

Chemistry Unit 2 (Modular)
Mark Scheme

Question Number	Answer	Notes	Mark
1(a)(i)	argon	ALLOW Ar	1

Question Number	Answer	Notes	Mark
1(a)(ii)	nitrogen	ALLOW N ₂ /N	1

Question Number	Answer	Notes	Mark
1(a)(iii)	hydrogen	ALLOW H ₂ /H	1

Question Number	Answer	Notes	Mark
1(b)	climate change/global warming /oceans becoming more acidic	ALLOW greenhouse effect ALLOW effects of global warming e.g. melting of polar ice caps/flooding/wild fires IGNORE acid rain REJECT references to ozone layer	1

Question Number	Answer	Notes	Mark
1(c)	M1 bubble/pass/add the gas/carbon dioxide into limewater M2 (limewater) turns cloudy/milky	ALLOW white precipitate M2 dep on mention of limewater REJECT addition of extra reagents for both marks	2

Question Number	Answer	Mark
1(d)	M1 volume of oxygen = $90 - 73 = 17 \text{ cm}^3$ M2 percentage of oxygen = $\frac{17 \times 100}{90} = 18.9 \%$	2

Question Number	Answer	Mark
2(a)(i)	2.5	1

Question Number	Answer	Mark
2(a)(ii)	P has the same number of outer shell electrons as N	1

Question Number	Answer	Mark				
2(b)(i)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;">M1 ammonium chloride</td> <td style="width: 50%; padding: 5px;">ammonium carbonate</td> </tr> <tr> <td style="width: 50%; padding: 5px; text-align: center;">NH_4Cl</td> <td style="width: 50%; padding: 5px;">M2 $(\text{NH}_4)_2\text{CO}_3$</td> </tr> </table>	M1 ammonium chloride	ammonium carbonate	NH_4Cl	M2 $(\text{NH}_4)_2\text{CO}_3$	2
M1 ammonium chloride	ammonium carbonate					
NH_4Cl	M2 $(\text{NH}_4)_2\text{CO}_3$					

Question Number	Answer	Notes	Mark
2(b)(ii)	$2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$	ALLOW multiples IGNORE state symbols even if incorrect	1

Question Number	Answer	Notes	Mark
2(b)(iii)	M1 add sodium hydroxide (solution) M2 test (gas / ammonia) with (damp) red litmus paper / (damp) universal indicator paper M3 (red litmus) turns blue / universal indicator) turns blue / purple	REJECT if solution / ammonium (sulfate) tested with litmus / universal indicator paper	3

Question Number	Answer	Notes	Mark
2(c)	M1 $2 \times 14 \div 80$ OR 0.35 M2 $(0.35 \times 100 =) 35 (\%)$	correct answer without working scores 2 ALLOW 1 mark for 17 / 17.5 / 18 (%)	2

Question Number	Answer	Notes	Mark
3(a)(i)	M1 copper(II) sulfate (solution) M2 shortest time taken to turn colourless	ALLOW copper sulfate ALLOW gave greatest increase in rate OWTTE ALLOW made reaction happen fastest OWTTE M2 dep on M1	2

Question Number	Answer	Notes	Mark
3(a)(ii)	M1 a catalyst provides an alternative pathway M2 of lower activation energy	Any reference to increasing energy/speed of particles scores 0	2

Question Number	Answer	Notes	Mark
3(b)(i)	An explanation with following four points M1 the rate of reaction increases/ the reaction is faster/ the reaction speeds up M2 because the particles gain (kinetic) energy/move faster M3 there are more collisions per unit time M4 more of the collisions are successful / more collisions/particles have energy greater than the activation energy	ACCEPT more frequent collisions OWTTE No M4 if refer to lower activation energy there are more frequent successful collisions scores M3 and M4	4

Question Number	Answer	Notes	Mark
3(b)(ii)	M1 fewer particles per unit volume M2 (hence) fewer collisions per unit time	ALLOW particles less tightly packed / particles further apart ALLOW decrease in the frequency of collisions between particles Any reference to changing energy/speed of particles scores 0	2

Question Number	Answer	Mark
4(a)(i)	C Measuring cylinder	1

Question Number	Answer	Notes	Mark
4(a)(ii)	M1 and M2 all the points correct \pm half a square	If only one plotting error scores M1	2

Question Number	Answer	Notes	Mark
4(a)(iii)	2 straight lines of best fit, ignoring the anomalous point	Left line does not have to go through/use (0.0, 10.0) if point has not been plotted	1

Question Number	Answer	Notes	Mark
4(a)(iv)	as the volume of sulfuric acid increases the (electrical) conductivity decreases	IGNORE references to gradient/slope/correlation	1

Question Number	Answer	Notes	Mark
4(a)(v)	(the student) forgot to stir the mixture	ALLOW any reference to adding less acid/lower volume (than should have done) OWTTE	1

Question Number	Answer	Notes	Mark
4(b)(i)	M1 barium sulfate has a (giant) ionic structure OR has ionic bonding M2 ionic substances do not conduct when solid M3 water has covalent bonding and covalent compounds do not (usually) conduct electricity	ALLOW only conduct when dissolved/molten ALLOW in solid ions cannot move ALLOW water does not conduct because it is covalent IGNORE explanations of why covalent do not conduct	3

Question Number	Answer	Mark
4(b)(ii)	filtration OR filtering	1

Question Number	Answer	Notes	Mark
5(a)	M1 (put the carbonate in the boiling tube) and the limewater in the test tube M2 heat the carbonate and time how long it takes for the limewater to turn cloudy OWTTE M3 repeat with the same mass / amount / number of moles of another carbonate M4 (the carbonate which decomposes the fastest) will turn the limewater cloudy in the least time	ACCEPT repeat with another carbonate using same volume of limewater OWTTE To score M4 reference to limewater turning cloudy must be mentioned at least once somewhere in answer	4

Question Number	Answer	Mark
5(b)(i)	C to stop solid particles leaving the tube	1

Question Number	Answer	Mark
5(b)(ii)	$2.20 \div 44.0 (= 0.0500 \text{ mol})$	1

Question Number	Answer	Notes	Mark
5(b)(iii)	0.05	ALLOW ECF from (ii)	1

Question Number	Answer	Notes	Mark
5(b)(iv)	M1 $7.40 \div 0.05$ M2 148	correct answer with or without working scores 2 ALLOW ECF from (iii)	2

Question Number	Answer	Notes	Mark
5(b)(v)	M1 A_r of metal = $148 - 60$ OR 88 M2 metal is strontium / Sr	If (iv) correct strontium/Sr scores 2 without working ALLOW ECF from (iv) ALLOW ECF from M1 as long as answer is nearest Group 2 metal	2

Question Number	Answer	Mark
6(a)(i)	2CO_2	1

Question Number	Answer	Notes	Mark
6(a)(ii)	yeast	IGNORE zymase/enzymes	1

Question Number	Answer	Mark
6(b)(i)	The only correct answer is B $\text{CH}_3\text{COOC}_4\text{H}_9$ <i>A is incorrect as this is propyl ethanoate</i> <i>C is incorrect as this is butyl propanoate</i> <i>D is incorrect as this is ethyl butanoate</i>	1

Question Number	Answer	Mark
6(b)(ii)	sweet/fruity/distinctive smell OWTTE	1

Question Number	Answer	Notes	Mark
6(b)(iii)	perfumes/(food) flavourings/solvents	IGNORE (food) colourings ACCEPT any other appropriate use e.g. emulsifiers	1

Question Number	Answer	Mark
6(c)	M1 (CH ₃ COO) ₂ Mg M2 H ₂ O + CO ₂	2

Question Number	Answer	Notes	Mark
6(d)(i)	(atom/group of atoms in a compound that) determines its chemical properties/reactions OWTTE	ALLOW (atom/group of atoms that) determines which homologous series a compound is in OWTTE	1

Question Number	Answer	Mark
6(d)(ii)	circle around O $\begin{array}{c} \text{O} \\ \parallel \\ \text{-C-O-H} \end{array}$	1

Question Number	Answer	Notes	Mark
6(e)	$\begin{array}{cccc} \text{O} & \text{O} & \text{H} & \text{H} \\ \parallel & \parallel & & \\ \text{-C} & \text{-C} & \text{-O} & \text{-C} & \text{-C} & \text{-O-} \\ & & & & & \\ & & \text{H} & \text{H} & & \end{array}$ <p>M1 correct displayed ester functional group M2 rest of structure correct</p>	<p>O can be on LHS instead of on RHS</p> <p>ALLOW structure without extension bonds</p> <p>IGNORE n and brackets</p>	2

Question Number	Answer	Notes	Mark
7(a)	M1 shared pair(s) of electrons M2 attracted to (two) nuclei	REJECT nucleus. Must be plural for M2 M2 dep on mention of electrons in M1	2

Question Number	Answer	Notes	Mark
7(b)	a pair of electrons in each bond and no non-bonding electrons.	ALLOW dots, crosses or any combination	1

Question Number	Answer	Mark
7(c)(i)	Any one from M1 oxygen is a smaller atom/particle than silicon M2 each (atom of) oxygen forms two bonds (to silicon atoms)	1

Question Number	Answer	Notes	Mark
7(c)(ii)	M1 silicon dioxide has a giant (covalent) structure M2 (in melting silicon dioxide) strong/many covalent bonds (need to be broken) M3 (in melting silicon hydride) weak intermolecular forces (of attraction need to be overcome/broken) M4 more (thermal/heat) energy is needed to break the (covalent) bonds (in SiO ₂) than break/overcome the intermolecular forces (in SiH ₄)	ALLOW description of covalent bonds as long as strong/many mentioned ALLOW weak intermolecular bonds Max 2 if contradictions/references to incorrect forces/particles	4

Question Number	Answer	Notes	Mark
7(d)	SiH ₄ + 2O ₂ → SiO ₂ + 2H ₂ O all formula correct and equation correctly balanced	IGNORE state symbols ALLOW multiples and fractions	1

Question Number	Answer	Notes	Mark
8(a)(i)	M1 $\text{WO}_3(\text{s}) + 3\text{H}_2(\text{g})$ M2 $\text{W}(\text{s}) + 3\text{H}_2\text{O}(\text{g or l})$	ALLOW upper case	2

Question Number	Answer	Mark
8(a)(ii)	heat again to constant mass OWTTE	1

Question Number	Answer	Notes	Mark
8(a)(iii)	M1 (mass of tungsten =) 1.84g AND (mass of oxygen =) 0.48g M2 (moles of tungsten) = $\frac{1.84}{184}$ or 0.01 AND (moles of oxygen) = $\frac{0.48}{16}$ or 0.03 M3 therefore ratio is 1:3	M2 subsumes M1 ALLOW M2 ECF from incorrect masses M3 dep on M2 ALLOW ECF from incorrect M2 only if does give 1:3 when rounded	3

Question Number	Answer	Notes	Mark
8(a)(iv)	Any one from M1 use a safety screen M2 position the class some distance from the apparatus OWTTE M3 do the experiment in a fume cupboard	ALLOW heat proof/safety gloves ALLOW tie back hair	1

Question Number	Answer	Notes	Mark
8(b)	<p>Example calculation</p> <p>M1 moles of tungsten oxide = $(2784 \times 10^6 \div 232) =$ 12 000 000</p> <p>M2 maximum mass of tungsten = $(12\ 000\ 000 \times 184)$ = 2208 000 000 g OR 2208 tonnes</p> <p>M3 mass of tungsten (considering 73.5% yield) = $(73.5 \times 2208 \div 100) = 1622.88$ (tonnes)</p>	<p>correct answer without working scores 3 ALLOW any number of significant figures ≥ 2 throughout ALLOW other correct methods</p> <p>ALLOW working in megamoles</p> <p>ALLOW ECF M1\times184</p> <p>ALLOW ECF from M2</p>	3

Question Number	Answer	Notes	Mark
9(a)	<p>An explanation of properties that includes five of the following points</p> <p>M1 conducts electricity</p> <p>M2 (because the) delocalised electrons can move/flow (through structure)</p> <p>M3 malleable/ductile</p> <p>M4 (because) layers of cations/atoms</p> <p>M5 layers/cations/atoms can slide/slip/move over each other</p> <p>M6 high melting point</p> <p>M7 (because) strong (electrostatic) attraction between cations and delocalised electrons</p>	<p>reason must be linked to correct property</p> <p>IGNORE references to cost/reactivity/hardness/strength/shiny</p> <p>If any mention of ions/atoms moving cannot score M2</p> <p>ALLOW explanations of malleable/ductile</p> <p>ALLOW sheets/rows</p> <p>IGNORE high boiling point</p> <p>ALLOW giant metallic lattice/strong bonds between cations and delocalised electrons /strong metallic bonds</p> <p>Max 4 if any mention of intermolecular forces/covalent/ionic bonding</p>	5

Question Number	Answer	Mark
9(b)(i)	Cu^{2+}	1

Question Number	Answer	Notes	Mark
9(b)(ii)	effervescence/bubbles/fizzing	IGNORE oxygen/gas	1

Question Number	Answer	Mark
9(b)(iii)	M1 O_2 M2 $4\text{H}^+ + 4\text{e}^{-}$	2

Question Number	Answer	Mark
9(b)(iv)	M1 conversion to 0.120 dm^3 M2 amount = $\frac{0.120}{24} = 0.005 \text{ (mol)}$	2

For information about Pearson Qualifications, including Pearson Edexcel, BTEC and LCCI qualifications visit [qualifications.pearson.com](https://www.pearson.com/qualifications)

Edexcel and BTEC are registered trademarks of Pearson Education Limited

Pearson Education Limited. Registered in England and Wales No. 872828
Registered Office: 80 Strand, London WC2R 0RL

VAT Reg No GB 278 537121

Getty Images: Alex Belmonlinsky

