

# **Chemistry B**

General Certificate of Secondary Education

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

## **Mark Scheme for January 2013**

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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 used in Scoris

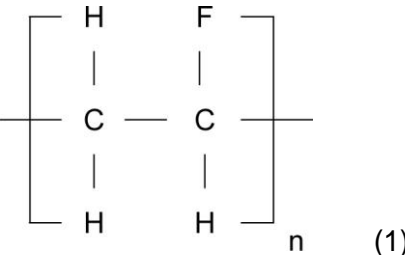
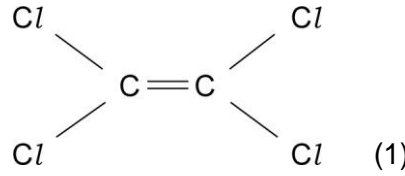
Annotation	Meaning
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt <b>not</b> given
	error carried forward
	information omitted
	ignore
	reject
	contradiction

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		Answer	Marks	Guidance
1	(a)	(bitumen) has highest boiling point (1)	1	<b>allow</b> are large molecules / high molecular mass (1) <b>allow</b> high boiling point (1)
	(b)	<b>any two from</b>  larger molecules or longer chain hydrocarbons have higher boiling points / ora (1)  intermolecular forces between larger molecules or longer chain hydrocarbons are stronger / ora (1)  forces between larger molecules or longer chain hydrocarbons are more difficult to break or overcome / AW / ora (1)	2	answer must have at least one statement that is a comparison to score full marks  <b>allow</b> large molecules or long chain hydrocarbons have high boiling points  <b>allow</b> forces or attraction or bonds between molecules for intermolecular forces  <b>allow</b> large molecules or long chain hydrocarbons have strong forces between molecules  <b>ignore</b> references to number of intermolecular bonds
	(c) (i)	contain (atoms of) hydrogen and carbon (1) only / AW (1)	2	<b>allow</b> H and C (1) <b>not</b> hydro <b>not</b> molecules of / mixture of hydrogen and carbon
	(ii)	$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$  correct reagents and products (1) correct balancing dependent on correct formulae (1)	2	<b>allow</b> any correct multiple including fractions <b>allow</b> = instead of $\rightarrow$ <b>not</b> and instead of + <b>not</b> and instead of + heat <b>allow</b> correct balanced equation with minor errors of subscripts, superscripts and case eg $C_3H_8 + 5O_2 \rightarrow 3Co_2 + 4H_2O$
<b>Total</b>			<b>7</b>	

Question		Answer	Marks	Guidance
2	(a)	sodium hydrogencarbonate → sodium carbonate + carbon dioxide + water (1)	1	<p><b>allow</b> any order of products  <b>allow</b> correct formulae or mix of formulae and words; if words and formula given for a product mark the words and <b>ignore</b> formula <b>ignore</b> balancing if formulae used  <math>2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2\text{O}</math></p> <p><b>not</b> hydrogencarbonate / sodium hydrocarbonate</p>
	(b)	(pass gas through a solution of) calcium hydroxide / limewater (1)  (which goes) cloudy (1)	2	<p><b>ignore</b> use of an indicator / litmus paper</p> <p><b>allow</b> a white solid / precipitate / suspension is formed / goes milky / white (1)</p> <p><b>ignore</b> reference to blowing through straw  <b>ignore</b> put out a lighted splint</p>
<b>Total</b>			<b>3</b>	

Question		Answer	Marks	Guidance
3	(a)	 <p style="text-align: center;">(1)</p>  <p style="text-align: center;">(1)</p>	2	must show the free bonds at either end but the bracket and 'n' can be missing
	(b)	high pressure / catalyst (1)	1	<b>allow</b> under pressure / any quoted pressure above atmospheric pressure (1) <b>allow</b> Ti / Ziegler-Natta catalyst (1)
	(c)	bromine (water) (1)  goes from orange / brown to colourless (1)	2	<b>allow</b> Br <sub>2</sub> / bromine solution (1) <b>not</b> Br  <b>allow</b> decolourises / turns colourless / orange colour disappears (1) <b>not</b> goes clear / orange to clear <b>ignore</b> colour change / discolours

Question		Answer	Marks	Guidance
	(d)	<p><b>any two from:</b>  waste of land / landfill full / takes up (valuable) space / fills up landfill (quickly) (1)</p> <p>does not biodegrade / decompose / break down (1)</p> <p>burning produces toxic gases / burning makes carbon dioxide / burning produces gases that increase global warming (1)</p> <p>difficult to sort / difficult to recycle (1)  uses up (valuable) resources / waste of plastic (1)  traps animals / wildlife (1)</p>	2	<p><b>allow</b> takes a long time to biodegrade / decompose / break down (1)</p> <p><b>ignore</b> makes dangerous gases / makes harmful gases / makes pollution  <b>ignore</b> makes toxic gases / makes carbon dioxide if not linked to burning</p> <p><b>allow</b> harms animals / wildlife (1)  <b>not</b> poisons animals / wildlife</p>
		<b>Total</b>	<b>7</b>	

Question		Answer	Marks	Guidance
4	(a)	B  temperature goes down / aw (1)	1	no mark for B – mark is for explanation but no mark unless B is chosen  <b>allow</b> because it takes in heat or because it takes in energy (1)  <b>ignore</b> because it loses heat or energy
	(b)	100 x 4.2 x 15 (1)  <b>but</b>  6300 scores (2)	2	look for correct answer first, 6300 on own scores (2) despite other working out  <b>allow</b> 6.3kJ (2) <b>allow</b> 189(J) or 3 x 4.2 x 15 (1) <b>allow</b> 6489 (J) or 103 x 4.2 x 15 (1)
<b>Total</b>			<b>3</b>	



Question		Answer	Marks	Guidance
5	(a)	<p>low density so less fuel needed (to lift plane) (1)</p> <p>strongest so more able to resist high forces or stress (1)</p>	2	<p><b>allow</b> less dense than iron (1)  <b>not</b> just 'density'            answer must imply density not weight eg the same aeroplane made from titanium will be lighter than if made from iron scores (1)</p> <p><b>allow</b> stronger than aluminium / stronger than iron / strongest of the metals (1)  <b>not</b> strong unless qualified eg very strong scores (0)</p> <p><b>allow</b> high melting point to withstand temperature of engine / high temperature to withstand friction with the air (1)</p> <p><b>ignore</b> any references to hardness</p>
	(b)	<p><b>any two from:</b>            protective layer on surface (1)</p> <p>of (aluminium) oxide (1)            which does not flake off (1)</p>	2	<p><b>allow</b> permanent / impervious / insoluble for protective eg layer that prevents reaction with (moist) air scores (1)  <b>allow</b> coating / barrier on surface for layer eg permanent coating scores (1)</p>
	(c)	<p>advantage – (aluminium) is less dense / aluminium is more lightweight / <b>car body</b> will be lighter / easier to shape / easier to bend / ora (1)</p> <p>disadvantage – aluminium is weaker (than steel) / aluminium is more expensive / not easily welded / ora (1)</p>	2	<p><b>allow</b> density / flexibility / malleability (1)  <b>allow</b> (aluminium) will give good fuel economy / (aluminium) makes the car more efficient to run (1)            if reverse argument used then answer must be qualified eg it is more dense scores (0) but steel is more dense than aluminium scores (1)</p> <p><b>allow</b> cost / weak (1)  <b>ignore</b> references to hardness</p>
<b>Total</b>			<b>6</b>	

Question			Answer	Marks	Guidance
6	(a)	(i)	A (1)	1	
		(ii)	0 – 20 (seconds) (1)	1	<b>allow</b> correct answer ticked, circled or underlined in list if answer line is blank answer line takes precedence
		(iii)	28 ÷ 20 (1)  <b>but</b>  1.4 (cm <sup>3</sup> /second) (2)	2	<b>allow</b> 2 marks for correct rate with no working out but if correct answer not given, look for evidence of working out on graph
	(b)		particles move faster / particles have more energy / aw (1)	1	<b>allow</b> higher level answers eg more (frequent) collisions / more (successful) collisions / greater chance of a collision (1)  <b>ignore</b> faster / quicker collisions <b>ignore</b> particles vibrate more
			<b>Total</b>	<b>5</b>	

Question		Answer	Marks	Guidance
7	(a)	any number from 340 to 500 <b>and</b> increased fuel consumption / higher population / greater awareness of impact has led to decrease / aw (1)	1	<b>no</b> mark for number on its own explanation must be consistent with given number  <b>allow</b> less photosynthesis / deforestation / more industrialisation (1)  <b>allow</b> one mark if answer indicates how they arrived at this number eg based on a pattern of numbers (which may be written in table)
	(b)	internal combustion engine / (car) exhaust / car engine / lorry engines (1)	1	<b>allow</b> lightning / jet engines / reaction of nitrogen and oxygen at high temperature / thunderstorms (1)  <b>ignore</b> from factories / fossil fuels burning
	(c)	$2\text{SO}_2 + \text{O}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{H}_2\text{SO}_4$  correct formulae of reactants and products (1) balancing dependent on correct formula (1)	2	<b>allow</b> any correct multiples including fractions <b>allow</b> = instead of $\rightarrow$ <b>not</b> and instead of + <b>not</b> and instead of + heat <b>allow</b> correct balanced equation with minor errors of subscripts, superscripts and case eg $2\text{SO}_2 + \text{O}_2 + 2\text{H}_2\text{o} \rightarrow 2\text{H}_2\text{So}_4$
<b>Total</b>			<b>4</b>	

Question		Answer	Marks	Guidance
8	(a)	break down (of a substance) (using heat) (1)	1	<p><b>allow</b> a reaction which produces two or more substances from one substance (by heating) (1)</p> <p><b>allow</b> (substance) decomposes (with heat) / break up (of a substance) (with heat) (1)</p> <p><b>allow</b> correct reference to specific reaction eg carbonates break down to give oxides and carbon dioxide</p> <p><b>ignore</b> breaks up bonds</p> <p><b>not</b> heat particles broken down</p> <p><b>ignore</b> decay / dissolve</p>
	(b)	<p><b>any two from</b></p> <p>limestone is a sedimentary rock / limestone made of grains of rock cemented together / limestone made from sediments subjected to pressure (1)</p> <p>marble is a metamorphic rock / marble made when limestone subjected to heat and pressure (without melting) (1)</p>	2	
	(c)	clay (1)	1	<p><b>allow</b> correct answer ticked, circled or underlined in list if answer line is blank</p> <p>answer line takes precedence</p>
	(d)	(steel) makes it more flexible / stronger (1)	1	<b>ignore</b> comments about hardness
<b>Total</b>			<b>5</b>	

Question			Answer	Marks	Guidance
9	(a)	(i)	blue (1)	1	more than one answer given scores (0)
		(ii)	orange (1)	1	more than one answer given scores (0)
	(b)		Fe(OH) <sub>2</sub> (1)	1	<b>allow</b> FeO <sub>2</sub> H <sub>2</sub> or (OH) <sub>2</sub> Fe (1)
	(c)		nickel (1)	1	<b>allow</b> Ni (1)
	(d)		<b>any two from:</b> super-fast circuits (1) make powerful electromagnets (1) loss free power transmission (1) virtually no or very little resistance (1)	2	
<b>Total</b>				<b>6</b>	

Question		Answer	Marks	Guidance
10	(a)	6 / six (1)	1	
	(b)	12 / twelve (1)	1	
	(c) (i)	4 / four / IV (1)	1	
	(ii)	2 / two (1)	1	
	(d)	diagram with 6 protons (open circles) and any number of neutrons (black circles) except 6 (1)	1	
<b>Total</b>			<b>5</b>	

Question		Answer	Marks	Guidance
11	(a)	decreases / become less reactive / AW (1)	1	<b>allow</b> higher level answers eg electrons further away from nucleus so less easy to gain an electron (1)
	(b)	any value between -120°C and -230°C (1)	1	<b>ignore</b> unit
	(c)	any value between 148pm and 170pm (1)	1	<b>ignore</b> unit
	(d)	potassium fluoride <b>and</b> iodine (1)	1	<b>both required for the mark</b> answers can be in any order  <b>allow</b> KF and I <sub>2</sub> (1)
<b>Total</b>			<b>4</b>	

Question			Answer	Marks	Guidance
12	(a)	(i)	covalent (1)	1	<b>allow</b> correct answer ticked, circled or underlined in list if answer line is blank answer line takes precedence
		(ii)	correctly drawn diagram (2)	2	<b>allow</b> 2 marks for correctly drawn diagram using shells, with or without inner electrons included  <b>allow</b> 1 mark for 1 shared pair of electrons between the two fluorine atoms  <b>not</b> ionic structures or charges shown on fluorine atoms
	(b)		positive ions in a sea of electrons (1)  attraction between electrons and positive ions (1)	2	<b>allow</b> copper ions or $\text{Cu}^{2+}$ and delocalised electrons (1)  <b>allow</b> marks from a labelled diagram
			<b>Total</b>	<b>5</b>	

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