

**Chemistry Unit 1 (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)(i)	Any one from: Na K Al In	ALLOW names of elements Apply list principle	1

Question Number	Answer	Notes	Mark
2(a)(ii)	Any one from: S Cl	ALLOW names of elements	1

Question Number	Answer	Notes	Mark
2(b)	same number / three electrons in the outer shell	ALLOW valence shell	1

Question Number	Answer	Notes	Mark
2(c)	M1 Xe or xenon M2 as it has a full outer shell (of electrons)	ALLOW has eight electrons in outer shell ACCEPT does not (easily) gain/lose/share electrons M2 dep on M1	2

Question Number	Answer	Mark
2(d)	M1 (number of protons) 17 M2 (number of neutrons) 18 M3 (number of electrons) 17	3

Question Number	Answer	Notes	Mark										
3(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	ALLOW condensing ALLOW subliming	4
Change	Change of state												
water to ice	freezing												
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iodine crystals to iodine vapour	sublimation												

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

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

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

Question Number	Answer	Notes	Mark
3(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
3(c)(iv)	the dye is the most soluble (in the solvent/water)	1

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

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

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

Question Number	Answer	Notes	Mark
4(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
4(b)(ii)	<p>Any two from:</p> <p>M1 shorter-chain alkanes are in high(er) demand / more useful / used for petrol / more flammable</p> <p>M2 alkenes are needed / used to make polymers</p>	<p>ALLOW C_8H_{18} is in high(er) demand (than $C_{13}H_{28}$) / more useful / used for petrol / more flammable</p> <p>IGNORE shorter-chain alkanes are used as fuels</p> <p>ALLOW C_2H_4 / C_3H_6 are needed / used to make polymers / plastics</p> <p>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</p>	2

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

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

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

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

Question Number	Answer	Notes	Mark
5(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
6(a)	to increase the rate of reaction	ACCEPT to make the reaction faster/ to speed up the reaction REJECT any reference to increasing the solubility of copper(II) oxide	1

Question Number	Answer	Notes	Mark
6(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
6(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
6(d)	blue	1

Question Number	Answer	Notes	Mark
6(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
6(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
6(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

Question Number	Answer	Notes	Mark
7(a)	<p>M1 (moles of TiO_2 =) $\frac{20 \times 10^6}{80}$</p> <p>OR 2.5×10^5 (mol)</p> <p>M2 (moles of Cl_2 =) $2.5 \times 10^5 \times 2$ OR 5.0×10^5 (mol)</p> <p>M3 (vol of Cl_2 =) $5.0 \times 10^5 \times 24$ OR 12 000 000 (dm^3)</p> <p>M4 1.2×10^7 (dm^3)</p>	<p>correct answer with or without working scores 4</p> <p>ACCEPT 250 000 (mol)</p> <p>ACCEPT 500 000 (mol)</p> <p>ALLOW ecf on M2 and M3</p> <p>6×10^6 scores 3</p> <p>3×10^6 scores 3</p> <p>6 000 000 scores 2</p> <p>3 000 000 scores 2</p> <p>2.083×10^4 scores 3</p>	4

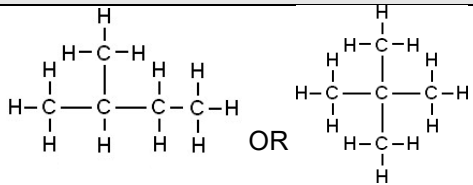
Question Number	Answer	Notes	Mark
7(b)	<p>An explanation that links the following three points</p> <p>M1 in pure titanium all atoms are the same size OR layers/atoms can slide over each other (making it soft /malleable)</p> <p>M2 the alloy has atoms of different sizes</p> <p>M3 (which disrupts the structure so that) atoms/layers do not/harder to slide over each other (making it stronger) OWTTE</p>	<p>all marks can be awarded from labelled diagrams</p> <p>ALLOW cations/ions /particles in place of atoms throughout</p> <p>REJECT mention of molecules once only</p>	3

Question Number	Answer	Notes	Mark
8(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
8(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</p> <p>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</p> <p>marks (= 2436)</p>	3

Question Number	Answer	Notes	Mark
8(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
9(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
9(a)(ii)	 M1 correct carbon skeleton M2 all hydrogen atoms and all bonds shown	M2 dep on M1	2

Question Number	Answer	Notes	Mark
9(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	Notes	Mark
9(b)(ii)	substitution		1

Question Number	Answer	Mark
10(a)(i)	pipette	1

Question Number	Answer	Notes	Mark
10(a)(ii)	red wine would mask the colour of the indicator / difficult to see colour change (at end point)	ACCEPT indicator and red wine are a similar colour OWTTE	1

Question Number	Answer	Notes	Mark
10(a)(iii)	to mix the contents (of the flask so that they can react) OWTTE	ACCEPT to ensure the colour change is permanent OWTTE ALLOW to speed up the reaction/ to ensure complete reaction	1

Question Number	Answer	Notes	Mark
10(a)(iv)	so as not to add more wine than is needed (for complete reaction)/ so as not to overshoot the end point OWTTE	ACCEPT to find the actual/precise point of neutralisation IGNORE to obtain an accurate reading	1

Question Number	Answer	Notes	Mark
10(b)	M1	final burette reading in cm ³	MAX 2 if final and initial burette readings are reversed. MAX 2 if readings not given to 2 decimal places. ALLOW ECF for M3 on correct subtraction of M1 – M2
	M2	initial burette reading in cm ³	
	M3	volume of wine added in cm ³	

Question Number	Answer	Mark
10(c)(i)	Ticks in boxes 1, 3 and 4	1

Question Number	Answer	Notes	Mark
10(c)(ii)	<ul style="list-style-type: none"> • setting out of calculation • answer <p>M1 $\frac{20.40 + 20.35 + 20.45}{3}$</p> <p>M2 20.40</p>	<p>20.40 without working scores 2</p> <p>20.4 with or without working scores 1</p> <p>If no results ticked then only use of 2 or 3 concordant titres can score both marks in (ii)</p> <p>If only one result ticked then M2 can be scored for averaging two or more titre values correctly</p> <p>M1 CQ on results ticked</p> <p>M2 CQ on correct calculation from M1</p> <p>Answer to M2 must be correct to 2dp</p>	2

Question Number	Answer	Notes	Mark
10(d)(i)	<ul style="list-style-type: none"> • setting out of calculation • final answer <p>M1 $\frac{25.0 \times 0.05(00)}{1000}$</p> <p>M2 0.00125</p>	<p>If no division by 1000</p> <p>giving an answer of 1.25 award 1 mark</p> <p>Correct answer without working scores 2</p>	2

Question Number	Answer	Mark
10(d)(ii)	0.00125 OR answer to (i)	1

Question Number	Answer	Notes	Mark
10(d)(iii)	<ul style="list-style-type: none"> setting out of calculation final answer <p>M1 $\frac{0.00125 \times 1000}{19.50}$ OR $\frac{\text{answer to (ii)} \times 1000}{19.5}$</p> <p>M2 0.0641 OR answer to M1</p>	<p>ACCEPT any number of sig fig cept 1</p> <p>Correct answer without working scores 2</p> <p><u>answer to (ii)</u> 19.5 correctly evaluated to 2 or more sig figs. scores 1</p> <p>Do not penalise not multiplying by 1000 in (iii) if they have not divided by 1000 in (i)</p>	2