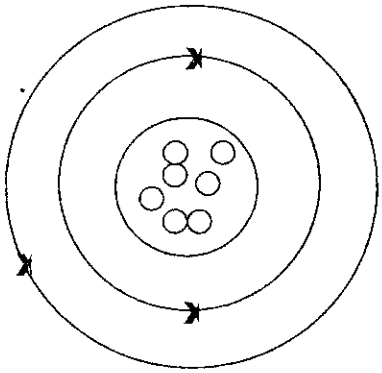
Chemistry

PAPER 2 MARKING SCHEME

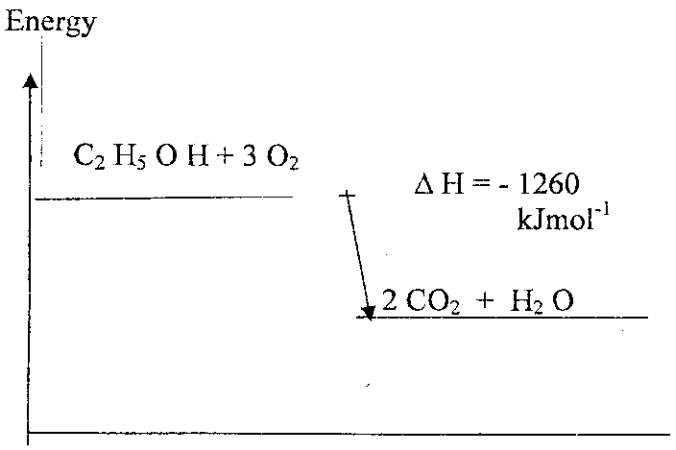
Question No.	Explanation	Mark	Σ Mark
1 (a)	No of electrons = 18, No of neutrons = 22	1+1	
b(i)	The total number of protons and neutrons in the nucleus of an atom	1	
(ii)	40	1	
c(i)	2.1	1	
(ii)		2	
d(i)	W,Y	1	
(ii)	Isotopes have the same number of valence electrons./proton number	1	
(iii)	Carbon dating to estimate the age of fossils /artefacts/wood	1	
	Total Marks		**10**

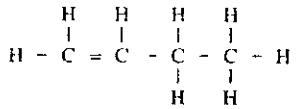
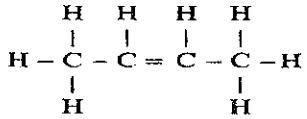
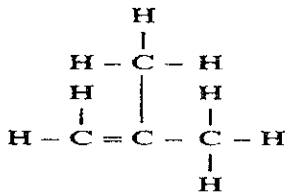
Question No.	Explanation	Mark	Σ Mark
2(a)	Is a representation of a chemical substance using letters for atoms and subscripts for each type of atoms present in the substance.	1	
(b)	[Able to name suitable acid and metal and its equation] For example		
(i)	Hydrochloric acid and zinc metal	1	
(ii)	$Zn + 2HCl \rightarrow ZnCl_2 + H_2$	1	
(c)	Hydrogen gas must be flowed/through/into the combustion tube for a few minutes before heating/ The flow of hydrogen gas must be continuous throughout the experiment/ [Accept any one answer]	1	
(d) (i)	Number of mole of copper = $\frac{1.62}{64}$ = 0.025mole	1	
(ii)	Number of mole of oxygen = $\frac{0.40}{16}$ = 0.025mole	1	
(iii)	Number of mole of copper : Number of mole of oxygen 0.025 : 0.025 The simplest ratio 1 : 1	1	
	The empirical formula of copper(II) oxide is CuO	1	
(e)	Iron(II) oxide / Tin(II) oxide / Lead(II) oxide	1	
(f)	Burning of metal in excess oxygen	1	
	Total marks		**10**

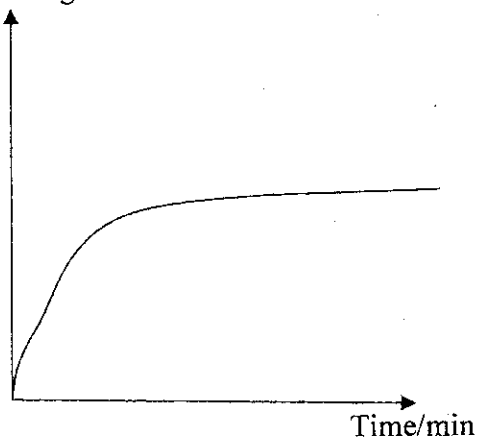
Question No.	Explanation	Mk	Σ Mark
3 (a)(i)	Group 1 and Period 4	1+1	
(ii)	G	1	
(b)(i)	D_2L	1	
(ii)	Soluble in water// high melting / boiling point// conducts electricity in molten or aqueous solution	1	
c(i)	E	1	
(ii)	The nuclei attraction towards the valence electrons is weaker in E.	1	
	Thus it is easier for E to lose / release an electron to form a positively charged ion.	1	
d(i)	L//M	1	
(ii)	Covalent bond	1	
	Total Marks		**10**

Question No.	Explanation	Mark	Σ Mark
4 (a)	A weak acid is an acid that dissociates partially in water to produce hydrogen ions	1	
(b)	Sour	1	
(c)	Colourless to pink	1	
(d)	Neutralisation is an exothermic reaction./ releases heat	1	
(e)	Some of the energy produced during the reaction between a weak acid and strong base is used to ionise/dissociate completely the weak acid molecules.	1	
(f)	$H^+ + OH^- \rightarrow H_2O$	1	
(g) (i)	Number of moles of malic acid= $\frac{5.00}{134}$ = 0.0373 mol	1	
(ii)	Number of moles of sodium hydroxide used = $\frac{2.00 \times 37.30}{1000}$ = 0.0746 mol	1	
	1 mole of H^+ reacts with 1 mole of OH^- Thus, number of mole of H+ ions in the sample = 0.0746	1	
	0.0374 mole of malic acid produces 0.0746 mole of hydrogen ion. Hence, 1 mole of malic acid produces $\frac{0.0746}{0.0373}$ = 2 mole of H^+	1	
	Or No of mole of malic acid : No of mole of NaOH 1 : 2 Therefore, malic acid is diprotic (proven)		
	Total marks		**10**

Question No.	Explanation	Mark	Σ Mark
5a(i)	Haber Process	1	
(ii)	$3H_2 + N_2 \rightarrow 2NH_3$	1	
(iii)	Catalyst : Iron Temperature : 450°C	1 1	
(b)	Sulphur trioxide is dissolved in concentrated H_2SO_4 to form oleum Oleum is diluted with water to produce sulphuric acid	1 1 1	
(c)(i)	$(NH_4)_2SO_4$	1	
(ii)	% of N = $\frac{2(14)}{132}$ x 100% = 21.21%	1 1	
	Total marks		**10**

Question No.	Explanation	Mark	Σ Mark
6(a)(i)	Ethanol	1	
(ii)	One mole of ethanol when completely burnt in oxygen (under standard conditions) will release 1260 kJ of heat energy	1	
(b)(i)	No of moles of alcohol = 0.23 / 46 = 0.005 mol	1	
	1 mol of alcohol burnt released 1260 kJ Thus, 0.005 mol of alcohol burnt released 6.3 kJ	1	
(ii)	mcø = 6.3 kJ Mcø = 6.3 x 1000	1	
	Ø = 6300/ 200 x 4.2 = 7.5 ^{0} C	1	
(c)	Heat is lost to the surrounding // Heat is absorbed by the apparatus or containers // Incomplete combustion	1	
(d)			
	Reaction path	1	
	Label energy and diagram has 2 different energy levels	1	
	Balanced chemical equation		
(e)	- 2656 kJmol^{-1} // 2500-2700 kJmol^{-1}	1	
	Total marks		**10**

Question No.	Explanation	Mark	Σ Mark
7(a)	 but-1-ene /  but-2-ene /  2-methylpropene 1. Correct structural formula 2. Correct name [Any two structural formulae and related names]	4	4
(b)(i)	X: propanol / propan-1-ol / propan-2-ol Y : propan-1,2-diol Z : propane	1 + 1 + 1	3
(ii)	Reaction I : $C_3H_6 + H_2O \rightarrow C_3H_7OH$ Reaction II : $C_3H_6 + H_2O + [O] \rightarrow C_3H_{16}(OH)_2$ Reaction III : $C_3H_6 + H_2 \rightarrow C_3H_8$	1 + 1 + 1	3
(c)	1. Hexene is a unsaturated hydrocarbon while hexane is a saturated hydrocarbon 2. Hexene has a double bond between carbon and carbon atoms 3. Undergoes addition reaction when it reacts with bromine water 4. Hexane has single bond between carbon and carbon atoms 5. Cannot react with bromine water 6. % of C in $C_6H_{14} = \frac{6(12)}{86} \times 100\%$ 7. $= 83.72\%$ 8. % of C in $C_6H_{12} = \frac{6(12)}{84} \times 100\%$ 9. $= 85.71\%$ 10. The percentage of carbon atoms in C_6H_{12} is higher than C_6H_{14}	1 1 1 1 1 1 1 1 1 1	10
	Total marks		**20**

Question No.	Explanation	Mark	Σ Mark
8 (a)(i)	Correct apparatus set up Correct labelling	1 1	
(b) (i)	Volume of gas / cm^3  		
(ii)	Curve labelling axes with units	1 1	4
	$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$	1	
	No. of moles acid = $\frac{(0.1)(50)}{1000} = 5 \times 10^{-3}$	1	
	2 mol of HCl reacted evolve 1 mol of CO_2 0.005 mol of HCl reacted evolve $\frac{0.005}{2}$ mol of CO_2 = 0.0025 mol CO_2	1	
	Volume of CO_2 =(0.0025)(24) = 0.06 dm^3 = 60 cm^3	1	4
	Overall average rate of reaction = $\frac{\text{Total volume of } CO_2}{\text{Total time}}$ = $\frac{60\ cm^3}{300\ s}$ = 0.2 $cm^3\ s^{-1}$	1 1	2

	Rate of reaction in Expt II is higher than Expt I Experiment II is at a higher temperature, the kinetic energy of the reacting particles increases and the particles move faster Frequency of collision between marble and hydrogen ions increases Frequency of effective collision increases Rate of reaction in Expt III is higher than Expt I Powdered marble in Expt III has greater total surface area/ bigger surface area per unit volume Powdered marble is more exposed to collision Frequency of collision between marble and hydrogen ions increases Frequency of effective collision increase [-1 if students use HCl or particles in the explaination]	1 1 1 1 1 1 1 1 1 1 **Total**	 5 5 **20**

Question No.	Explanation	Mark	Σ Mark
9 (a)(i)	Precipitation // Exothermic	1	
	$Ag^+ + Cl^- \rightarrow AgCl$	1	2
(b)	Salt Y is added into a test tube and distilled water is added to dissolve it. The aqueous solution is separated into 3 portions. Sodium hydroxide solution is added into one portion until in excess White precipitate formed dissolves in excess sodium hydroxide solution showing zinc ion , lead ion & aluminium ion may be present in salt Y. Ammonia solution is added to another portion until in excess . White precipitate dissolves confirming the presence of ion zinc in salt Y. Dilute sulphuric acid is added to the last portion , followed by acidified iron (II) sulphate solution and concentrated sulphuric acid. Brown ring formed shows the presence of NO_3^- ion in salt Y. ***<u>Preparation of zinc sulphate salt</u>***	1 1 1 1 1 1 1 1 1 1	Max 8
(c)	About 50 cm^3 of 1 mol dm^{-3} sulphuric acid is poured into a beaker. The beaker containing the sulphuric acid is heated gently . Zinc oxide powder is added little by little into the warm sulphuric acid, and stirred continuously till the zinc oxide powder no longer dissolves in the acid. The excess zinc oxide is removed by filtering. The solution of zinc sulphate /the filtrate is poured into an evaporating dish and heated until it becomes saturated / concentrated. The hot saturated zinc sulphate solution is allowed to	1 1 1 1 1 1 1 1	

	cool and crystals of zinc sulphate are formed. The zinc sulphate crystals are filtered and then dried between sheets of filter papers. The equation for the reaction is: $ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$ (accept procedures in active voice)	1 1	10
	Total marks		**20**

Question No.	Explanation	Mark	Σ Mark
10 (a)	Chemical Equations : II and III	1+1	
	Reasons : Involving oxidation and reduction occurring simultaneously/at the same time	1	
	Reaction II Oxidation: Cu loses electron to form Cu^{2+} Reduction: Ag^+ gain electron to form Ag // Electron transfer from Cu to Ag^+ or Oxidation: Oxidation number of Cu increase from 0 to 2+ Reduction: Oxidation number of Ag^+ decrease from +1 to 0	1+1	
	Reaction III Oxidation: Zn loses electron to form Zn^{2+} Reduction: $2H^+$ gain electron to form H_2 or Oxidation: Oxidation number of Zn increase from 0 to 2+ Reduction: Oxidation number of H^+ decrease from +1 to 0 // Electron transfer from Zn to H^+	1+1	Max 6
(b)(i)	Bromine water	1	
(ii)	Terminal: negative; Half-equation: $Fe^{2+} \rightarrow Fe^{3+} + e$; Observation: Green to brown/yellow	1+1	
	Terminal: positive; Half-equation: $Br_2 + 2e \rightarrow 2Br^-$; Observation: brown to colourless /decolourises	1+1	5

(iii)	Draw out 1 cm^3 of the solution from terminal negative into a test tube. Add NaOH / NH_3 solution / Potassium Hexanocyanoferrate(II) solution to the test tube Observation: Brown ppt / brown ppt / dark blue ppt respectively. Shows that iron(II) ion is changed / oxidised to iron(III) ion	1 1 1	3
(d)			

	Electrolytic Cells	Chemicals Cells	
Energy change	Electrical energy → Chemical energy	Chemical Energy → Electrical Energy	1+1
Half-equation at anode	Cu → Cu^{2+} + 2e	Zn → Zn^{2+} + 2e	1+1
Electron flow	Electrons flow from anode to cathode.	Electrons flow from zinc to copper./	1+1

[-1 if students does not construct a table]

Total marks **20**