Atomic, Molecular and Equivalent masses

1. Which property of an element is always a whole number?

Answer: (c) Atomic number

Reason: Atomic number represents the number of protons in an atom, which is always a whole number.

2. Which one of the following properties of an element is not variable?

Answer: (b) Atomic weight

Reason: Atomic weight is characteristic of each element and does not change for that element.

3. The modern atomic weight scale is based on?

Answer: (a) C^{12}

Reason: The modern atomic mass scale is defined relative to the carbon-12 isotope.

4. 1 amu is equal to?

Answer: (a) 1/12 of C-12

Reason: 1 atomic mass unit (amu) is defined as 1/12 of the mass of a carbon-12 atom.

5. Sulphur forms the chlorides S_2Cl_2 and SCl_2. The equivalent mass of sulphur in SCl_2 is?

Answer: (b) 16 g/mole

Reason: Equivalent mass = Atomic mass / Valency. In SCl2, valency of S = 2, atomic mass of S = 32, so equivalent mass = 32/2 = 16 g/mole.

6. The sulphate of a metal M contains 9.87% of M. This sulphate is isomorphous with $ZnSO_4.7H_2O$. The atomic weight of M is?

Answer: (a) 40.3

Reason: $ZnSO_4.7H_2O$ has formula weight 287.5 g. Metal M percentage = 9.87%, so atomic weight = (9.87/19.15)*65.38 ≈ 40.3 g/mole

7. (d) For *NaOH*, $M = N$

$N_1V_1 = 100ml \times 1N = 100ml(N)$

For H_2SO_4, $N_2V_2 = 10ml \times 10N = 100ml(N)$

Hence, $N_1V_1 = N_2V_2$.

8. In chemical scale, the relative mass of the isotopic mixture of oxygen atoms (O16, O17, O18) is assumed to be equal to?

Answer: (b) 16.00

Reason: The relative atomic mass of oxygen on the chemical scale is defined as 16.00 for practical calculations, ignoring minor isotopes.

9. For preparing 0.1 N solution of a compound from its impure sample of which the percentage purity is known, the weight of the substance required will be?

Answer: (a) More than the theoretical weight

Reason: Since the sample is impure, more weight than the theoretical pure sample is required to achieve the desired normality.

10. (b) 1 mole of CH_4 contains 4 mole of hydrogen atom *i.e.* 4*g* atom of hydrogen.

11. (a) $\overset{+2}{Na_2}SO_3 + I_2 \rightarrow \overset{+2.5}{Na_2}S_4O_6 + NaI$

$\boldsymbol{n = 2 \times 0.5 = 1}$

$\boldsymbol{E = \frac{M}{n\text{-factor}} = \frac{M}{1} = M}$

12. (b) $E = \frac{M}{5}$

13. (a) Atomic mass $= \frac{10\times19+81\times11}{100} = \frac{190+891}{100} = \frac{1081}{100}$

$= 10.81$

14. (c) 0.1*M* $AgNO_3$will react with 0.1*M NaCl* to form $0.1M\ NaNO_3$. But as the volume doubled, conc. of $NO_3^- = \frac{0.1}{2} = 0.05M$.

16. (c) wt. of metallic chloride$= 74.5$

wt. of chlorine = 35.5

∴wt. of metal $= 74.5 - 35.5 = 39$

Equivalent weight of metal $= \frac{\text{weight of metal}}{\text{weight of chlorine}} \times 35.5$

$= \frac{39}{35.5} \times 35.5 = 39$

17. (a) ∵5.8*L* of gas has mass $= 7.5gm$

∴22.4*L* " " " $= \frac{7.5}{5.8} \times 22.4 = 28.96$

So molecular weight = 29

So, molecular formula of compound is *NO*

18. (d) ∵ 17*gm* NH_3contains 6×10^{23}molecules of NH_3

∴ 4.25*gm* NH_3contains = $\frac{6\times10^{23}}{17} \times 4.25$

∴ No. of atoms $= \frac{6\times10^{23}\times4.25}{17} \times 4 = 6 \times 10^{23}$.

19. (a) ∵ 1*L* of gas at S.T.P. weight 1.16*g*

∴ 22.4 *L* of gas at S.T.P. weight $= 22.4 \times 1.16$

$= 25.984 \approx 26$

This molecular weight indicates that given compound is C_2H_2.

20. (a) Molecular weight $= 2 \times V.D = 2 \times 11.2 = 22.4$

$\because$ 22.4*gm* of gas occupies 22.4*L* at S.T.P.

$\therefore$ 11.2*gm* of gas occupies $\frac{22.4}{22.4} \times 11.2 = 11.2L$.

21. (b) Equivalent weight $= \frac{\text{Molecular weight}}{\text{Valency}}$

Molecular weight of $\begin{matrix} COOH \\ | \\ COOH \end{matrix} \cdot 2H_2O = \frac{126}{2} = 63.$

22. (b) Valency of the element $= \frac{2 \times V.D}{E+35.5} = \frac{2 \times 59.25}{4+35.5}$

$= \frac{118.50}{39.5} = 3.$

23. (d) Molarity $= \frac{W(gm) \times 1000}{V(ml) \times \text{molecular weight}}$

$\mathbf{0.25} = \frac{\mathbf{1.25 \times 1000}}{\mathbf{25 \times molecular\ weight}}$

$\therefore$ Molecular weight $= \frac{1.25 \times 1000}{0.25 \times 25} = 200.$

24. (c) Let weight of metal oxide = 100*gm*

Weight of oxygen = 32*gm*

$\therefore$ weight of metal $= 100 - 32 = 68gm$

Equivalent weight of oxide $= \frac{\text{wt. of metal}}{\text{wt. of oxygen}} \times 8$

$= \frac{68}{32} \times 8 = 17.$