

Topic : Mole Concept

Type of Questions

Single choice Objective ('-1' negative marking) Q.5, 6, 8	(3 marks, 3 min.)	M.M., Min. [9, 9]
Multiple choice objective ('-1' negative marking) Q.1 to Q.2	(4 marks, 4 min.)	[8, 8]
Short Subjective Questions ('-1' negative marking) Q.3	(3 marks, 3 min.)	[3, 3]
Match the Following (no negative marking) (2 × 4) Q.7	(8 marks, 10 min.)	[8, 10]

- 1.* 124 amu of P₄ will contain : (At. mass of P = 31)
 (A) 4N_A atoms of phosphorus (B) 4 atoms of phosphorus
 (C) 1 molecule of phosphorus (D) N_A molecules of phosphorus
- 2.* In which of the following pairs do 1 g of each have an equal number of molecules :
 (A) N₂O and CO (B) N₂ and C₃O₂ (C) N₂ and CO (D) N₂O and CO₂
- 3._ How many atoms are present in '64 amu' of oxygen.
4. Fill the blanks in the table (where N_A is Avogadro number)

S.No.	Sample	Gram Atomic mass of sample	Moles of sample	No. of atoms present in the sample	Mass removed from the sample	Mole removed from the sample	Atoms removed from the sample	Mass of same no. of C atom as no. of atoms present in the original sample
1.	8 g O	---	---	---	---	---	---	---
	For Example	16 g	½ mole	$\frac{N_A}{2}$	2 g	$\frac{1}{8}$ mole	$\frac{N_A}{8}$	6 g
2.	230 g Na				46 g			
3.	60 g Ca					1 mole		
4.	20 g He					3 mole		
5.	56 g N					½ mole		
6.	12 g Mg						$\frac{N_A}{4}$	
7.	128 g S						N _A	
8.	93 g P						$\frac{3N_A}{2}$	

5. If the mass of 0.25 moles of an element X is 2.25 g, the mass of one atom of X is about :
 (A) 1.5×10^{-24} g (B) 2.5×10^{-23} g (C) 1.5×10^{-23} g (D) 2.5×10^{-24} g
6. From 392 mg of H₂SO₄, 1.204×10^{21} molecules of H₂SO₄ are removed. How many moles of H₂SO₄ are left:
 (A) 2×10^{-3} (B) 1.2×10^{-3} (C) 4×10^{-3} (D) 1.5×10^{-3} .
7. **Column - I** (A) 49 g H₂SO₄ (B) 20 g NaOH (C) 11.2 L of CO₂ at STP (D) 6.022×10^{23} atoms of Oxygen
- Column - II** (p) 0.5 mole of given unit (q) $1.5 N_A$ atoms (r) $0.5 N_A$ molecules (s) 2 mole of 'O' atom
8. If all the O-atoms from 4.4 g CO₂, 6.022×10^{22} molecules of N₂O₆, 0.2 moles of CO and 1.12 L of SO₂ gas at NTP are removed and combined to form O₂ gas, then the resulting gas occupies a volume of at NTP.
 (A) 22.4 L (B) 44.8 L (C) 33.6 L (D) 11.2 L

Answer Key

PHYSICAL CHEMISTRY

1.* (BC) 2.* (CD) 3. 4

4.

S.No.	Sample	Relative Atomic Mass for the element	Gram Atomic mass of sample	Moles of sample	No. of atoms of sample	Mass removed from the sample	Mole removed	Atoms removed	Mass of same no. of C atom as no. of atoms present in the original sample
1.	8 g O	16	---	---	---	---	---	---	---
	For Example	16	16 g	½ Mole	$\frac{N_A}{2}$	2 g	$\frac{1}{8}$ Mole	$\frac{N_A}{8}$	6 g
2.	230 g Na	23	23g	10 Mole	$10 N_A$	46 g	2 Mole	$2 N_A$	120 g
3.	60 g Ca	40	40 g	$\frac{3}{2}$ Mole	$\frac{3}{2} N_A$	40 g	1 Mole	N_A	16 g
4.	20 g He	4	4 g	5 Mole	$5 N_A$	12 g	3 Mole	$3 N_A$	60 g
5.	56 g N	14	14 g	4 Mole	$4 N_A$	7 g	$\frac{1}{2}$ Mole	$\frac{N_A}{2}$	48 g
6.	12 g Mg	24	24 g	$\frac{1}{2}$ Mole	$\frac{N_A}{2}$	6 g	$\frac{1}{4}$ Mole	$\frac{N_A}{4}$	6 g
7.	128 g S	32	32 g	4 Mole	$4 N_A$	32 g	1 Mole	N_A	48 g
8.	93 g P	31	31 g	3 Mole	$3 N_A$	46.5 g	$\frac{3}{2}$ Mole	$\frac{3N_A}{2}$	36 g

5. (C) 6. (A) 7. (A - p, s, r), (B - p, q, r), (C - p, q, r), (d - r).

8. (D)

Hints & Solutions

1.* Molecular mass of $P_4 = 4 \times 31 = 124$ amu
 \therefore 124 amu of P_4 contains 1 molecule of P_4
 1 molecule of P_4 contains 4 atoms of P.

2.* (A) No. of molecules (N_2O) = $\frac{1}{44} \times N_A$; No. of molecules (CO) = $\frac{1}{28} \times N_A$
 (B) No. of molecules (N_2) = $\frac{1}{28} \times N_A$; No. of molecules (C_3O_2) = $\frac{1}{68} \times N_A$
 (C) No. of molecules (N_2) = $\frac{1}{28} \times N_A$; No. of molecules (CO) = $\frac{1}{28} \times N_A$
 (D) No. of molecules (N_2O) = $\frac{1}{44} \times N_A$; No. of molecules (CO_2) = $\frac{1}{44} \times N_A$

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S.No.	Sample	Relative Atomic Mass for the element	Gram Atomic mass of sample	Moles of sample	No. of atoms of sample	Mass removed from the sample	Mole removed
1.	8 g O	16	---	---	---	---	---
	For Example	16	16 g	½ Mole	$\frac{N_A}{2}$	2 g	$\frac{1}{8}$ Mole
2.	230 g Na	23	23g	10 Mole	10 N_A	46 g	2 Mole
3.	60 g Ca	40	40 g	3/2 Mole	3/2 N_A	40 g	1 Mole
4.	20 g He	4	4 g	5 Mole	5 N_A	12 g	3 Mole
5.	56 g N	14	14 g	4 Mole	4 N_A	7 g	½ Mole
6.	12 g Mg	24	24 g	½ Mole	$\frac{N_A}{2}$	6 g	¼ Mole
7.	128 g S	32	32 g	4 Mole	4 N_A	32 g	1 Mole
8.	93 g P	31	31 g	3 Mole	3 N_A	46.5 g	3/2 Mole

5. Mass of $0.25 N_A$ atoms of X is 2.25 gram

$$\text{so, mass of 1 atom is} = \frac{2.25}{0.25N_A} \text{ gram} = 1.5 \times 10^{-23} \text{ gram}$$

6. $W_{H_2SO_4} = 392 \text{ mg} = 392 \times 10^{-3} \text{ g}$

$$M_{H_2SO_4} = 98$$

$$\text{Left moles} = \text{Total moles} - \text{removed moles} = \frac{392 \times 10^{-3}}{98} - \frac{1.204 \times 10^{21}}{6.022 \times 10^{23}}$$

$$\text{Left moles} = 4 \times 10^{-3} - 2 \times 10^{-3} = 2 \times 10^{-3} \text{ moles.}$$

7. (A - p, s, r), (B - p, q, r), (C - p, q, r), (d - r).

8. Total number of moles of O-atoms = $2 \times n_{CO_2} + 5 \times n_{N_2O_5} + 1 \times n_{CO} + 2 \times n_{SO_2}$

$$= 2 \times \left(\frac{4.4}{44} \right) + 5 \times \left(\frac{6.022 \times 10^{22}}{N_A} \right) + 1 \times 0.2 + 2 \times \frac{1.12}{22.4} = 1$$

$$\therefore \text{Moles of } O_2 \text{ gas} = \frac{1}{2}$$

$$\therefore \text{Vol. of } O_2 \text{ gas at NTP} = \frac{1}{2} \times 22.4 = 11.2 \text{ L}$$