Atomic & Molecular Weights, Mole Concept and Equivalent Weights

1. Molecular mass of Silver (Z=47) is

1) 47amu 2) 47gm 3)108amu 4)108gm

2. Molar mass of Sulphur is

1) 32amu 2) 32gm 3) 256amu 4) 256gm

3. The number of water molecules in a drop of water weighing 5mg is

1) 6.023×10^{22} 2) 3.0125×10^{21}

3) 1.67×10^{20} 4) 1.67×10^{21}

4. The mass of 1.5×10^{19} molecules of a substance is 2mg. The molar mass of the substance is

1) 20g 2) 40g 3) 80g 4) 80 a.m.u.

5. The number of nitrogen molecules present in 1c.c of gas at NTP is

1) 2.67×10^{22} 2) 2.67×10^{21} 3) 2.67×10^{20} 4) 2.67×10^{19}

6. The density of water is 1g/mL. Assuming that there are no interspaces between water molecules in liquid water, the volume of a water molecule is

1) 1.5×10^{-23}ml 2) 6×10^{-23}ml

3) 3×10^{-23}ml 4) 3×10^{-22}ml

7. The equivalent weight of glucose in the reaction

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ is [M=mol. wt]

1) M 2) M/6 3) M/12 4) M/24

8. A gaseous mixture contains oxygen and nitrogen in the ratio 1:4 by weight. The ratio of their number of molecules is

1) 1:4 2) 4:1 3) 7:32 4) 3:16

9. The number of oxygen atoms present in 50g of calcium carbonate is

1) 6.023×10^{23} 2) 30.1×10^{23} 3) 9.035×10^{23} 4) 1.206×10^{24}

10. The mixture containing the same number of molecules as that of 14 g of CO is

1) 14g of nitrogen + 16g of oxygen 2) 7g of nitrogen + 16g of oxygen

3) 14g of nitrogen + 8g of oxygen 4) 7g of nitrogen + 8g of oxygen

11. 3gm of carbon is completely burnt to get carbon dioxide. The number of molecules of CO_2 obtained is

1) 6×10^{23} 2) 3×10^{23} 3) 1.5×10^{23} 4) 7.5×10^{22}

12. Which of the following contains the maximum number of atoms?

1) 10g of $CaCO_3$ 2) 4g of hydrogen 3) 9g of NH_4NO_3 4) 1.8g of $C_6H_{12}O_6$

13. Which contains more number of molecules?

1) 1g of carbon dioxide 2) 4g of hydrogen 3) 8g of oxygen 4) 6g of Urea

14. Which of the following gases has the highest density under standard conditions?

1) CO 2) N_2O 3) C_3H_8 4) SO_2

15. Which of the following is heaviest?

1) 50g of iron 2) 5 moles of nitrogen

3) 0.1 gram atom of silver 4) 10^{23} atoms of carbon

16. The molar volume of any gas at STP is

1) 1 liter 2) 22.414 lit 3) 6.02×10^{23} lit 4) 22.414 ml

17. 1 gram - atom of oxygen is

1) 1 g of oxygen 2) 16g of oxygen 3) 22.4 g of oxygen 4) 8g of oxygen

18. One gram molecule of oxygen is

1) 16 g of oxygen 2) 32 g of oxygen 3) 8g of oxygen 4) 1g of oxygen

19. Avogadro number is

1) The number of atoms in one gram-atomic-weight

2) The number of molecules in one gram-molecular-weight

3) The number of atoms in 0.012 kg of C–12

4) All of these

20. A mole is

1) The amount of substance containing the same number of chemical units as the number of atoms in exactly 12g of C^{12}.

2) The amount of substance containing Avogadro number of chemical units.

3) The unit for expressing amount of a substance

4) All the above

21. The mass of a mole of hydrogen atoms is

1) 1.008 g 2) 2.016g 3) 6.02×10^{23}g 4) 1.008 amu

22. The molar mass of hydrogen is

1) 1.008 g 2) 2.016 g 3) 6.02×10^{23} g 4) 2.016 amu

23. One mole of atoms of nitrogen represents

1) 6.02×10^{23} atoms of nitrogen 2) 28 g of nitrogen

3) 22.4L of N_2 at STP 4) 7g of nitrogen

24. One mole of molecules of nitrogen represents

1) 6.02×10^{23} molecules of nitrogen
2) 7 g of nitrogen
3) 14g of N_2
4) 11.2L of N_2 at STP

25. One mole of sodium represents

1) 6.02×10^{23} atoms of sodium
2) 46 g of sodium
3) 11g of sodium
4) 34.5g of sodium

26. The charge present on 1 mole electrons is

1) 96500 Coulombs
2) 1Coulomb
3) 1.60×10^{-19} Coulombs
4) 0.1 Faraday

27. The weight of 0.1 mole of Na_2CO_3 is

1) 106 g
2) 10.6 g
3) 5.3 g
4) 6.02×10^{22}g

28. The molar mass of a substance is 20g. The molecular mass of the substance is

1) 20g
2) 20 a.m.u
3) 10g
4) 10 a.m.u

29. Avogadro number of helium atoms have a mass of

1) 2g
2) 4g
3) 8g
4) $4\times6.02\times10^{23}$g

30. The volume of two moles of SO_3 at STP is

1) 22.4 L
2) 11.2 L
3) 40 L
4) 44.8 L

31. The following property of a gas does not vary with pressure and temperature

1) Density
2) Volume of a mole
3) Volume
4) Vapour density

32. The ratio between the number of molecules in equal masses of Oxygen and ozone is

1) 3:2
2) 2:3
3) 1:1
4) 1:3

33. The gas which is twice as dense as oxygen under the same conditions is

1) Ozone 2) Sulphur trioxide 3) Sulphur dioxide 4) Carbon dioxide

34. 1 mole of water vapour is condensed to liquid at 25°C. Now this water contains

i) 3 moles of atoms

ii) 1 mole of H_2

iii) 10 moles of electrons

iv) 16 g of oxygen

The correct combination is

1) (i) & (ii) are correct

2) (i) & (iii) are correct

3) (i) & (iv) are correct

4) All are correct

35. A chemical equation is always balanced with respect which one of the following

i) Number of atoms

ii) Number of molecules

iii) Number of moles

iv) Mass

1) Only i is correct

2) Only iii correct

3) Only iv Correct

4) Both i & iv correct

Assertion & reason type questions

Note: 1) Both (A) and (R) are true and (R) is the correct explanation of (A).

2) Both (A) and (R) are true and (R) is not the correct explanation of (A).

3) (A) is true but (R) is false.

4) Both (A) and (R) are false.

36. (A): 2 g of hydrogen contains Avogadro number of molecules

(R): One mole of an ideal gas at STP occupies 22.4 lt.

37. (A): One liter of water at 4°C contains 55.5 N molecules.

(R): Density of water at 4°C is 1 g/ml and 18g. Of water represents one mole.

38. (A): 2 g of Hydrogen contains Avogadro number of atoms.

(R): One mole of any gas contains Avogadro number of atoms.

39. (A): 1 c.c. of Nitrogen at STP contains 2.67×10^{19} molecules.

(R): Molar volume of an ideal gas at STP contains Avogadro number of molecules.

40. (A): 28 g of nitrogen occupies 22.4 lt. at STP.

(R): Vapour density of nitrogen is 14 at all temperatures and pressures.

41. (A): 8 g CH_4 and 14 gr. nitrogen together occupy 11.2 lt. of volume at STP.

(R): Equal weights of all gases under the same conditions contain equal number of molecules.

42. (A): 58.5 g of solid NaC*l* contains Avogadro number of Cl^- ions.

(R): Chloride ion has Inert gas configuration.

43. Which of the following has highest mass?

1) One gram atom of Iron 2) 5 moles of N_2

3) 10^{24} carbon atoms 4) 44.8 lit of Heat STP

44. Elements are always combine in the ratio of their

1) Atomic weights 2) Molecular weights

3) Equivalent weights 4) Mass numbers

45. Molecular weight of orthophosphoric acid is M. Its equivalent weight is

1) 3M 2) M 3) M/3 4) 3/M

46. Which of the following acid has the same molecular weight and equivalent weight?

1) H_3PO_2 2) H_3PO_3 3) H_3PO_4 4) H_2SO_4

47. The equivalent weight of Na_2CO_3 is

1) 106 2) 53 3) 26.5 4) 35.33

48. The following is not a fixed quantity

1) Atomic weight of an element 2) Equivalent weight of an element (or) compound

3) Molecular weight of a compound 4) Formula Weight of a substance

49. Equivalent weight of $K_2Cr_2O_7$ in acidic medium is

1) 24.5 2) 49 3) 147 4) 296

50. The equivalent weight of Bayer's reagent is

1) 31.6 2) 52.6 3) 79 4) 158

51. Molecular weight of $KMnO_4$ is "M". In a reaction $KMnO_4$ is reduced to K_2MnO_4. The equivalent weight of $KMnO_4$ is

1) M 2) M/5 3) M/3 4) 2M

52. When Ferrous sulphate acts as reductant, its equivalent weight is

1) Twice that of its molecular weight

2) Equal to its molecular weight

3) One-half of its molecular weight

4) One-third of its molecular weight

53. $2H_2O \rightarrow 4e^- + O_2 + 4H^+$. The equivalent weight of molecular oxygen is

1) 32 2) 16 3) 8 4) 4

54. (A): The equivalent weights of nitric acid and crystalline oxalic acid are same.

(R): The basicity is same for both the acids.

55. (A): The basicity of H_3PO_3 is 2.

(R): Two hydrogen atoms are attached to phosphorus through oxygen atoms.

56. In acidic medium Dichromate ion oxidizes ferrous ion to Ferric ion. If the gram-molecular weight of potassium dichromate is 294 gm, its equivalent weight is

1) 294 2) 147 3) 49 4) 24.5

57. The equivalent weight of Iodine in the reaction

$2Na_2S_2O_3 + I_2 \rightarrow 2NaI + Na_2S_4O_6$ is [M=mol. wt]

1) M 2) M/2 3) M/4 4) 2M

58.

Medium	**Equivalent weight of $KMnO_4$**
A) Acidic	a) 158
B) Neutral	b) 79
C) Strongly basic	c) 52.6
D) Weakly basic	d) 31.6

The correct match is

1) A - d, B - c, C - a, D – c 2) A - d, B - c, C - a, D - b

3) A - d, B - b, C - a, D – c 4) A - d, B - c, C - a, D – a

59. Molecular mass of white phosphorous is

1) 31 amu 2) 31 g 3) 124 amu 4) 124 g

60. Basicity of sulphuric acid is

1) 0 2) 1 3) 2 4) 3

KEY

1)3	2)4	3)3	4) 3	5) 4	6) 3	7) 4	8) 3	9) 3	10) 4
11) 3	12) 2	13) 2	14) 4	15) 2	16)2	17) 2	18) 2	19) 4	20) 4
21)1	22) 2	23) 1	24) 1	25) 1	26) 1	27) 2	28) 2	29) 2	30) 4
31) 4	32) 1	33) 3	34) 4	35) 4	36) 2	37) 1	38)4	39) 1	40) 2
41) 4	42) 2	43)2	44)3	45) 3	46)1	47)2	48) 2	49) 2	50) 2
51) 1	52) 2	53)3	54)3	55)1	56)3	572	58) 1	59) 3	60) 3

Solutions

2). Sulphur molecule is S_8. Its molar mass= 8X32=256gm

3) Weight of water=5mg=$5X10^{-3}$g

No. of water molecules= (weight/GMW) X6.023X1023= ($5X10^{-3}$g/18) X6.023X10^{23}=1.67X10^{20}

4). Mass of 1.5X10^{19} molecules=2mg=2X10^{-3}g

$\therefore$ Mass of 6X10^{23}molecules (i.e. GMW) = (6X10^{23}/1.5X10^{19})X2X10^{-3}g=80gm

5) Refer Point 12

6) d=1g/ml i.e. mass of 1ml water=1gm

No. of molecules in 1gm water= 1 X6.023X10^{23}/18

Volume of (6.023X10^{23}/18) molecules=1ml

Volume of one molecule= 1/ (6.023X10^{23}/18) =3X10^{-23}ml

7) Change in oxidation state per molecule= +24-0=24

$\therefore$ GEW=M/24

8) Molecules are I the ratio of their moles. Moles of O_2: moles of N_2= (1/32) :(4/28) =7:32

9)1mole i.e. 100g $CaCO_3$ contains 3gram atoms i.e. $3X6.023X10^{23}$atoms of Oxygen

No, of atoms of Oxygen in 50g $CaCO_3$= $(50/100)X3X6.023X10^{23}=9.035X10^{23}$

10. No. of moles in 14gm CO=14/28=0.5

Moles in 7gm N_2+8gm O_2= (7/28) + (8/32) =0.5

11) 12gm carbon gives 6.023X1023 molecules of CO_2

3gm carbon gives $(3/12)6.023X10^{23}=1.506X10^{23}$ molecules of CO_2

12. No. of atoms = (weight/molar mass) $X6.023X10^{23}$Xno, of atoms per molecule

13. No. of molecules = (weight/molar mass) $X6.023X10^{23}$

14. At STP density=GMW/22.4g/lit. Higher the Gmw, higher will be the density.

15. Mass of 5moles Nitrogen=5X28=140gm

Mass of 0.1 gram atoms Ag=0.1X108=10.8gm

Mass of 10^{23} atoms of carbon= $(10^{23}/6X10^{23})$ X12=2gm

26. Charge on electron=$1.602X10^{-19}$coulmbs

Charge o 1mole i.e. $6X10^{23}$electrons=$1.602X10^{-19}$coulmbs$X6X10^{23}$=96500coulmbs=1 Faraday

27. Mass of 0.1molesNa_2CO_3=moles XGMW=0.1X106=10.6g

28. Molar mass is in gm while molecular mass in a,m.u.

29. Mass of Avogadro number of atoms=GAW=4gm

30. Volume at STP= moles X 22.4=2X22.4=44.8lit

31. V.D is the ratio of density of a gas to density of H_2. It is always constant.

32. Molecules are In the ratio of their moles. Moles of O_2: moles of O_3= (1/32) :(1/48) =3:2

33 $d \propto GMW$ or $(d_1/M_1) = (d_2/M_2)$

34,1mole water contains 2moles of H atoms+1mole of O atoms=3moles of atoms

i.e. 1mole of H_2, 16gm O and (2X1+8) =10 moles of electrons.

37. Mass of 1lit=1kg=1000gm water

No. of molecules = (wt/GMW) XN= (1000/18) XN=55.5N

43. Mass of One gram atom of Iron=56gm

Mass of 5 moles of N_2 =5X28=140gm

Mass of 10^{24} carbon atoms= (12X 10^{24})/6X10^{23}=20gm

Mass of 44.8 lit of Heat STP= (4X44.8/22.4)=8gm

45. Ortho phosphoric acid is a tri basic acid.

46. H_3PO_2 is a mono basic acid. Thus GMW=GEW

47. The equivalent weight of Na_2CO_3 =GMW/2 =106/2 =53gm

50. Bayer's reagent is cold and alkaline $KMnO_4$. In alkaline medium, oxidation number of Mn changes from +7 to +4. Thus GEW= M/3 =158/3 =52.6

51. Oxidation number of Mn changes from +7 to+6. Thus GEW= M/1

52. Oxidation number of Fe changes from +2 to+3. Thus GEW= M/1

54. Nitric acid is monobasic while oxalic acid is dibasic.

56. In acid medium oxidation state of Cr changes from +6to+3.Thus change in oxidation state per molecule =2X+3=+6

GEW of K_2CrO_7=GMW/6 =294/6 =49