# Miscellaneous Exercise Question Bank

**1.** When the propane is burned in air, carbon dioxide and water are formed. If 0.15 mol of $CO_2$ is produced, how many drops of water will be formed, assuming one drop is 0.05 $cm^3$ and contains $1.70 \times 10^{21}$ water molecules?

**(A)** $1.2 \times 10^{23}$ **(B)** 4 **(C)** 53 **(D)** 70

**2.** An aqueous ammonium sulphate solution containing 50 moles of solute reacts with excess of calcium hydroxide. How many litres of a solution (specific gravity 0.85) containing 20% by mass of ammonia can be prepared using this reaction?

**(A)** 10.0 L **(B)** 8.5 L **(C)** 20.0 L **(D)** 17.0 L

**3.** Specialized cells in the stomach release HCl to aid digestion. If they release too much, the excess can be neutralized by antacid tablets. Which of the following should be more effective active ingredient of antacid tablets?

**(A)** $Mg(OH)_2$ **(B)** $Al(OH)_3$ **(C)** $Ca(OH)_2$ **(D)** $H_2SO_4$

**4.** If 0.250 g of an element, M, reacts with excess fluorine to produce 0.547 g of the hexafluoride, $MF_6$, the element should be (Cr = 52, Mo = 95.94, S = 32, Te = 127.6, F = 19)

**(A)** Cr **(B)** Mo **(C)** S **(D)** Te

**5.** Fluorine reacts with uranium to form uranium hexafluoride, $UF_6$, as represented by this equation;

$U(s) + 3F_2(g) \longrightarrow UF_6$

How many fluorine molecules are required to produce 2.0 mg of uranium hexafluoride, $UF_6$, from an excess of uranium? The molar mass of $UF_6$ is 352.0 g $mol^{-1}$.

**(A)** $5.13 \times 10^{18}$ **(B)** $1.026 \times 10^{19}$ **(C)** $2.052 \times 10^{19}$ **(D)** $1.026 \times 10^{20}$

**6.** What is the total mass of the products formed, when 51 g of $H_2S$ is oxidized by oxygen to produce water and sulphur dioxide?

**(A)** 72 g **(B)** 27 g **(C)** 123 g **(D)** 96 g

**7.** Diborane tetrachloride was treated with excess of NaOH and the following reaction occurred:

$B_2Cl_4 + NaOH \longrightarrow NaBO_2 + H_2O + H_2 + NaCl$

If 1362 mL of hydrogen gas is formed at STP, how much $B_2Cl_4$ was consumed?

**(A)** 9.97 g **(B)** 9.84 g **(C)** 0.0968 g **(D)** 23.57 g

**8.** What total volume, in litre at 727°C and 1 atm, could be formed by the decomposition of 16 g of $NH_4NO_3$ ?

Reaction: $2NH_4NO_3 \longrightarrow 2N_2(g) + O_2(g) + 4H_2O(g)$.

**(A)** 57.471 L **(B)** 114.94 L **(C)** 41.781 L **(D)** 24.631 L

**9.** A compound of iron and chlorine is soluble in water. An excess of silver nitrate was added to precipitate all chloride ions as silver chloride. If a 127 mg sample of the compound gave 287 mg AgCl, what is the formula of the compound? (Fe = 56, Ag = 108)

**(A)** $FeCl_2$ **(B)** $FeCl_3$ **(C)** $Fe_2Cl_6$ **(D)** None of these

**10.** From the following reactions:

$2CoF_2 + F_2 \longrightarrow 2CoF_3$

$(CH_2)_n + 4n\ CoF_3 \longrightarrow (CF_2)_n + 2n\ HF + 4n\ CoF_2$

Calculate how much $F_2$ will be consumed to produce 1 kg of $(CF_2)n$. (F = 19)

**(A)** 1.52 Kg **(B)** 2.04 kg **(C)** 0.76 kg **(D)** 4.56 kg

**11.** An element 'A' reacts with the compound $BO_3$ to produce $A_3O_4$ and $B_2O_3$. The number of moles of $A_3O_4$ produced if 1 mole each of A and $BO_3$ are allowed to react, is:

**(A)** 3 **(B)** 1 **(C)** 1/3 **(D)** 2/3

**12.** A 1.50 g sample of type metal (an alloy of Sn, Pb, Cu and Sb) is dissolved in nitric acid, metatannic acid, $H_2SnO_3$, precipitates. This is dehydrated by heating to tin (IV) oxide, which is found to weight 0.50 g. What percentage of tin was in the original type metal sample? (Sn = 119)

**(A)** 33.33% **(B)** 26.27% **(C)** 29.38% **(D)** 52.54%

**13.** An amount of 5 moles of A, 6 moles of B and excess amount of C are mixed to produce a final product D, according to the reactions:

$A + 2B \longrightarrow I$

$I + C \longrightarrow B + D$

What is the maximum moles of D, which can be produced assuming that the products formed can also be reused in the reaction?

**(A)** 3 moles **(B)** 4.5 moles **(C)** 5 moles **(D)** 6 moles

**14.** Hydrogen cyanide, HCN, can be made by a two step process. First, ammonia is reacted with $O_2$ to give nitric oxide, NO.

$4NH_3(g) + 5O_2(g) \longrightarrow 4NO(g) + 6H_2O(g)$

Then nitric oxide is reacted with methane, $CH_4$.

$2NO(g) + 2CH_4(g) \longrightarrow 2HCN(g) + 2H_2O(g) + H_2(g)$

When 25.5 g of ammonia and 32.0 g of methane are used, how many grams of hydrogen cyanide can be produced?

**(A)** 1.5 **(B)** 2.0 **(C)** 40.5 **(D)** 54.0

**15.** To determine soluble (free) $SiO_2$ in a rock, an alkaline extraction was carried out, as a result of which there was found 1.52% of $SiO_2$ in the extract and also 1.02% of $Al_2O_3$. Considering that, apart the free $SiO_2$, the extract also contained the $SiO_2$ that had passed into it from kaolin ($2SiO_2 . Al_2O_3$) the percentage of free $SiO_2$ in the rock being analysed is (Si = 28, Al = 27)

**(A)** 1.27 **(B)** 0.32 **(C)** 0.50 **(D)** 1.52

**16.** A sample of iron oxide has FeO and $Fe_2O_3$ in the mole ratio 2 :1. It is partially oxidized to change this ratio to 1 : 2. the number of moles of FeO oxidized per mole of initial mixture is:

**(A)** 0.2 **(B)** 0.333 **(C)** 0.4 **(D)** 0.5

**17.** When x g carbon is burnt with y g oxygen in a closed vessel, no residue is left behind. Which of the following statement is correct regarding the relative amounts of oxygen and carbon?

**(A)** y/x must be less than 1.33 **(B)** y/x must be greater than 1.33

**(C)** y/x must be greater than 2.67 **(D)** y/x must lie between 1.33 and 2.00

**18.** An amount of 1 mole of calcium cyanamide ($CaCN_2$) and 1 mole of water allowed to react. The number of moles of ammonia produced is: (Hint: $CaCN_2 + 3H_2O \longrightarrow CaCO_3 + 2NH_3$)

**(A)** 3.0 **(B)** 2.0 **(C)** 1.0 **(D)** 0.67

**19.** An amount of 1 mole of $N_2$ and 4 moles of $H_2$ are allowed to react in a vessel and after reaction, water is added. Aqueous solution required 1 mole of HCl for complete neutralization. Mole fraction of $H_2$ in the gas mixture after neutralization reaction is:

**(A)** 1/6 **(B)** 5/6 **(C)** 1/3 **(D)** 2/3

**20.** A quantity of 5.08 g of iodine held in suspension in water is slowly acted upon by 460 mL of $H_2S$ measured at 0°C and 1 atm. What weight of sulphur will be liberated? (I = 127)

**(A)** 0.64 g **(B)** 0.457 g **(C)** 1.297 g **(D)** 0.017 g

**21.** A quantity of 27.6 g of $K_2CO_3$ was treated by a series of reagents so as to convert all of its carbon to $K_2Zn_3[Fe(CN)_6]_2$. The mass of the product formed is (K = 39, Zn = 65.4, Fe = 56)

**(A)** 139.2 g **(B)** 11.6 g **(C)** 69.6 g **(D)** 23.2 g

**22.** Cyclohexanol ($C_6H_{12}O$) is dehydrated to cyclohexene ($C_6H_{10}$) on heating with conc. $H_2SO_4$. If the yield of this reaction is 75%, how much cyclohexene will be obtained from 100 g of cyclohexanol?

**(A)** 61.5 g **(B)** 82 g **(C)** 109.3 g **(D)** 75 g

**23.** A sample of pure Cu (4.00 g) is heated in a stream of oxygen for some time, gains in weight with the formation of black oxide of copper (CuO). The final mass is 4.90 g. What percent of copper remains unoxidized? (Cu = 64)

**(A)** 90% **(B)** 10% **(C)** 20% **(D)** 80%

**24.** If the yield of $CHCl_{3(g)}$ obtainable from reaction of $CH_{4(g)}$ and $Cl_{2(g)}$ is 75%, what mass of $CH_{4(g)}$ would required to produce 30 g of $CHCl_{3(g)}$.

**(A)** 5.36g **(B)** 8.87g **(C)** 12.34g **(D)** 7.57g

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

(A) 104.4 kg (B) 105.4 kg (C) 212.8 kg (D) 106.4 kg

**26.** A 12 g sample of $CH_4$ and $C_2H_4$ yielded 35.2 g of $CO_2$ on complete oxidation. What was the mean molar mass of the original sample?

**(A)** 20.0 **(B)** 22.0 **(C)** 14.7 **(D)** 23.0

**27.** For a hydrocarbon, the ratio of volume of $O_2$ used for complete combustion and the volume of $CO_2$ formed is independent to the number of carbon atoms present in the hydrocarbon. The hydrocarbon may be:

**(A)** Alkane **(B)** Alkene **(C)** Alkyne **(D)** Arene

**28.** A mixture is made of equal volume of CO and air. A spark is passed through so that all the oxygen is converted to carbon dioxide. What will be fractional decrease in the total volume of system assuming pressure and temperature remain constant? Air contains 20% oxygen by volume.

**(A)** 0.1 **(B)** 0.2 **(C)** 0.15 **(D)** 0.3

**29.** $\begin{matrix}COOH\\|\\COOH\end{matrix} \xrightarrow[H_2SO_4]{Conc.} CO_{(g)} + CO_{2(g)}$

If yield of the reaction is 80% then find pressure of the gases created by dehydration of 5 moles of the oxalic acid at 300 K inside a chamber of volume 10 L.

**(A)** 24.6 atm **(B)** 20.86 atm **(C)** 19.68 atm **(D)** 18.93 atm

**30.** In which of the following reaction the % yield of the solid product obtained will be maximum (in terms of mass of the solid product obtained per gram of the solid reactants).

**(A)** $CaCO_{3(g)} \longrightarrow CaO_{(s)} + CO_{2(g)}$

**(B)** $CaSO_4 \cdot 2H_2O_{(s)} \longrightarrow CaSO_4 \cdot \frac{1}{2}H_2O_{(s)} + \frac{3}{2}H_2O_{(g)}$

**(C)** $CaCl_2 \cdot 6H_2O_{(s)} \longrightarrow CaCl_{2(s)} + 6H_2O_{(g)}$

**(D)** $NaNO_{3(s)} \longrightarrow NaNO_{2(s)} + \frac{1}{2}O_{2(g)}$

**31.** A human patient suffering from a duodenal ulcer may show a concentration of HCl of $80 \times 10^{-3}$ molar in gastric juice. If his stomach receives 3 liter of gastric juice per day, how much medicine (antacid syrup) containing 2.6 g of $Al(OH)_3$ per 100 mL must be used every day to neutralize the acid?

**(A)** 27 mL **(B)** 80 mL **(C)** 240 mL **(D)** 120 mL

**32.** 100 mL of $H_2SO_4$ solution having molarity 1 M and density 1.5 g/mL is mixed with 400 mL of water. Calculate final molarity of $H_2SO_4$ solution, if final density is 1.25 g/mL :

**(A)** 4.4 M **(B)** 0.145 M **(C)** 0.52 M **(D)** 0.227 M

**33.** A quantity of 23.6 g of succinic acid $(HOOC - CH_2CH_2 - COOH)$ is dissolved in 500 mL of 0.1 M acetic acid $(CH_3COOH)$ solution. Assuming that neither acid is dissociated in solution, calculate the molarity of '–COOH' in the solution.

**(A)** 0.3 M **(B)** 0.5 M **(C)** 0.9 M **(D)** 0.8 M

**34.** Chlorofluorocarbons such as $CCl_3F$ (M = 137.5) and $CCl_2F_2$ (M = 121) have been linked to ozone depletion in Antarctica. As of 2004, these gases were found to 275 and 605 parts per trillion ($10^{12}$), by volume. What are the concentrations of these gases under conditions typical of Antarctica stratosphere (200 K and 0.08 atm)? (R = 0.08 L – atm/K- mol)

**(A)** $[CCl_3F] = 1.375 \times 10^{-12} mol\ L^{-1}, [CCl_2F_2] = 3.025 \times 10^{-12}\ mol\ L^{-1}$

**(B)** $[CCl_3F] = 2.75 \times 10^{-14}\ mol\ L^{-1}, [CCl_2F_2] = 6.05 \times 10^{-14}\ mol\ L^{-1}$

**(C)** $[CCl_3F] = 2.75 \times 10^{-10}\ mol\ L^{-1}, [CCl_2F_2] = 6.05 \times 10^{-10}\ mol\ L^{-1}$

**(D)** $[CCl_3F] = 1.375 \times 10^{-13}\ mol\ L^{-1} m\ [CCl_2F_2] = 3.025 \times 10^{-12}\ mol\ L^{-1}$

**35.** A quantity of 1 L of 1 M glucose solution is diluted to 5 L. The molarity of the diluted solution should be:

**(A)** 0.2 M **(B)** 0.02 M **(C)** 0.207 M **(D)** 0.175 M

**36.** Liquid HF vapourises at 23°C and 1 atm pressure to given vapours of discrete as well as associated HF molecules. What would be the composition of the vapours if the vapour density achieved is 25.

**(A)** $HF_{(g)}$ and $(HF)_{2(g)}$ **(B)** $(HF)_{3(g)}$ and $(HF)_{4(g)}$

**(C)** $(HF)_{2(g)}$ and $(HF)_{3(g)}$ **(D)** HF only

**37.** A mixture of $NH_4NO_3$ and $(NH_4)_2HPO_4$ contain 30.40 mass percent 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

**38.** What volume of 75% alcohol by mass $(d = 0.80 g / cm^3)$ must be used to prepare $150 cm^3$ of 30% alcohol by mass $(d = 0.90 g / cm^3)$ ?

**(A)** 67.5 mL **(B)** 56.25 mL **(C)** 44.44 mL **(D)** None of these

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

**(A)** 2x **(B)** y **(C)** x/2 **(D)** (y – x)

**40.** 0.1 g of a solution containing $Na_2CO_3$ and $NaHCO_3$ requires 10 mL of 0.01N 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

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

**(A)** 2 : 1 **(B)** 1 : 2 **(C)** 4 : 1 **(D)** 1 : 4

**42.** 1 L of 9.8% $H_2SO_4$ solution is mixed with 2L of 4.9 % $H_2SO_4$ solution having density 1.1 g/ml. The molarity of $H_2SO_4$ in the resulting solution is :

**(A)** 1 M **(B)** 0.65 M **(C)** 0.49 M **(D)** 0.70 M

**43.** 1L of pond water contains 20 mg of $Ca^{2+}$ and 12 mg of $Mg^{2+}$ ions. What is the volume of a 2N $Na_2CO_3$ solution required to soften 5000 L of pond water?

**(A)** 500 L **(B)** 50 L **(C)** 5 L **(D)** None of these

**44.** Certain organic compound consist of only C, H and O atoms. The number of C atoms in the compound is 70% to that of number of H atoms and number of H atoms is 15 times of number of oxygen atoms. If molecular formula of the compound is same to its empirical formula, then molecular mass of the compound is :

**(A)** 342 **(B)** 314 **(C)** 324 **(D)** 334

**45.** Select correct statement.

**(A)** Dalton's law of partial pressure is valid only for a mixture of reacting gases

**(B)** Avogadro's number was given by Avogadro to assign a numerical value to 1 mole quantity of a matter

**(C)** A sample of water having 1000 ppb of HCl have 1000 ppb of $H^+$ ions

**(D)** 1 molal $H_2SO_4$ solution having density 1.5 g/ml is more concentrated than 1 M $H_2SO_4$ solution

***46.** A quantity of 0.22 g of a gas occupies a volume of 112 mL at pressure of 1 atm and temperature of 273 K. The gas may be:

**(A)** Nitrogen dioxide **(B)** Nitrous oxide **(C)** Carbon dioxide **(D)** propane

***47.** The number of hydrogen atoms in 0.9 g glucose $C_6H_{12}O_6$, is same as

**(A)** 0.48 g hydrazine, $N_2H_4$ **(B)** 0.17 g ammonia, $NH_3$

**(C)** 0.30 g ethane, $C_2H_6$ **(D)** 0.03 g hydrogen, $H_2$

***48.** Which of the following statements(s) is/are correct for water?

**(A)** H and O are in 2 : 1 atomic ratio

**(B)** H and O are in 2 ; 1 mass ratio

**(C)** H and O are in 1 : 8 mass ratio

**(D)** Hydrogen and Oxygen gases are combined in 2 : 1 volume ratio

***49.** Three isotopes of an element have mass numbers M, (M + 1) and (M + 2). If the mean mass number is (M + 0.5), then which of the following ratio(s) may be accepted for M, (M + 1) and (M + 2) in the order :

**(A)** 1 : 1 : 1 **(B)** 4 : 1 : 1 **(C)** 9 : 6 : 1 **(D)** 2 : 1 : 1

***50.** Which of the following statement(s) is/are correct about the Avogadro's number?

**(A)** It is the number of atoms contained in one mole of atoms of any element.

**(B)** It is the number of electrons required to deposit one mole of ion of any metallic element from a solution of the metal salt.

**(C)** It is the number of grams of any element which contains $6.022 \times 10^{23}$ atoms of that element.

**(D)** It is the number of particles (atoms, molecules or ions) required to make one gram of the substance under consideration.

***51.** The non-stoichiometric compound, titanium monoxide, has continuous range of composition from $Ti_{0.75}O$ to $TiO_{0.69}$. Which of the following is/are the correct regarding the possible composition of the compound? [Atomic wt. of Ti = 48]

**(A)** The maximum percentage by mass of oxygen in the compound is 30.8

**(B)** The minimum percentage by mass of titanium in the compound is 69.2

**(C)** The minimum percentage by mass of oxygen in the compound is 18.7

**(D)** The minimum percentage by mass of titanium in the compound is 82.3

***52.** Which of the following(s) is/are correct statement?

**(A)** The empirical formula of all alkanes is same.

**(B)** The empirical formula of all alkenes is same.

**(C)** The empirical formula of all the members of any homologous series is same.

**(D)** Two different compounds can have the same molecular formula.

***53.** Which of the following will have the composition (by mass) similar to that of acetic acid?

**(A)** Methyl formate, $HCOOCH_3$ **(B)** Glucose, $C_6H_{12}O_6$

**(C)** Formaldehyde, HCHO **(D)** Formic acid, HCOOH

***54.** Four groups of students are studying with different samples of alkali metal halides as given below:

Group A : NaCl Group B : NaBr

Group C : KCl Group D : KBr

If all the four groups dissolved 0.1 moles of their salt in some water and then treated with the excess of acidified $AgNO_3$ solution, then which of the following statement(s) is/are correct regarding the mass of precipitate formed?

**(A)** All the four groups will obtain the same mass of precipitate.

**(B)** Group A and C will obtain the same mass of precipitate.

**(C)** Group B and D will obtain the same mass of precipitate.

**(D)** Group A and B will obtain the same mass of precipitate.

***55.** Which of the following is the **INCORRECT** conclusion regarding the reaction:

$2H_2(g)+O_2(g) \longrightarrow 2H_2O(\ell)$

**(A)** 2 mole of $H_2(g)$ will produce 2 mole of $H_2O(\ell)$

**(B)** 32 g of $O_2(g)$ will produce 2 mole of $H_2O(\ell)$

**(C)** 2 litre of $O_2(g)$ at 25°C and 1 atm will produce 4 litre of $H_2O(\ell)$ at 25°C and 1 atm

**(D)** 2 molecules of $H_2O(\ell)$ is obtained from every 3 molecules of gaseous mixt. of $H_2$ & $O_2$.

***56.** A quantity of 8 g $CH_4$ is mixed with 28 g $O_2$ and fired. Which of the following is correct about the combustion of $CH_4$ in this condition?

**(A)** 1 g $CH_4$ will remain left unburned if carbon is quantitatively converted into $CO_2$.

**(B)** 4 g $O_2$ will remain unused if carbon is quantitatively converted into CO.

**(C)** Equal moles of CO and $CO_2$ are formed if none of the reactants is left

**(D)** 18 g water will form in any possible condition.

***57.** The oxygen needed for complete combustion of 8 g $CH_4$ may be obtained from complete decomposition of :

**(A)** 2/3 mole of $KClO_3$ **(B)** 1 mole of $H_2O_2$

**(C)** 2 mole of $NaNO_3$ (up to 300°C) **(D)** 2 mole of $BaO_2$

***58.** When hydrocarbons are burnt completely in excess of oxygen gas, then

**(A)** Equal moles of $CO_2$ and $H_2O$ are formed from alkenes.

**(B)** More moles of $H_2O$ than $CO_2$ are formed from alkanes.

**(C)** More moles of $CO_2$ than $H_2O$ are formed from alkynes.

**(D)** More moles of $CO_2$ than $H_2O$ are formed for any kind of hydrocarbon.

***59.** When hydrocarbons (alkanes, alkenes or alkynes) are burnt completely in excess of oxygen, then :

**(A)** For the same number of carbon atoms, more oxygen is consumed for alkanes.

**(B)** For the same number of hydrogen atoms, more oxygen is consumed for alkynes.

**(C)** For the same number of carbon atoms, more water is formed for alkynes.

**(D)** For the same number of hydrogen atoms, more $CO_2$ is formed from alkynes.

***60.** A mixture contains NaCl and unknown chloride, MCl. When 1 g of this mixture is dissolved in water and excess of $AgNO_3$ solution is added to it, 2.567 g of white precipitate is obtained. In another experiment, 1 g of the same original mixture is heated to 300°C. Some vapours come out which are absorbed in acidified $AgNO_3$ solution by which 1.341 g of white precipitate is formed. The molecular mass of unknown chloride is:

**(A)** 53.4 **(B)** 58.5 **(C)** 44.5 **(D)** 74.4

***61.** A volume of 10 mL of a mixture of $H_2$ and $O_2$ is exploded. If the final volume becomes 1 mL, the composition of original mixture may be:

**(A)** 7 mL $H_2$, 3 mL $O_2$ **(B)** 6 mL $H_2$, 4 mL $O_2$

**(C)** 5 mL $H_2$, 5 mL $O_2$ **(D)** 3 mL $H_2$, 7 mL $O_2$

***62.** 170 g of $NH_{3(g)}$ is passed through a series of electric spark that helps to dissociate the gas into a mixture of $N_{2(g)}$ and $H_{2(g)}$. After some time the gaseous mixture obtained is cool down to room temperature and made to pass through 5 L of an aqueous solution of HCl. If mass of the remaining gaseous mixture reduces to 100g then :

**(A)** Mass of $N_{2(g)}$ to $H_{2(g)}$ formed after electric spark is 100g

**(B)** Remaining moles of $NH_{3(g)}$ after electric spark (140/34)

**(C)** Minimum required molarity of HCl is 14/17

**(D)** $NH_{3(g)}$ will act as a base and will completely dissolve in dilute HCl solution

***63.** To what extent must a given solution of concentration of 40 mg silver nitrate per mL be diluted to yield a solution of concentration of 16 mg silver nitrate per mL?

**(A)** Each mL should be diluted to 2.5 mL

**(B)** To each mL of solution, 1.5 mL of water should be added

**(C)** To 2.5 mL of solution, 2 mL of water should be added

**(D)** To 1.5 mL of solution, 1.5 mL of water should added

***64.** If a definite volume '20 vol' $H_2O_2$ solution is diluted such that the volume of diluted solution becomes double than that of original volume, then

**(A)** The volume strength of diluted solution becomes '40 vol.'

**(B)** The molarity of solution becomes half of its initial molarity

**(C)** The molality of solution becomes half of its initial molality

**(D)** The maximum amount of $O_2$ gas obtainable from the solution remains the same.

***65.** A volume of 100 mL of 1M – NaCl solution, 100 mL of 2M – $MgCl_2$ solution and 300 mL of 4M $Mg(NO_3)_2$ solution is mixed together and the mixture is diluted to 2 liter. Which of the following is the correct final concentration of ions?

**(A)** $Na^+ = 0.05M$ **(B)** $Mg^{2+} = 0.7M$

**(C)** $Cl^- = 0.25\,M$ **(D)** $NO_3^- = 1.2\ M$

***66.** If the ratio of mole fractions of solute and solvent is unity, then the mass percent of solute is (Molar mases of solute and solvent are X and Y, respectively.)

**(A)** 50% **(B)** $\frac{X}{X+Y} \times 100\%$

**(C)** $\frac{X}{Y}$ × mass percent of solvent **(D)** $\frac{X}{Y}\times$ mass percent of solvent

***67.** A quantity of 720 g water is added in 230 g ethanol at a certain temperature to get 1 liter of solution. Which of the following is/are correct regarding the solution formed?

**(A)** The density of solution is $950 kg/m^3$. **(B)** The mole fraction of ethanol is 0.11.

**(C)** The molarity of solution is 5 M. **(D)** The molality of solution is 6.94 m

***68.** 1 g atom of nitrogen represents :

**(A)** $6.02\times10^{23}$ $N_2$ molecules **(B)** 22.4 litre of $N_2$ at 1 atm and 237 K

**(C)** 11.2 litre of $N_2$ at 1 atm and 273 K **(D)** 14 g of nitrogen

***69.** 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

***70.** 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

***71.** 1 mole of $Ba(OH)_2$ will exactly neutralize:

**(A)** 0.5 mole of HCl **(B)** 1 mole of $H_2SO_4$ **(C)** 1 mole of $H_3PO_3$ **(D)** 2 mole of $H_3PO_2$

***72.** 30 mL of $CH_3OH$ ($d = 0.8 g/cm^3$) is mixed with 60 mL of $C_2H_5OH$ ($d = 0.92 g/cm^3$) at 25°C to form a solution of density $0.88\,g/cm^3$. Select the correct option:

**(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 13.59 and zero respectively

**(D)** mole fraction of solvent and molality are 0.615 and 13.59 respectively

**73.** Select INCORRECT statements.

**(A)** Molarity of an aqueous solution slightly decreases by small increment in temperature

**(B)** Molarity of $H_2O$ is 55.55 M as density of $H_2O$ is 1g/ml

**(C)** 1M solution is always more concentrated than 1 molal solution

**(D)** Vapour density of a gas is $\frac{M^\circ}{2}$ irrespective of the reference gas used

***74.** Solutions containing 23 g HCOOH is/are :

**(A)** 46 g of 70% (w/v) HCOOH ($d_{solution} = 1.40\,g/mL$)

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

**(C)** 50 g of 25% (w/w) HCOOH

**(D)** 46 g of 5 M HCOOH ($d_{solution} = 1\,g/mL$)

***75.** A sample of $H_2O_2$ solution labelled as "28 volume" has density of 265 g/L. Mark the correct option(s) $H_2O_2$. representing concentration of same solution in other units :

**(A)** $M_{H_2O_2} = 2.5$ **(B)** $\%\frac{w}{V} = 17$

**(C)** mole fraction of $H_2O_2 = 0.2$ **(D)** $m_{H_2O_2} = 13.88$

**Paragraph for Question No. 76 - 79**

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, an 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 $SO_3 + H_2O \longrightarrow H_2SO_4$.

**76.** 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

**77.** 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 L at STP **(B)** 7.46 L at STP **(C)** 3.73 L at STP **(D)** 11.2 L at STP

**78.** If excess water is added into a bottle sample labelled as "112 % $H_2SO_4$" and is reacted with 5.3 g $Na_2CO_3$, 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

**79.** 1 g of oleum sample is diluted with water. The solution required 54 mL of 0.4 N NaOH for complete neutralization. The % of free $SO_3$ in the sample is :

**(A)** 74 **(B)** 26 **(C)** 20 **(D)** None of these

**Paragraph for Question No. 80 - 83**

Chemical reactions can be either redox or non redox type. In redox reactions, oxidation and reduction processes occur that involve flow of electron from one atom to another. Non redox reaction can be either double displacement reaction or acid base neutralisation etc.

**80.** Iron reacts with steam according to a redox reaction and given out $H_{2(g)}$. The balanced reaction can be written as :

**(A)** $Fe_{(s)} + H_2O_{(g)} \longrightarrow FeO_{(s)} + H_{2(g)}$ **(B)** $2Fe_{(s)} + 3H_2O_{(g)} \longrightarrow Fe_2O_{3(s)} + 3H_{2(g)}$

**(C)** $3Fe_{(s)} + 4H_2O_{(g)} \longrightarrow Fe_3O_{4(s)} + 4H_{2(g)}$ **(D)** $Fe_{(s)} + 2H_2O_{(g)} \longrightarrow FeO_{2(s)} + 2H_{2(g)}$

**81.** Concentrated HCl solution can be used to digest precipitate of $Ba_3(PO_4)_2$. Volume of 5M HCl required to digest 20g of $Ba_3(PO_4)_2$ would be approx. : [Ba = 137, P = 31, O = 16]

**(A)** 40 ml **(B)** 50 ml **(C)** 60 ml **(D)** 35 ml

**82.** Percentage yield of a reaction under a given set of conditions can be determine by comparing the actual yield with theoretical yield. Haber's process is an industrial method to prepare $NH_{3(g)}$ which then used in various other forms as nitrogen fertiliser to the plants. The process involve combination of $N_{2(g)}$ and $H_{2(g)}$ into $NH_{3(g)}$. What would be the mass of $NH_{3(g)}$ obtained % yield is only 60%.

**(A)** 59.5 kg **(B)** 48.9 kg **(C)** 34.8 kg **(D)** 35.7 kg

**83.** A solid mixture of $CaCO_3$, $Na_2CO_3$ and $LiNO_3$ was subjected to heating at 1000°C. Mass of the solid sample decreases on thermal decomposition. Select correct statement.

**(A)** Final solid residue consist of CaO, $Na_2O$ and $Li_2O$

**(B)** Final solid residue consist of $CaCO_3$, $Na_2O$ and $Li_2O$

**(C)** Final solid residue consist of CaO, $Na_2CO_3$ and $Li_2O$

**(D)** Final solid residue consist of CaO, $Na_2CO_3$ and $LiNO_3$

**Paragraph for Question No. 84 - 86**

Consider the following series of reactions :

$$Cl_2 + 2NaOH \longrightarrow NaCl + NaClO + H_2O$$

$$3NaClO \longrightarrow 2NaCl + NaClO_3$$

$$4NaClO_3 \longrightarrow 3NaClO_4 + NaCl$$

**84.** 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

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

**(A)** $\frac{1}{12}$ moles **(B)** 1.67 moles **(C)** 1.75 moles **(D)** 0.75 mole

**86.** How many moles of $NaClO_3$ obtained after the completion of reaction by taking 1 mole $Cl_2$ and other reagents in excess ?

**(A)** $\frac{1}{3}$ mole **(B)** zero **(C)** $\frac{1}{4}$ mole **(D)** 1 mole

Column-I and Column-II contain four entries in each. Entries of Column-I are to be matched with some entries of Column-II. One or more than one entries of Column-I may have the matching with the same entries of Column-II.

**87.** Match the Column:

| Column-I | | Column-II | |
|---|---|---|---|
| **(A)** | 0.5 mole of $SO_2(g)$. | **(P)** | Occupy 11.2 L at 1 atm and 273 K |
| **(B)** | 1 g of $H_2(g)$ | **(Q)** | Weighs 24 g |
| **(C)** | 0.5 mole of $O_3(g)$ | **(R)** | Total no. of atoms $= 1.5 \times N_A$ |
| **(D)** | 1 g molecule of $O_2(g)$ | **(S)** | Weighs 32 g |

**88.** Match the Column:

| Column-I | | Column-II | |
|---|---|---|---|
| **(A)** | 44 g $CO_2$ gas | **(P)** | 1g molecule |
| **(B)** | 35.2 g of $CH_4$ | **(Q)** | $N_A$ molecule |
| **(C)** | 48 g of $O_3$ gas | **(R)** | 22 $N_A$ electrons |
| **(D)** | 44 g of $N_2O$ gas | **(S)** | 49.28 L at 1 atm and 273 K |
| | | **(T)** | $N_A$ atoms of oxygen |

**89.** Match the Column :

| **Column-I [Atomic masses (M)]** | | | | **Column-II (% composition of heavier isotope)** | |
|---|---|---|---|---|---|
| Isotope-I | | Isotope-II | Average | | |
| **(A)** | (Z – 1) | (Z + 3) | Z | **(P)** | 25% by moles |
| **(B)** | (Z + 1) | (Z + 3) | (Z + 2) | **(Q)** | 50% by moles |
| **(C)** | Z | 3Z | 2Z | **(R)** | % by mass dependent on Z |
| **(D)** | (Z – 1) | (Z + 1) | Z | **(S)** | 75% by mass |

**90.** Which of the following options, the molecules are correctly matched with their atomicity :

| | | | |
|---|---|---|---|
| **(1)** | $P_4$ | **(P)** | 7 |
| **(2)** | $HNO_3$ | **(Q)** | 6 |
| **(3)** | $C_2H_4$ | **(R)** | 5 |
| **(4)** | $H_2SO_4$ | **(S)** | 4 |

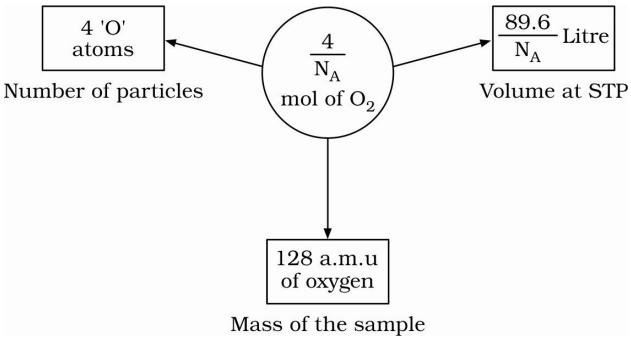
**(A)** (1-S), (2-R), (3-P), (4-Q) **(B)** (1-Q), (2-S), (3-P), (4-R)

**(C)** (1-Q), (2-S), (3-R), (4-P) **(D)** (1-S), (2-R), (3-Q), (4-P)

**91.** 39.4 kg of gold was recovered from a smuggler. The number of atoms of gold recovered are :

**(A)** 200 **(B)** $1.2044\times10^{25}$ **(C)** $6.022\times10^{25}$ **(D)** $1.2044\times10^{26}$

**92.** A sample of oxygen containing $\frac{4}{N_A}$ mol of oxygen is represented on a Y-map where its volume at NTP, mass of the sample and number of particles are shown. Study the map & choose the correct option.




**(A)** Y-map is correct **(B)** mass of sample is wrong

**(C)** Number of 'O' atoms is wrong **(D)** Volume of oxygen is wrong

**93.** Total number of neutrons present in 4 g of heavy water ($D_2O$) is : (Were $N_A$ represents Avogadro's number)

**(A)** $2N_A$ **(B)** $4N_A$ **(C)** $1.2N_A$ **(D)** $2.4N_A$

**94.** Assuming 100% yield of the reaction, how many moles of $NaHCO_3$ will produce 448 mL of $CO_2$ gas at STP according to the reaction : $NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + CO_2 + H_2O$ (unbalanced)

**(A)** 0.04 **(B)** 0.4 **(C)** 4 **(D)** 40

**95.** $3Cl_{2(g)} + 6OH^-_{(aq)} \longrightarrow 5Cl^-_{(aq)} + ClO^-_{3(aq)} + 3H_2O_{(\ell)}$

According to the given reaction :

**(A)** 0.1 L, 6 M NaOH solution is sufficient to convert 5 moles of $Cl_{2(g)}$ completely to an aqueous mixture of NaCl and $NaClO_3$

**(B)** 500 ml, 12M KOH solution is sufficient to convert 3 moles of $Cl_{2(g)}$ completely to an aqueous mixture of KCl and $KClO_3$

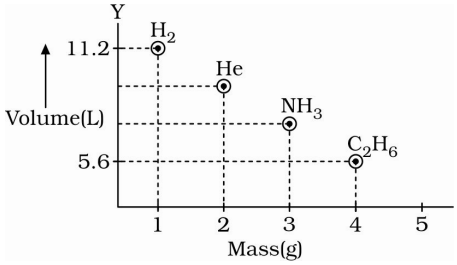
**(C)** 1L, 3M NaOH solution is sufficient to convert 3 moles of $Cl_{2(g)}$

1L, 3M NaCl and $NaClO_3$ solution is sufficient to

**(D)** 800 ml, 5M $Ca(OH)_2$ solution is just sufficient to convert 3 moles of $Cl_{2(g)}$ to an aqueous mixture $CaCl_2$ and $Ca(ClO_3)_2$

**96.** Following is the graphical presentation of volume occupied by different gases at S.T.P. Which is/are placed at correct position ?

x-axis : mass of the gas sample ; y-axis : volume of the gas sample at STP




**(A)** $H_2$ **(B)** He

**(C)** $NH_3$ **(D)** $C_2H_6$

***97.** $X + Y \rightarrow X_3Y_4$

Above reaction is carried out by taking 6 moles each of X and Y respectively then :

**(A)** X is the limiting reagent **(B)** 1.5 moles of $X_3Y_4$ is formed

**(C)** 1.5 moles of excess reagent is left behind

**(D)** 33.3% excess of excess reagent was present initially

**Paragraph for Question No. 98 - 99**

We know that balancing of a chemical equation is entirely based on law of conservation of mass. However, the concept of Principle of Atom Conservation (POAC) can also be related to law of conservation of mass in a chemical reaction. Here, we equate total moles of a particular element on reactant and product sides, if it remains conserved in a single reaction or a reaction sequence. So, POAC can also act as a technique for balancing a chemical equation.

For example, for a reaction: $ABC_3 \longrightarrow AB + C_2$

On applying POAC for A, B & C and relating the 3 equations, we get:

$$\frac{n_{ABC_3}}{2} = \frac{n_{AB}}{2} = \frac{n_{C_2}}{3} \quad (n_x : \text{number of moles of X})$$

Thus, the coefficient of $ABC_3$, AB & $C_2$ in the balanced chemical equation will be 2, 2 & 3 respectively and the balanced chemical equation can be represented as:

$2ABC_3 \longrightarrow 2AB + 3C_2$

Now answer the following questions:

**98.** What percentage of Sulphur by mass is present in an organic compound, if whole of sulphur from 0.5 g compound on conversion to $BaSO_4$ gave its 1.165 g on analysis:

**(A)** 8% **(B)** 16% **(C)** 24% **(D)** 32%

**99.** Whole of the carbon from x mg sucrose ($C_{12}H_{22}O_{11}$) converted into $K_4[Fe(CN)_6]$ through a series of reactions. If $K_4[Fe(CN)_6]$ obtained has mass 73.6 mg, find the value of x :

**(A)** 34.2 **(B)** 68.4 **(C)** 17.1 **(D)** 51.3

**100.** Caffine has a molecular weight of 175. If it contain 32% by mass of Nitrogen, find the number of atoms of nitrogen in one molecule of caffine.