

Chemistry B

General Certificate of Secondary Education

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

Mark Scheme for June 2012

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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

Annotation	Meaning
/	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
<u> </u>	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		Answers	Marks	Guidance
1	(a)	lowest boiling point (1)	1	allow low or lower boiling point allow smaller the molecule the lower the boiling point
	(b)	<p>any three from:</p> <p>large molecules have higher boiling points / ora (1)</p> <p>intermolecular forces between large molecules are strong(er) / ora (1)</p> <p>the stronger the intermolecular forces the higher the boiling point or more energy is required to break these forces / ora (1)</p> <p>during boiling intermolecular forces are broken (1)</p>	3	<p>allow longer chains molecules for large molecules</p> <p>ignore because they have different boiling points</p> <p>allow bonds between molecules for forces between molecules</p> <p>allow heat for energy</p> <p>but the larger the molecule the stronger the intermolecular forces therefore the higher the boiling point scores 3 / ora</p> <p>allow covalent bonds between atoms are stronger than intermolecular forces between molecules (1)</p>
Total			4	

Question		Answers	Marks	Guidance								
2	(a)	(polystyrene insulates) so person does not get burnt or harmed / drink stays warm (1) polystyrene is insoluble in water so that it does not dissolve in the drink / is insoluble in water so drink cannot leak out	2	allow outside of cup does not get hot / keeps cool allow heat does not escape / keeps heat in allow cup does not dissolve in water or cup does not go soggy allow water in drink will not react with the cup allow cup will not mix with drink								
	(b)	a reaction in which many monomer molecules react together (1) (tick in 2 nd box)	1	<table border="1"> <tr> <td>a reaction which requires low pressure and a low temperature</td> <td></td> </tr> <tr> <td>a reaction in which many monomer molecules react together</td> <td>✓</td> </tr> <tr> <td>a reaction which converts large alkane molecules into smaller alkane and alkene molecules</td> <td></td> </tr> <tr> <td>a reaction in which many small alkane molecules join together</td> <td></td> </tr> </table>	a reaction which requires low pressure and a low temperature		a reaction in which many monomer molecules react together	✓	a reaction which converts large alkane molecules into smaller alkane and alkene molecules		a reaction in which many small alkane molecules join together	
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	(c)	any one from: wastes a valuable resource (1) produces toxic or poisonous gases or fumes (1) produces a greenhouse gas (1)	1	ignore a dangerous or harmful gas allow kills allow produces carbon monoxide, sulfur dioxide allow produces carbon, soot allow named greenhouse gas eg carbon dioxide allow contributes to global warming ignore references to pollution ignore smoke								
Total			4									

Question		Answers	Marks	Guidance
3	(a)	same apparatus / equipment / spirit burner / copper can / calorimeter / thermometer spirit burner same distance from can (1)	1	allow same starting temperature allow same temperature rise allow heat for same time ignore same mass of water each time ignore same mass of fuel
	(b) (i)	correct answer on answer line 10 920 (J) (2) but if answer is incorrect 100 x 4.2 x 26 scores (1)	2	
	(ii)	5460 (J)	1	allow ecf from 6(b)(i) e.g. if 218.4 in part (i) answer 109.2 scores 1
	(c)	energy is released when bonds are made / bond forming is exothermic (1) more energy is given out than taken in (1) but more energy given out in bond making than taken in bond breaking (2)	2	answers implying more bonds made than broken score 0 but 1 mark can still be awarded for a correct additional statement just energy is given out scores 0 allow heat for energy
		Total	6	

Question		Answers	Marks	Guidance
4	(a)	contains hydrogen and carbon atoms only (1)	1	allow contains only carbon and hydrogen not is a mixture of carbon and hydrogen only not contains only carbon and hydrogen molecules
	(b)	double (covalent) bond (between carbon atoms) (1)	1	allow formula fits C_nH_{2n} allow two bonds between carbon atoms
	(c)	C_4H_{10} (1)	1	allow $H_{10} C_4$ not C4 H10
	(d)	D (1)	1	
		Total	4	

Question		Answers	Marks	Guidance
5	(a)	slows down growth of bacteria / stops growth of mould (1) ora.	1	allow stops bacteria / mould from growing or reproducing / makes it harder for bacteria / mould to grow not prevents bacteria entering
	(b)	intelligent (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank
Total			2	

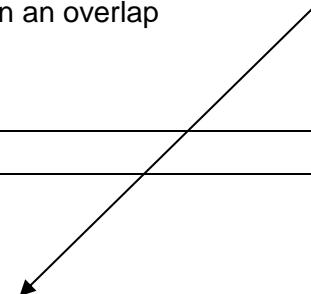
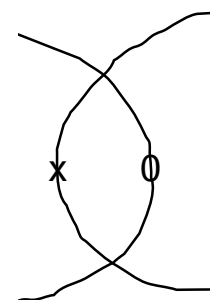
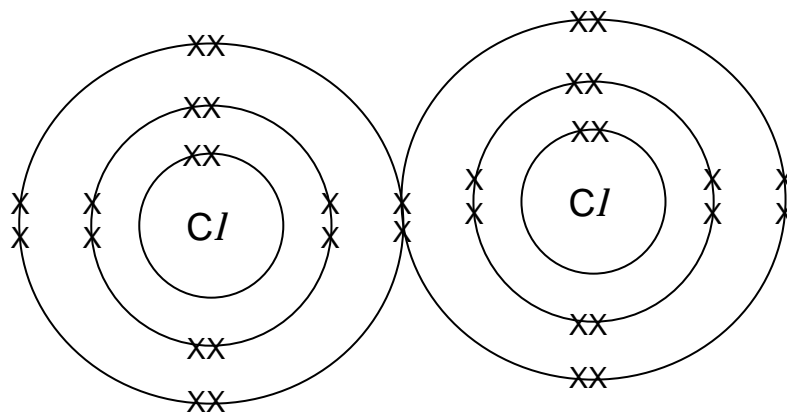
Question		Answers	Marks	Guidance
6	(a)	incomplete combustion (of petrol) (1)	1	allow not complete combustion allow not enough oxygen to completely burn (petrol)
	(b)	$N_2 + O_2 \rightarrow 2NO$ correct formula (1) balancing (1)	2	allow = instead of \rightarrow not and or & in equation allow any correct multiple including fractions balancing mark is dependent on the correct formulae allow one mark for correct balanced equation with minor errors in case or subscript e.g. $N_2 + O_2 \rightarrow 2NO$ or $N_2 + O_2 \rightarrow 2No$ if + heat / energy max one mark for correct formula but heat / energy can be above \rightarrow or =
	(c) (i)	particles have little energy / particles are moving slowly (1) not many collisions (per second) (1)	2	no need for a comparison allow particles are moving slower / particles have less energy allow collisions are not successful / collisions are not energetic allow fewer collisions allow particles are far apart / concentration very low
	(ii)	more collisions per second / increased collision frequency (1)	1	allow more collisions in the same time / collisions more often / higher chance of collisions / collisions more likely no mark for just more collisions ignore bump into each other quicker / collide more easily / faster collisions
Total			6	

Question		Answers	Marks	Guidance
7	(a)	→ hydrated iron(III) oxide (1)	1	allow hydrated iron oxide not hydrated iron(II) oxide iron hydrated (III) oxide scores 0
	(b)	salt (water) / sodium chloride (1)	1	allow NaCl / electrolytes / other named ionic salt ignore oxygen / water ignore sulphuric acid, sulphur dioxide and nitric acid
	(c) (i)	25 – 28 (minutes)	1	unit not needed ignore wrong unit
	(ii)	$\frac{30}{10}$ (1) but 3 (cm ³ /min) (2)	2	allow full marks for correct answer If answer is wrong look for working out <ul style="list-style-type: none"> this could be shown on the graph as a line from 10 minutes up to the line and then across to 30 cm³ this could be a line from any time less than 10 minutes to the line and then across to the volume an expression such as $\frac{15}{5}$ or $\frac{18}{6}$ etc
	(d)	less corrosion so the car has a longer lifetime (before it must be replaced) (1) lower density (aluminium) or lower weight (car) so that the car has better fuel economy (1)	2	allow one mark for two advantages which can be a property from the table or the effect on the car without any explanation allow rust for corrosion when referring to aluminium allow less maintenance of bodywork allow more fuel efficient for fuel economy
		Total	7	

Question		Answers	Marks	Guidance
8	(a)	any two from: particles are dispersed (throughout the mixture) (1) particles are too small to settle at the bottom (1) particles do not dissolve (1) it is a colloid (1)	2	allow suspended for dispersed allow particles not dense enough to sink
	(b)	reacts with oxygen / reacts with air / it is oxidised (1)	1	
	(c)	absorb energy and release it (later) / over a period of time (1)	1	allow absorb light / UV for absorb allow take in / store light
Total			4	

Question		Answers	Marks	Guidance
9	(a)	glass / concrete (1)	1	
	(b)	granite (1)	1	
	(c)	marble / limestone (1)	1	
Total			3	

Question		Answers	Marks	Guidance
10	(a)	7 (1)	1	
	(b)	4 (1)	1	
	(c)	green (gas) (1)	1	not an incorrect state e.g. green liquid
	(d)	correct shared pair of electrons between two chlorine atoms (1) eight electrons in the outer shell of the second chlorine atom	2	electrons can be crosses or dots typical 'dot and cross' diagram is shown below or one in which the shared pair of electrons may be on or within an overlap ignore missing inner shell electrons any indication of electron transfer scores 0
Total			5	



Question		Answers	Marks	Guidance
11	(a)	magnesium + oxygen → magnesium oxide (1)	1	allow formulae instead of words allow symbol equation even if not balanced eg $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$ (but case and subscript must be correct) allow = for → not and or & for + not + heat but heat can be above → or =
	(b)	(i) 24 (1)	1	
		(ii) loses two electrons (1)	1	allow gives away two electrons / gives two electrons to oxygen
	(c)	(i) ions are strongly bonded to each other / (very) strong ionic bond (1) needs lots of energy to break bonds / difficult to break bonds / difficult to overcome attraction between ions (1)	2	allow ions are strongly attracted to each other not reference to covalent bonds or intermolecular bonds not bonds between atoms or reference to molecules not reference to metallic bonds / structure
		(ii) ions cannot move / ions fixed in position (1)	1	ignore reference to electrons
Total			6	

Question		Answers	Marks	Guidance
12	(a)	0.70 (g)	1	unit not needed allow 0.7 (g)
	(b)	$\text{ZnCO}_3 \rightarrow \text{ZnO} + \text{CO}_2$ (1)	1	allow = instead of \rightarrow not and or & in equation allow any correct multiple including fractions not + heat in equation but allow heat over the arrow case and subscripts must be correct
	(c)	(i) green precipitate (1)	1	allow green solid / green grey solid
		(ii) Fe(OH)_2 (1)	1	allow any order of symbols e.g. O_2 Fe H_2
		Total	4	

Question		Answers	Marks	Guidance	
13	(a)	observations floats (1) moves around (1) lilac / purple flame or just flame / ignites (1) melts / forms a ball shape (1) gets smaller (1) fizzes (1) dissolves / forms a (colourless) solution (1) temperature of water increases (1) steam (1) explodes (1) products hydrogen / H ₂ (1) potassium hydroxide / KOH (1)	3	maximum of three marks but at least one product and one observation . mark incorrect answers first up to a maximum of 3 ignore water turns purple allow disappears allow potassium oxide	
	(b)	(i)	any value between 19 to 28°C inclusive (1)	1	
		(ii)	atomic radius is always increasing but density increases, then decreases and then increases / fluctates aw (1)	1	allow atomic radius always increasing and density is not always increasing allow density fluctuates aw allow atomic radius follows a pattern and the density does not
			Total	5	

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