

Mark Scheme Summer 2008

GCE

GCE O Level Chemistry (7081)

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Summer 2008

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Contents

	Page
1. 7081/01 (Paper 1) Mark Scheme	1
2. 7081/02 (Paper 2) Mark Scheme	16

7081/01 O Level Chemistry Mark Scheme - June 2008

Question Number	Acceptable Answers	Reject	Mark
1 (a)	BaO		(1)

Question Number	Acceptable Answers	Reject	Mark
1 (b)	Sulphur dioxide / sulphur(IV) oxide		(1)

Question Number	Acceptable Answers	Reject	Mark
1 (c)	Potassium carbonate		(1)

Question Number	Acceptable Answers	Reject	Mark
1 (d)	$\text{CH}_2=\text{CH}_2$ / C_2H_4 / CH_2CH_2 / $\text{H}_2\text{C}=\text{CH}_2$		(1)

Question Number	Acceptable Answers	Reject	Mark
1 (e)	Iron(III) oxide/ferric oxide		(1)

Question Number	Acceptable Answers	Reject	Mark
1 (f)	$\text{Al}_2(\text{SO}_4)_3$		(1)

(Total 6 Marks)

Question Number	Acceptable Answers	Reject	Mark
2 (a)	<ul style="list-style-type: none"> • Sodium • 10 • 2.8.6 		(1) (1) (1)

Question Number	Acceptable Answers	Reject	Mark
2 (b)(i)	Sulphur /S		(1)

Question Number	Acceptable Answers	Reject	Mark
2 (b)(ii)	Sodium/Na		(1)

Question Number	Acceptable Answers	Reject	Mark
2 (b)(iii)	Neon/Ne		(1)

(Total 6 Marks)

Question Number	Acceptable Answers	Reject	Mark
3 (a)	Phosphorus / P		(1)

Question Number	Acceptable Answers	Reject	Mark
3 (b)	Iodine / I ₂		(1)

Question Number	Acceptable Answers	Reject	Mark
3 (c)	Oxygen / O ₂		(1)

Question Number	Acceptable Answers	Reject	Mark
3 (d)	Sulphur / S ₈		(1)

Question Number	Acceptable Answers	Reject	Mark
3 (e)	Bromine/Iodine / Br ₂ / I ₂		(1)

Question Number	Acceptable Answers	Reject	Mark
3 (f)	Argon / Ar		(1)

(Total 6 Marks)

Question Number	Acceptable Answers	Reject	Mark
4 (a)	blue		(1)

Question Number	Acceptable Answers	Reject	Mark
4 (b)	black		(1)

Question Number	Acceptable Answers	Reject	Mark
4 (c)	green		(1)

(Total 3 Marks)

Question Number	Acceptable Answers	Reject	Mark
5 (a)	Reduction		(1)

Question Number	Acceptable Answers	Reject	Mark
5 (b)	Not oxidation or reduction		(1)

Question Number	Acceptable Answers	Reject	Mark
5 (c)	Redox		(1)

Question Number	Acceptable Answers	Reject	Mark
5 (d)	Not oxidation or reduction		(1)

Question Number	Acceptable Answers	Reject	Mark
5 (e)	Redox		(1)

Question Number	Acceptable Answers	Reject	Mark
5 (f)	Oxidation		(1)

(Total 6 Marks)

Question Number	Acceptable Answers	Reject	Mark
6 (a)	11		(1)

Question Number	Acceptable Answers	Reject	Mark
6 (b)	3		(1)

Question Number	Acceptable Answers	Reject	Mark
6 (c)	3		(1)

Question Number	Acceptable Answers	Reject	Mark
6 (d)	2		(1)

Question Number	Acceptable Answers	Reject	Mark
6 (e)	60		(1)

Question Number	Acceptable Answers	Reject	Mark
6 (f)	0.01		(1)

(Total 6 Marks)

Question Number	Acceptable Answers	Reject	Mark
7 (a)(i)	S ²⁻ / P ³⁻		(1)

Question Number	Acceptable Answers	Reject	Mark
7 (a)(ii)	K ⁺ / Ca ²⁺ / Sc ³⁺ / Ti ⁴⁺		(1)

Question Number	Acceptable Answers	Reject	Mark
7 (b)	<ul style="list-style-type: none"> 4 single electron pair bonds correct Remaining outer electrons correct on all atoms (<i>Second mark can only be scored if first mark awarded</i>) (Can be all dots or all crosses) 		(1)
			(1)

Question Number	Acceptable Answers	Reject	Mark
7 (c)(i)	Allotropes		(1)

Question Number	Acceptable Answers	Reject	Mark
7 (c)(ii)	<ul style="list-style-type: none"> Diamond has strong covalent bonds (between all the atoms) / each carbon atom is covalently bonded to four other carbon atoms or diamond has a rigid tetrahedral structure / is a tetrahedral macromolecule Graphite has weak forces/ van der Waals forces between layers / hexagonal rings or Graphite <u>layers</u> are able to slide 	any reference to intermolecular forces scores 0/1 particles slide over one another	(1)
			(1)

(Total 7 Marks)

Question Number	Acceptable Answers	Reject	Mark
8 (a)	<ul style="list-style-type: none"> e.g. hydrogen peroxide / H_2O_2 and manganese(IV) oxide /manganese dioxide/MnO_2 		(1)
	<ul style="list-style-type: none"> Relights a <u>glowing</u> splint 	lighted splint burns brighter	(1)

Question Number	Acceptable Answers	Reject	Mark
8 (b)	<ul style="list-style-type: none"> Mg/Zn/Fe and (dilute) hydrochloric acid/HCl /sulphuric acid/H_2SO_4 / concentrated hydrochloric acid Accept calcium and water 	concentrated H_2SO_4	(1)
	<ul style="list-style-type: none"> Pops with a lighted splint / burns with a pop 	glowing splint gives a pop	(1)

Question Number	Acceptable Answers	Reject	Mark
8 (c)	<ul style="list-style-type: none"> Any specified metal carbonate/ $NaHCO_3$ / $KHCO_3$ and (dilute) hydrochloric acid/sulphuric acid/nitric acid (<i>accept name or correct formula</i>) 	concentrated sulphuric acid	(1)
	<ul style="list-style-type: none"> Add to lime water/calcium hydroxide (solution) turns milky/forms white ppt. /turns cloudy 		(1)

(Total 6 Marks)

Question Number	Acceptable Answers	Reject	Mark
9 (a)	39.5 (allow 39-40)		(1)

Question Number	Acceptable Answers	Reject	Mark
9 (b)	33.5 (allow 33-34)		(1)

Question Number	Acceptable Answers	Reject	Mark
9 (c)	43 °C (allow 42-44)		(1)

Question Number	Acceptable Answers	Reject	Mark
9 (d)(i)	crystals would form at the same temperature		(1)

Question Number	Acceptable Answers	Reject	Mark
9 (d)(ii)	If cooled slowly, crystals would be larger / if cooled quickly, crystals would be smaller		(1)

(Total 5 Marks)

Question Number	Acceptable Answers	Reject	Mark
10 (a)	HCO_3^-		(1)

Question Number	Acceptable Answers	Reject	Mark
10 (b)	OH^-		(1)

Question Number	Acceptable Answers	Reject	Mark
10 (c)	SO_4^{2-}		(1)

Question Number	Acceptable Answers	Reject	Mark
10 (d)	Br^-		(1)

Question Number	Acceptable Answers	Reject	Mark
10 (e)	NO_3^-		(1)

Question Number	Acceptable Answers	Reject	Mark
10 (f)	O^{2-}		(1)

(Total 6 Marks)

Question Number	Acceptable Answers	Reject	Mark
11 (a)	81		(1)

Question Number	Acceptable Answers	Reject	Mark
11 (b)	$(4.05/81 =) 0.05$		(1)

Question Number	Acceptable Answers	Reject	Mark
11 (c)	volume = moles/concentration \therefore volume = $0.05/2$ (allow t.e.)		(1)
	= 0.025 dm^3 or 25 cm^3 Answer without working scores (1)		(1)

Question Number	Acceptable Answers	Reject	Mark
11 (d)	$M_r(\text{ZnSO}_4) = 161$ mass = 161×0.05 = 8.05 g (allow t.e.)		(1)
			(1)

Question Number	Acceptable Answers	Reject	Mark
11 (e)(i)	$14.35 - 8.05$ (or answer in d) = 6.30 g		(1)

Question Number	Acceptable Answers	Reject	Mark
11(e)(ii)	$8.05/161 : 6.30/18$		(1)
	$0.05 : 0.35$		(1)
	$1 : 7$		(1)
	or $M_r(\text{ZnSO}_4 \cdot x\text{H}_2\text{O}) = 161 \times 14.35/8.05$ = 287		(1)
	mass water = 126 moles = $126/18$ = 7		(1)
	or $M_r(\text{ZnSO}_4 \cdot x\text{H}_2\text{O}) = 14.35/0.05$ = 287 $161 + 18x = 287$ $18x = 126$ $x = 7$		(1)

(Total 9 Marks)

Question Number	Acceptable Answers	Reject	Mark
12 (a)	Fe ₂ O ₃		(1)

Question Number	Acceptable Answers	Reject	Mark
12 (b)	carbon monoxide / CO		(1)

Question Number	Acceptable Answers	Reject	Mark
12 (c)	coke / carbon reacts with air / oxygen or oxidation of coke / carbon or combustion of coke or $C + O_2 \rightarrow CO_2$		(1)

Question Number	Acceptable Answers	Reject	Mark
12 (d)(i)	silicon dioxide / silica / SiO ₂		(1)

Question Number	Acceptable Answers	Reject	Mark
12(d)(ii)	* limestone / calcium carbonate decomposes to calcium oxide		(1)
	* calcium oxide then reacts with the silicon dioxide to form slag / calcium silicate /CaSiO ₃		(1)
	* $CaCO_3 \rightarrow CaO + CO_2$		(1)
	* $CaO + SiO_2 \rightarrow CaSiO_3$		(1)
	or * SiO ₂ reacts with limestone / calcium carbonate		(1)
	* to form slag / calcium silicate /CaSiO ₃		(1)
	* $CaCO_3 + SiO_2 \rightarrow CaSiO_3 + CO_2$		(2)

Question Number	Acceptable Answers	Reject	Mark
12(d)(iii)	makes iron brittle / attacks furnace lining		(1)

(Total 9 Marks)

Question Number	Acceptable Answers	Reject	Mark
13 (a)(i)	Some attempt to show a tetrahedral structure	If any incorrect bonding	(1)

Question Number	Acceptable Answers	Reject	Mark
13(a)(ii)	V-shaped	If any incorrect bonding	(1)

Question Number	Acceptable Answers	Reject	Mark
13 (b)	Intermolecular forces in water are stronger (or converse) / molecules are more strongly attracted (to each other) in water	If any mention of covalent bonds being broken / being stronger in water than in methane	(1)

Question Number	Acceptable Answers	Reject	Mark
13 (c)(i)	<ul style="list-style-type: none"> • Number of bonds 4, 2 • Energy required 1652, 992, 2644 		(1) (1)

Question Number	Acceptable Answers	Reject	Mark
13(c)(ii)	<ul style="list-style-type: none"> • Number of bonds 2, 4 • Energy released 1610, 1852, 3462 		(1) (1)

Question Number	Acceptable Answers	Reject	Mark
13(c)(iii)	$2644 - 3462 = -818$ (allow t.e.)	if $3462 - 2644$	(1)

(Total 8 Marks)

Question Number	Acceptable Answers	Reject	Mark
14 (a)(i)	* $24.24 / 12 : 4.04 / 1 : 71.72 / 35.5$ * $2.02 : 4.04 : 2.02$ or $2:4:2$ $\therefore 1:2:1$ or * $49.5 \times 24.24/100 = 12$ $49.5 \times 4.04/100 = 2$ $49.5 \times 71.22/100 = 35.5$ * divide by relative atomic masses $\therefore 1:2:1$	any use of atomic numbers = 0/2	(1) (1) (1) (1)

Question Number	Acceptable Answers	Reject	Mark
14(a)(ii)	$C_2H_4Cl_2$		(1)

Question Number	Acceptable Answers	Reject	Mark
14(a)(iii)	$24 + 4 + 71 = 99$ (Allow t.e. but only if $1:2:1$ ratio in (a)(ii))		(1)

Question Number	Acceptable Answers	Reject	Mark
14 (b)(i)	$ \begin{array}{c} \text{H} \quad \text{Br} \\ \quad \\ \text{H} - \text{C} - \text{C} - \text{H} \\ \quad \\ \text{H} \quad \text{Br} \end{array} $ $ \begin{array}{c} \text{Br} \quad \text{Br} \\ \quad \\ \text{H} - \text{C} - \text{C} - \text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $		(1) (1)

Question Number	Acceptable Answers	Reject	Mark
14(b)(ii)	<u>dibromoethane</u> / 1,1- <u>dibromoethane</u> / 1,2- <u>dibromoethane</u>		(1)

(Total 7 Marks)

Question Number	Acceptable Answers	Reject	Mark
15 (a)(i)	electrons		(1)

Question Number	Acceptable Answers	Reject	Mark
15(a)(ii)	ions		(1)

Question Number	Acceptable Answers	Reject	Mark
15 (b)	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$ or $\text{Cu} - 2\text{e}^- \rightarrow \text{Cu}^{2+}$		(1)

Question Number	Acceptable Answers	Reject	Mark
15 (c)(i)	$9.675 - 9.040 = 0.635$		(1)

Question Number	Acceptable Answers	Reject	Mark
15(c)(ii)	$8.760 - 0.635 = 8.125$ (allow t.e. from (i))		(1)

Question Number	Acceptable Answers	Reject	Mark
15(c)(iii)	$0.635 = 0.01$ mole seen or implied $96500 \times 2 \times 0.01 = 1930 \text{ C}$ (allow t.e. from (i))		(1) (1)

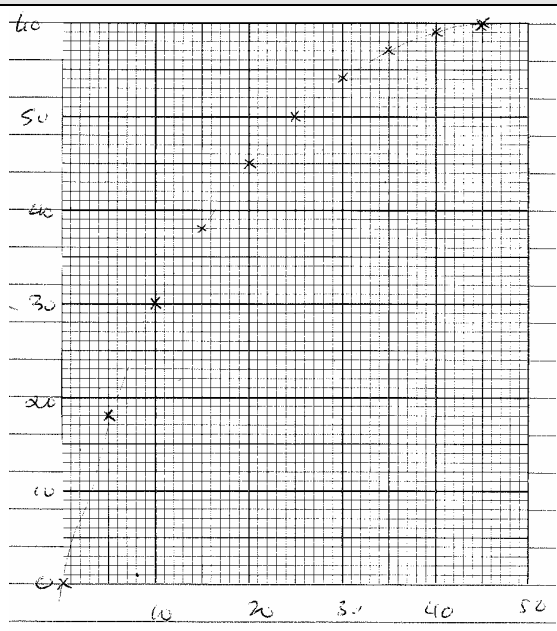
Question Number	Acceptable Answers	Reject	Mark
15(c)(iv)	$1930 / 386$ $= 5\text{A}$ (allow t.e. from (iii))		(1) (1)

Question Number	Acceptable Answers	Reject	Mark
15 (d)	exactly 2 mol dm^{-3}		(1)

(Total 10 Marks)

PAPER TOTAL 100 MARKS

7081/02 O Level Chemistry Mark Scheme - June 2008

Question Number	Acceptable Answers	Reject	Mark
1 (a)	 <ul style="list-style-type: none"> • all plots correct (2) • [9/10 plots correct (1)] • • line of best fit (1) 		(2) (1)

Question Number	Acceptable Answers	Reject	Mark
1 (b)(i)	10 (s) (1)	Penalise incorrect units	(1)

Question Number	Acceptable Answers	Reject	Mark
1 (b)(ii)	(15 /60=) 0.25 / ¼ (1)		(1)

Question Number	Acceptable Answers	Reject	Mark
1 (c)	M1 moles H ₂ = 60/24000 OR 2.50 x 10 ⁻³ (1)	Answer only scores (0) (60/1000 = 0.06)	(1)
	M2 mass of Mg = 2.5 x 10 ⁻³ x 24 = 0.06 (1)		(1)
	M2 dependent on the use of 24000 cm ³ in M1		

Question Number	Acceptable Answers	Reject	Mark
1 (d)	M1 increases (1)	M1 incorrect, does not score M2/M3	(1)
	M2 greater surface area (1)		(1)
	M3 more (effective) collisions per unit time/		

	more frequent collisions (1)		(1)
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(Total 10 marks)

Question Number	Acceptable Answers	Reject	Mark
2 (a)(i)	carboxylic acid group identified (1) (circle around COOH only)		(1)

Question Number	Acceptable Answers	Reject	Mark
2 (a)(ii)	ester group identified (1) (circle around OCO or OCOCH ₃)		(1)

Question Number	Acceptable Answers	Reject	Mark
2 (b)(i)	C ₆ H ₉ NO ₅ (1)		(1)

Question Number	Acceptable Answers	Reject	Mark
2 (b)(ii)	M1 mass of carbon = 6 x 12 = 72 (1) [ecf from C atoms in b(i)]		(1)
	M2 (72 x 100)/175 = 41.14 / allow 41.1 (1) [ecf from M1]	41	(1)

Question Number	Acceptable Answers	Reject	Mark
2 (c)(i)	bubbles / effervescence / fizz (1)	Carbon dioxide Gas Contradiction	(1)

Question Number	Acceptable Answers	Reject	Mark
2 (c)(ii)	2H ⁺ + CO ₃ ²⁻ → H ₂ O + CO ₂ (2) allow (1) mark for 2H ⁺ + CO ₃ ²⁻ → H ₂ CO ₃ or H ⁺ + CO ₃ ²⁻ → H ₂ O + CO ₂ (1)		(2) or (1)

Question Number	Acceptable Answers	Reject	Mark
2 (d)	M1 Sweeterex / molecules / particles diffuse / molecules / particles move (through the coffee) (1)		(1)
	M2 (Sweeterex) molecules / particles in collision (with other molecules) (1)		(1)

(Total 10 marks)

Question Number	Acceptable Answers	Reject	Mark
3 (a)	CH ₂ = CH-CH ₃ (1) Butene / but-1-ene (1) 70 (1)		(1) (1) (1)

Question Number	Acceptable Answers	Reject	Mark
3 (b)	boiling point increases as length of carbon chain increases (1)		(1)

Question Number	Acceptable Answers	Reject	Mark
3 (c)(i)	addition / hydration (1)		(1)

Question Number	Acceptable Answers	Reject	Mark
3 (c)(ii)	$ \begin{array}{c} \text{H H} \\ \\ \text{H-C-C-O-H} \\ \\ \text{H H} \end{array} $ (1)	Structure must show the bonds but allow OH -C-H-O	(1)

Question Number	Acceptable Answers	Reject	Mark
3 (d)(i)	CH ₃ CH ₂ OH + O ₂ → CH ₃ COOH + H ₂ O (1) Accept C ₂ H ₅ OH and CH ₃ CO ₂ H	C ₂ H ₆ O and C ₂ H ₄ O ₂	(1)

Question Number	Acceptable Answers	Reject	Mark
3 (d)(ii)	oxidation / redox (1)	combustion	(1)

Question Number	Acceptable Answers	Reject	Mark
3 (e)(i)	sodium ethoxide (1)		(1)

Question Number	Acceptable Answers	Reject	Mark
3 (e)(ii)	chloroethane / ethyl chloride (1)		(1)

(Total 10 marks)

Question Number	Acceptable Answers	Reject	Mark
4 (a)	17 and 18 (1)		(1)
	17 and 20 (1)		(1)

Question Number	Acceptable Answers	Reject	Mark
4 (b)	^{35}Cl to ^{37}Cl 3 to 1 / 75% to 25%(1)		(1)
	If ^{35}Cl and ^{37}Cl not stated, the first number refers to ^{35}Cl		

Question Number	Acceptable Answers	Reject	Mark
4 (c)(i)	$\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$		(2)
	Correct formulae (1) Balnced equation (1)		or (1) (1)

Question Number	Acceptable Answers	Reject	Mark
4 (c)(ii)	$2\text{Fe} + 3\text{Cl}_2 \rightarrow 2\text{FeCl}_3$ (2)		(2)
	Correct formulae (1) Balanced equation (1)		or (1) (1)

Question Number	Acceptable Answers	Reject	Mark
4 (d)	M1 Add (aqueous) sodium hydroxide / NaOH / (aqueous) ammonia / NH_3 . (1)	Incorrect or no reagent scores (0)	(1)
	Allow M2/M3 for partially correct reagent eg OH^- ion /hydroxide / alkali		(1)
	M2 Fe^{2+} gives green precipitate (1)		(1)
	M3 Fe^{3+} gives brown /red brown /orange precipitate (1)		
	There are other possible reagents, eg acidified KMnO_4		

(Total 10 marks)

Question Number	Acceptable Answers	Reject	Mark
5 (a)	M1 hexagonal structure (minimum of 2 fused hexagons) (1) M2 layers (minimum of 2 layers) (1) M2 dependent on at least one hexagon in M1		(1) (1)

Question Number	Acceptable Answers	Reject	Mark
5 (b)	M1 contain delocalised electrons / electron cloud (between layers) (1) M2 (delocalised) electrons move (to carry current) (1)		(1) (1)

Question Number	Acceptable Answers	Reject	Mark
5 (c)(i)	exothermic <u>because</u> : energy of products lower than reactants / energy released (in forming bonds) is greater than energy required (to break bonds) (1)	Heat given out	(1)

Question Number	Acceptable Answers	Reject	Mark
5 (c)(ii)	M1 incomplete combustion (-) 110 kJ mol ⁻¹ (1) M2 complete combustion (-) 391 to (-)399 kJ mol ⁻¹ (1) M3 both M1 / M2 shown as negative values (1)		(1) (1) (1)

Question Number	Acceptable Answers	Reject	Mark
5 (d)	M1 gives out less heat (1) M2 poisonous gas CO formed CO attacks haemoglobin / red blood cells forms carboxyhaemoglobin / CO causes asphyxia (1)	Acid rain Attacks ozone Harmful / pollutant gas without qualification	(1) (1)

(Total 10 marks)

Question Number	Acceptable Answers	Reject	Mark
6 (a)	M1 chemical reaction / decomposition brought about by passage of electricity (1) M2 raw material identified as bauxite (1) M3 electrolyte is purified bauxite / alumina / aluminium oxide / Al_2O_3 (1) M4 (dissolved in) molten (1) M5 cryolite (1) M6 graphite / carbon electrodes / cathode (1) M7 aluminium formed at cathode (1) M8 $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$ (1) M9 aluminium collects at bottom of cell / aluminium siphoned off (1)		(9)

Question Number	Acceptable Answers	Reject	Mark
6 (b)	M1 separation of liquids on basis of boiling point difference (1) M2 raw material identified as crude oil / petroleum (1) M3 heat (in a furnace) (1) M4 to vaporise / crude oil becomes vapour (1) M5 (vapours) pass into fractionating column (1) M6 temperature gradually falls rising up the tower (1) M7 (petrol) fraction condenses / becomes liquid (1) M8 petrol collected near the top of tower (1) Points could be scored on a labelled diagram	Heat in column	(8)

Question Number	Acceptable Answers	Reject	Mark
6 (c)	<p>M1 when the rate of reaction is increased by the addition of a catalyst (1)</p> <p>M2 the catalyst remains unchanged at the end of the reaction / the catalyst provides an alternative route of lower energy of activation (1)</p> <p>M3 starting materials sulphur dioxide (1)</p> <p>M4 and air (1)</p> <p>M5 catalyst identified as vanadium(V) oxide / V_2O_5 (1)</p> <p>M6 temperature 300 – 550 °C (1)</p> <p>M7 pressure 1 – 3 atm (1)</p> <p>M8 $2SO_2 + O_2 \rightarrow 2SO_3$ (1)</p>	Any other ox state of V	(8)

(Total 25 marks)

Question Number	Acceptable Answers	Reject	Mark
7 (a)	<p>M1 heat the (blue) copper(II) sulphate (in a test tube) (1)</p> <p>M2 colour change to white (1)</p> <p>M3 colourless liquid condenses near top of tube water collected in cooled receiver (1)</p> <p>M4 turns blue / anhydrous cobalt chloride paper pink (1)</p> <p>M5 $\text{CuSO}_4 \cdot 5\text{H}_2\text{O} \rightarrow \text{CuSO}_4 + 5\text{H}_2\text{O}$ (1)</p> <p>Allow boils at 100° for M4 M3 could be scored for holding CoCl_2 paper in vapours</p>	Addition of water to white CuSO_4	(5)

Question Number	Acceptable Answers	Reject	Mark
7 (b)	<p>M1 add iron to specified copper(II) salt <u>solution</u> (1)</p> <p>M2 pink-brown / red brown solid formed / deposit (1)</p> <p>M3 $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Cu} + \text{Zn}^{2+}$ / or molecular (1)</p> <p>M4 add iron to specified zinc salt <u>solution</u> (1)</p> <p>M5 no reaction (so iron does not displace zinc ions) (1)</p> <p>Allow for M4/M5 add Zn to $\text{FeSO}_4(\text{aq})$, grey black solid</p> <p>Allow Zn and Cu in $\text{FeSO}_4(\text{aq})$ for all marks</p> <p>Alternative answers:</p> <p>M1 add the 3 metals to dilute hydrochloric/ sulphuric acid (1)</p> <p>M2 copper has no reaction (1)</p> <p>M3 zinc and iron: effervescence /bubbles / fizz (1)</p> <p>M4 zinc gives faster effervescence / more vigorous</p> <p>M5 $\text{Zn (or Fe)} + 2\text{HCl} \rightarrow \text{ZnCl}_2 \text{ (or FeCl}_2) + \text{H}_2$ (1)</p>	Metal / oxide reactions	(5)

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Question Number	Acceptable Answers	Reject	Mark
7 (c)	<p>M1 cotton wool pads soaked in (concentrated) hydrochloric acid and in (concentrated) ammonia (solution) (1)</p> <p>M2 place pads at opposite ends of a (long) tube (1)</p> <p>M3 white ring / deposit / fumes / smoke (of ammonium chloride) (1)</p> <p>M4 nearer to hydrogen chloride end of tube (1)</p> <p>M5 $\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4\text{Cl}$ (1)</p> <p>Labelled diagram could score M1 to M4</p> <p>If gas jars of NH_3 and HCl mixed together, allow M5 only</p>	If gases are used	(5)

Question Number	Acceptable Answers	Reject	Mark
7 (d)	<p>M1 two test tubes / flasks containing equal volumes of hydrochloric acid of same concentration (1)</p> <p>M2 heat one test tube / flask (1)</p> <p>M3 add equal masses equal surface area / same amount of zinc to test tubes / flask (1)</p> <p>M4 reaction in warm acid more vigorous / more effervescence (1)</p> <p>M5 $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ / or ionic (1)</p>		(5)

Question Number	Acceptable Answers	Reject	Mark
7 (e)	<p>M1 Grind / crush leaf in solvent / alcohol / propanone / acetone (1)</p> <p>M2 spot onto chromatography / filter paper (1)</p> <p>M3 stand paper in solvent / alcohol / propanone / acetone (to elute) (1)</p> <p>M4 spot just above solvent (1)</p> <p>M5 series of spots obtained / colours separate (1)</p>	<p>water</p> <p>water</p>	(5)

	Labelled diagram could score M2 to M5.		
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(Total 25 marks)

Question Number	Acceptable Answers	Reject	Mark
8 (a)	<p>M1 coloured compounds / ions (1)</p> <p>M2 copper (II) compounds / ions are blue /green (1) (ignore any reference to the colour of Cu(I))</p> <p>M3 variable oxidation states (1)</p> <p>M4 Cu^+ and Cu^{2+} / Cu(I) and Cu(II) (1)</p> <p>M5 form complex ions (1)</p> <p>M6 diaquatetraamminecopper(II) (ion) / $\text{Cu}[(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{2+}$ (1)</p> <p>(allow use as catalysts; Cu for dehydrogenation of alcohols)</p>	<p>oxides</p> <p>CuO black</p>	(6)

Question Number	Acceptable Answers	Reject	Mark
8 (b)	<p>M1 heat copper (1)</p> <p>M2 in air / oxygen / O₂ (1)</p> <p>M3 $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$ (1)</p> <p>M4 add excess copper(II) oxide (1)</p> <p>M5 to (dilute) sulphuric acid / H₂SO₄ (1)</p> <p>M6 heat / warm (1)</p> <p>M7 $\text{CuO} + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$ (1)</p> <p>M8 filter off (excess) copper(II) oxide (1)</p> <p>M9 heat filtrate to remove some water / to crystallise (1)</p> <p>M10 allow (remaining solution) to cool (1)</p> <p>M11 filter off crystals / decant (1)</p> <p>M12 leave to dry / dry with tissue (1)</p> <p>Alternative</p> <p>M1 add concentrated nitric acid / dilute nitric acid (1)</p> <p>M2 heat copper (II) nitrate (1)</p> <p>M3 $\text{Cu} + 4\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{NO}_2 + 2\text{H}_2\text{O}$</p> <p>$3\text{Cu} + 8\text{HNO}_3 \rightarrow 3\text{Cu}(\text{NO}_3)_2 + 2\text{NO} + 4\text{H}_2\text{O}$</p> <p>$2\text{Cu}(\text{NO}_3)_2 \rightarrow 2\text{CuO} + 4\text{NO}_2 + \text{O}_2$ (1)</p>	<p>conc H₂SO₄ but mark on</p> <p>If precipitate of CuSO₄ no further marks</p> <p>heat to dryness no further marks</p>	(12)

(Total 25 marks)

Question Number	Acceptable Answers	Reject	Mark
8 (c)(i)	M1 carbon dioxide (1) M2 $\text{CuCO}_3 \rightarrow \text{CuO} + \text{CO}_2$ (1)		(2)

Question Number	Acceptable Answers	Reject	Mark
8 (c)(ii)	M1 water (1) M2 $\text{Cu(OH)}_2 \rightarrow \text{CuO} + \text{H}_2\text{O}$ (1)		(2)

Question Number	Acceptable Answers	Reject	Mark
8 (c)(iii)	M1 nitrogen dioxide / nitrogen (IV) oxide AND oxygen (1) $2\text{Cu(NO}_3)_2 \rightarrow 2\text{CuO} + 4\text{NO}_2 + \text{O}_2$ (1) M2 all formulae correct (1) M3 balanced equation (1)		(3)

Question Number	Acceptable Answers	Reject	Mark
9 (a)	<p>M1 $\text{H}_2\text{N}-(\text{CH}_2)_6-\text{NH}_2$ (1)</p> <p>M2 $\text{HOOC}-(\text{CH}_2)_4-\text{COOH}$ (1)</p> <p>$-\text{HN}-(\text{CH}_2)_6-\text{N}-\text{C}-(\text{CH}_2)_4-\text{CO}-$ $\begin{array}{c} \quad \\ \text{H} \quad \text{O} \end{array}$</p> <p>M3 minimum of $-\text{CH}_2-\text{N}-\text{C}-\text{CH}_2-$ (1) $\begin{array}{c} \quad \\ \text{H} \quad \text{O} \end{array}$</p> <p>M4 overall correct repeating unit (10)</p> <p>Allow ecf on incorrect values of x and y in M1 and M2. Allow the use of x and y in polymer structure</p>	OH-OC-	(4)

Question Number	Acceptable Answers	Reject	Mark
9 (b)	<p>M1 polyester (1)</p> <p>M2 $\text{HOOC}-(\quad)-\text{COOH}$ / allow $-(\text{C}_6\text{H}_4)-$ (1)</p> <p>M3 $\text{HO}-(\quad)-\text{OH}$ / allow $-(\text{CH}_2.\text{CH}_2)-$ (1)</p>	<p>OH-OC-(</p> <p>OH-()-OH</p>	(3)

Question Number	Acceptable Answers	Reject	Mark
9 (c)(i)	<p>addition</p> <p>M1 unsaturated monomer (1)</p> <p>M3 no other product / no mass loss (1)</p>	<p>condensation</p> <p>M2 monomer(s) must have two different functional groups (1)</p> <p>M4 small molecule lost / loss of mass (1)</p>	(4)
	Must be comparative properties to score >2 marks.		

Question Number	Acceptable Answers	Reject	Mark
9 (c)(ii)	<p>M1 cracking (1)</p> <p>M2 use high temperature / specified temperature 450-900° or catalyst / zeolite / aluminosilicate / Al_2O_3 / SiO_2 (1)</p> <p>M3 long-chain alkane (1)</p> <p>M4 changed into (short-chain) alkane plus alkene / ethene (1)</p>	heat other specified catalyst	(5)

	M5 e.g. $C_8H_{18} \rightarrow C_6H_{14} + C_2H_4$ (1) any alkane to ethene + other alkane		
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Question Number	Acceptable Answers	Reject	Mark
9 (d)(i)	-CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ - (1) must have bonds at each end and must contain 6 C atoms		(1)

Question Number	Acceptable Answers	Reject	Mark
9 (d)(ii)	poly(ethyne) contains carbon-carbon double bonds / unsaturated whereas poly(ethene) does not contain double bonds/ contains carbon-carbon single bonds / is saturated (1) must contain a statement for both polymers.		(1)

Question Number	Acceptable Answers	Reject	Mark
9 (d)(iii)	M1 poly(ethene) CH ₂ ONLY (1) M2 poly(ethyne) CH ONLY (1)	Any extra formula is a contradiction.	(1) (1)

Question Number	Acceptable Answers			Reject	Mark
9 (d)(iv)	Reagent (1)	Bromine water or Br ₂ /H ₂ O	Acidified / alkaline KMnO ₄ / potassium manganate (VII) / permanganate	K ₂ Cr ₂ O ₇	(1)
	Obs with poly(ethene) (1)	no reaction	No reaction		(1)
	Obs with poly(ethyne) (1)	Goes colourless	Goes colourless / green (if alkaline)		(1)

Question Number	Acceptable Answers	Reject	Mark
9 (d)(v)	M1 combustion (1) M2 carbon monoxide / carbon dioxide and water / CO / CO ₂ and H ₂ O (1)		(1) (1)

(Total 25 marks)

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