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Mark Scheme January 2009

GCE

GCE O Chemistry (7081)

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January 2009

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7081/01 Chemistry Paper 1

Question Number	Acceptable Answers	Reject	Mark
1	Br^- $CaBr_2$ aluminium sulphate $Al_2(SO_4)_3$ iron(II) nitrate / ferrous nitrate Fe^{2+} Cr^{3+} $Cr(OH)_3$	BR^-, CA^{2+} etc	**(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)**

(Total 8 Marks)

Question Number	Acceptable Answers	Reject	Mark
2 (a)	2,8,8,2		**(1)**

Question Number	Acceptable Answers	Reject	Mark
2 (b)	2,8,8		**(1)**

Question Number	Acceptable Answers	Reject	Mark
2 (c)	35		**(1)**

Question Number	Acceptable Answers	Reject	Mark
2 (d)	7		**(1)**

Question Number	Acceptable Answers	Reject	Mark
2 (e)	5		**(1)**

Question Number	Acceptable Answers	Reject	Mark
2 (f)	5		**(1)**

(Total 6 Marks)

Question Number	Acceptable Answers	Reject	Mark
3 (a)	white		**(1)**

Question Number	Acceptable Answers	Reject	Mark
3 (b)	blue		**(1)**

Question Number	Acceptable Answers	Reject	Mark
3 (c)	purple or violet		**(1)**

Question Number	Acceptable Answers	Reject	Mark
3 (d)	black		**(1)**

Question Number	Acceptable Answers	Reject	Mark
3 (e)	white		**(1)**

Question Number	Acceptable Answers	Reject	Mark
3 (f)	dark blue or deep blue		**(1)**

(Total 6 Marks)

Question Number	Acceptable Answers	Reject	Mark
4 (a)	He / Ne / Ar / Kr / Xe / Rn or full names		**(1)**

Question Number	Acceptable Answers	Reject	Mark
4 (b)	hydrochloric / sulphuric / nitric acid **or** HCl / H_2SO_4 / HNO_3	hydrogen chloride	**(1)**

Question Number	Acceptable Answers	Reject	Mark
4 (c)	carbon monoxide / CO		**(1)**

Question Number	Acceptable Answers	Reject	Mark
4 (d)	chlorine / Cl_2		**(1)**

Question Number	Acceptable Answers	Reject	Mark
4 (e)	copper(II) oxide / CuO		**(1)**

Question Number	Acceptable Answers	Reject	Mark
4 (f)	methane / CH_4		**(1)**

(Total 6 Marks)

Question Number	Acceptable Answers	Reject	Mark
5 (a)	moles of P = 22.5/31 (= 0.726) and moles of Cl = 77.5/35.5 (= 2.18) P:Cl = 1:3 hence PCl_3		**(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
5 (b)	pairs of electrons in covalent bonds correctly shown other electrons correct (mark dependent on first being awarded)		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
5 (c)	Any two : chloroethane / ethyl chloride or C_2H_5Cl hydrogen chloride or HCl phosphorus oxychloride or $POCl_3$		 **(1)** **(1)**

(Total 7 Marks)

Question Number	Acceptable Answers	Reject	Mark
6 (a)(i)	**X** proton **Y** neutron **Z** electron		**(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
6 (a)(ii)	proton and neutron or **X** and **Y**		**(1)**

Question Number	Acceptable Answers	Reject	Mark
6 (a)(iii)	atomic no. = 3 mass no. = 7		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
6 (b)(i)	3 protons + 3 neutrons / 3**X** and 3**Y**		**(1)**

Question Number	Acceptable Answers	Reject	Mark
6 (b)(ii)	same number of electrons (in outer shell)/ same electron configuration / same electron arrangement		**(1)**

(Total 8 Marks)

Question Number	Acceptable Answers	Reject	Mark
7 (a)	condensation / liquefaction		**(1)**

Question Number	Acceptable Answers	Reject	Mark
7 (b)	in steam, particles are far apart; and move freely/randomly / long distances before collision; in water, particles are close together; and can only move short distances before collision / slide past each other;		**(1)** **(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
7 (c)	water to steam: particles have to be completely separated/intermolecular forces have to be completely overcome. ice to water: particles need to be loosened / intermolecular forces partially overcome		**(1)** **(1)**

(Total 7 Marks)

Question Number	Acceptable Answers	Reject	Mark
8 (a)(i)	explodes/violent reaction / ignites any ONE floats/moves on surface / fizzes / melts any ONE		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
8 (a)(ii)	$2Rb + 2H_2O \rightarrow 2RbOH + H_2$ formulae balance		 **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
8 (b)	$2RbNO_3 \rightarrow 2RbNO_2 + O_2$ formulae balance		 **(1)** **(1)**

(Total 6 Marks)

Question Number	Acceptable Answers	Reject	Mark
9 (a)(i)	experiment A		**(1)**

Question Number	Acceptable Answers	Reject	Mark
9 (a)(ii)	boiled to remove dissolved air covered in oil to exclude air		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
9 (a)(iii)	to dry the air / remove water vapour / remove moisture		**(1)**

Question Number	Acceptable Answers	Reject	Mark
9 (a)(iv)	both air and water are required for rusting		**(1)**

Question Number	Acceptable Answers	Reject	Mark
9 (b)(i)	zinc is above iron in reactivity series / more reactive corrodes/reacts in preference to iron **or** acts as sacrificial metal		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
9 (b)(ii)	magnesium		**(1)**

(Total 8 Marks)

Question Number	Acceptable Answers	Reject	Mark
10 (a)(i)	yeast		**(1)**

Question Number	Acceptable Answers	Reject	Mark
10(a)(ii)	25—40 °C (any value within this range)		**(1)**

Question Number	Acceptable Answers	Reject	Mark
10(a)(iii)	exclude air / oxygen		**(1)**

Question Number	Acceptable Answers	Reject	Mark
10(a)(iv)	filter/decant		**(1)**

Question Number	Acceptable Answers	Reject	Mark
10(a)(v)	fractional distillation		**(1)**

Question Number	Acceptable Answers	Reject	Mark
10(a)(vi)	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ formulae balance		 **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
10(b)	advantage: renewable starting material / lower temperature required disadvantage: slow / product requires purification	answers based on cost	**(1)** **(1)**

(Total 9 Marks)

Question Number	Acceptable Answers	Reject	Mark
11 (a)	structure showing the ester linkage (bonding must be shown in the —COO— section) methyl ethanoate		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
11 (b)(i)	$—COOCH_2CH_2—$		**(1)**

Question Number	Acceptable Answers	Reject	Mark
11(b)(ii)	condensation nylon/ polyamide/terylene		**(1)** **(1)**

(Total 5 Marks)

Question Number	Acceptable Answers	Reject	Mark
12 (a)	3,2		**(1)**

Question Number	Acceptable Answers	Reject	Mark
12 (b)	5,4,6		**(1)**

Question Number	Acceptable Answers	Reject	Mark
12 (c)	2,2		**(1)**

Question Number	Acceptable Answers	Reject	Mark
12 (d)	4,2		**(1)**

(Total 4 Marks)

Question Number	Acceptable Answers	Reject	Mark
13 (a)	Experiment 1, increase Experiment 2, decrease		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
13 (b)	Experiment 1, addition of oxygen / copper reacts with oxygen / oxide layer forms Experiment 2, loss of CO_2		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
13 (c)	Experiment 1, oxidation Experiment 2, (thermal) decomposition		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
13(d)	Experiment 1, $2Cu + O_2 \rightarrow 2CuO$ Experiment 2, $CuCO_3 \rightarrow CuO + CO_2$		**(1)** **(1)**

(Total 8 Marks)

Question Number	Acceptable Answers	Reject	Mark
14 (a)	acid: burette alkali: pipette		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
14(b)	methyl orange / phenolphthalein orange / colourless		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
14(c)	to ensure accuracy / check results		**(1)**

Question Number	Acceptable Answers	Reject	Mark
14 (d)	28.80, 27.95, 28.05		**(2)**

Question Number	Acceptable Answers	Reject	Mark
14(e)	ignore 28.80 mean = 28.00		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
14(f)	moles HCl = 0.200 x 0.028 = 0.0056 concentration NaOH = 0.0056/0.025 = 0.224 (mol dm^{-3})		**(1)** **(2)**

(Total 12 Marks)

PAPER TOTAL 100 MARKS

7081/02 Chemistry Paper 2

SECTION A

Question Number	Acceptable Answers	Reject	Mark
1 (a)	*Accept name or formula* Zn / Mg / Fe AND dil H_2SO_4 / H_2SO_4 / dil HCl / conc HCl / HCl conc. H_2SO_4 / anhydrous $CaCl_2$ / silica gel / CaO / soda lime / P_2O_5 upward delivery / downward displacement of air / syringe	Conc H_2SO_4	**(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
1 (b)(i)	$2H_2 + O_2 \rightarrow 2H_2O$ / $H_2 + ½O_2 \rightarrow H_2O$ *(ignore state symbols)*		**(1)**

Question Number	Acceptable Answers	Reject	Mark
1 (b)(ii)	add to anhydrous / white $CuSO_4$ / OR anhydrous / blue $CoCl_2$ OR $CoCl_2$ paper ($CuSO_4$) turns blue / ($CoCl_2$) turns pink		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
1 (b)(iii)	find b.pt. / m.pt. 100 ^{0}C / 0 ^{0}C		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
1 (c)	$H_2 + Cl_2 \rightarrow 2HCl$ / $½H_2 + ½Cl_2 \rightarrow HCl$ hydrogen chloride	hydrochloric acid	**(1)** **(1)**

(Total 10 marks)

Question Number	Acceptable Answers *Incorrect reagent / no reagent scores 0/3*	Reject	Mark
2 (a)	add barium chloride / $BaCl_2$ (and HCl) NaCl: no precipitate / no reaction / no observation / no change Na_2SO_4: white precipitate		**(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
2 (b)	add sodium hydroxide / NaOH $FeCl_2$: green ppt. $FeCl_3$: brown ppt.	 Green solution Brown solution	**(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
2 (c)	heat and pass gas through lime water / $Ca(OH)_2$ Na_2CO_3: no ppt. / no reaction / does not decompose $MgCO_3$: turns milky / white ppt. *Lime water mark could be scored in M3, (gas turns LW milky)*		**(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
2 (d)	$Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NaCl$ / $SO_4^{2-} + Ba^{2+} \rightarrow BaSO_4$ $FeCl_2 + 2NaOH \rightarrow Fe(OH)_2 + 2NaCl$ / $Fe^{2+} + 2OH^- \rightarrow Fe(OH)_2$ $FeCl_3 + 3NaOH \rightarrow Fe(OH)_3 + 2NaCl$ / $Fe^{3+} + 3OH^- \rightarrow Fe(OH)_3$ $MgCO_3 \rightarrow MgO + CO_2$ $CO_2 + Ca(OH)_2 \rightarrow CaCO_3 + H_2O$		**(1)**

(Total 10 marks)

Question Number	Acceptable Answers	Reject	Mark
3 (a)(i)	fraction 1 name use fraction 2 name LPG — calor gas / camping gas / fuel Petrol / gasoline — motor fuel Naphtha — petrochemicals / cracking Kerosene / paraffin — aircraft fuel / petrochemicals Gas oil / diesel — central heating fuel / motor fuel / Petrochemicals Mineral / lubricating oil — lubrication / petrochemicals Fuel oil — fuel for ships / fuel for power stations Wax / grease — candles / grease / polish Bitumen — roofing / road surfacing		**(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
3 (a)(ii)	(thermal / catalytic) cracking provides high value / more useful products demand for short chain molecules / petrol / alkenes > supply need more short chain molecules / petrol / alkenes		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
3 (a)(iii)	Minimum requirement $-CH_2-CH_2-$ (*accept any number of $-CH_2-$ units but must have bond at each end)*		**(1)**

Question Number	Acceptable Answers	Reject	Mark
3 (b)(i)	structural / displayed formula for isomer 1 structural / displayed formula for isomer 2 *(if 3 structures given all 3 must be different to score (2)* one correct name *(if 2 names given both must be correct)*		**(1)** **(1)** **(1)**
	$CH_3CH_2CH_2CH_2CH_3$ pentane $CH_3CH_2CHCH_3$ (2-)methylbutane $CH_3C(CH_3)_2CH_3$ (2,2-)dimethyl**propane**		

Question Number	Acceptable Answers	Reject	Mark
3 (b)(ii)	structural / displayed formula (*must show double bond)*		**(1)**
	$CH_3CH_2CH=CH_2$ $CH_3CH=CHCH_3$ $CH_3C(CH_3)=CH_2$ *(as bi for > 1 formula ignore names)*		

(Total 10 marks)

Question Number	Acceptable Answers	Reject	Mark
4 (a)	red-brown / brown solution OR black precipitate / solid		**(1)**
	(*name)* iodine		**(1)**
	(name) sodium chloride *(any extra product >2 loses mark)*		**(1)**
	Cl_2 +2NaI → 2NaCl + I_2		**(1)**

Question Number	Acceptable Answers	Reject	Mark
4 (b)	black solid/crystals OR black (or brown) fumes formed		**(1)**
	(*name)* iron(III) / ferric chloride *(any extra product loses mark)*		**(1)**
	$2Fe + 3Cl_2 \rightarrow 2FeCl_3$		**(1)**

Question Number	Acceptable Answers	Reject	Mark
4 (c)	cream / off-white / <u>pale</u> yellow precipitate	yellow	**(1)**
	(*name)* silver bromide *(any extra product loses mark)*		**(1)**
	$AgNO_3$ + NaBr → AgBr + $NaNO_3$		**(1)**

(Total 10 marks)

Question Number	Acceptable Answers	Reject	Mark
5 (a)(i)	M1 0.05 x 4.2 x 24		**(1)**
	M2 5.04 kJ *(accept 5040 J)*		**(1)**
	(M2 dependent on M1)		

Question Number	Acceptable Answers	Reject	Mark
5 (a)(ii)	M3 moles $CuSO_4$ = (0.5 x 0.05) = 0.025		**(1)**
	M4 enthalpy change = 5.04/0.025		**(1)**
	M5 = 201.6 or 202 kJ (mol^{-1})		**(1)**
	(M4 ecf M2 / M3)		
	(M5 dependent on M4, (accept 201600 J(mol^{-1}))		

Question Number	Acceptable Answers	Reject	Mark
5 (a)(iii)	M6 −202 (or −201.6) (negative sign essential)		**(1)**
	(M6 must be negative answer to M5 in kJ)		

Question Number	Acceptable Answers	Reject	Mark
5 (b)(i)	$Fe(s) + Cu^{2+}(aq) \rightarrow Fe^{2+}(aq) + Cu(s)$		**(1)**
	M7 formulae + balance		**(1)**
	M8 state symbols *(M8 dependent on M7)*		

Question Number	Acceptable Answers	Reject	Mark
5 (b)(ii)	M9 Fe loses electrons therefore oxidised		**(1)**
	M10 Cu^{2+} gains electrons therefore reduced		**(1)**
	or		
	M9 Fe loses electrons, Cu^{2+} gains electrons		
	M10 Fe oxidised, Cu^{2+} reduced		
	(must be answered in terms of electron transfer)		

(Total 10 marks)

SECTION B

Question Number	Acceptable Answers	Reject	Mark
6 (a)(i)	M1 O_2 and N_2 have different b.pts. / boil off at different temperatures M2 fractional distillation M3 liquid air M4 N_2 boils off before O_2/ N_2 has lower b.pt. *(M4 could score both M1 and M4)*		**(1)** **(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
6 (a)(ii)	M1 spill <u>burns brighter</u> / <u>continues to burn</u> in O_2 M2 spill is <u>extinguished</u> in N_2 *(do not accept answers in terms of a glowing splint / lighted splint rekindles in O_2 / no effect with N_2)*		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
6 (a)(iii)	**Names of any two gases + uses** Helium balloons, air/helium mixture for diving, inert atmosphere for welding neon advertising signs, lights etc argon inert atmosphere for welding extraction of metals preserving food krypton electric lamps, discharge tubes, lasers etc xenon arc lamps, lasers		**(1x2)**

Question Number	Acceptable Answers	Reject	Mark
6 (a)(iv)	M1 *(name)* carbon dioxide M2/M3 $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ M2 formulae (1) M3 balance (1) *(M3 dependent on M2)*		**(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
6 (b)(i)	M1 correct arrangement for triple bond		**(1)**
	M2 1 lone pair on each N atom		**(1)**
	(M2 dependent on M1)		
	M3 triple bond strong / hard to break		**(1)**

Question Number	Acceptable Answers	Reject	Mark
6 (b)(ii)	M1 300 –550°C		**(1)**
	M2 150 – 400 atm		**(1)**
	M3 *(name)* iron catalyst		**(1)**
	M4 low temperature because exothermic reaction		**(1)**
	M5 high pressure because less mol(e)s/volume on right		**(1)**
	M6 low temperature means slow rate		**(1)**
	M7 use higher/compromise temperature (to increase rate)		**(1)**
	M8 add catalyst to increase rate		**(1)**

Question Number	Acceptable Answers	Reject	Mark
6 (b)(iii)	M1 moles NH_4Cl = 0.535/53.5 mol = 0.01 mol		**(1)**
	M2 moles NH_3 formed = 0.01		**(1)**
	M3 volume NH_3 = 0.01 x 24 or 24000 = 0.24 dm^3 / 240 cm^3		**(1)**
	(ecf from M1 to M2)		
	(ecf from M2 to M3, M3 = answer M2 x 24)		
	(accept any correct method for 3 marks)		
	eg M1 53.5g NH_4Cl gives 24 dm^3 of NH_3		
	M2 0.533g gives (0.533 x 24) / 53.5 *(ecf from M_r)*		
	M3 = 0.24 dm^3 / 240 cm^3 *(ecf from M2)*		

(Total 25 marks)

Question Number	Acceptable Answers			Reject	Mark
7 (a)(i)	M1	allotropy	an element can exist in two (or more) forms in the same physical state	substance molecule compound atom	**(1)**
	M2 / M3		rhombic / α Monoclinic / β		**(1)** **(1)**

Question Number	Acceptable Answers		Reject	Mark
7 (a)(ii)	M1	A and B		**(1)**
	M2	addition of oxygen / increase in oxidation state of S		**(1)**

Question Number	Acceptable Answers		Reject	Mark
7 (a)(iii)	M1	$2SO_2 + O_2 \rightleftharpoons 2SO_3$ *(accept single arrow)*		**(1)**
	M2	300 to 500°C		**(1)**
	M3	1 to 3 atms		**(1)**
	M4	V_2O_5 / vanadium(V) oxide catalyst *(M4 penalise any other oxidation state of V for)*		**(1)**

Question Number	Acceptable Answers		Reject	Mark
7 (a)(iv)	M1	add SO_3 to conc/98% sulphuric acid		**(1)**
	M2	add / dilute with water		**(1)**
	M3	gets too hot / mist of acid droplets / exothermic reaction / dangerous with qualification		**(1)**

Question Number	Acceptable Answers	Reject	Mark
7 (b)(i)	*Incorrect reagent scores zero.* *Incomplete reagent eg dichromate lose M1 but allow M2* M1 (acidified) potassium dichromate / (VI) / $K_2Cr_2O_7$ OR (acidified) potassium manganate / (VII) / $KMnO_4$ potassium permanganate M2 colour change (from orange) to green OR (purple) to colourless *(M1 penalise any other oxidation state of Mn or Cr but allow M2)*		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
7 (b)(ii)	$2NaOH + SO_2 \rightarrow Na_2SO_3 + H_2O$ M1 formulae M2 balance *(M2 dependent on M1)* M3 *(name)* sodium sulphite / sulphate(IV) *(mark M3 independent of M1/M2, ignore other products in equation)*		**(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
7 (c)(i)	M1 heat / 150 to 200°C / use hot conditions		**(1)**
	M2 $C_2H_5OH \rightarrow C_2H_4 + H_2O$		**(1)**
	M3 role of H_2SO_4 : dehydrating agent / removes water		**(1)**
(ii)	*(M2 allow CH_3CH_2OH and $CH_2{=}CH_2$ / CH_2CH_2)*	C_2H_6O	
	M4 warm / heat (60 to 100°C)		**(1)**
	M5 $CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$		**(1)**
	M6 role of H_2SO_4 : catalyst / to increase rate		**(1)**
	M7 structure *(M7 could be scored in the equation)* $CH_3.C(=O)-OCH_2CH_3$ allow C_2H_5		**(1)**
	M8 ethyl ethanoate *(Mark M8/M7 independently)*		**(1)**

(Total 25 marks)

Question Number	Acceptable Answers		Reject	Mark
8 (a)(i)	M1	sodium has delocalised electrons (in solid and liquid)		**(1)**
	M2	electrons <u>move</u> (to carry the current)		**(1)**
	M3	NaCl has ions / is an ionic compound		**(1)**
	M4	ions fixed in solid / cannot move / only vibrate		**(1)**
	M5	ions can <u>move</u> in liquid state		**(1)**

Question Number	Acceptable Answers		Reject	Mark
8 (a)(ii)	M1	covalent compounds consist of molecules		**(1)**
	M2	<u>weak</u> attractive forces between molecules / intermolecular forces / Van der Waals forces		**(1)**
	M3	ionic compounds consist of positive and negative ions / oppositely charged ions		**(1)**
	M4	strong attraction between ions		**(1)**
	M5	hence covalent particles / molecules further apart than solid particles / ions in solid state		**(1)**

Question Number	Acceptable Answers		Reject	Mark
8 (a)(iii)	M1	gas is hydrogen / H_2 *(accept H_2 in equation)*		**(1)**
	M2	HCl in water is acidic / forms hydrochloric acid / forms ions / is ionic		**(1)**
	M3	H^+(aq) ions present in water (gives acidic properties)		**(1)**
	M4	HCl in methylbenzene consists of molecules / remains covalent		**(1)**

Question Number	Acceptable Answers		Reject	Mark
8 (a)(iv)	M1	powder reacts faster		**(1)**
	M2	powder has a larger surface area		**(1)**
	M3	so more (frequent) collisions (between acid and solid)		**(1)**
	(M2/M3 dependent on M1)			

Question Number	Acceptable Answers	Reject	Mark
	Q8b(i) and (ii) require descriptions of experiments and a statement of the observation made.		
8 (b)(i)	M1 t.t / flask with H_2O_2 only M2 t.t / flask with H_2O_2 and MnO_2 / catalyst M3 gas evolved / effervescence with catalyst OR gas evolved with catalyst only *For M1/M2: apparatus must be mentioned* *M3: observation mark can be scored independently*		**(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
8 (b)(ii)	M1 <u>weigh</u> sample of catalyst		**(1)**
	M2 add to H_2O_2 and allow reaction to go to completion		**(1)**
	M3 filter off catalyst		**(1)**
	M4 dry catalyst		**(1)**
	M5 reweigh to see if mass is the same		**(1)**

(Total 25 marks)

Question Number	Acceptable Answers	Reject	Mark
9 (a)(i)	M1 moles $CuFeS_2$ = 367000 / 183.5 = 2000 *(accept 2)* M2 moles Cu = 2000 *(accept 2)* M3 mass Cu = 63.5 x 2 or 2000 g = 127 kg / 127000 g *(M2 ecf from M1, M2 = M1 answer)* *(M3 ecf from M2, answer 63.5 x M2, insist on units)* OR M1 734 kg/g $CuFeS_2$ gives 254 kg/g Cu M2 367 kg/g $CuFeS_2$ gives (367 254 / 734) kg/g M3 = 127kg / 127000g		**(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
9 (a)(ii)	SO_2 and water form acid rain / SO_2 is a source of acid rain *(ignore reference to global warming / ozone layer)*		**(1)**

Question Number	Acceptable Answers	Reject	Mark
9 (b)(i)	M1 electrolyte : *name* (aqueous) copper sulphate (solution) M2 pure copper cathode M3 impure copper anode M4 cathode; $Cu^{2+} + 2e \rightarrow Cu$ M5 anode: $Cu \rightarrow Cu^{2+} + 2e$ M6 any one observation brown deposit on cathode / blue solution remains / cathode increase in size or mass anode decreases in size or mass		**(1)** **(1)** **(1)** **(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
9 (b)(ii)	M1 reduction at cathode M2 (Cu^{2+}) gains electrons / oxidation state of Cu decreases (from +2 to 0) *(M1 must be in agreement with the answer in part b(i))*		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
9 (b)(iii)	M1 2 faradays give 63.5 g copper M2 200 f gives 6350 g		**(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
9 (c)	**Any 2 chemical characteristics 2x(1)** **with examples from <u>Cu</u> chemistry2 x (1)** variable valency / oxidation state e.g. Cu(I) and Cu(II) or formulae / name of compounds coloured salts/ions e.g. blue $CuSO_4$ / blue solutions of $CuSO_4$ or $Cu(NO_3)_2$ *(ignore reference to CuO)* forms complexes e.g. $[Cu(NH_3)_4(H_2O)_2]^{2+}$ / tetraamminediaquacopper(II) *(do not accept $[Cu(NH_3)_4\ 2H_2O]^{2+}$)* catalyst e.g. dehydrogenation of alcohol *(accept $CuSO_4$ in preparation of H_2 from Zn and acid)*		**1+1** **1+1**

Question Number	Acceptable Answers	Reject	Mark
9 (d)(i)	M1 blue precipitate M2/M3 $CuSO_4 + 2NaOH \rightarrow Cu(OH)_2 + Na_2SO_4$ Or $Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2$ M2 all formulae correct M3 balance *(M3 dependent on M2)*		**(1)** **(1)** **(1)**

Question Number	Acceptable Answers	Reject	Mark
9 (d)(ii)	M1 black solid/residue OR turns black M2 (red / yellow / orange) / brown gas *(M1/M2ignore other observations such as melting, steam evolved etc,)* $2Cu(NO_3)_2 \rightarrow 2CuO + 4NO_2 + O_2$ M3 all formulae correct M4 balance *(M4 dependent on M3)*		**(1)** **(1)** **(1)** **(1)**

(Total 25 marks)

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