

Chemistry B

General Certificate of Secondary Education

Unit **B641/02**: Modules C1, C2, C3 (Higher Tier)

Mark Scheme for January 2012

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

Annotation	Meaning
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt not given
	error carried forward
	information omitted
	ignore
	reject
	contradiction

Subject-specific Marking Instructions

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

- / = alternative and acceptable answers for the same marking point
- (1) = separates marking points
- allow = answers that can be accepted
- not = answers which are not worthy of credit
- reject = answers which are not worthy of credit
- ignore = statements which are irrelevant
- () = words which are not essential to gain credit
- = underlined words must be present in answer to score a mark (although not correctly spelt unless otherwise stated)
- ecf = error carried forward
- AW = alternative wording
- ora = or reverse argument

Question		Expected Answers	Marks	Additional Guidance
1	(a)	high pressure (1) (named) catalyst (1)	2	allow any pressure above atmospheric pressure ignore just 'pressure'
	(b)	E (1) insoluble (in oil) (1) melting point is above 100°C (1)	3	allow correct answer ticked, circled or underlined in table if answer line is blank allow 1 mark for B with the reason that melting point is above 100°C no marks if A, C or D chosen allow it has the highest melting point allow melting point is 150°C ignore it has a high melting point allow won't melt carrying the oil ignore density / strength
	(c)	idea that forces or bonds between polymer chains or molecules are weak / idea that molecules can slide over one another (1)	1	allow weak intermolecular forces / weak forces between polymers allow polymer chains are not connected together allow it has no cross-linking / no covalent bonds between the molecules allow no bonds between polymer chains ignore polymer has weak bonds – must have idea of bonds between polymer molecules any reference to bonds within the molecule are weak scores 0

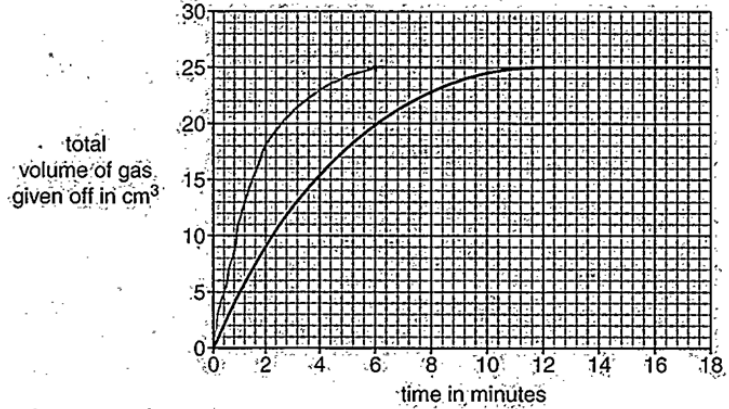
Question	Expected Answers	Marks	Additional Guidance
(d)	$\left[\begin{array}{cc} \text{H} & \text{H} \\ & \\ -\text{C} & -\text{C}- \\ & \\ \text{H} & \text{Cl} \end{array} \right]_n$ <p style="text-align: right;">(1)</p>	1	brackets required (may be round or square) bonds at the sides must be present, but do not need to pass through the brackets allow formula without 'n' allow two or more repeat units, brackets not required, eg $\begin{array}{cccc} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ -\text{C} & -\text{C} & -\text{C} & -\text{C}- \\ & & & \\ \text{H} & \text{Cl} & \text{H} & \text{Cl} \end{array}$
	Total	7	

Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	water (1)	1	allow H ₂ O
		(ii)	lime water goes cloudy / lime water goes milky / a white precipitate is seen (1) due to presence of carbon dioxide (1)	2	allow it goes white ignore it bubbles allow due to presence of CO ₂
	(b)		idea that bond formation is exothermic (1) more energy given out (in bond formation) than is taken in (in bond breaking) (1)	2	allow bond making releases energy allow more energy released than absorbed ignore reference to the number of bonds broken and made
	(c)		50 x 4.2 x 25 scores (1) BUT 5250 (J) (2)	2	allow full marks for 5250 with no working out allow 5.25 kJ, but not 5250kJ allow 210 (J) (1) allow 52 x 4.2 x 25 or 5460 (J) (1)
			Total	7	

Question		Expected Answers	Marks	Additional Guidance
3	(a)	<p>non-toxic – idea that perfume does not poison you (1)</p> <p>insoluble in water – so perfume cannot be washed off (easily) (1)</p>	2	<p>ignore so that the perfume does not harm you</p> <p>ignore idea that perfume does irritate the skin</p> <p>allow so perfume doesn't come off when you sweat</p> <p>ignore so perfume doesn't react with water / sweat</p>
	(b)	<p>any two from:</p> <p>idea that forces or attractions between the particles in the liquid are overcome or weakened or broken (1)</p> <p>idea that (only) weak attraction between particles in perfume / weak intermolecular forces (1)</p> <p>idea that particles gain energy / particles with lots of energy escape from the liquid (1)</p>	2	<p>allow bonds instead of forces</p> <p>allow molecules instead of particles</p> <p>not weak covalent bonds</p> <p>ignore energy gets stronger</p> <p>ignore references to particles becoming spread out or separated</p> <p>ignore references to diffusion</p>
		Total	4	

Question			Expected Answers	Marks	Additional Guidance
4			$2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2\text{O}$ correct formulae (1) balancing (1)	2	allow = instead of \rightarrow allow any correct multiples not and / & instead of + balancing mark is conditional on correct formulae allow 1 mark for correctly balanced equation with minor errors of case or subscript eg $2\text{NaHCo}3 \rightarrow \text{NA}_2\text{CO}3 + \text{CO}2 + \text{H}_2\text{O}$
			Total	2	

Question			Expected Answers	Marks	Additional Guidance
5	(a)		solvent evaporates (1)	1	allow water evaporates / liquid evaporates allow (the paint) dries by evaporation allow (binder) reacts with oxygen or air ignore oil evaporates
	(b)	(i)	idea that (pigment) particles are dispersed or suspended (in the solvent or liquid) (1)	1	allow idea of particles mixed together (but not dissolved)
		(ii)	(pigment) particles are (too) small (1)	1	allow particles are not big enough allow particles are not very dense
			Total	3	

Question		Expected Answers	Marks	Additional Guidance
6	(a)	$\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ <p>correct formulae (1) balancing (1)</p>	2	<p>allow = instead of \rightarrow allow any correct multiples not and / & instead of + allow any order of reactants and any order of products</p> <p>balancing mark is conditional on correct formulae</p> <p>allow 1 mark for correctly balanced equation with minor errors of case or subscript eg $\text{Zn} + 2\text{HCL} \rightarrow \text{ZnCl2} + \text{H2}$</p>
	(b)	12 minutes	1	allow 11 – 12 minutes
	(c)	<p>gradient steeper than original line (1)</p> <p>line ends at 25 cm^3 (1)</p>	2	<p>mark independently if line does not clearly start at origin, lose first marking point</p> <p>the line must not go above $25 \text{ cm}^3 \pm \frac{1}{2}$ square</p> 
Total			5	

Question		Expected Answers	Marks	Additional Guidance
7	(a)	nitrogen 77 – 80 (%) and oxygen 20 – 22 (%)	1	both required for 1 mark
	(b)	idea that photosynthesis takes in or lowers carbon dioxide and gives out or increases oxygen (1) idea that respiration takes in or lowers oxygen and gives out or increases carbon dioxide (1)	2	allow word or unbalanced symbol equation for photosynthesis water + carbon dioxide → glucose + oxygen $\text{H}_2\text{O} + \text{CO}_2 \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$ not references to plants breathing allow word or unbalanced symbol equation for respiration glucose + oxygen → water + carbon dioxide $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 \rightarrow \text{H}_2\text{O} + \text{CO}_2$ allow photosynthesis gives out oxygen / takes in carbon dioxide and respiration gives out carbon dioxide / takes in oxygen scores 1
	(c)	C D A B (2)	2	if all correct, 2 marks if two correct, 1 mark
Total			5	

Question		Expected Answers	Marks	Additional Guidance
8	(a)	$\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ (1)	1	allow any order of products allow any correct multiples allow = instead of \rightarrow not and / & instead of + allow heat above arrow but not '+ heat' or '+ energy' in equation
	(b)	<p>any two from:</p> <p>steel is strong (under tension) / concrete is weak (under tension) (1)</p> <p>steel is (more) flexible (1)</p> <p>concrete is hard (1)</p> <p>concrete is strong under compression (1)</p> <p>steel stops the concrete stretching / cracking / breaking (1)</p>	2	<p>allow steel gives concrete (more) strength (1)</p> <p>allow concrete cracks (without steel reinforcing)</p> <p>allow combines the strength / flexibility of steel with the hardness of concrete (2)</p>
		Total	3	

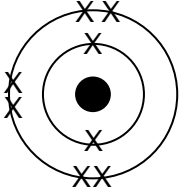
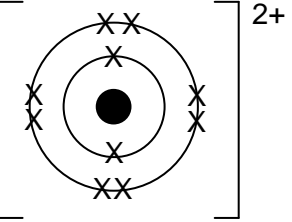
Question		Expected Answers	Marks	Additional Guidance
9	(a)	A (1)	1	allow 40 allow correct answer ticked, circled or underlined in table if answer line is blank
	(b)	particles move faster / particles have more energy (1) more frequent collisions / AW (1) more energetic or successful or effective collisions (1)	3	ignore vibrations allow more chance of collisions / particles collide more often / more collisions per second ignore faster collisions allow collisions are harder or collisions are more powerful or particles collide with more force allow more collisions for one mark if no other marks awarded
		Total	4	

Question			Expected Answers	Marks	Additional Guidance										
10	(a)	(i)	(element B) has one electron in the outer shell (1)	1											
		(ii)	(element E) has three (electron) shells (1)	1	allow has 3 rings / 3 outer shells										
		(iii)	D (1)	1											
	(b)	(i)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 5px;">relative charge</td> <td style="padding: 5px;">relative mass</td> </tr> <tr> <td style="padding: 5px;">0 / no charge / neutral</td> <td style="padding: 5px;">1 / one</td> </tr> </table> <p style="text-align: right;">(1)</p>	relative charge	relative mass	0 / no charge / neutral	1 / one	1	both required for 1 mark allow +1 but not -1 for relative mass						
relative charge	relative mass														
0 / no charge / neutral	1 / one														
		(ii)	${}_{17}^{37}\text{Cl}$ (1) protons 17, neutrons 20, electrons 17 (1)	2	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>symbol</th> <th>number of protons</th> <th>number of neutrons</th> <th>number of electrons</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">chlorine-37</td> <td style="padding: 5px;">${}_{17}^{37}\text{Cl}$</td> <td style="padding: 5px;">17</td> <td style="padding: 5px;">20</td> <td style="padding: 5px;">17</td> </tr> </tbody> </table>		symbol	number of protons	number of neutrons	number of electrons	chlorine-37	${}_{17}^{37}\text{Cl}$	17	20	17
	symbol	number of protons	number of neutrons	number of electrons											
chlorine-37	${}_{17}^{37}\text{Cl}$	17	20	17											
			Total	6											

Question		Expected Answers	Marks	Additional Guidance
11	(a)	<p>any two from:</p> <p>use of any appropriate utensil (1)</p> <p>dip wire in acid (1)</p> <p>dip wire or splint in (solid) sample (1)</p> <p>place solid / wire / splint in Bunsen flame (1)</p>	2	<p>all marks can be scored from a labelled diagram</p> <p>allow flame test wire / splint / spatula / glass rod / metal rod / spoon / tongs</p> <p>not incorrect use of splint, eg lighted splint</p> <p>allow spray chemical (1) into flame (1)</p>
	(b)	potassium chloride (1)	1	<p>not potassium chlorine</p> <p>allow KCl</p>
	(c)	<p>any two from:</p> <p>metal floats (1)</p> <p>metal moves (1)</p> <p>bubbles / fizzing / gas given off (1)</p> <p>purple or lilac or pink colour or flame / catches fire / sparks / explodes (1)</p> <p>metal melts (1)</p> <p>makes a colourless solution (1)</p>	2	<p>allow metal stays on surface (1)</p> <p>allow metal moves on the surface (of the water) (2)</p> <p>ignore burns</p> <p>allow pops or bang / AW</p> <p>allow dissolves / metal gets smaller</p> <p>allow references to metal disappearing</p> <p>ignore water changing colour but allow references to a named indicator changing to an alkaline colour, eg universal indicator turns blue / litmus turns blue</p>
		Total	5	

Question		Expected Answers	Marks	Additional Guidance
12	(a)	$\text{Fe}^{2+} + 2\text{OH}^- \rightarrow \text{Fe}(\text{OH})_2$ formulae (1) balancing (1)	2	allow = instead of \rightarrow allow any correct multiples not and / & instead of + ignore state symbols balancing mark is dependent on correct formulae allow 1 mark for a balanced equation with a minor error in subscripts / formulae eg $\text{Fe}^{2+} + 2\text{OH}^- \rightarrow \text{Fe}(\text{OH})_2$
	(b)	green (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank
Total			3	

Question		Expected Answers	Marks	Additional Guidance
13	(a)	magnesium + oxygen \rightarrow magnesium oxide (1)	1	allow reactants in either order allow correct formulae or mix of formulae and words $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$ symbol equation does not need to be balanced ignore incorrect balancing allow = instead of \rightarrow not and / & instead of +

Question	Expected Answers	Marks	Additional Guidance
(b)	 <p style="text-align: right;">(1)</p>	1	allow 2.6
(c)	 <p style="text-align: right;">(1)</p>	1	<p>correct electron arrangement and charge required for 1 mark</p> <p>brackets not required</p>
(d)	<p>strong attraction between (positive and negative) ions / strong electrostatic attraction / strong ionic bond (1)</p> <p>so large amount of energy needed to overcome the attraction / AW (1)</p>	2	<p>allow strong bond between ions</p> <p>allow has a giant or strong ionic structure or lattice</p> <p>allow particles for ions</p> <p>not atoms</p> <p>not strong intermolecular forces</p> <p>allow needs lots of heat to break (ionic) bond</p>
(e)	Na ₂ O (1)	1	not Na ₂ O / Na ² O
	Total	6	

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