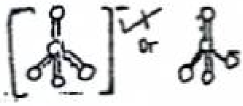
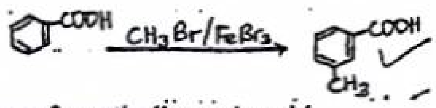
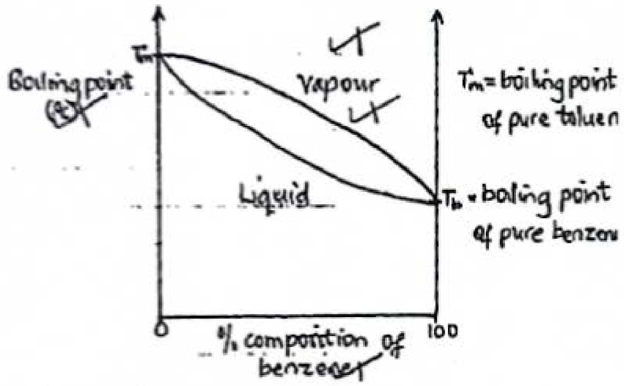
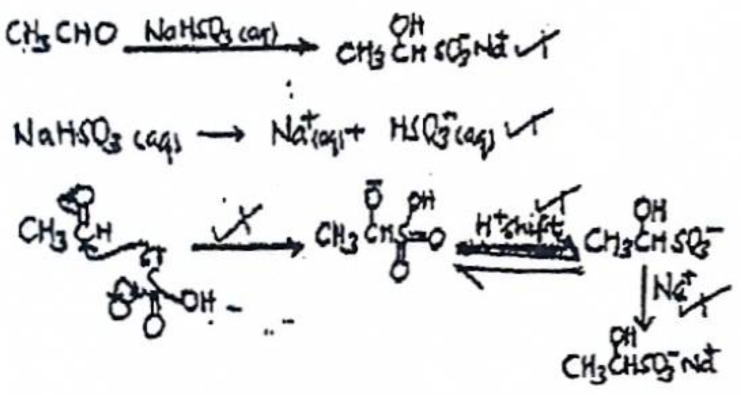
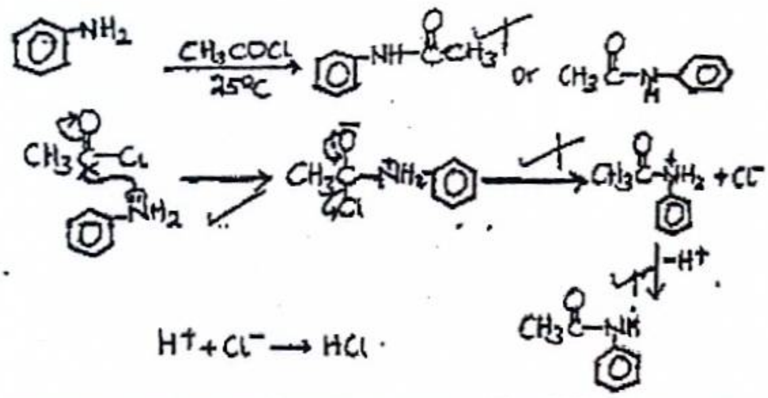
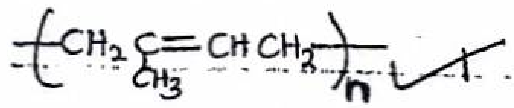
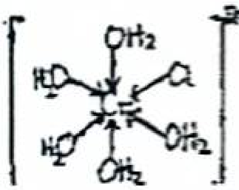
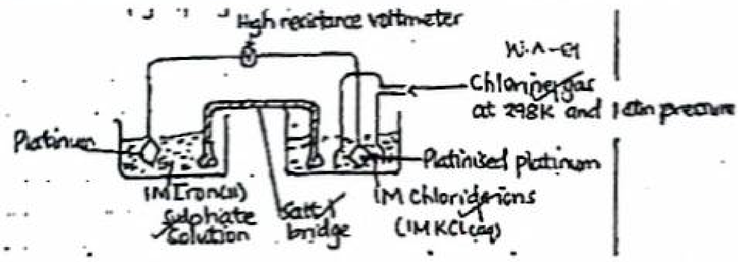
WAKISSHA JOINT MOCK EXAMINATIONS
SCORING GUIDE
Uganda Certificate of Education
Chemistry P525/1
July/August 2025

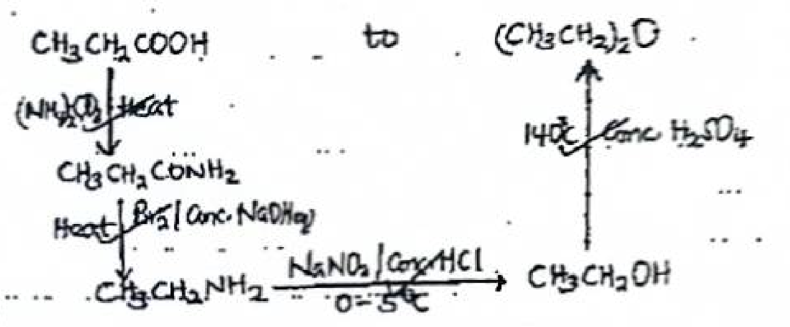
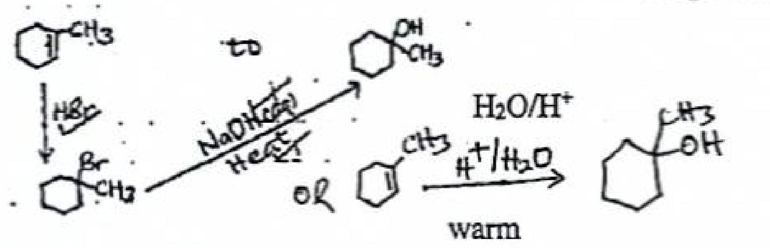
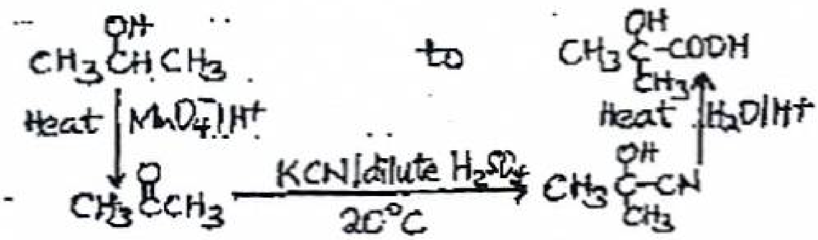
1(a)	Br Cl_3  T-shaped rej – T- shape CLO_4^-  Tetrahedral Accept C – O only one position	02
(b)	(i) Pale green solution turns brown / orange. (ii) $8Fe^{2+}_{(aq)} + ClO^-_{4(aq)} + 8H^+_{(aq)} \rightarrow 8Fe^{3+}_{(aq)} + Cl^-_{(aq)} + 4H_2O_{(l)}$	
		04 M
2(a)	(a) $CH_3CHO \xrightarrow[Heat]{Ag_2O/NH_{3(aq)}} CH_3COOH$ Name Ethanoic acid (b)  Name Phenylmethanal / IUPAC only (c)  Name 3-methylbenzoic acid (d) $H_2NCH_2COOH \xrightarrow[<5^\circ C]{NaNO_2 / conc.HCl} HOCH_2COOH$ Name – 2- hydroxyethanoic acid	
		06 M
3(a)	The intermolecular force between the molecules of different components in solution are equal to the magnitude of forces between pure component molecules (average cohesive forces)	01 m
(b)	Let the mole fraction of benzene in solution be x. Partial V.P of benzene = Partial V.P of methylbenzene (relevant formula) $Pb^\theta x = Pm^\theta (1-x)$ $95.10\,x = 28.4(1-x)$	03 m

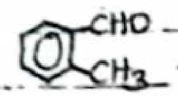
	$x = 0.229959$ (22.9959%) mole fraction of methylbenzene $= 1 - 0.2299 \simeq 0.7700$	
©	 01 – shape + phases	02 marks
		06MARKS
4 (a)	$= B_aSO_{4(s)}+aq \rightleftharpoons Ba^{2+}_{(aq)}+SO^{2-}_{4(aq)}$ rej $BaSO_{4(s)}$	01 marks
(b)	R.F.M of $SO_4^{2-} = 32.1+16\times4 = 96.1$ $\left[SO_4^{2-}\right] = \frac{1.053\times10^{-3}}{96.1}$ $= 1.095734 \times 10^{-5}$ moldm^{-3} Ksp = $[Ba^{2+}][SO_4^{2-}]$ $= (1.095734 \times 10^{-5})^2$ $= 1.200632 \times 10^{-10}$ mol^2 dm^{-6} units	03 marks $\frac{1}{2}$
(c)	(i) Solubility increases (ii) Lead (II) ions react with sulphate ions to form lead (ii) sulphate reducing the concentration of sulphate ions in the saturated solution. To restore the solubility product (equilibrium) more solid barium sulphate dissociates.	$1\frac{1}{2}$
		06 MARKS
5(a)	(i) Heat energy absorbed to break one mole of covalent bonds into its constituent free gaseous atoms. (ii) The atomic radius of chlorine is smaller than the atomic radius of iodine which is less electro negative. The hydrogen to chlorine bond is shorter, more polar and stronger than the hydrogen to iodine bond. Therefore, More heat is required to break the H-Cl bond than the H-I bond.	01 mark 02 marks

(b)	HCL does not react with sulphuric acid. HI is oxidized to iodine by concentrated sulphuric acid which is reduced to sulphur dioxide and water. $2HI_{(g)} + H_2SO_{4(l)} \rightarrow SO_{2(g)} + I_{2(g)} + H_2O_{(l)}$	
		05
6(a)		02
(b)		02
		05 MAR
7(a)	Rate = K[$S_2O_3^{2-}$] [I^-]	01 mar
(b)	$K = \frac{Rate}{[S_2O_8^{2-}][I^-]}$ $= \frac{5.6\times10^{-4}}{0.05\times0.02}$ $= 0.56 mol dm^3 s^{-1}$	02 mark
(c)	Iron(ii) ions (Fe^{2+}) acts as a catalyst. It provides an alternative reaction path of lower activation energy. more $S_2O_8^{2-}$ and I^- ions have sufficient kinetic energy to overcome the activation energy, increasing the frequency of effective collisions.	02 mark
		05 MARK

8(a)	(i) Carbon forms gaseous oxides. (accept first 2) Carbon tetrachloride does not undergo hydrolysis Carbon does not complexes (ii) For carbon tetrachloride, carbon lacks the vacant 3 – d orbitals that can accept the lone pair of electrons from water, hence no hydrolysis. (for complex hydrolysis) - For gaseous oxides, carbon forms double bonds with each oxygen atom (0 = c = 0). This leads to formation of discrete molecules which are joined together by weak vander waals forces that are broken at room temperature, hence enabling the oxide of carbon to exist as a gas.	01 mark 01 mark
(b)	Carbon does not react with dilute nitric acid Tin reduces dilute nitric acid to ammonium nitrate and itself oxidized to tin (II) nitrate. $4Sn_{(s)} + 10H^{+}_{(aq)} + NO^{-}_{3(aq)} \rightarrow 4Sn^{2+}_{(aq)} + NH^{+}_{4(aq)} + 3H_2O_{(l)}$ $4Sn_{(s)} + 10HNO_{3(aq)} \rightarrow 4Sn(NO_3)_{2(aq)} + NH_4NO_{3(aq)} + 3H_2O_{(l)}$	02 marks
		05 MARKS
9(a)	(i)  (ii) 	$^1/_2$ $^1/_2$
(b)	R.F.M of monomer = 5 x 12 + 8 x 1 = 68 R.F.M of polymer = 68 x 820 = 55,760	$^1/_2$
(c)	– Car tyres – Medical gloves, catheters and seals, brake pads – Making wetsuits, cycling shorts, balloons, erasers, conveyor belts etc.	01 marks
		3½ MARKS
	SECTION B (54 MARKS)	
10(a)	(i) The isomers contain free chloride ions which react with silver nitrate to form sparingly soluble silver chloride. $Ag^{+}_{(aq)} + Cl^{-}_{(aq)} \rightarrow AgCl_{(s)}$ (for reacting forming) (ii) Chromium forms Coloured compounds	$1^1/_2$ 02

	$Cr(H_2O)_6^{3+}$ - green Variable oxidation states $^+2$, $^+3$ and $^+6$ Catalytic activity – Cr/ polymerization of H.D.P. Paramagnetic – eg with unpaired electrons in 3d – subshell.	
(b)	(i) X - Hexa aqua chromium (III) chloride (ii) $[Cr(H_2O)_4Cl_2]^+ Cl^- 2H_2O$ (iii)  $(Cl^-)_2 \cdot H_2O$ Octahedral Accept dative bonds without arrows.	
(c)	(i) The green solution turns yellow (ii) Hydrogen peroxide oxidizes chromium (III) ions in alkaline medium to chromate (VI) ions and itself reduced to water. $2Cr^{3+}_{(aq)} + 3H_2O_{2(aq)} + 10\bar{O}H_{(aq)} \rightarrow 2CrO^{2-}_{4(aq)} + 8H_2O_{(l)}$	
		09 M
11(a)	Atomization energy Ionisation energy Enthalpy of hydration	1
(b)	 $\frac{1}{2}$ for salt bridge or 03 fully correct.	03
(c)	$E^{\theta}_{cell} = E^{\theta}_{R} - E^{\theta}_{L}$ $\Delta G = -nE^{\theta}_{cell}F$ $= 1.36 - 0.77$ $= {}^-2 \times 0.59 \times 96500$ $= 0.59$ volts $= {}^-113.87KJ$	03
(d)	$2Fe^{3+}_{(aq)} + Zn_{(s)} \rightarrow 2Fe^{2+}_{(aq)} + Zn^{2+}_{(aq)}$	$1\frac{1}{2}$
		09 MA

12 (a)		04
(b)	reagent / condition 	02
©		03
		09 MARKS
13(a)	(i) $K_p = P_{NH_3}^2 \times P_{CO_2}$	$\frac{1}{2}$
	(ii) $P_{NH_3} = \frac{2}{3} \times 1.20 = 0.8$ atm $P_{CO_2} = \frac{1}{3} \times 1.20 = 0.4$ atm or $P_{CO_2} = 1.2 - 0.8 = 0.4$ atm $K_p = 0.8^2 \times 0.4$ $= 0.256$ atm^3	04
(b)	(i) Kp value increases The dissociation of ammonium carbamate is endothermic hence increasing temperature favours the forward reaction and increases the partial pressures of the gaseous products.	$1\frac{1}{2}$
	(ii) Equilibrium position shifts from the left to right Neon is an inert gas which decreases the partial pressures of ammonia and carbon dioxide. To restore the Kp value, more ammonium-carbamate dissociates.	$1\frac{1}{2}$
	(iii) Degree of dissociation increases. Sodium hydroxide reacts with carbon dioxide to form sodium	

	carbonate. The reaction decreases the concentration of carbon dioxide at equilibrium. More solid ammonium carbamate dissociates to restore the equilibrium.	
		09
14(a)	**Reagent** Fehling's solution and heat reject other reagents **Observation** CH_3CHO – reddish brown precipitate  - No observable change	
(b)	**Reagent** Ammoniacal silver nitrate solution **Observations** $HOCH_2COOH$ – No observable change $HCOOH$ – silver mirror deposit	
(c)	**Reagent** Hot concentrated sodium hydroxide solution/ dilute / acidified silver nitrate nitric acid followed by silver nitrate solution. **Observations** $CH_3\underset{\underset{Cl}{\vert}}{C}HCH_3$ - white precipitate $CH_3\underset{\underset{I}{\vert}}{C}HCH_3$ - Yellow precipitate	
		09 MA[illegible]
15(a)	(i) $Cl_{2(g)} + 2I^-_{(aq)} \rightarrow 2Cl^-_{(aq)} + I_{2(aq)}$ (ii) Starch indicator	1½
(b)	Moles of $S_2O_3^{2-}$ ions = $\frac{23.8 \times 0.10}{1000}$ $= 2.38 \times 10^{-3}$ $I_{2(aq)} + 2S_2O^{2-}_{3(aq)} \rightarrow S_4O^{2-}_{6(aq)} + 2I^-_{(aq)}$ Moles of I_2 = $\frac{1}{2} \times 2.3 \times 10^{-3}$	½

	$= 1.19 \times 10^{-3}$ Moles of I_2 in 500cm^3 of solution $= \frac{500}{25.0} \times 1.19 \times 10^{-3}$ $= 0.0238$ $MnO_2 : Cl_2 = 1:1$ and $I_2 : Cl_2 = 1:1$ $\therefore$ Moles of MnO_2 in pyrolusite = 0.0238 Mass of pure $MnO_2 = 0.0238 \times (54.9 + 16 \times 2)$ $= 2.06822$g % of $MnO_2 = \frac{2.06822}{2.40} \times 100$ $= 86.176\%$	05
(c)	(i) MnO_4^{2-} or Manganate (VI) ions (ii) $3MnO^{2-}_{4(aq)} + 4H^+_{(aq)} \rightarrow 2MnO^-_{4(aq)} + MnO_{2(s)} + 2H_2O_{(l)}$	$^1/_2$ $^1/_2$
		09 MARKS
16.(a)	(i) The depression in freezing point of 1000g of solvent caused by dissolving one mole of non-volatile solute (ii) 200g of benzene dissolved 4.6g of solute. 1000g of benzene dissolved $\left(\frac{1000 \times 4.6}{200}\right)$g of solute. $= 23$g 1.28k is the depression caused by 23g 5.12k is the depression caused by $\left(\frac{5.12 \times 23}{1.28}\right)$ $= 92$ Molar mass = 92g/mol. (iii) Observed molar mass is twice the theoretical value (R.F.M of HCOOH = 46) Methanoic acid dimerises through intermolecular hydrogen bonding in a non-polar solvent (benzene) The concentration of solute particles is halved thus the molar mass doubles since it's inversely proportional to the depression in freezing point.	01 03 02

(b) (i) Methanoic acid ionizes in water to release hydrogen (hydroxonium) ions into solution.

Reject dissociate

Give $\frac{1}{2}$ for equation only.

(ii) Methanoic acid reacts with sodium hydroxide to form sodium methanoate

Or $HCOOH + NaOH \rightarrow HCOONa_{(aq)} + H_2O_{(l)}$

Sodium methanoate undergoes hydrolysis to form weak Methanoic acid and excess hydroxide ions hence the solution is alkaline

$HCOO + H_2O_{(l)} \leftrightharpoons HCOOH + OH$

09 MA

17(a) Heat change that occurs when one mole of a less electropositive metal is displaced from its aqueous solution by a more reactive (electropositive) metal. 01

(b)

ΔT (^{0}C)	0.0	7.4	11.4	13.8	14.8	14.8	14.6	14.2
Time(s)	0	30	60	90	120	150	180	210

01

(Graph at the back) 03

At 6 correct ΔT values.

(c) $\Delta T\text{max} = (16.40 \pm 0.20)^0C$ from graph.

Mass of solution = 50 x 1.0

= 50g

Heat evolved = mc ΔTmax

= 50 x 4.2 x 16.4

= 3.444J

Moles of $CuSO_4 = \frac{50 \times 0.32}{1000}$

= 0.016

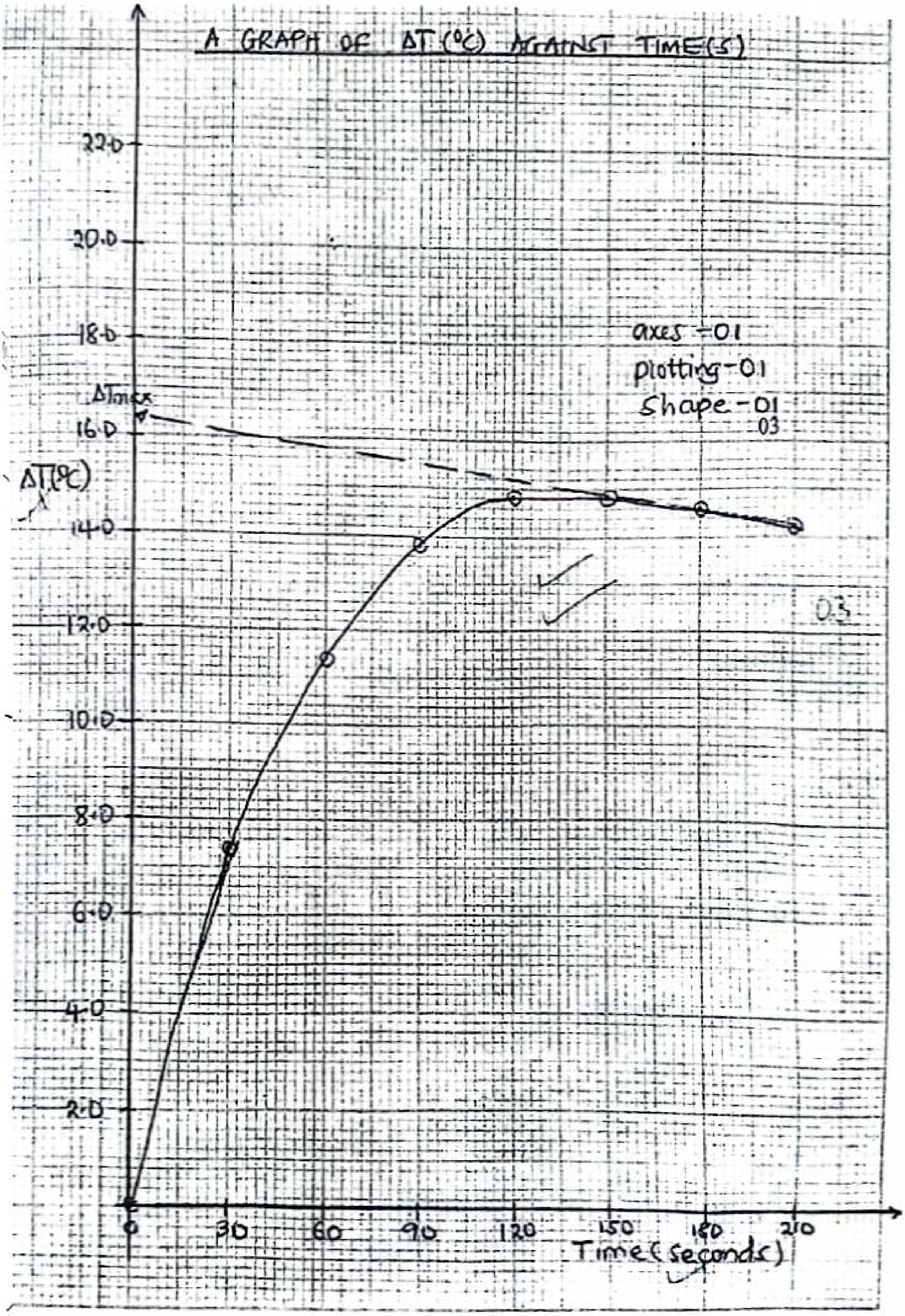
0.016 moles evolved 3.444KJ 04

1 mole evolved $\left(\frac{3.444}{0.016}\right)$KJ

= 215.25KJ

Enthalpy of displacement = -215.25KJmol^{-1}

09 MARKS


A GRAPH OF ΔT (°C) AGAINST TIME(S)
22.0
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
ΔTmax
ΔT(°C)
axes - 01
plotting - 01
shape - 01
03
03
0
30
60
90
120
150
180
210
Time (seconds)

END