

# PACE-IIT & MEDICAL

MUMBAI / AKOLA / DELHI / KOLKATA / GHAZIABAD / NASHIK / GOA / BOKARO / PUNE

IIT - JEE: 2022-24

TWT

DATE: 26/05/22

TIME: 1 Hrs.

TOPIC : MOLE CONCEPT

MARKS: 100

## Single choice 25 question (+4 -1)

1. If 'STUDENT' is written by a graphite pencil, it weights  $3.0 \times 10^{-10}$  g. How many carbon atoms are present in it? ( $N_A = 6 \times 10^{23}$ )

- (A)  $1.5 \times 10^{13}$   
(B)  $5 \times 10^{12}$   
(C)  $2 \times 10^{33}$   
(D)  $1.5 \times 10^{10}$

$$\begin{array}{r} 3.0 \times 10^{-10} \times 6 \times 10^{23} \\ \hline 12 \times 10^{13} \\ \hline 1.2 \times 10^{14} \end{array}$$

2. The atomic masses of two elements P and Q are 20 and 40, respectively. If 'a' g of P contains 'b' atoms, then how many atoms are present in '2a' g of Q?

- (A) a  
(B) b  
(C) 2a  
(D) 2b

$$\begin{array}{ccc} a \text{ g} \rightarrow 2b & \frac{40}{20} & P \quad Q \\ 2a \text{ g} \rightarrow x & & 20 \quad 40 \\ & & \frac{20}{40} \end{array}$$

3. The molecular formula of a compound is  $X_4O_9$ . If the compound contains 40% X by mass, then what is the atomic mass of X?

- (A) 24  
(B) 12  
(C) 26  
(D) 13

4. If isotopic distribution of  $C^{12}$  and  $C^{14}$  is 98.0% and 2.0%, respectively, then the number of  $C^{14}$  atoms in 12 g of carbon is

- (A)  $1.032 \times 10^{22}$   
(B)  $1.20 \times 10^{22}$   
(C)  $5.88 \times 10^{23}$   
(D)  $6.02 \times 10^{23}$

$$\frac{12}{121}$$

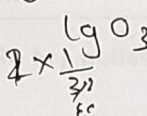


5. Vapour density of a volatile substance 1.2 is. Its molecular mass would be  
 (A) 1.2  
 (B) 2.4  
 (C) 36  
 (D) 72

6. Out of 1.0 g dioxygen, 1.0 g atomic oxygen and 1.0 g ozone, the maximum number of oxygen atoms are contained in  
 (A) 1.0 g of atomic oxygen  
 (B) 1.0 g of ozone  
 (C) 1.0 g of oxygen gas  
 (D) All contain the same number of atoms



$$\frac{1}{16}$$



$$1 \times \frac{1}{16} \times N_A$$

7. Total number of electrons present in 4.4 g oxalate ion ( $C_2O_4^{2-}$ )

$$(A) 0.05N_A$$

$$(B) 2.3N_A$$

$$(C) 2.2N_A$$

$$(D) 2.0N_A$$

$$8 \times 0.3 \times N_A$$

$$\frac{24}{64} \times N_A$$

$$3 \times \frac{1}{16} \times N_A$$

$$26.4 \times \frac{90}{88} \times N_A$$

8. The number of  $F^-$  ions in 4.2 g  $AlF_3$  is ( $Al = 27, F = 19$ )

$$(A) 0.05$$

$$(B) 9.03 \times 10^{22}$$

$$(C) 3.01 \times 10^{22}$$

$$(D) 0.15$$

$$\frac{4.2}{88} \times 0.3 \times N_A$$

9. A quantity of 13.5 g of aluminium when changes to  $Al^{3+}$  ion in solution will lose ( $Al = 27$ )

$$(A) 18.0 \times 10^{23} \text{ electrons}$$

$$(B) 6.02 \times 10^{23} \text{ electrons}$$

$$(C) 3.01 \times 10^{23} \text{ electrons}$$

$$(D) 9.03 \times 10^{23} \text{ electrons}$$

10. The volume of one mole of water at 277 K is 18 ml. One ml of water contains 20 drops. The number of molecules in one drop of water will be ( $N_A = 6 \times 10^{23}$ )

$$(A) 1.07 \times 10^{21}$$

$$(B) 1.67 \times 10^{21}$$

$$(C) 2.67 \times 10^{21}$$

$$(D) 1.67 \times 10^{20}$$

$$18$$

$$1 \text{ ml} \rightarrow 20 \text{ drops}$$

$$\times$$

$$1 \text{ drop}$$

$$9 \times 6 \times 10^{22}$$

$$\frac{1}{20}$$

$$0.2$$

$$\frac{0.2}{18}$$

$$\frac{2}{180} \times 10^{23}$$



$$\begin{array}{r} 12 \\ 6 \times 22.4 \\ \hline 1344 \end{array}$$

11. Number of gas molecules present in 1 ml of gas at 0°C and 1 atm is called Loschmidt number. Its value is about

- (A)  $2.7 \times 10^{19}$
- (B)  $6 \times 10^{23}$
- (C)  $2.7 \times 10^{22}$
- (D)  $1.3 \times 10^{28}$

$$\frac{1}{6 \times 10^{23}} \times \frac{1}{22.4} = \frac{1}{1344 \times 10^{23}} = \frac{1}{1.3 \times 10^{25}}$$

12. From 2 mg calcium,  $1.2 \times 10^{19}$  atoms are removed. The number of g-atoms of calcium left is (Ca = 40)

- (A)  $5 \times 10^{-5}$
- (B)  $2 \times 10^{-5}$
- (C)  $3 \times 10^{-5}$
- (D)  $5 \times 10^{-6}$

$$\frac{0.2}{40} \times 6 \times 10^{23} = 3 \times 10^{21}$$

$$\frac{1}{2 \times 100} = 0.005$$

$$0.02 \times 6 \times 10^{23} = 1.2 \times 10^{25}$$

$$1.2 \times 10^{25} - 1.2 \times 10^{21} = 1.2 \times 10^{25}$$

13. The number of g-molecules of oxygen in  $6.023 \times 10^{24}$  CO molecules is

- (A) 1 g-molecule
- (B) 0.5 g-molecule
- (C) 5 g-molecules
- (D) 10 g-molecules

$$\frac{6.023 \times 10^{24}}{10} = 6.023 \times 10^{23}$$

14. Equal masses of oxygen, hydrogen and methane are taken in identical conditions. What is the ratio of the volumes of the gases under identical conditions?

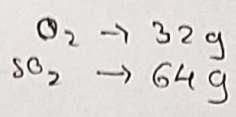
- (A) 16 : 1 : 8
- (B) 1 : 16 : 2
- (C) 1 : 16 : 8
- (D) 2 : 16 : 1

$$32 : 2 : 16$$

$$16 : 1 : 8$$

15. A pre-weighed vessel was filled with oxygen at NTP and weighed. It was then evacuated, filled with  $\text{SO}_2$  at the same temperature and pressure, and again weighed. The weight of oxygen is

- (A) the same as that of  $\text{SO}_2$
- (B)  $\frac{1}{2}$  that of  $\text{SO}_2$
- (C) twice that of  $\text{SO}_2$
- (D)  $\frac{1}{4}$  that of  $\text{SO}_2$



16. Molecular mass of dry air is

- (A) less than moist air
- (B) greater than moist air
- (C) equal to moist air
- (D) may be greater or less than moist air



- Handwritten calculations for molecular mass:
- $$\begin{array}{r} 3760 \\ - 980 \\ \hline 2780 \end{array}$$
- $$\begin{array}{r} 1200 \\ - 980 \\ \hline 2180 \end{array}$$
- $$\begin{array}{r} 1500 \\ - 980 \\ \hline 2480 \end{array}$$
- $$\begin{array}{r} 980 \\ + 126.6 \\ \hline 1106.6 \end{array}$$
- $$\begin{array}{r} 1980 \\ - 1266 \\ \hline 3246 \end{array}$$
17. A gaseous mixture contains 70%  $N_2$  and 30% unknown gas by volume. If the average molecular mass of gaseous mixture is 37.60, then the molecular mass of unknown gas is

- (A) 42.2  
(B) 60  
(C) 40  
(D) 50
- Handwritten calculations for Q17:
- $$\frac{70 \times 28 + 30x}{100} = 37.60$$
- $$1960 + 30x = 3760$$
- $$30x = 1800$$
- $$x = 60$$
18. The mass composition of universe may be given as 90%  $H_2$  and 10% He. The average molecular mass of universe should be

- (A) 2.20  
(B) 2.10  
(C) 3.80  
(D) 3.64
- Handwritten calculations for Q18:
- $$\frac{90 \times 2 + 10 \times 4}{100} = \frac{180 + 40}{100} = 2.20$$

19. For  $CuSO_4 \cdot 5H_2O$ , which is the correct mole relationship?
- (A) 9 × Mole of Cu = Mole of O  
(B) 5 × Mole of Cu = Mole of O  
(C) 9 × Mole of Cu = Mole of  $O_2$   
(D) Mole of Cu = 5 × Mole of O
- Handwritten calculations for Q19:
- $$\begin{array}{r} 1960 \\ + 1900 \\ \hline 3860 \end{array}$$
- $$\begin{array}{r} 1960 \\ + 126.6 \\ \hline 2186.6 \end{array}$$

20. A compound contains 36% carbon by mass. If each molecule contains two carbon atoms, the number of moles of compound in its 10 g is
- (A) 66.67  
(B) 0.15  
(C) 0.30  
(D) 1.5

21. The percentage of oxygen in a compound is 4%. Its minimum molecular mass will be
- (A) 100  
(B) 400  
(C) 200  
(D) 32
- Handwritten calculations for Q21:
- $$\frac{4 \times 16}{100} = \frac{64}{100}$$
- $$\frac{64}{100} \times 100g = 64g$$
- $$\frac{64}{100} \times 100g = 64g$$

22. A compound contains elements X and Y in 1 : 4 mass ratio. If the atomic masses of X and Y are in 1 : 2 ratio, the empirical formula of the compound should be
- (A)  $XY_2$   
(B)  $X_2Y$   
(C)  $XY_4$   
(D)  $X_4Y$
- Handwritten calculations for Q22:
- $$\begin{array}{ccc} 1 & 1 & 1 \\ 2 & 2 & 2 \end{array}$$



23. A compound contains equal masses of the elements A, B and C. If the atomic masses of A, B and C are 20, 40 and 60, respectively, then the empirical formula of the compound is

(A)  $A_3B_2C$   
 (B)  $AB_2C_3$   
 (C)  $ABC$   
 (D)  $A_6B_3C_2$

24. A gaseous mixture contains 40%  $H_2$  and 60% He by volume. What is the total number of moles of gases present in 10 g of such mixture?

(A) 5  
 (B) 2.5  
 (C) 3.33  
 (D) 3.125

$$\begin{array}{r} 40 \times 2 + 60 \times 4 \\ \hline 100 \end{array} \quad \begin{array}{r} 80 + 240 \\ \hline 100 \end{array}$$

$$\frac{32}{100} \quad \begin{array}{r} 100 \\ 10 \end{array} \quad \begin{array}{r} 3.2 \\ 2 \end{array} \quad \begin{array}{r} 320 \\ 100 \end{array} \quad 3.2$$

25. If the mass of neutron is doubled and that of proton is halved, the molecular mass of  $H_2O$  containing only  $H^1$  and  $O^{16}$  atoms will

(A) increase by about 25%  
 (B) decrease by about 25%  
 (C) increase by about 16.67%  
 (D) decrease by about 16.67%

SPACE FOR ROUGH WORK