

MOLE CONCEPT & GASEOUS STATE

EXERCISE-I

- Which of the following contain largest number of carbon atoms ?
 (1) 15 gm ethane, C_2H_6
 (2) 40.2 gm sodium oxalate, $Na_2C_2O_4$
 (3) 72 gm glucose, $C_6H_{12}O_6$
 (4) 35 gm pentene, C_5H_{10}
- The percentage by mole of NO_2 in a mixture of $NO_2(g)$ and $NO(g)$ having average molecular mass 34 is :
 (1) 25% (2) 20% (3) 40% (4) 75%
- Volume of O_2 obtained at 2 atm & 546K, by the complete decomposition of 8.5 g $NaNO_3$ is
 $2NaNO_3 \rightarrow 2NaNO_2 + O_2$
 (1) 2.24 lit (2) 1.12 lit (3) 0.84 lit (4) 0.56 lit
- A metal carbonate decomposes according to following reaction

$$M_2CO_3(s) \longrightarrow M_2O(s) + CO_2(g)$$
 Percentage loss in mass on complete decomposition of $M_2CO_3(s)$
 (Atomic mass of M = 102)
 (1) $\frac{100}{3}\%$ (2) $\frac{50}{3}\%$ (3) $\frac{25}{3}\%$ (4) 15%
- 25.4 gm of iodine and 14.2 gm of chlorine are made to react completely to yield a mixture of ICl and ICl_3 . Ratio of moles of ICl & ICl_3 formed is (Atomic mass : I = 127, Cl = 35.5)
 (1) 1 : 1 (2) 1 : 2 (3) 1 : 3 (4) 2 : 3
- 100 ml of PH_3 decomposes according to given reaction.

$$PH_3(g) \longrightarrow P(s) + 3/2 H_2(g)$$
 The change in volume of the gas is :-
 (1) 50 ml increase (2) 500 ml decrease
 (3) 900 ml decrease (4) 150 ml increase
- 44 g of a sample of organic compound on complete combustion gives 88 g CO_2 and 36 g of H_2O . The molecular formula of the compound may be :-
 (1) C_4H_6 (2) C_2H_6O (3) C_2H_4O (4) C_3H_6O
- A metal oxide has the formula X_2O_3 . It can be reduced by hydrogen to give free metal and water. 0.156 gm of metal oxide requires 6 mg of hydrogen for complete reduction. The atomic mass of metal in amu is :-
 (1) 15.6 (2) 156 (3) 108 (4) 54
- Two oxides of a metal contain 22.22% and 30% oxygen by mass respectively. If the formula of the first oxide is MO , then the formula of the second oxide is:-
 (1) MO_2 (2) M_2O_3 (3) M_2O (4) M_2O_5
- In the reaction $4A + 2B + 3C \longrightarrow A_4B_2C_3$, what will be the number of moles of product formed, starting from 1 mol of A, 0.6 mol of B and 0.72 mol of C :-
 (1) 2.32 (2) 0.24 (3) 0.3 (4) 0.25
- Two isotopes of an element Q are Q^{97} (23.4% abundance) and Q^{94} (76.6% abundance). Q^{97} is 8.082 times heavier than C^{12} and Q^{94} is 7.833 times heavier than C^{12} . What is the average atomic weight of the element Q ?
 (1) 94.702 (2) 78.913 (3) 96.298 (4) 94.695
- 12 g of Mg was burnt in a closed vessel containing 32 g oxygen. Remaining unreacted gm-molecules of O_2 will be :-
 (1) 0.5 (2) 0.75 (3) 1 (4) 0.25
- The total number of electrons present in 9 mL of water (density of water is 1 gmL^{-1}) :-
 (1) 3.01×10^{23} (2) 3.01×10^{22}
 (3) 3.01×10^{24} (4) 3.01×10^{25}
- From 200 mg of CO_2 , 10^{21} molecules are removed. How many moles of CO_2 are left ?
 (1) 126.9×10^{-1} (2) 2.88×10^{-3}
 (3) 7.31×10^{-3} (4) 4.4×10^{-3}
- On heating 10 g of $CaCO_3$, 5.6 g CaO is formed. Moles of CO_2 obtained in this reaction will be :-
 (1) 2.2 (2) 4.4 (3) 0.1 (4) 0.2
- 40 gm of a carbonate of an **alkali metal** or **alkaline earth metal** containing some inert impurities was made to react with excess HCl solution. The liberated CO_2 occupied 12.315 lit. at 1 atm & 300 K. The correct option is
 (1) Mass of impurity is 1 gm and metal is Be
 (2) Mass of impurity is 3 gm and metal is Li
 (3) Mass of impurity is 5 gm and metal is Be
 (4) Mass of impurity is 2 gm and metal is Mg
- 1 mole of H_2SO_4 will not exactly neutralise :
 (1) 2 mole of ammonia (2) 1 mole of $Ba(OH)_2$
 (3) 0.5 mole of $Ca(OH)_2$ (4) 2 mole of KOH
- 12 g of Mg was burnt in a closed vessel containing 32 g oxygen. Which of the following is incorrect.
 (1) 2 gm of Mg will be left unburnt.
 (2) 0.75 gm-molecule of O_2 will be left unreacted.
 (3) 20 gm of MgO will be formed.
 (4) The mixture at the end will weight 44 g.

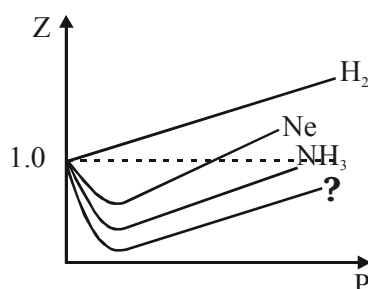
19. 50 gm of CaCO_3 is allowed to react with 68.6 gm of H_3PO_4 then select the incorrect option-
 $3\text{CaCO}_3 + 2\text{H}_3\text{PO}_4 \rightarrow \text{Ca}_3(\text{PO}_4)_2 + 3\text{H}_2\text{O} + 3\text{CO}_2$
 (1) 51.67 gm salt is formed
 (2) Amount of unreacted reagent = 35.93 gm
 (3) $n_{\text{CO}_2} = 0.5$ moles
 (4) 0.7 mole CO_2 is evolved
20. Select the correct statement(s) for $(\text{NH}_4)_3\text{PO}_4$.
 (1) Ratio of number of oxygen atoms to number of hydrogen atoms is 1 : 3
 (2) Ratio of number of cations to number of anions is 3 : 2
 (3) Ratio of number of gm-atoms of nitrogen to gm-atoms of oxygen is 3 : 2
 (4) Total number of atoms in one mole of $(\text{NH}_4)_3\text{PO}_4$ is 20.
21. At STP, the order of root mean square speed of molecules H_2 , N_2 , O_2 and HBr is :
 (1) $\text{H}_2 > \text{N}_2 > \text{O}_2 > \text{HBr}$ (2) $\text{HBr} > \text{O}_2 > \text{N}_2 > \text{H}_2$
 (3) $\text{HBr} > \text{H}_2 > \text{O}_2 > \text{N}_2$ (4) $\text{N}_2 > \text{O}_2 > \text{H}_2 > \text{HBr}$
22. Most probable speed, average speed and RMS speed are related as :
 (1) 1 : 1.128 : 1.224 (2) 1 : 1.128 : 1.424
 (3) 1 : 2.128 : 1.224 (4) 1 : 1.428 : 1.442
23. If the average velocity of N_2 molecules is 0.3 m/sec. at 27°C , then the velocity of 0.6 m/sec will take place at:
 (1) 273 K (2) 927 K (3) 1000 K (4) 1200 K
24. The total KE of an ideal monoatomic gas at 27°C is
 (1) 900 cal (2) 1800 cal (3) 300 cal (4) None
25. The correct expression for the van der Waals' equation of state is :
 (1) $\left(P + \frac{a}{n^2V^2}\right)(V - nb) = nRT$
 (2) $\left(P + \frac{an^2}{V^2}\right)(V - nb) = \Delta nRT$
 (3) $\left(P + \frac{an^2}{V^2}\right)(V - b) = nRT$
 (4) $\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$

26. At relatively high pressure, van der Waals' equation reduces to :

$$(1) PV_m = RT \quad (2) PV_m = RT + \frac{a}{V_m}$$

$$(3) PV_m = RT + Pb \quad (4) PV_m = RT - \frac{a}{V_m^2}$$

27. Observe the following Z vs P graph.



The missing gas in the above graph can be :

- (1) He (2) Ar
 (3) C_5H_{12} (4) All are correct
28. The values of van der Waals' constant 'a' for the gases O_2 , N_2 , NH_3 and CH_4 are 1.360, 1.390, 4.170 and 2.253 L atm mol⁻² respectively. The gas which can most easily be liquefied is :
 (1) O_2 (2) N_2 (3) NH_3 (4) CH_4
29. A gas can be liquefied by :
 (1) Cooling (2) Compressing
 (3) Both (1) and (2) (4) None
30. Which set of conditions represents easiest way to liquefy a gas :
 (1) Low temperature and high pressure
 (2) High temperature and low pressure
 (3) Low temperature and low pressure
 (4) High temperature and high pressure

				ANSWER KEY						Exercise-I	
Que.	1	2	3	4	5	6	7	8	9	10	
Ans.	4	1	2	2	1	1	3	4	2	2	
Que.	11	12	13	14	15	16	17	18	19	20	
Ans.	4	2	3	2	3	2	3	1	4	1	
Que.	21	22	23	24	25	26	27	28	29	30	
Ans.	1	1	4	1	4	3	3	3	3	1	

PREVIOUS YEARS' QUESTIONS

EXERCISE-II

- How many moles of e^- weight one Kg :
[JEE '2002 (Scr), 1]
(1) 6.023×10^{23}
(2) $\frac{1}{9.108} \times 10^{31}$
(3) $\frac{6.023}{9.108} \times 10^{54}$
(4) $\frac{1}{9.108 \times 6.023} \times 10^8$
- As the temperature is raised from 20°C to 40°C , the average kinetic energy of neon atoms changes by factor of which of the following ? [AIEEE-2004]
(1) $1/2$ (2) $\sqrt{(313/293)}$
(3) $313/293$ (4) 2
- In Van der Waals equation of state of the gas law, the constant 'b' is a measure of : [AIEEE-04]
(1) intermolecular repulsions
(2) intermolecular attractions
(3) volume occupied by the molecules
(4) intermolecular collisions per unit volume
- Calculate the amount of Calcium oxide required when it reacts with 852 g of P_4O_{10} . [JEE 2005]
 $6\text{CaO} + \text{P}_4\text{O}_{10} \longrightarrow 2\text{Ca}_3(\text{PO}_4)_2$ [Ca = 40, P = 31]
(1) 2000 g (2) 3008 g
(3) 1008 g (4) 500 g
- Given that the abundances of isotopes ^{54}Fe , ^{56}Fe and ^{57}Fe are 5%, 90% and 5%, respectively, the atomic mass of Fe is : [JEE 2009]
(1) 55.85 (2) 55.95
(3) 55.75 (4) 56.05
- A 5.2 molal aqueous solution of methyl alcohol, CH_3OH , is supplied. What is the mole fraction of methyl alcohol in the solution ? [AIEEE-2011]
(1) 0.086 (2) 0.050
(3) 0.100 (4) 0.190
- 'a' and 'b' are Van der Waals constants for gases. Chlorine is more easily liquefied than ethane because :- [AIEEE-2011]
(1) a for $\text{Cl}_2 < a$ for C_2H_6 but b for $\text{Cl}_2 > b$ for C_2H_6
(2) a for $\text{Cl}_2 > a$ for C_2H_6 but b for $\text{Cl}_2 < b$ for C_2H_6
(3) a and b for $\text{Cl}_2 > a$ and b for C_2H_6
(4) a and b for $\text{Cl}_2 < a$ and b for C_2H_6
- The compressibility factor for a real gas at high pressure is :- [AIEEE-2012]
(1) $1 - \frac{\text{Pb}}{\text{RT}}$ (2) $1 + \frac{\text{RT}}{\text{Pb}}$ (3) 1 (4) $1 + \frac{\text{Pb}}{\text{RT}}$
- The concentrated sulphuric acid that is peddled commercially is 95% H_2SO_4 by weight. If the density of this commercial acid is 1.834 g cm^{-3} , the molarity of this solution is :- [JEE-(Main)-2012]
(1) 17.8 M (2) 15.7 M (3) 10.5 M (4) 12.0 M
- The density of a solution prepared by dissolving 120 g of urea (mol. mass = 60 u) in 1000 g of water is 1.15 g/mL . The molarity of this solution is [JEE-(Main)-2012]
(1) 2.05 M (2) 0.50 M (3) 1.78 M (4) 1.02 M
- A transition metal M forms a volatile chloride which has a vapour density of 94.8. If it contains 74.75% of chlorine the formula of the metal chloride will be [AIEEE 2012 (Online)]
(1) MCl_2 (2) MCl_4 (3) MCl_5 (4) MCl_3
- The ratio of number of oxygen atoms (O) in 16.0 g ozone (O_3), 28.0 g carbon monoxide (CO) and 16.0 g oxygen (O_2) is :- (Atomic mass : C = 12, O = 16 and Avogadro's constant $N_A = 6.0 \times 10^{23} \text{ mol}^{-1}$) [AIEEE 2012 (Online)]
(1) 3 : 1 : 1 (2) 1 : 1 : 2
(3) 3 : 1 : 2 (4) 1 : 1 : 1
- The relationship among most probable velocity, average velocity and root mean square velocity is respectively :- [JEE(Main-online)-2012]
(1) $\sqrt{2} : \sqrt{8/\pi} : \sqrt{3}$ (2) $\sqrt{2} : \sqrt{3} : \sqrt{8/\pi}$
(3) $\sqrt{3} : \sqrt{8/\pi} : \sqrt{2}$ (4) $\sqrt{8/\pi} : \sqrt{3} : \sqrt{2}$
- A gaseous hydrocarbon gives upon combustion 0.72 g of water and 3.08 g of CO_2 . The empirical formula of the hydrocarbon is [JEE(Main)-2013]
(1) C_2H_4 (2) C_3H_4 (3) C_6H_5 (4) C_7H_8
- For gaseous state, if most probable speed is denoted by C, average speed by $\bar{C}$ and mean square speed by C , then for a large number of molecules the ratios of these speeds are :- [JEE(Main-offline)-2013]
(1) $C : \bar{C} : C = 1.225 : 1.128 : 1$
(2) $C : \bar{C} : C = 1.128 : 1.225 : 1$
(3) $C : \bar{C} : C = 1 : 1.128 : 1.225$
(4) $C : \bar{C} : C = 1 : 1.225 : 1.128$

- 16.** 10 mL of 2(M) NaOH solution is added to 200 mL of 0.5 (M) of NaOH solution. What is the final concentration ? **[JEE(Main-online)-2013]**
 (1) 0.57 M (2) 5.7 M
 (3) 11.4 M (4) 1.14 M
- 17.** The density of 3M solution of sodium chloride is 1.252 g mL^{-1} . The molality of the solution will be (molar mass, NaCl = 58.5 g mol^{-1}) **[JEE(Main-online)-2013]**
 (1) 2.18 m (2) 3.00 m
 (3) 2.60 m (4) 2.79 m
- 18.** The ratio of masses of oxygen and nitrogen in a particular gaseous mixture is 1 : 4. The ratio of number of their molecule is : **[JEE(Main)-2014]**
 (1) 1 : 8 (2) 3 : 16
 (3) 1 : 4 (4) 7 : 32
- 19.** If Z is the compressibility factor, Van der Waals equation at low pressure can be written as : **[JEE-MAINS-2014]**
 (1) $Z = 1 - \frac{Pb}{RT}$ (2) $Z = 1 + \frac{Pb}{RT}$
 (3) $Z = 1 + \frac{RT}{Pb}$ (4) $Z = 1 - \frac{a}{V_m RT}$
- 20.** The amount of BaSO_4 formed upon mixing 100 mL of 20.8% BaCl_2 solution with 50 mL of 9.8% H_2SO_4 solution will be : **[JEE(Main-online)-2014]**
 (Ba = 137, Cl = 35.5, S=32, H = 1 and O = 16)
 (1) 33.2 g (2) 11.65 g
 (3) 23.3 g (4) 30.6 g
- 21.** For the estimation of nitrogen, 1.4 g of an organic compound was digested by Kjeldahl method and the evolved ammonia was absorbed in 60 mL of $\frac{M}{10}$ sulphuric acid. The unreacted acid required 20 mL of $\frac{M}{10}$ sodium hydroxide for complete neutralization. The percentage of nitrogen in the compound is : **[JEE(Main-online)-2014]**
 (1) 3% (2) 5%
 (3) 6% (4) 10%
- 22.** The temperature at which oxygen molecules have the same root mean square speed as helium atoms have at 300 K is : **[JEE(Main-online)-2014]**
 (Atomic masses : He = 4 u, O = 16 u)
 (1) 1200 K (2) 600 K
 (3) 300 K (4) 2400 K
- 23.** In Carius method of estimation of halogens, 250 mg of an organic compound gave 141 mg of AgBr. The percentage of bromine in the compound is : (Atomic mass Ag = 108; Br = 80) **[JEE(Main)-2015]**
 (1) 48 (2) 60
 (3) 24 (4) 36
- 24.** When does a gas deviate the most from its ideal behaviour ? **[JEE-MAINS(ONLINE)-2015]**
 (1) At high pressure and low temperature
 (2) At high pressure and high temperature
 (3) At low pressure and low temperature
 (4) At low pressure and high temperature
- 25.** The most abundant elements by mass in the body of a healthy human adult are :
 Oxygen (61.4%) ; Carbon (22.9%), Hydrogen (10.0%) ; and Nitrogen (2.6%). The weight which a 75 kg person would gain if all ^1H atoms are replaced by ^2H atoms is **[JEE(Main)-2017]**
 (1) 15 kg (2) 37.5 kg
 (3) 7.5 kg (4) 10 kg
- 26.** 1 gram of a carbonate (M_2CO_3) on treatment with excess HCl produces 0.01186 mole of CO_2 . The molar mass of M_2CO_3 in g mol^{-1} is :- **[JEE(Main)-2017]**
 (1) 1186 (2) 84.3
 (3) 118.6 (4) 11.86

PREVIOUS YEARS QUESTIONS				ANSWER KEY			Exercise-II			
Que.	1	2	3	4	5	6	7	8	9	10
Ans.	4	3	3	3	2	1	2	4	1	1
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	2	4	1	4	3	1	4	4	4	2
Que.	21	22	23	24	25	26				
Ans.	4	4	3	1	3	2				