



# GCSE

## 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 <b>not</b> 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

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

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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>(1)</p>	1	<p>brackets required (may be round or square) bonds at the sides must be present, but do not need to pass through the brackets</p> <p><b>allow</b> formula without 'n'</p> <p><b>allow</b> two or more repeat units, brackets not required, eg</p> $\begin{array}{ccccccc} & \text{H} & & \text{H} & & \text{H} & & \text{H} \\ &   & &   & &   & &   \\ - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - \\ &   & &   & &   & &   \\ & \text{H} & & \text{Cl} & & \text{H} & & \text{Cl} \end{array}$
			Total	7	

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

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

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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	<b>allow</b> = instead of $\rightarrow$ <b>allow</b> any correct multiples <b>not</b> and / & instead of +  balancing mark is conditional on correct formulae  <b>allow</b> 1 mark for correctly balanced equation with minor errors of case or subscript eg $2\text{NaHCo3} \rightarrow \text{NA}_2\text{CO3} + \text{CO2} + \text{H}_2\text{O}$
			<b>Total</b>	<b>2</b>	

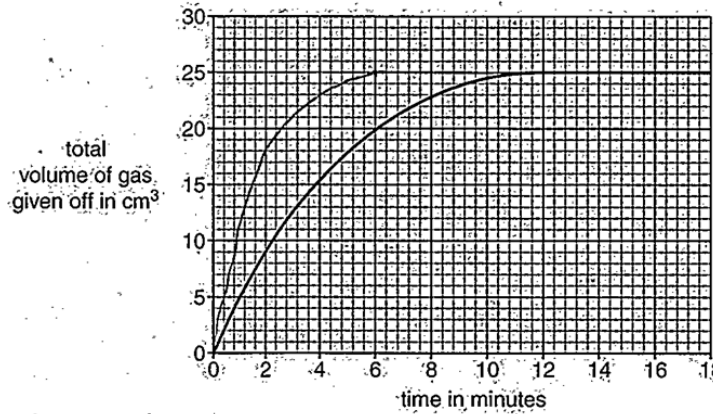
Question			Expected Answers	Marks	Additional Guidance
5	(a)		solvent evaporates (1)	1	<b>allow</b> water evaporates / liquid evaporates <b>allow</b> (the paint) dries by evaporation <b>allow</b> (binder) reacts with oxygen or air <b>ignore</b> oil evaporates
	(b)	(i)	idea that (pigment) particles are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



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

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

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

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

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

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

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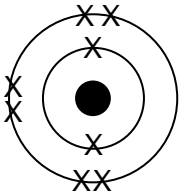
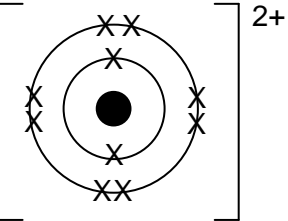
Question			Expected Answers	Marks	Additional Guidance
12	(a)		$\text{Fe}^{2+} + 2\text{OH}^- \rightarrow \text{Fe}(\text{OH})_2$  formulae (1) balancing (1)	2	<b>allow</b> = instead of $\rightarrow$ <b>allow</b> any correct multiples <b>not</b> and / & instead of + <b>ignore</b> state symbols  balancing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

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

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



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