UNIT : 1 SOME BASIC CONCEPTS IN CHEMISTRY

Important Points

[A] Important formulae :

1. $No.of\ moles = \dfrac{mass}{Molar\ mass}$

2. $No.of\ moles\ of\ gas = \dfrac{Volume\ at\ STP}{22.4}$

3. $No.of\ moles\ of\ Particles = \dfrac{No.of\ \ Particles}{6.022 \times 10^{23}}$

4. $No.\ of\ moles\ of\ solute = Molarity \times Vol(L)$

5. $Eq.wt.of\ a\ salt = \dfrac{M.W.of\ salt}{Total + ve\ \ charge\ of\ metal\ ion}$

6. $Eq.\ wt.of\ element = \dfrac{Atomic\ Weight}{Valency}$

7. $Avg.at.mass = \dfrac{m \times a + n \times b}{m + n}$

   where, a + b are atomic masses
   and m + n are precentage.

8. % of element in compound = $= \dfrac{n\ (at\ mass\ of\ element)}{M.W.\ of\ \ compound} \times 100$

   where, n= No. of atoms of that element

9. $Molarity = \dfrac{w \times 1000}{M.W.\ \times V(ml)}$

10. $Normality = \dfrac{w \times 1000}{E.W.\ \times V(ml)}$

11. $$Molality = \frac{w \times 1000}{MW \times Wo(g)}$$

Wo = Weight of solvent

12. $$Mole\ fraction\ (X) = \frac{n}{n+N}$$

13. $$\%W/W = \frac{W \times 100}{W + Wo}$$

14. $$ppm = \frac{weight(vol)\ of\ solute \times 10^6}{weight(vol)\ of\ solution}$$

15. Molecalar weight = 2 x V.D.

16. $$Eq.wt\ of\ metal = \frac{Wt.\ of\ metal}{wt\ of\ H_2\ displaced} \times 1.008$$

17. $$Eq.wt\ of\ metal = \frac{Wt.\ of\ metal \times 11200}{Vol\ of\ H_2\ displaced\ at\ STP\ (mL)}$$

18. $$Eq.wt\ of\ metal = \frac{Wt.\ of\ metal \times 35.5}{Wt\ of\ Chlorine\ combined}$$

19. $$Eq.wt\ of\ metal = \frac{Wt.\ of\ metal \times 11200}{Vol\ of\ Cl_2\ combined\ at\ STP\ (mL)}$$

20. $$Eq.wt\ of\ metal = \frac{Wt.\ of\ metal \times 8}{Wt\ of\ oxygen\ combined}$$

21. $$Eq.wt\ of\ metal = \frac{Wt.\ of\ metal \times 5600}{Vol\ of\ O_2\ displaced\ at\ STP\ (mL)}$$

22. $Molority = \dfrac{\%W/W \times density \times 10}{Molecular\ weight}$

23. $M_1 V_1 = M_2 V_2\ (Molarity\ equation)$

24. $N_1 V_1 = N_2 V_2\ (Normality\ equation)$

25. $n = \dfrac{Molecular\ weight}{Empirical\ \ formula\ Weight}$

26. ${}^0F = \dfrac{9}{5}({}^0C) + 32$

27. $K = {}^0C + 273.15$

28. $1\,L = 1\,dm^3, 1\,mL = 1\,cm^3$

[B] Important Facts :

1. Antoine Lavoisier - Law of conservation of mass
2. Joseph proust - Law of definite proportions
3. John Dalton - Law of Multiple proportions
4. Richter - Law of combining weights.
5. Gay Lussac - Law of combining Volumes.
6. 1 amu = 1.6605×10^{-24} gram
7. $Mass\ of\ {}^{12}C\ atom = 1.9926 \times 10^{-23}\ gram$
8. $Avogadro\ number(N_A) = 6.022 \times 10^{23}$

[c] Precision and Accuracy.

The term precision refers for the closeness of the set of values obtained form identical measurements of a quantity.

Accuracy refers to the closeness of a single measurement to its true value.

Let us take an example to illustrute. this. Three students were asked to determine the mass of a piece of metal where mass is known to be 0.520g. Data obtained by each Student are recorded in table below

	mesurements in g.			
	1	2	3	Average
Student A	0.521	0.515	.0509	0.515
Student B	0.516	0.515	.0514	0.515
Student C	0.521	0.500	.0520	0.520

The data for student A are neither, precise nor accurate. The data for student B are precise but not accurate. The data for student C are both precise and accurate.

التحضير رقم (1): تحضير المحاليل القياسية بالمولارية و العيارية

أولا: تحضير محاليل قياسية بالمولارية

1. الأساس النظري:

تعبر المولارية عن عدد المولات المذابة في واحد لتر من المحلول و حسب حالة المادة (صلبة أو سائلة) المستعملة نطبق القوانين التالية:

1 ـ 1 تحضير محلول مولاري من مادة صلبة:

$$\text{Weight} = \text{Molarity} \times \text{MW} \times \frac{\text{V (ml)}}{1000} \qquad (1)$$

علما بأن:

Weight: الوزن ، Molarity: المولارية ، MW: الوزن الجزيئي و V: حجم المحلول.

مثال: احسب الوزن اللازم لتحضير محلول من كلوريد البوتاسيوم تركيزه 0.1 مولار و حجمه 100 مل.

الحل:

من الجدول الدوري (الملحق 1) نجد بأن الأوزان الذرية لكل من البوتاسيوم و الكلور هي 39.10 و 35.45 على التوالي.

الوزن الجزيئي لـ KCl = 39.10 + 35.45 = 74.55 جرام/مول

لكي نحسب الوزن، نطبق القانون رقم (1):

$$\text{Weight} = 0.1 \times 74.55 \times \frac{100}{1000} = 0.7455 \text{ g}$$

Example:

A sample of 21.4 g of $CaCl_2$ (M.m = 111.0 g/mol) is dissolved in 450.0 mL of aqueous solution. Calculate the molarity of $CaCl_2$ in solution:

a) 0.124 b) 0.778 **c) 0.428** d) 2.46 e) 70.4

Solution:

$$n_{CaCl_2} = \frac{m}{Mw} = \frac{21.4}{111} = 0.193\,mol$$

$$V = 450\ ml = 0.45L$$

$$M = \frac{n}{v}$$

$$M = \frac{0.193}{0.45} = 0.428M$$

Example

A sample of iron ore weighing 0.2792 g was dissolved in diluted acid solution and all the Fe(II) was converted to Fe(III) ions. The solution required 23.30 mL of 0.0194 M $K_2Cr_2O_7$ for titration. Calculate the percent by mass of iron (Mr 55.85) in the ore. "المادة الخام"