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Answers Key:

IV. ANSWER ANY FOUR QUESTIONS

1.

Compound	Molecular formula	Empirical Formula
Fructose	$C_6H_{12}O_6$	CH_2O
Caffeine	$C_8H_{10}N_4O_2$	$C_4H_5N_2O$

2.

Element	Percentage	Atomic mass	Relative number of atoms	simple ratio	Whole no
C	76.6	12	$\frac{76.6}{12} = 6.38$	$\frac{6.38}{1.06} = 6$	6
H	6.38	1	$\frac{6.38}{1} = 6.38$	$\frac{6.38}{1.06} = 6$	6
O	17.02	16	$\frac{17.02}{16} = 1.06$	$1.06\frac{1.06}{1.06} = 1$	1

Empirical Formula = C_6H_6O

$n = \frac{molar\ mass}{calculated\ eprirical\ formula\ mass}$

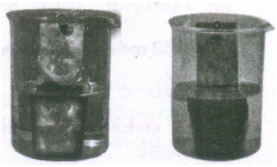
$= \frac{2\times\ vapour\ density}{94}\ \frac{2\times47}{94} = 1,$

Molecular formula (C_6H_6O) x 1 = C_6H_6O.

3. Displacement reaction: Redox reactions in which an ion (or an atom) in a compound is replaced by an ion (or atom) of another element are called displacement reactions. They are further classified into

(i) metal displacement reactions

(ii) non-metal displacement reactions.

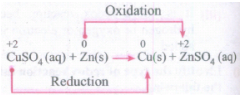


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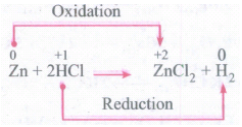
(i) Metal displacement reactions :

Place a zinc metal strip in an aqueous copper sulphate solution taken in a beaker. Observe the solution, the intensity of the blue colour of the solution slowly reduced and finally disappeared.

The zinc metal strip became coated with brownish metallic copper. This is due to the following metal displacement reaction.



(ii) Non-metal displacement:

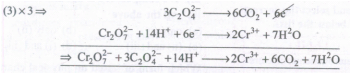


4. $\overset{+3}{C}_2O_4^{2-} \longrightarrow \overset{+4}{C}O_2$

$\overset{+6}{C}r_2O_7^{2-} \longrightarrow Cr^{3+}$

(1) $\Rightarrow C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^-$

$Cr_2O_7^{2-} \longrightarrow 2Cr^{3+} + 7H^2O$



5.

Content	Reactant		Product	
	x	y	l	m
Stoichiometric coefficient	2	3	4	1
No. of moles allowed to react	8	15	-	-
No. of moles of reactant reacted and product formed	8	12	16	4
No. of moles of un-reacted reactants and the product formed	-	3	16	4

Limiting reagent : x

Product formed : 16 moles of l & 4 moles of m

Amount of excess reactant : 3 moles of y

6.

Chemical equality	Equivalent Factor(n)	Formula for calculating equivalent mass (E)	Example
Acids	Basicity (no. of moles of ionisable H^+ ions Present in 1 mole of the acid)	E = Molar mass of the acid / Basicity of the acid	H_2SO_4 basicity = 2 eq mol^{-1} Molar mass of H_2SO_4 = =(2 x 1)+(1 x 32)+(4 x 16) = 98 g mol^{-1} Gram equivalent mass of H_2SO_4 = $\frac{98}{2}$ = 49 g eq^{-1}
Bases	Acidity (no. of moles of ionisable OH^- ion present in 1 mole of the base)	E = Molar mass of the base / Acidity of the base	KOH acidity = 1 eq mol^{-1} Molar mass of KOH = (1 x39)+(1 x 1) + (1 x 16) = 56 g mol^{-1} Gram equivalent mass of KOH $\frac{56}{1}$ = 56 g eg^{-1}
Oxidising agent (or) reducing agent	No. of moles of electrons gained (or) lost by one mole of the reagent during redox reaction	E = Molar mas of the oxidising (or) reducing agent / No.of moles of electrons gain or loss by one mole of the oxidising (or) reducing agent	$KMnO_4$ is an oxidising agent, Molar mass of $KMnO_4$ = (1 x 39) +(1 x 55) + (4 x 16) =158 g mol^{-1} In acid medium permanganate is reduced during oxidation.and is given by the following equation MnO^-_4 + $8H^+$ + $5e^-$ > Mn^{2+} + $4H_2O$ $\therefore$ n = 5 eq mol^{-1} Gram equivalent mass of $KMnO_4$ = $\frac{158}{5}$ = 31.6 g eq^{-1}

III. ANSWER ANY FOUR QUESTIONS. Q.No: 19 IS COMPULSORY

7.

	Oxidation	Reduction
1.	Addition of oxygen	Addition of Hydrogen
2.	Removal of Hydrogen	Removal of oxygen
3.	Addition of an electronegative element.	Addition of an electro positive element
4.	Removal of an electro positive element	Removal of an electro negative element
5.	Loss of electron	Gain of electron
6.	Increase in oxidation state / number	Decrease in oxidation state/ number.

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8. Molar mass = density x Molar volume
= 1.965 x 2.24 x 10^{-2}
= 4.4016 x 10^{-2} kg/mol
= 4.4016 x 10^{-2} x 10^3 g/mol
= 44.016 g/mol

9.

Compound	Given No.of moles	No.of oxygen atoms
Ethanol - C_2H_5OH	1	$1\times6.022\times10^{23}$
Formic acid - HCOOH	1	$2\times6.022\times10^{23}$
Water - H_2O	1	$1\times6.022\times10^{23}$
Formic acid		

10. 1) The unit of molecular mass is atomic mass unit [amu]. The unit of molar mass is gram per mole.
2) Molecular mass is the mass of one molecule while molar mass is the mass of one mole of molecules (6.022 x 10^{23})
(i) Molecular mass of CO_2 = 1(C) + 2(0) = 12 + 32 = 44 amu
or 7.304 x 10^{-23} g
(ii) Molar mass of CO_2 = 44 g mol^{-1}.

11. The balanced equation for the combustion of ethane
$C_2H_6 + \frac{7}{2}O_2 \longrightarrow 2CO_2 + 3H_2O$
$2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$
To produce 4 moles of CO_2, 2 moles of ethane is required
To produce 1 moles (44 g) of CO_2 required
Number of moles of ethane
$= \frac{2 \text{ mol ethane}}{4 \text{ mol} CO_2} \times 1 \text{ mol} CO_2$
$= \frac{1}{2} mole \quad of \quad ethane$
= 0.5 mole of ethane

12.

The balanced stoichiometric equation for the formation of ammonia is

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

As per the stoichiometric equation,

To produce 2 moles of ammonia, 3 moles of hydrogen are required.

$\therefore$ to produce 10 moles of ammonia,

$$\frac{3 \text{ moles of } H_2}{2 \text{ moles of } NH_3} \times 10 \text{ moles of } NH_3 = 15$$

= 15 moles of hydrogen are required.

II. ANSWER ANY FOUR QUESTIONS. Q.No: 15 IS COMPULSORY

13. "The relative atomic mass is defined as the ratio of the average atomic mass factor to the unified atomic mass unit".
14. One mole is the amount of substance of a system, which contains as many elementary particles as there are atoms in 12 g of carbon -12 isotope.
15. It is defined as the imaginary charge left on the atom when all other atoms of the compound have been removed in their usual oxidation states that are assigned according to set of rules.
16. i) urea $[CO(NH_2)_2]$
    Mol.mass = 1 (C) + 2(N) + 4(H) + 1(0)
    = 1(12) + 2(14) + 4(1) + 1(16)
    = 12 + 28 + 4 + 16 = 60
    ii) Acetone $[CH_3\,COCH_3]$
    Mol.mass = 3(C) + 6(H) + 1(0)
    = 3(12) + 6(1) + 1(16)
    = 36 + 6 + 16 = 58
    iii) Boric Acid $[H_3BO_3]$
    Mol.mass = 3(H) + 1(B) + 3(0)
    = 3(1) + 1(11) + 3(16)
    = 3 + 11 + 48 = 62
    iv) Sulphuric Acid $[H_2SO_4]$
    Mol.mass = 2(H) + 1(S) + 4(0)
    = 2(1) + 1(32) + 4(16)
    = 2 + 32 + 64 = 98
17. Molar mass of ethane, C_2H_6 = (2 x 12) + (6 x 1) = 30 g mol^{-1}
    n = mass / molar mass = 9g / 30 g mol^{-1} = 0.3 mole
18. (i) Element - Copper wire, Silver plate
    (ii) Compound - Sugar, distilled water, carbon dioxide, Table salt, Naphthalene balls
    (iii) Mixture - Sea water

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I.ANSWER ALL THE QUESTIONS

19. (b) Oxygen
20. (a) 102 g
21. (c) 16%
22. (d) 1 moles of HCl (g)
23. (b) $P_4(s) + 3NaOH + 3H_2O \longrightarrow PH_3(g) + 3NaH_2PO_2(aq)$
24. (d) 6.022×10^{24}molecules of water
25. (c) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-} < SO_4^{2-}$
26. (d) the mass of one mole of carbon
27. (b) 44 g mol^{-1}
28. (b) 52.7