CBSE Test Paper 05

Chapter 03 Atoms and Molecules

1. “Gram atomic mass of an element and the gram molecular mass of a compound contains the same number of molecules”. This is a _____. **(1)**

   a. False statement
   b. Partially false statement
   c. True statement
   d. Partially true statement

2. Match the following with the correct response: **(1)**

(1) PCI_5	(A) Dinitrogen tetraoxide
(2) N_2O_5	(B) Phosphorous pentachloride
(3) N_2O_4	(C) Carbon tetrachloride
(4) CCl_4	(D) Dinitrogen pentaoxide

   a. 1-C, 2-B, 3-D, 4-A
   b. 1-D, 2-A, 3-C, 4-B
   c. 1-A, 2-C, 3-B, 4-D
   d. 1-B, 2-D, 3-A, 4-C

3. Why $CuSO_4$ (anhydrous) is dirty white? **(1)**

   a. It does not absorb light from visible region
   b. It absorbs light from visible region
   c. It is anhydrous salt
   d. It does not have water

4. Which of the following two statement(s) is/are true? **(1)**

   Statement A : Mole is quite often known as chemist's dozen.

   Statement B : The mass of one-twelfth (1/12) of the mass of one atom of Carbon is

taken as 1 u.

a. Statement A
b. Statement B
c. Neither Statement A nor Statement B.
d. Both the statements - A and B

5. How many atoms are present in PO_4^{-3} ion? **(1)**

a. 5
b. 1
c. 4
d. 3

6. Oxygen is: **(1)**

a. Monovalent
b. Bivalent
c. Trivalent
d. Tetravalent

7. Match the following with correct response: **(1)**

(1) Instrument used to produce images of atoms	(A) STM
(2) Atomic theory of matter	(B) Fullerene
(3) An allotrope of carbon	(C) John Dalton
(4) Potassium Sulphate	(D) Compound

a. 1-C, 2-B, 3-D, 4-A
b. 1-A, 2-C, 3-B, 4-D
c. 1-B, 2-D, 3-A, 4-C
d. 1-D, 2-A, 3-C, 4-B

8. State the law of constant Proportion? **(1)**

9. The visible universe is estimated to contain 10^{22} stars. How many moles of stars are

present in the visible universe? **(1)**

10. An elements Z forms an oxide with formula Z_2O_3. What is its valency? **(1)**

11. The mass of one steel screw is 4.11 g. Find the mass of one mole of these steel screws. Compare this value with the mass of the Earth $(5.98 \times 10^{24} kg)$. Which one of the two is heavier and by how many times? **(3)**

12. Calculate the molecular Mass of **(3)**

    a. Ammonium sulphate $[(NH_4)_2SO_4]$
    b. Penicillin $[C_{16}H_{18}N_2SO_4]$
    c. Paracetamol $[C_8H_9NO]$

13. A sample of ethane (C_2H_6) gas has the same mass as 1.5×10^{20} molecules of methane (CH_4). How many C_2H_6 molecules does the sample of gas contain? **(3)**

14. Calculate the formula unit masses of ZnO, Na_2O, K_2CO_3, given atomic masses of Zn = 65 u, Na = 23 u, K = 39 u, C = 12 u, and O = 16 u. **(5)**

15. Calculate the molecular masses of **(5)**

    a. H_2
    b. O_2
    c. Cl_2
    d. CO_2
    e. CH_4
    f. C_2H_6
    g. C_2H_4
    h. NH_3
    i. CH_3OH

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Answers

1. c. True statement

   Explanation: Gram atomic mass of an element and the gram molecular mass of a compound contain the same number of molecules, which is equal to 6.022×10^{23}molecules.

2. d. 1-B, 2-D, 3-A, 4-C

   Explanation:

(1) PCl_5	(B) Phosphorous pentachloride
(2) N_2O_5	(D) Dinitrogen pentaoxide
(3) N_2O_4	(A) Dinitrogen tetraoxide
(4) CCl_4	(C) Carbon tetrachloride

3. a. It does not absorb light from visible region

   Explanation: It does not absorb light from visible region and does not radiate blue colour.

   $CuSO_4$ is a white amorphous solid. **Copper sulphate** compound obtains blue colour only when it gets exposed to moisture. Each copper sulphate molecule aggregates with 5 molecules of water (water of crystallization) to form blue colour crystals, commonly known as blue vitriol.

4. d. Both the statements - A and B

   Explanation: Both the statements are correct. A mole is also known as a chemist's dozen. A mole, just like a dozen, is a common counting unit. A counting unit is a convenient number that makes it easier to count objects. The mass of one-twelfth of the mass of one atom of Carbon is taken as 1 u.

5. a. 5

   Explanation: There are 5 atoms in the phosphate ion - 1 atom of Phosphorus and 4 atoms of Oxygen.

6. b. Bivalent

   Explanation: Oxygen (with atomic number Z = 8) is a bivalent element. An atom of oxygen has 2 electrons in the innermost shell and 6 electrons in its outermost shell. It can accept 2 more electrons and complete an octet (8 electrons in the outermost shell).

7. b. 1-A, 2-C, 3-B, 4-D

   Explanation:

(1) Instrument used to produce images of atoms	(A) STM
(2) Atomic theory of matter	(C) John Dalton
(3) An allotrope of carbon	(B) Fullerene
(4) Potassium Sulphate	(D) Compound

   A **scanning tunneling microscope** (**STM**) is a type of electron microscope used for imaging surfaces at the atomic level. Its development earned its inventors - Gerd Binnig and Heinrich Rohrer - the Nobel Prize in Physics in 1986. The **atomic theory** was given by John Dalton. **Fullerene** is an allotrope of carbon having a large spheroidal molecule consisting of a hollow cage of sixty or more atoms. Buckminsterfullerene (buckyballs) was the first known example.

8. According to the law of constant proportions: A chemical compound always consists of the same element combined together in the same proportion by mass. This law means that whatever be the source from which it is obtained (or the method by which it is prepared), a pure chemical compound is always made up of the same elements in the same mass percentage.

9. Given, Number of stars in visible universe = 10^{22}.
   One mole= 6.023×10^{23}
   Therefore, Number of moles of stars = $\frac{10^{22}}{6.023 \times 10^{23}}$ = 0.0166 mol.

10. The valency of the element in Z_2O_3 is 3+.

11. 1 mole of steel screws = 6.022×10^{23}screws

Mass of 1 screw = 4.11 g

Therefore, Mass of 1 mole of screws = $4.11 \times 6.022 \times 10^{23}$ g

= 24.75×10^{23}g

= 2.475×10^{24}g

One mole of screw weighs = 2.475×10^{24}= 2.475×10^{21}kg

$$\frac{Mass\ of\ the\ Earth}{Mass\ of\ 1\ mole\ of\ screws} = \frac{5.98 \times 10^{24} kg}{2.475 \times 10^{21} kg} = 2.4 \times 10^{3}$$

Mass of Earth is 2.4×10^{3} times the mass of screws.

The Earth is 2400 times heavier than one mole of screws.

12. a. **Molecular Mass of Ammonium Sulphate [$(NH_4)_2SO_4$]**

=[(1 × mass of N atom +4 × Mass of hydrogen atom) × 2 + (1 × Mass of sulphur atom) + (4 × Mass of oxygen atom)].

=[(1 × 14 + 4 × 1)× 2 + (1 × 32) + (4 × 16)].

=18 × 2 + 32 + 64

=36 + 32 + 64

= 132g/mol.

b. **Molecular Mass of Penicillin [$C_{16}H_{18}N_2SO_4$]**

=[(16 × mass of carbon atom) + (18 × Mass of hydrogen atom)+ (2 × Mass of Nitrogen atom) + (1 × mass of sulphur atom) +(4 × Mass of oxygen atom)]

= [(16 × 12) + (18 × 1)+ (2 × 14) + (1 × 32) + (4 × 16)]

= 192 + 18 + 28 + 32 + 64

= 334 g /mol.

c. **Molecular Mass of Paracetamol [$(NH_4)_2SO_4$]**

= **[(**8 × Mass of carbon atom) + (9 × Mass of hydrogen atom) + (1 × mass of Nitrogen atom) + (1 × mass of oxygen atom)**]**

=**[**(8 × 12) + (9 × 1) + (1 × 14) + (1 ×16)**]**

= 96 + 9 + 14 + 16

= 135 g /mol

13. Molecular Mass of methane, CH_4 = 1 × C + 4 × H = 1 × 12 + 4 × 1 = 12+4= 16 u

Molecular mass of ethane, C_2H_6 = 2 × C +6 ×H= 2 × 12 + 6 × 1 =24 +6 =30u

Mass of 1 molecule of methane,CH_4 = $\frac{Molecular\ Mass}{Avogadro's\ number}$ = $\frac{16g}{N_A}$

Mass of 1.5 × 10^{20} molecules of methane = $\frac{1.5\times10^{20}\times16}{N_A}g$

Mass of 1 molecule of ethane, C_2H_6 = $\frac{Molecular\ Mass}{Avogadro's\ number}$ = $\frac{30}{N_A}$ g

Mass of 1.5 × 10^{20} molecules of ethane, C_2H_6 = $\frac{1.5\times10^{20}\times16}{N_A}$ g

∴ Number of molecules of ethane = $\frac{1.5\times10^{20}\times16}{N_A}$ = × $\frac{N_A}{30}$ = 0.8 × 10^{20}

14. Given atomic masses of Zn = 65 u, Na = 23 u, K = 39 u, C = 12 u, and O = 16 u.

Formula unit mass of:

i. ZnO = Atomic mass of Zn + atomic mass of O

= (65 + 16) u = 81 u

ii. Na_2O =Atomic mass of Na + atomic mass of O

= (23×2)+16= 46 + 16 = 62 u

iii. K_2CO_3= Atomic mass of K_2 + Atomic mass of C + Atomic mass of O

= (39×2) + 12 + (16×3)= 78 + 12 + 48 = 138 u

15. i. Molecular mass of H_2= atomic mass of $H \times 2$ =1×2 = 2u

ii. Molecular mass of O_2= atomic mass of $O \times 2$ = 16×2 = 32u.

iii. Molecular mass of Cl_2= atomic mass of $Cl \times 2$ = 35.5×2 = 71u.

iv. Molecular mass of CO_2= atomic mass of C + (atomic mass of O × 2)

= (12 + 32) = 44 u

v. Molecular mass of CH_4= 12 + atomic mass of hydrogen $\times 4$

= 12 + (1×4) = 16 u

vi. Molecular mass of C_2H_6= $(12 \times 2) + (1 \times 6)$

=24+6 =30 u

vii. Molecular mass of C_2H_4= $(12 \times 2) + (1 \times 4)$

=24 + 4 =28 u

viii. Molecular mass of NH_3= $14 + (1 \times 6)$=14 + 3= 17 u

ix. Molecular mass of CH_3OH= $12 + (1 \times 3)$ +16+1 =12+3+16+1 = 32u