^+$  /  $OH^-$

furnished per mole of acid/base n-factor of a reactant is number of moles electrons lost or gained per mole of reactant.

Example 1:



Total number of moles  $e^-$  lost by 1 mole of  $FeC_2O_4$

$$= 1 + 1 \times 2 \Rightarrow 3$$

n-factor of  $Ba(MNO_4)_2$  in acidic medium is :

A. 2

B. 6

C. 10

D. None of these

**Answer: C**



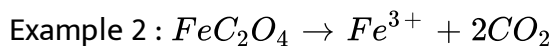
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13. "Equivalent mass" = ("Molecular mass/Atomic mass" )/("n-factor")

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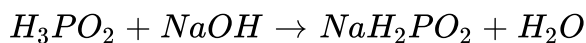
Example 1:



Total number of moles  $e^-$  lost by 1 mole of  $FeC_2O_4$

$$= 1 + 1 \times 2 \Rightarrow 3$$

Consider the following reaction.



What is the equivalent mass of  $H_3PO_2$  ? (mol. Wt. is M)

A. M

B.  $M/2$

C.  $M/3$

D. None of these

**Answer: A**



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14. "Equivalent mass" = ("Molecular mass/Atomic mass" )/("n-factor")

n-factor is very important in redox as well as non-redox reactions. With the help of n-factor we can predict the molar ratio of the reactant species taking part in reactions. The reciprocal of n-factor's ratio of the reactions is the molar ratio of the reactants.

In general n-factor of acid/base is number of moles of  $H^+$  /  $OH^-$  furnished per mole of acid/base n-factor of a reactant is number of moles electrons lost or gained per mole of reactant.

Example 1:

(1) In acidic medium :  $KMnO_4(n = 5) \rightarrow Mn^{2+}$

(2) In neutral medium :  $KMnO_4(n = 3) \rightarrow Mn^{2+}$

(3) In basic medium :  $KMnO_4(n = 1) \rightarrow Mn^{6+}$

Example 2 :  $FeC_2O_4 \rightarrow Fe^{3+} + 2CO_2$

Total number of moles  $e^-$  lost by 1 mole of  $FeC_2O_4$

$$= 1 + 1 \times 2 \Rightarrow 3$$

For the reaction,  $O(\text{molar mass} = M) \rightarrow Fe_2O_3$  what is the eq. mass of

$Fe_{0.95}O$  ?

A.  $\frac{M}{0.85}$

B.  $\frac{M}{0.95}$

C.  $\frac{M}{0.8075}$

D. None of these

**Answer: A**



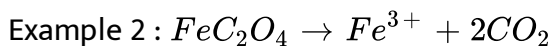
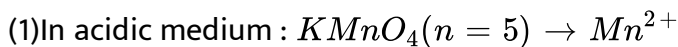
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15. "Equivalent mass" = ("Molecular mass/Atomic mass" )/("n-factor")

n-factor is very important in redox as well as non-redox reactions. With the help of n-factor we can predict the molar ratio of the reactant species taking part in reactions. The reciprocal of n-factor's ratio of the reactions is the molar ratio of the reactants.

In general n-factor of acid/base is number of moles of  $H^+$  /  $OH^-$  furnished per mole of acid/base n-factor of a reactant is number of moles electrons lost or gained per mole of reactant.

Example 1:



Total number of moles  $e^-$  lost by 1 mole of  $FeC_2O_4$

$$= 1 + 1 \times 2 \Rightarrow 3$$

In the reaction,  $xVO + yFe_2O_3 \rightarrow FeO + V_2O_5$  what is the value of x and y respectively?

B. 2,3

C. 3,2

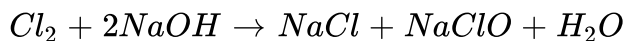
D. None of these

**Answer: B**



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**16.** Consider the following series of reactions :



How much  $Cl_2$  is required to prepare 122.5 g of  $NaClO_4$  by above sequential reactions ?

A. 284 g

B. 213 g

C. 142 g



D. 71 g

**Answer: A**



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17. Consider the following series of reactions :



How many moles of NaCl will be formed by using 1 mole  $Cl_2$  and other reagents in excess ?

A.  $\frac{1}{12}$  mole

B. 1.67 mole

C. 1.75 mole

D. 0.75 mole

**Answer: C**



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18. Consider the following series of reactions :



How many moles of  $\text{NaClO}_3$  obtained after the completion of reaction by taking 1 mole of  $\text{Cl}_2$  and other reagents in excess ?

A.  $\frac{1}{3}$  mole

B. Zero

C.  $\frac{1}{4}$  mole

D. 1 mole

**Answer: B**



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1. 1 g of nitrogen represents :

- A.  $6.02 \times 10^{23} N_2$  molecules
- B. 22.4 litre of  $N_2$  at 1 atm and 273 K
- C. 11.2 litre of  $N_2$  at 1 atm and 273 K
- D. 14 g of nitrogen

Answer: C::D



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2. 1 g molecule of  $V_2O_5$  contains :

- A. 5 mole of oxygen atom
- B. 2 mole of V atom
- C. 1 mole of oxygen atom

D. 2.5 mole of oxygen atom

**Answer: A::B**



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3. Select the dimensionless quantity (ies) :

A. vapour density

B. molality

C. specific gravity

D. mass fraction

**Answer: A::C::D**



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4. Which of the following concentration terms is/are affected by a change in temperature ?

- A. Molarity
- B. Molality
- C. Normality
- D. Specific gravity

**Answer: A::C::D**



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5. Which of the following statements regarding the compound  $A_xB_y$  is /are correct?

- A. 1 mole of  $A_xB_y$  contains 1 mole of A and 1 mole B
- B. 1 equivalent of  $A_xB_y$  contains 1 equivalent of A and 1 equivalent of

B

C. 1 mole of  $A_xB_y$  contains x moles of A and y moles of B

D. equivalent mass of  $A_xB_y$  = equivalent mass of A + equivalent mass of

B

**Answer: B::C::D**

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6. 1 mole of  $Ba(OH)_2$  will exactly neutralize :

A. 0.5 mole HCL

B. 1 mole of  $H_2SO_4$

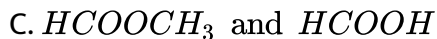
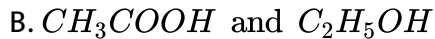
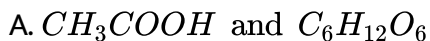
C. 1 mole of  $H_3PO_3$

D. 2 mole of  $H_3PO_2$

**Answer: B::C::D**

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7. The pair of species having different percentage (mass) of carbon is :



**Answer: B::D**

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8.  $30\text{mL}$  of  $CH_3OH$  ( $d = 0.8\text{g}/\text{cm}^3$ ) is mixed with  $60\text{mL}$  of  $C_2H_5OH$  ( $d = 0.92\text{g}/\text{cm}^3$ ) at  $25^\circ\text{C}$  to form a solution of density  $0.88\text{g}/\text{cm}^3$ . Select the correct option(s) :

A. Molarity and molality of resulting solution are 6.33 and 13.59 respectively

B. The mole fraction of solute and molality are 0.385 and 13.59 respectively

C. Molarity and % change in volume are 0.615 and zero respectively

D. Mole fraction of solvent and molality are 0.615 and 13.59 respectively

**Answer: B::C**

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9. Which of the following is/are incorrect for 17 g/L of  $H_2O_2$  solution ?

A. Volume strengths is 5.6 at 273 K and 1 atm

B. Molarity of solution is 0.5 M

C. 1 mL of thios solution gives 2.8 mL  $O_2$  at 273 K and 2 atm

D. The normality of solution is 2 N

**Answer: A::B::C**





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10. Solutions containing 23 g  $\text{HCOOH}$  is/are :

A. 46g of 70 %  $\left(\frac{w}{V}\right) \text{HCOOH}$  ( $d_{\text{solution}} = 1.40\text{g/mL}$ )

B. 50g of 10 M  $\text{HCOOH}$  ( $d_{\text{solution}} = 1\text{g/mL}$ )

C. 50g of 25 %  $\left(\frac{w}{w}\right) \text{HCOOH}$

D. 46 g " of 5 M "  $\text{HCOOH}$  ( $d_{\text{solution}} = 1\text{g/mL}$ )

Answer: A:B



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11. A sample of  $\text{H}_2\text{O}_2$  solution labelled as "28 volume" has density of 265 g/L. Mark the correct option(s) representing concentration of same solution in other units :

A.  $M_{\text{H}_2\text{O}_2} = 2.5$

B.  $\% \frac{w}{V} = 17$

C. Mole fraction of  $H_2O_2 = 0.2$

D.  $m_{H_2O_2} = 13.88$

**Answer: A::C::D**

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12. A mixture of 100ml of  $CO$ ,  $CO_2$  and  $O_2$  was sparked. When the resulting gaseous mixture was passed through  $KOH$  solution, contraction in volume was found to be 80ml, the composition of initial mixture may be (in the same order)

A. 30 mL, 60mL, 10mL

B. 30 mL, 50mL, 20mL

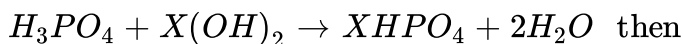
C. 50 mL, 30mL, 20mL

D. 20 mL, 70 mL, 10 mL

Answer: A::B

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13. If 1 mole of  $H_3PO_4$  reacts with 1 mole of  $X(OH)_2$  as shown below :



A. the equivalent mass of base is  $\frac{\text{mol. mass}}{2}$

B. the eq. mass of  $H_3PO_4$  is  $\frac{98}{3}$

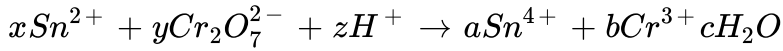
C. the resulting solution requires 1 mole NaOH for complete neutralization

D. minimum 1 mole of  $X(OH)_2$  is required for complete neutralization of  $XHPO_4$

Answer: A::C

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14. In acidic medium dichromate ion oxidizes stannous ion as :



A. "the value of x:y is " 1:3

B. the value of x+y+z is 18

C. a:b " is " 3:2

D. the value of z-c is 7

**Answer: B::C::D**



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15. When a equimolar mixture of  $\text{Cu}_2\text{S}$  and  $\text{CuS}$  is titrated with  $\text{Ba}(\text{MnO}_4)_2$  in acidic medium, the final products contain  $\text{Cu}^{2+}$ ,  $\text{SO}_2$  and  $\text{Mn}^{2+}$ . If the mol. Mass of  $\text{Cu}_2\text{S}$ , and  $\text{Ba}(\text{MnO}_4)_2$  are  $M_1$ ,  $M_2$  and  $M_3$  respectively then :

A. eq. mass of  $\text{Cu}_2\text{S}$  is  $\frac{M_1}{8}$

B. eq. mass of  $\text{CuS}$  is  $\frac{M_2}{6}$

C. eq. mass of  $Ba(MnO_4)_2$  is  $\frac{M_3}{5}$

D.  $Cu_2$  and  $CuS$  both have same equivalents in mixture

**Answer: A::B**

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**16. Which is/are INCORRECT statement ?**

A. Equivalent mass of  $H_2PO_3^-$  is 40.5.

B. Eq. mass of  $H_2PO_4^-$  may be equal to molar mass or less than molar mass because it depends on the reaction.

C.  $KMnO_4$  has maximum eq. mass in acidic medium.

D. Oxidation state of H in  $MgH_2$  is greater than in  $H_2O_2$ .

**Answer: A::C::D**

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### 1. Match the following Column-I to Column-II

#### Column-I

- (A) 0.5 mole of  $\text{SO}_2(\text{g})$
- (B) 1 g of  $\text{H}_2(\text{g})$
- (C) 0.5 mole of  $\text{O}_3(\text{g})$
- (D) 1 g molecule of  $\text{O}_2(\text{g})$

#### Column-II

- (P) Occupy 11.2 L at 1 atm and 273 K
- (Q) Weighs 24 g
- (R) Total no. of atoms =  $1.5 \times N_A$
- (S) Weighs 32 g



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#### Column-I

- (A) 44 g  $\text{CO}_2$  gas
- (B) 35.2 g of  $\text{CH}_4$
- (C) 48 g of  $\text{O}_3$  gas
- (D) 44 g of  $\text{N}_2\text{O}$  gas

#### Column-II

- (P) 1g molecule
- (Q)  $N_A$  molecule
- (R)  $22 N_A$  electrons
- (S) 49.28 L at 1 atm and 273 K
- (T)  $N_A$  atoms of oxygen

2.



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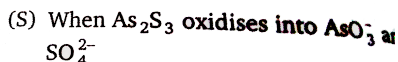
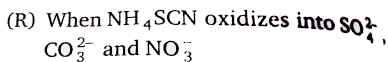
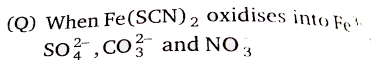
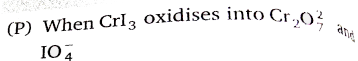
**Column-I**

$$(A) \text{ Eq. mass} = \frac{\text{Molecular mass}}{33}$$

$$(B) \text{ Eq. mass} = \frac{\text{Molecular mass}}{27}$$

$$(C) \text{ Eq. mass} = \frac{\text{Molecular mass}}{28}$$

$$(D) \text{ Eq. mass} = \frac{\text{Molecular mass}}{24}$$

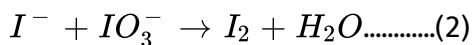
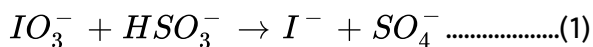
**Column-II**

3.



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4. A sample of raw material contain  $\text{NaNO}_3$ . It contains some  $\text{NaIO}_3$  also. The  $\text{NaIO}_3$  can be used as a source of iodine, produced in the following reactions:



One litre of sample solution containing 396 g  $\text{NaIO}_3$  is treated with stoichiometric quantity of  $\text{NaHSO}_3$ . Now a substantial amount of

solution is added to reaction mixture to bring about the reaction (2).

**Column-I**

**Column-II**

- |  |         |
|--|---------|
| (A) $n$ -factor of $\text{IO}_3^-$ in reaction (2)           | (P) 6   |
| (B) Number of moles of $\text{HSO}_3^-$ used in reaction (1) | (Q) 1.2 |
| (C) Moles of $\text{I}_2$ produced                           | (R) 2   |
| (D) Equivalents of $\text{IO}_3^-$ used in reaction (2)      | (S) 5   |

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**Column-I**

**Column-II (Type of Redox Reaction)**

- |  |                    |
|--|--------------------|
| (A) $\text{Br}_2 + \text{OH}^- \rightarrow \text{BrO}_3^- + \text{Br}^-$                   | (P) Intermolecular |
| (B) $\text{FeCl}_2 + \text{KMnO}_4 + \text{HCl} \rightarrow \text{MnCl}_2 + \text{FeCl}_3$ | (Q) Intramolecular |
| (C) $\text{Ag}_2\text{O} \rightarrow \text{Ag} + \frac{1}{2}\text{O}_2$                    | (R) Disproportion  |
| (D) $\text{NH}_4\text{NO}_3 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$           | (S) Comproportion  |

5.

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## Level 3 - Assertion - Reason Type Questions

1. STATEMENTS-1 : Specific gravity is dimensionless.

STATEMENTS-2 : Specific gravity is density of a substance measured w.r.t.



density of water at  $4^{\circ}C$ .

- A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1
- B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
- C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
- D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: A**

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2. STATEMENT-1: Molarity of pure water is 55.55 M at 298K.

STATEMENT-2 : Molarity is temperature dependent.

- A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1

- B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
- C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
- D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: B**

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3. STATEMENT-1: Gram molecular mass of  $O_2$  is 32.

STATEMENT-2: Relative atomic mass of oxygen is 32 a.m.u.

- A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1
- B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
- C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: C**

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4. STATEMENT-1: The oxidation state of S in  $H_2S_2O_8$  is 6.

STATEMENT-2: Maximum oxidation state of A is 6 because the maximum oxidation state of an element is equal to number of its valence electrons in it.

A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: A**

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5. STATEMENT-1:  $0.1M H_3PO_3(aq)$  solution has normality equal to 0.3 N when completely reacted with NaOH.

STATEMENT-2 :  $H_3PO_3$  is a dibasic acid.

- A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1
- B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
- C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
- D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: D**

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6. STATEMENT-1 :  $MnO_2$  can act as an oxidizing agent as well as reducing agent.

STATEMENT-2 : Oxidation state of  $MnO_2$  lies between highest and lowest oxidation state.

- A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1
- B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
- C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
- D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: A**



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7. STATEMENT-1 : Equivalent volume of  $H_2$  is 11.2 L at 1 atm and 273 K.

STATEMENT-2 :  $1/2$  mole  $H_2$  has produced when 1 mole of  $H^+$  (aq) accepted 1 mole of  $e^-$ .

- A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1
- B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
- C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
- D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: A**



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8. STATEMENT-1 : For the reaction in titration  $Na_2CO_3 + HCL \rightarrow NaCl + NaHCO_3$ , the suitable indicator is

phenolphthalein.

STATEMENT-2 : Phenolphthalein provide its colour in acidic medium.

- A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1
- B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
- C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
- D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: C**

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9. STATEMENT-1 :  $[Fe(CN)_6]^{4-} \rightarrow Fe^{3+} + CO_2 + NO_3^-$ , the equivalent mass of reactant is 3.74.

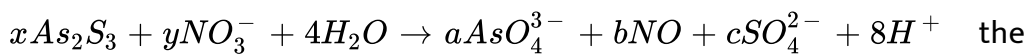
STATEMENT-2 : "Equivalent mass of reactant" = ("Mol.mass")/(61).

- A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1
- B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
- C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
- D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: D**

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**10. STATEMENT-1 :** In the balanced redox reaction,



n-factor of  $As_2S_3$  and  $NO_3^-$  is 28 and 3 respectively.

Statement-2 : Molar ratio is reciprocal of n-factor's ratio so  $x : t$  is 3 : 28.

- A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1



B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: A**

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11. STATEMENT-1 : In the given reaction,  
 $NaOH + H_3PO_4 \rightarrow NaH_2PO_4 + H_2O$  equivalent mass of  $H_3PO_4$  is  
 $M/3$

STATEMENT-2 :  $H_3PO_4$  is tribasic acid.

A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1

B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

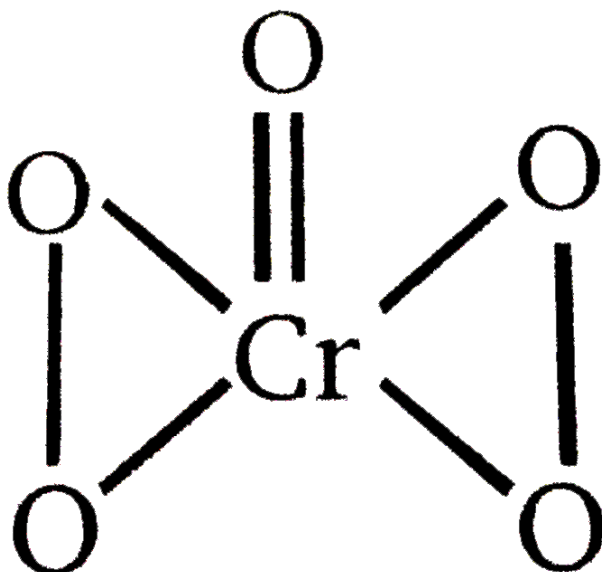
D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: D

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12. STATEMENT-1: In  $CrO_5$  oxidation number of Cr is +6.

STATEMENT-2 :  $CrO_5$  has butterfly structure in which peroxide peroxide bonds are present.



- A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1
- B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
- C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
- D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: A**

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13. STATEMENT-1 :  $I_2 \rightarrow IO_3^- + I^-$ , is example of a disproportionation reaction.

STATEMENT-2 : Oxidation number of I can vary from  $-1$  to  $+7$ .

- A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1

- B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
- C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
- D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: B**

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**14.** Assertion: Fluorine exists only in  $-1$  oxidation state.

Reason: Fluorine has  $2s^2 2p^5$  configuration.

- A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1
- B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
- C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: B**

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15. STATEMENT-1 :  $H_2SO_4$  can not act as reducing agent.

STATEMENT-2 : Sulphur can not increase its oxidation number beyond +6.

- A. If both the statement are TRUE and STATEMENT -2 is the correct explanation of STATEMENT-1
- B. If both the statement are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1
- C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE
- D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

**Answer: A**

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### Level 3 - Subjective Problems

1. What volume of a liquid (in L) will contain 10 mole ? If molar mass of liquid is 280 and its density is 1.4 g/mL.

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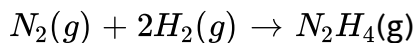
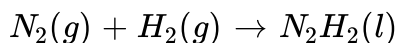
2. 16 g of  $SO_x$  gas occupies 5.6 L at 1 atm and 273 K. What will be the value of x ?

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3. 200 mL of 1 M HCl, is mixed with 300 mL of 6 M and the final solution is diluted to 1000 mL. Calculate molar concentration of  $[H^+]$  ion .

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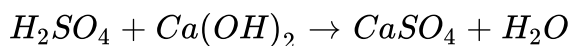
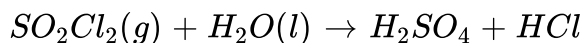
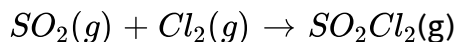
4.  $N_2(g)$  reacts with  $H_2(g)$  in either of the following ways depending upon supply of  $H_2(g)$  :



If 5 L  $N_2(g)$  and 3 L  $H_2(g)$  are taken initially (at same temperature and pressure), calculate the contraction in volume after the reaction (in L).

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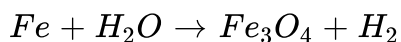
5. One commercial system removes  $SO_2$  emission from smoke at  $95(^\circ)C$  by the following set of reaction :



How many grams of  $CaSO_4$  may be produced from 3.78 g of  $SO_2$  ?

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6. W is the mass of iron (in g) which will be converted into  $Fe_3O_4$  by the action of 18 g of steam on it . What is the value of W/7 ?



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7. Calculate the total moles of atoms of each element present in 122.5 g of  $KClO_3$

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8. On dissolving 2.0 g of metal in sulphuric acid ,4.51 g of the metal sulphate was formed . The specific heat of the metal is  $0.057 \text{ cal } g^{-1} . ^\circ C^{-1}$ . What is the valency of metal ?

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9. One gram of a metallic chloride was found to contain 0.835 g of chlorine. Its vapour density is 85.5. If its molecular formula is  $M_xCl_y$ , then what is the value of  $(x+y)$  ?

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10. 0.7875 g of crystalline barium hydroxide is dissolved in water. For the neutralization of this solution 20 mL of  $N/4$   $HNO_3$  is required. How many moles of water of crystallization are present in one mole of this base ?  
(Given : Atomic mass Ba=137, O=16, N=14, H=1)

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11. 2.0 g of polybasic organic acid (Molecular mass = 600) required 100 mL of a  $\frac{M}{6}$  NaOH solution for complete neutralisation. Find the basicity of acid.

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12. A mixture contains 1.0 mole each of  $\text{NaOH}$ ,  $\text{Na}_2\text{CO}_3$  and  $\text{NaHCO}_3$ . When half of mixture is titrated with  $\text{HCl}$ , it required  $x$  mole of  $\text{HCl}$  in presence of phenolphthalein. In another experiment, half of mixture required  $y$  mole of same  $\text{HCl}$  in presence of methyl orange. Find the value of  $(x+y)$ .

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13. When  $\text{BrO}_3^-$  ion reacts with  $\text{Br}^-$  ion in acidic medium,  $\text{Br}_2$  is liberated. Calculate the ratio of molecular mass and equivalent mass of  $\text{KBrO}_3$

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14. A volume of 12.5 mL of 0.05 M  $\text{SeO}_2$  reacts with 25 mL of 0.1 M  $\text{CrSO}_4$  which is oxidised to  $\text{Cr}^{3+}$ . To what oxidation state was the selenium converted by the reaction ?

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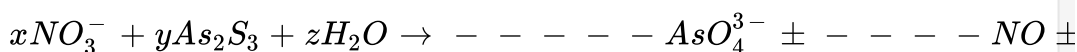
15. A 0.276 g impure sample of copper ore is dissolved and  $Cu^{2+}$  is titrated with KI solution.  $I_2$  liberated required 40 mL of 0.1 M  $Na_2 S_2 O_3$  solution for titration. What is the % of impurities in the ore ?

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16. A sample of 28 mL of  $H_2 O_2$  (aq) solution required 10 mL of 0.1 M  $KMnO_4$  (aq) solution for complete reaction in acidic medium. What is the volume strength of  $H_2O_2$  ? X

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17. For the redox reaction given, what is the value of  $\frac{x}{z}$  ?



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18. On heating 0.220 g of a metallic oxide in presence of hydrogen, 0.045 g of water is formed. If the equivalent mass of the metal is E, then what is the value of  $E/9$

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19. 10 g mixture of  $K_2Cr(2)O_7$  and  $KMnO_4$  was treated with excess of KI in acidic medium. Iodine liberated  $100\text{cm}^3$  of 2.2 N sodium thiosulphate solution for titration. If the mass percent of  $KMnO_4$  in the mixture Z, then what is the value of  $2Z/5$  ?

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20. In an ore, the only oxidizable material is  $Sn^{2+}$ . This ore is titrated with a dichromate solution containing 2.5g of  $K_2Cr_2O_7$  in 0.5 litre. A 0.40g sample of the ore required  $10.0\text{cm}^3$  of titrant to reach equivalence point. Calculate the percentage of tin in ore.



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