

# BEGINNER'S BOX-3

**Isotope, Average Molecular mass, E.F. and M.F.**

→ use atomicity = 1

1. A compound was found to contain 5.37% nitrogen. What is the minimum molecular wt. of compound :

(A) 26.07 g

(B) 2.607

(C) 260.7

(D) none

$$\%N = \frac{\text{Atomic mass} \times \text{atomicity}}{\text{Molecular mass}} \times 100$$

$$= 260.7$$

$$5.37 = \frac{14 \times 1}{\text{molecular mass}} \times 100, \text{ molecular mass} = \frac{1400}{5.37}$$

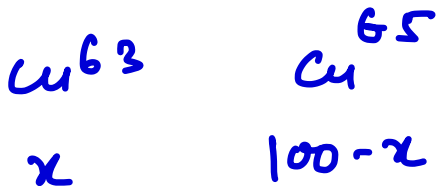
2\*. The atomic weight of Cu is 63.546. There are only two naturally occurring isotopes of copper  $^{63}\text{Cu}$  and  $^{65}\text{Cu}$ . The natural abundance of the  $^{63}\text{Cu}$  isotope must be approximately :

(A) 10%

(B) 30%

(C) 50%

✓ (D) 70%

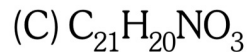
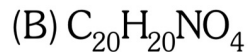
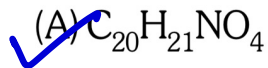


$$63.546 = \frac{63 \cdot x + 65(100-x)}{100}$$

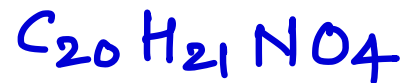
$$6354.6 = 6500 - 2x$$

$$2x = 145.4 \Rightarrow x = 72.7\%$$

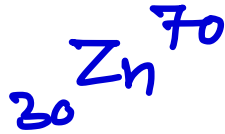
3. A certain alkaloid has 70.8% carbon, 6.2% hydrogen, 4.1% nitrogen and the rest oxygen. What is its empirical formula:



E	mass	mole	S.R
C	70.8	$\frac{70.8}{12} = 5.9$	$\frac{5.9}{0.29} = 20$
H	6.2	$\frac{6.2}{1} = 6.2$	$\frac{6.2}{0.29} = 21$
N	4.1	$\frac{4.1}{14} = 0.29$	$\frac{0.29}{0.29} = 1$
O	18.9	$\frac{18.9}{16} = 1.18$	$\frac{1.18}{0.29} = 4$



4. The total number of neutrons in dipositive zinc ions with mass number 70 is  
(A) 34      ☒ (B) 40      (C) 36      (D) 38



$$\begin{aligned}\text{neutrons} &= A - Z \\ &= 70 - 30 = 40\end{aligned}$$

5. Number of gm-atoms of sulphur present in  $\text{SO}_2$  gas which occupy 22.7 ml at S.T.P.  
☒ (A) 0.001      (B) 0.01      (C) 1      (D) 10

gram atom means mole of atom

$$\text{moles of } \text{SO}_2 = \frac{22.7 \times 10^{-3}}{22.7} = 10^{-3}$$

$$\begin{aligned}\text{moles of S atoms} &= \text{moles of } \text{SO}_2 \times \text{atomicity of S} \\ &= 10^{-3} \times 1 = 0.001\end{aligned}$$

6\*. In an organic compound of molar mass greater than 100 containing only C, H and N, the percentage of C is 6 times the percentage of H while the sum of the percentages of C and H is 1.5 times the percentage of N. What is the least molar mass :

(A) 175

☒ (B) 140

(C) 105

(D) 210

% C

% H

% N

$6x$

$x$

$100 - 7x$

51.43

8.57

40

$$x = \frac{150}{17.5} = 8.57$$

$$(\%C + \%H) = 1.5(\%N)$$

$$(6x + x) = 1.5(100 - 7x)$$

$$7x = 150 - 10.5x$$

$$17.5x = 150$$

El.	mass	molc	S.R
C	51.43	$\frac{51.43}{12} = 4.29$	$\frac{4.29}{2.86} = 1.5$
H	8.57	$\frac{8.57}{1} = 8.57$	$\frac{8.57}{2.86} = 3$
N	40	$\frac{40}{14} = 2.86$	$\frac{2.86}{2.86} = 1$

$$\times 2 = 3$$

$$\times 2 = 6$$

$$\times 2 = 2$$



$$M_{wt} = n(70) \rightarrow \begin{matrix} n=1 & n=2 & n=3 & n=4 \\ 70 & 140 & 210 & 280 \end{matrix}$$

7. The simplest formula of a compound containing 50% of element X (atomic mass = 10) and 50% of the element Y (atomic mass = 20) by weight is :

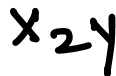
(A) XY

☒ (B) X<sub>2</sub>Y

(C) XY<sub>2</sub>

(D) X<sub>2</sub>Y<sub>3</sub>

E	mass	molc	S.R
X	50	$\frac{50}{10} = 5$	2
Y	50	$\frac{50}{20} = 2.5$	1



8. Cortisone is a molecular substance containing 21 atoms of carbon per molecule. The mass percentage of carbon in cortisone is 69.98 %. Its molar mass is :

(A) 176.5

(B) 252.2

(C) 287.6

☒ (D) 360.1

$$\% C = \frac{\text{atomic mass} \times \text{atomicity}}{\text{molecular mass}} \times 100$$

$$\text{molecular mass} = \frac{12 \times 21}{69.98} \times 100 = 360.1 \text{ g/mol}$$

9\*. Sample I has higher  $O^{18}/O^{16}$  ratio of atoms are compared to Sample II. The average mass of oxygen in Sample I is .....that of Sample II :

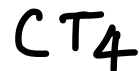
- (A) equal to                      (B) greater than                      (C) less than                      (D) None of these

$\left(\frac{O^{18}}{O^{16}}\right)$  Ratio is greater means that sample contains more  $O^{18}$  and that has more mass.

10. Calculate the change in percentage of C (by weight) when all H-atoms are replaced by 'T' in  $CH_4$  molecule.

(Given atomic weight - C : 12, H : 1, T : 3)

- (A) 75%                      (B) 50%                      ✓ (C) 25%                      (D) 40%                      \_\_\_\_\_



$$\%C = \frac{12}{16} \times 100$$

$$\%C = 75\%$$

$$\%C = \frac{12}{24} \times 100 = 50\%$$

$$\text{change in \% of C} = 25\%$$

