

Chemistry Unit 3
Science (Double Award) (Modular)
Mark Scheme

Question Number	Answer	Notes	Mark
1(a)	nucleus	ACCEPT nuclei	1

Question Number	Answer	Mark
1(b)	11 / eleven	1

Question Number	Answer	Mark
1(c)	1 / one / group 1	1

Question Number	Answer	Mark
1(d)	3 / three / period 3	1

Question Number	Answer	Notes	Mark										
2(a)	<table border="1"> <thead> <tr> <th>Change</th> <th>Change of state</th> </tr> </thead> <tbody> <tr> <td>water to ice</td> <td>freezing</td> </tr> <tr> <td>steam to water</td> <td>condensation</td> </tr> <tr> <td>solid wax to liquid wax</td> <td>melting</td> </tr> <tr> <td>iodine crystals to iodine vapour</td> <td>sublimation</td> </tr> </tbody> </table>	Change	Change of state	water to ice	freezing	steam to water	condensation	solid wax to liquid wax	melting	iodine crystals to iodine vapour	sublimation	<p>ALLOW condensing</p> <p>ALLOW subliming</p>	4
Change	Change of state												
water to ice	freezing												
steam to water	condensation												
solid wax to liquid wax	melting												
iodine crystals to iodine vapour	sublimation												

Question Number	Answer	Notes	Mark
2(b)	<p>M1 heat</p> <p>M2 stir / mix</p>	<p>ALLOW use hot water</p> <p>IGNORE add more water</p> <p>ALLOW grind / crush the solid / mixture</p>	2

Question Number	Answer	Mark
2(c)(i)	B	1

Question Number	Answer	Mark
2(c)(ii)	A and B	1

Question Number	Answer	Notes	Mark
2(c)(iii)	M1 2 and 8 M2 0.25	0.25 without working scores 2 ALLOW M1 for 1.8-2.2 and 8 and ALLOW M2 ECF as long as correctly evaluated to at least 2 SF (Special case if used ruler and then) 1.4-1.7 and 5.9-6.2 used no M1 but ALLOW M2 ECF as long as correctly evaluated to at least 2 SF	2

Question Number	Answer	Mark
2(c)(iv)	the dye is the most soluble (in the solvent/water)	1

Question Number	Answer	Notes	Mark
3(a)(i)	(crude oil/it is) heated / vapourised	ALLOW evaporated / boiled REJECT melted	1

Question Number	Answer	Notes	Mark
3(a)(ii)	gasoline	ALLOW petrol	1

Question Number	Answer	Mark
3(a)(iii)	road (surfacing) / roofs / tarmac	1

Question Number	Answer	Notes	Mark
3(b)(i)	M1 silica / alumina (catalyst) M2 600 to 700 °C	ACCEPT SiO ₂ /Al ₂ O ₃ / silicon dioxide / aluminium oxide /aluminosilicates / zeolites	2

Question Number	Answer	Notes	Mark
3(b)(ii)	Any two from: M1 shorter-chain alkanes are in high(er) demand / more useful / used for petrol / more flammable M2 alkenes are needed / used to make polymers	ALLOW C ₈ H ₁₈ is in high(er) demand (than C ₁₃ H ₂₈) / more useful / used for petrol / more flammable IGNORE shorter-chain alkanes are used as fuels ALLOW C ₂ H ₄ / C ₃ H ₆ are needed / used to make polymers / plastics shorter chain hydrocarbons / the products are in high(er) demand / more useful / more flammable scores 1 if no other mark awarded to create shorter alkanes and alkenes scores 1 if no other mark awarded	2

Question Number	Answer	Notes	Mark
3(c)	An explanation that links the following three points: M1 sulfur dioxide produced when fuel is burned M2 (sulfur dioxide) dissolves in / reacts with rain / water M3 (causing) acid rain	ALLOW sulfur / fuel reacts with oxygen / oxidises forming sulfur dioxide IGNORE sulfur trioxide and sulfur oxide ACCEPT (sulfur oxide / sulfur trioxide) dissolves in / reacts with rain / water IGNORE mixes	3

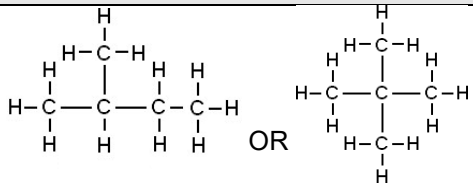
Question Number	Answer	Mark
4(a)	The only correct answer is B (Z X Y W) <i>A is not correct as Z is the most reactive metal</i> <i>C is not correct as Z is the most reactive metal</i> <i>D is not correct as X is more reactive than Y</i>	1

Question Number	Answer	Mark
4(b)(i)	W	1

Question Number	Answer	Mark
4(b)(ii)	X	1

Question Number	Answer	Notes	Mark
4(c)	M1 brown/pink/pink-brown solid forms M2 solution turns colourless	ALLOW red-brown /orange-brown IGNORE red or orange alone ALLOW precipitate for solid ALLOW solution becomes paler IGNORE clear IGNORE incorrect initial colour of solution IGNORE references to magnesium disappearing IGNORE references to heat	2

Question Number	Answer	Notes	Mark
5(a)(i)	M1 (compounds/molecules) with the same molecular formula M2 but with different structural/displayed formula	ACCEPT same number and same type of atoms REJECT elements for compounds/molecules once only ACCEPT different structures ACCEPT atoms arranged differently REJECT contradicting statements, e.g. same displayed formula but different structures scores 0 out of 2	2

Question Number	Answer	Notes	Mark
5(a)(ii)	 M1 correct carbon skeleton M2 all hydrogen atoms and all bonds shown	M2 dep on M1	2

Question Number	Answer	Notes	Mark
5(b)(i)	$(C_5H_{12} + Br_2) \rightarrow C_5H_{11}Br + HBr$ M1 correct formula of organic product M2 HBr as a product and correctly balanced	deduct 1 mark if cases or subscripts incorrect ACCEPT multiple substitutions of bromine $C_5H_{10}Br_2 + H_2$ scores M1	2

Question Number	Answer	Mark
5(b)(ii)	substitution	1

Question Number	Answer	Notes	Mark
6(a)	<p>An explanation that links together</p> <p>M1 the reaction is endothermic and either of the following points:</p> <p>M2 it takes in thermal energy/heat (from the surroundings)</p> <p>OR</p> <p>M3 as shown by the decrease in temperature (of the reaction mixture)</p>	<p>REJECT exothermic for both marks</p> <p>ALLOW references to cooling</p> <p>No M2 or M3 if the statements contradict each other</p>	2

Question Number	Answer	Notes	Mark
6(b)	<ul style="list-style-type: none"> • calculation of temperature change • substitution into $Q = mc\Delta T$ • evaluation <p>Example calculation</p> <p>M1 $14.2 - 20.0 = (-)5.8$</p> <p>M2 $Q = 100 \times 4.18 \times (-)5.8$</p> <p>M3 $= (-)2420$ (J)</p>	<p>$100 \times 4.18 \times (20 - 14.2)$</p> <p>scores M1 and M2</p> <p>ACCEPT any number of sig figs greater than 2</p> <p>Calculator answer is 2424.4</p> <p>and M3 (= 2618)</p> <p>2400 alone scores 0</p> <p>ALLOW use of 4.2 for all 3 marks (= 2436)</p>	3

Question Number	Answer	Notes	Mark
6(c)	<ul style="list-style-type: none"> • calculation of moles (n) of ammonium nitrate • division of Q by n • conversion of J to kJ • answer given with + sign <p>Example calculation</p> <p>M1 $n[\text{NH}_4\text{NO}_3] = 8.00 \div 80$ OR $0.1(00)$ (mol)</p> <p>M2 $\frac{Q}{n}$ OR $\frac{2420}{0.1(00)}$ OR <u>answer to b</u> answer to M1</p> <p>M3 $\Delta H = (+)24.2$ (kJ/mol)</p> <p>M4 positive sign included</p>	<p>ACCEPT any number of sig figs in the numerator except 1</p> <p>ACCEPT any number of sig figs except 1</p> <p>ALLOW ecf from M2</p> <p>correct answer with no working and no sign or incorrect sign scores 3</p> <p>correct answer with no working and correct sign scores 4</p>	4

Question Number	Answer	Notes	Mark
7(a)	to increase the rate of reaction	<p>ACCEPT to make the reaction faster/ to speed up the reaction</p> <p>REJECT any reference to increasing the solubility of copper(II) oxide</p>	1

Question Number	Answer	Notes	Mark
7(b)	(the copper(II) oxide/it) stops disappearing OR mixture turns cloudy (black) OR (black) solid settles (at the bottom of the beaker)	ALLOW stops dissolving REJECT any other colour REJECT any other colour ALLOW copper(II) oxide/ it settles (at the bottom of the beaker) IGNORE precipitate	1

Question Number	Answer	Notes	Mark
7(c)	to remove excess/unreacted copper(II) oxide/solid/base (from the mixture)	ACCEPT to separate the copper(II) sulfate solution (from the copper(II) oxide/unreacted solid/excess solid)	1

Question Number	Answer	Mark
7(d)	blue	1

Question Number	Answer	Notes	Mark
7(e)	<p>M1 heat/boil the filtrate</p> <p>M2 until crystals form in a cooled sample/ on a glass rod</p> <p>M3 leave the solution to cool/crystallise</p> <p>M4 filter (to remove the crystals)</p> <p>M5 dry the crystals on filter paper/on paper towel/in a warm oven /in a desiccator /leave to dry</p>	<p>NOTE: If the solution is heated to remove all the water then only M1 can be awarded</p> <p>NOTE If the solution is left to evaporate all the water without heating only 1 mark can be awarded</p> <p>ACCEPT to crystallisation point /to form a saturated solution /until crystals start to form /to remove some of the water</p> <p>M2 dep on M1</p> <p>NOTE: If the solution is left to completely evaporate after heating then award MAX 3</p> <p>ACCEPT decant the (excess) solution</p> <p>IGNORE references to washing the crystals</p> <p>REJECT hot oven or any method of direct heating e.g. Bunsen burner</p> <p>No M5 if crystals washed after drying</p>	5

Question Number	Answer	Notes	Mark
7(f)(i)	<ul style="list-style-type: none"> calculate the moles of CuO calculate the mass of CuSO₄.5H₂O give the answer to an appropriate number of significant figures <p>Example calculation</p> <p>M1 $n[\text{CuO}] = 9.54 \div 79.5$ OR 0.120 (mol)</p> <p>M2 mass of CuSO₄.5H₂O = 0.120 × 249.5 OR 29.94 (g)</p> <p>M3 = 29.9 OR M1 249.5 ÷ 79.5</p> <p>M2 9.54 (g) × (249.5 ÷ 79.5) (g) OR 29.94 (g)</p> <p>M3 = 29.9</p>	<p>Final answer must be to 3 sig figures</p> <p>29.94 with no working scores 2</p> <p>29.9 with no working score 3</p>	3

Question Number	Answer	Notes	Mark
7(f)(ii)	<p>M1 $(23.92 \div 29.9) \times 100$ OR $(23.92 \div \text{M3 from (i)}) \times 100$</p> <p>M2 = 80(%)</p>	<p>ALLOW use of M2 from (i) 29.94 gives 79.89%</p> <p>ALLOW any number of sig figs</p> <p>ACCEPT answer of 79.7(3)% using 30g</p> <p>Correct answer without working scores 2</p>	2