CHEMISTRY-01

MARKING SCHEME

032/1

(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
C	E	A	B	E	C	C	B	D	B

10 Marks@01

2. **01 mark @ =05 marks**

I	Ii	iii	iv	v	vi
D	H	F	C	G	J

SECTION B

3. a) (i) Striking back effect or burning back effect of a Bunsen burner. (03 Mark)

(ii) The following are the causes of Striking back effect;

- ❖ insufficient gas pressure
- ❖ Excessive air flow
- ❖ Blockage of the jet or gas inlet
- ❖ Damaged burner

Any one reason, ***03 Mark***

(iii) solutions to the problems above

- ❖ Turn off the gas tap
- ❖ Close the air holes
- ❖ Ensure gas supply is sufficient
- ❖ Avoid over heating or prolonged use of the burner.

Any 2 solutions, ***03Marks @01***

4. Heat value (E) = 43400KJ/Kg

Volume of water (V_w) =20 Lts =0.02m^3

Temperature change = 100^0C- 24^0C = 76K

Specific heat capacity of water (C_w) =4.18J/KgK^{-1} = 4180$KJkg^{-1}K^{-1}$

Density of water = 1000Kg/m^3

Density of Ethanol = 810Kg/m^3 **02mark**

Volume of Ethanol (V_E) = ?

From; Heat value (E) = Total energy liberated/mass of fuel burnt

E = Mass of water (M_w) x Cw x change in temperature/mass of fuel burn **02mark**

Hence mass of fuel burn = $M_w C_w$ change in temperature/ E

And, M_w = Density of water x V_w = 1000Kg/m^3 x 0.02m^3

Mass of fuel burn = 1000Kg/m^3x0.02m^3x4180KJ$Kg^{-1}K^{-1}$x76K/43400KJ$Kg^{-1}K^{-1}$ **02mark**

Mass of fuel burn =146.40Kg. **01 mark**

Volume of Ethanol (V_E) = Mass of fuel burn/Density of ethanol

V_E =146.40Kg/810Kgm^{-3}

V_E = 0.18m^3

The volume of Ethanol is 0.18m^3. **02mark**

5. (a) The reactant which was present in small amount.

$$2SO_2(g) + O_2(g) \longleftrightarrow 2SO_3(g)$$

$$\frac{2moles\ SO2}{3moles\ SO2} = \frac{1mole\ O2}{x\ moles\ O2}$$

$$x = \frac{3moles \times 1mole}{2moles}$$

$$x = 1.5\ moles\ of\ O2$$

: Because 3 moles of SO_2 need 1.5 moles of oxygen out of 5 moles, therefore **Sulphur dioxide** is present in small amount. ***02 Marks***

(b) To calculate the mass of reactant left in the container.

Moles of oxygen left unreacted = 5moles-1.5 moles

= 3.5 moles

From,

$$moles, n = \frac{mass}{molar\ mass}$$

$$mass = n \times molar\ mass$$

$$= 3.5moles \times 32g/moles$$

$$= 112g$$ ***03 Marks***

: The mass of reactant left in the container is 112g of Oxygen gas.

(c) To find the moles of sulphur trioxide produced.

$$\frac{2Moles\ SO2}{3Moles\ SO2} = \frac{2Moles\ SO3}{x\ moles\ SO3}$$

$$x = \frac{3moles \times 2moles}{2moles}$$

$$= 3moles\ of\ SO3$$ ***02 Marks***

The number of moles of sulphur trioxide produced is 3 moles

(d) To find the volume of sulphur trioxide produced at STP.

From,

$$moles, n = \frac{volume}{molar\ volume}$$

$$volume = n \times molar\ volume$$

$$= 3moles \times 22.4l/moles$$

$$= 67.2L$$ ***02 Marks***

The volume of Sulphur trioxide produced is 67.2 litres

6. (a) (i). The effervescence was due to evolution of carbon dioxide gas since egg shells contain calcium carbonate (01 mark).

$CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$.

(ii). It turns lime water milky. (01 mark)

(iii).

- Fire extinguisher.
- Manufacture of aerated (fizzy) drinks.
- Refrigeration: Carbon dioxide is used for refrigeration purposes (i.e. in the deep-freezing of foods).
- Manufacture of sodium carbonate by the Solvay process.
- Manufacture of baking soda. 02 marks
- To raise dough.
- Photosynthesis. ***(Any three uses of carbon dioxide gas.)***

(b). (i). Solution A ***(01 Mark)***

(ii). Solution C ***(01 Mark)***

Sodium hydrogen carbonate (**$NaHCO_3$**) is formed by the neutralization of a **strong base** (**NaOH**) and a **weak acid** (**H_2CO_3**, carbonic acid). Since it is derived from a **strong base and a weak acid**, it is a **basic salt** and has a **slightly alkaline** nature. In aqueous solution, **$NaHCO_3$** undergoes partial hydrolysis **(02 marks)**

$NaHCO_3 + H_2O \rightleftharpoons Na^+ + OH^- + H_2CO_3$

(c) The presence of **OH^- ions** makes the solution slightly **basic.** (01 marks)

7. (a). Electrolysis is a redox reaction because cations are reduced at the cathode (by gaining of electrons) and anions are oxidized at the anode (by loosing electrons. (01 marks)

(b). Data:

2g of Cl-

How many electrons?

$2Cl^- \longrightarrow Cl_2(g) + 2e$ (01 marks)

From the eqn:

2mols of Cl^- $\longrightarrow$ 2F

71g of Cl^- $\longrightarrow$ 2F **(01 marks)**

2g of Cl^- $\longrightarrow$?

$= \frac{2 \times 2}{71}$

= 0.056F

0.056F = **0.056 mol of electrons**

N = n X NA

= 0.056 X 6.02 X 10^{23}

= 3.3712 X 10^{22} electrons 200W **(01 marks)**

(c). Data:

Time = 30 minutes = **1800s**

P= 200W **(02 marks)**

V= 110V

$I = \frac{200}{110}$

= 1.818 A.

$M = \frac{Ar.I.t}{V.F}$ ***(01 marks)***

$M = \frac{65\ X 1.818\ X\ 1800}{2\ X\ 96500}$. **(01marks)**

The mass of zinc produced is 1.102g (*01 marks)*

8. (a) CH_3OH- Methanol ***(02 Marks@01)***
HCOOH- Methanoic acid

(b) (i) $2CH_3OH\ (aq) + 2Na(s) \rightarrow 2\ CH_3ONa(aq) + H_2(g)$ ***(01 Mark)***

(ii) $HCOOH + NaOH(aq) \rightarrow HCOONa(aq) + H_2O(l)$ ***(02 Marks)***

(c) The following are the series of substitution reaction taking place during chlorination of methane gas.

(i) $CH_4\ (g) + Cl_2(g) \xrightarrow{U.V\ light} CH_3Cl(g) + HCl(g)$

(ii) $CH_3Cl\ (g) + Cl_2(g) \xrightarrow{U.V\ light} CH_2Cl_2(g) + HCl(g)$

(iii) $CH_2Cl\ (g) + Cl_2(g) \xrightarrow{U.V\ light} CHCl_3(g) + HCl(g)$

(iv) $CHCl_3\ (g) + Cl_2(g) \xrightarrow{U.V\ light} CCl_4(g) + HCl(g)$

(04 Marks@01)

SECTION C

9. One of the ways by which copper (II) sulphate crystals can be made, is this one.

(a) It doesn't matter if the amount of sulphuric acid used is more or less than $50cm^3$ because an excess of copper (II) oxide was used. **(02 marks)**

(b) The mixture was stirred with a glass rod and not with an iron rod because
- the iron rod would react with the sulphuric acid
- iron being more reactive than copper, displaces copper from its solution of its salt **(03 marks)**

(c) Excess copper (II) Oxide was used to ensure that all the acid has been used **(01marks)**

(d) A balanced equation of the reaction, including the state symbols
- $CuO_{(s)} + H_2SO_{4\ (aq)} \rightarrow CuSO_{4\ (aq)} + H_2O_{(l)}$ **(02 marks)**

(e) The solution filtered before evaporation to remove excess copper (II) oxide **(01 marks)**

(f) The crystals dried between filter papers and not heated to dryness. If heated, the crystals would lose water of crystallization and anhydrous copper (II) sulphate would be left. **(02 marks)**
- $CuSO_4 \cdot 5H_2O_{(s)} \rightleftharpoons CuSO_{4(s)} + 5H_2O_{(g)}$

(g) The relative molecular mass of hydrated Copper (II) sulphate, ($CuSO_4 \cdot 5H_2O$)
64 + 32 + (4 x 16) + (5 x 18) = 250
(01 mark)
-

(h) The mass of $CuSO_4 \cdot 5H_2O$ crystals that could be obtained from $50cm^3$ of 1M H_2SO_4
- $100cm^3$ of 1M $H_2SO_4 = \frac{100\ x\ 1}{1000} = 0.1\ mole\ of\ acid$

- As in, $CuO_{(s)} + H_2SO_{4\,(aq)} \rightarrow CuSO_{4\,(aq)} + H_2O_{(l)}$
- 1 mole of the acid reacts with 1 mole copper (II) oxide to form 1 mole of copper (II) sulphate. **(03 marks)**
- Moles of copper (II) sulphate crystals = 0.1
  $\therefore Mass\ of\ copper\ (II)\ sulphate\ crystals = 0.1\ x\ 250 = 25g$

10. Data: Carbon = 80%, Hydrogen = 20% (01 marks)

Elements	C	H
Relative Atomic mass	12	1
% composition by mass	80	20
Divide by RAM	$\frac{80}{12}$ =6.7	$\frac{20}{1}$ =20
Divide by the smallest	$\frac{6.7}{6.7}$ =1	$\frac{20}{6.7}$ =2.9 ≈ 3

(a). Empirical formula = **CH_3**
Vapour density X 2 = Relative molecular weight
15 X 2 = 30
Molecular formula= (Empirical formula) $_n$
30 = (CH_3) n
30 = (12 + 3)n
30= 15n
n=2
Molecular formula **$2(CH_3)$ = P = C_2H_6** **(04 marks)**

(b). $C_2H_6(g) + Br_2(l) \longrightarrow C_2H_5Br(g) + HBr(g)$

$C_2H_5Br(g) + NaOH(l) \longrightarrow C_2H_5OH(l) + NaBr(aq)$

$$C_2H_5OH(l) \xrightarrow[H+]{KMnO_4} CH_3COOH(aq) + H_2O(l)$$ (@ 02)

$CH_3CH_2OH(l) + CH_3COOH(aq) \longrightarrow CH_3COOCH_2CH_3 + H_2O(l)$

P= C_2H_6
Q= C_2H_5Br
R= C_2H_5OH
S= CH_3COOH
M= $CH_3COOCH_2CH_3$ (04 marks)

11. a) (i) Litmus paper will retain its blue colour since cucumber juice solution is alkaline. ***(01 Mark)***

(ii) Litmus paper will change its colour from blue to red since lemon juice solution is acidic. ***(01 Mark)***

b) (i) In order to neutralize excess acid in the patient's stomach. ***(01 Mark)***

(ii) The balanced chemical equation;

$2HCl(aq) + Mg(OH)_2 \longrightarrow MgCl_2(aq) + H_2O(l)$ ***(01 Mark)***

(iii) Data given

Normal stomach acid concentration=160Mm

= 0.16M Stomach acid concentration present

= 210mM = 0.21M Excess stomach

concentration = 0.21M-0.16M=0.05M

Volume of acid solution = 0.5L

Molarity = $\frac{\text{moles}}{\text{Volume}}$

Mole = Molarity X volume

= 0.05M X 0.5L

= 0.025 moles ***(03 Mark)***

2 moles of HCl = 1 mole Mg (OH)2

0.025 mole of HCl=? mole Mg (OH)2

X = 0.0125 ***(01 Mark)***

moles $Mg(OH)_2$ n = mass/molar mass

mass = n X molar mass

= 0.0125moles X 58g/mole

= 0.725g ***(03 Marks)***

The mass of the antacid needed to neutralize excess acid in patients' stomach is 0.725g

(iv) 1 tablet = 0.145g of $Mg(OH)_2$

? tablet = 0.725g Mg $(OH)_2$

X= 5 tablets ***(01 Mark)***

1 tablet = 12 hours

5 table t=? Hours

= 60hours

1day = 24 hours

? days= 60hours

X= $2^{1/2}$ days ***(03 Marks)***