

Chemistry B

General Certificate of Secondary Education

Unit **B741/01**: Modules C1, C2, C3 (Foundation 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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For answers marked by levels of response:













- a. **Read through the whole answer from start to finish**
- b. **Decide the level that best fits** the answer – match the quality of the answer to the closest level descriptor
- c. **To determine the mark within the level**, consider the following:

Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

Quality of Written Communication skills assessed in 6-mark extended writing questions include:

- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

Annotations used in scoris

Annotation	Meaning
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt not given
	error carried forward
	information omitted
	ignore
	Level 1
	Level 2
	Level 3
	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
<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		Answer	Marks	Guidance
1	(a)	methane / ethene (1)	1	allow correct displayed formula allow CH ₄ / C ₂ H ₄
	(b)	nine / 9 (1)	1	
	(c)	poly(ethene) / polythene (1)	1	NB brackets are part of the answer – ethene in poly(ethene) is essential to gain credit allow polyethene
		Total	3	

Question		Answer	Marks	Guidance
2	(a)	oil because <ul style="list-style-type: none"> • oil is easy to use / coal is not easy to use (1) • oil is available / natural gas is not available (1) 	2	marks are for explanation not oil is the cheapest but allow it is the cheapest fuel that is available ignore oil is cheap / oil is cheaper
	(b)	any two from: idea of energy content (1) idea of renewable (1) idea of storage (1) idea of toxicity of fuel (1) idea of pollution products / does it produce harmful substances when burned / does it have a clean flame / is it smelly / AW (1) idea of volatility (1) viscosity of fuel (1) physical state / is it solid, liquid or gas (1) idea of safety (1)	2	eg gives off lots of energy / heat allow is it poisonous / must be non-poisonous / no harmful effects if in contact with people / will it irritate skin allow is it harmful ignore dangerous ignore environmentally friendly / does it harm the environment allow idea of contribution to greenhouse effect / global warming / acid rain not ozone layer allow is it safe ignore efficiency of fuel

Question		Answer	Marks	Guidance
	(c)	propane + oxygen → carbon dioxide + water	1	allow = instead of → not and / & / instead of + allow correct formulae but equation does not need to balance eg $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$ allow mix of correct formulae and words
			Total	5

Question		Answer	Marks	Guidance
3	(a)	<div style="display: flex; flex-direction: column; gap: 10px;"> <div style="display: flex; align-items: center; gap: 10px;"> <input style="width: 200px; height: 20px;" type="text"/> <input style="width: 20px; height: 20px;" type="checkbox"/> </div> <div style="display: flex; align-items: center; gap: 10px;"> <input style="width: 200px; height: 20px;" type="text"/> <input checked="" style="width: 20px; height: 20px;" type="checkbox"/> </div> <div style="display: flex; align-items: center; gap: 10px;"> <input style="width: 200px; height: 20px;" type="text"/> <input style="width: 20px; height: 20px;" type="checkbox"/> </div> <div style="display: flex; align-items: center; gap: 10px;"> <input style="width: 200px; height: 20px;" type="text"/> <input style="width: 20px; height: 20px;" type="checkbox"/> </div> </div>	1	more than 1 tick = 0 marks
	(b)	<p>paint Y because it contains more solvent (1)</p> <p>solvent thins the paint / solvent makes the paint easier to spread (1)</p>	2	
	(c)	<p>any two from:</p> <p>(paint Y contains less binding medium), so the pigment will not stick to the surface as well / ora (1)</p> <p>(paint Y contains less pigment), so may not be as strongly or brightly coloured / ora (1)</p> <p>(paint Y has less additives), so will not dry as quickly / ora (1)</p>	2	<p>assume unqualified answer refers to paint Y</p> <p>allow (contains less pigment), so may need more than one coat</p>
		Total	5	

Question		Answer	Marks	Guidance
4	(a)	many small molecules / many monomers (1) join together / bond together (1)	2	allow higher level answers in terms of many alkene molecules / many unsaturated molecules
	(b)	(polymer) D (1)	1	allow correct answer indicated in table if answer line is blank
	(c)	at least one from: (disposal of polymers) by landfill / burying underground (1) burning / incineration (1) recycling / re-use / broken down to make other things (1) cracked (1) and at least one from: (scientists are developing new types of polymers) so they do not take up (valuable) space (1) (scientists are developing new types of polymers) so that they can be disposed of easily by dissolving (1) (scientists are developing new types of polymers) which are biodegradable (1)	3	
		Total	6	

Question	Answer	Marks	Guidance
5	<p>[Level 3] Gives an explanation as to why the levels of pollution have changed and an explanation as to why it is important that atmospheric pollution is controlled and describes a trend from the data given. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Two from: Gives a limited explanation as to why the levels of pollution have changed or gives a limited explanation as to why it is important that atmospheric pollution is controlled or describes a trend from the data given. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Gives a limited explanation as to why the levels of pollution have changed or gives a limited explanation as to why it is important that atmospheric pollution is controlled or describes a trend from the data given. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to C</p> <p>Indicative scientific points may include:</p> <ul style="list-style-type: none"> • Levels of carbon monoxide, oxides of nitrogen and sulfur dioxide have all decreased (between 1990 and 2008) <p>Levels of pollutants have changed because:</p> <ul style="list-style-type: none"> • carbon monoxide and oxides of nitrogen emissions from road transport has decreased due to increased used of catalytic converters on vehicles • catalytic converter removes carbon monoxide and oxides of nitrogen and converts them to nitrogen and carbon dioxide • less sulphur dioxide because less coal is burnt or sulfur is now removed from diesel • more efficient combustion of fuels to reduce carbon monoxide <p>needs to be controlled because:</p> <ul style="list-style-type: none"> • air pollution travels everywhere • atmospheric pollution affects the environment • atmospheric pollution affects people’s health / can trigger asthma • these effects will get worse unless atmospheric pollution is controlled • want to have less acid rain (due to sulfur dioxide) • sulphur dioxide or nitrogen oxides causes acid rain • carbon monoxide is toxic • want to have less photochemical smog
	Total	6	

Question			Answer	Marks	Guidance
6	(a)	(i)	nitrogen and phosphorus (1)	1	allow N and P
		(ii)	20 / twenty (1)	1	
	(b)		add universal indicator (to solution in flask) (1) compare colour to colour chart (1)	2	mark independently second mark not dependent on use of a suitable indicator ignore litmus allow use universal indicator paper / pH paper allow compare to pH chart / use a pH scale
	(c)	(i)	burette (1)	1	
		(ii)	potassium hydroxide (1)	1	allow KOH allow potassium carbonate / potassium hydrogencarbonate / K_2CO_3 / $KHCO_3$ ignore potassium oxide
			Total	6	

Question			Answer	Marks	Guidance
7			(solder) conducts electricity (well) (1)	2	allow conducts (well) allow it is easy to melt / has a melting point of 183°C (1) ignore strong
			has a low melting point (1)		
			Total	2	

Question		Answer	Marks	Guidance								
8	(a)	crystals are small because lava cooled quickly / AW (1)	1									
	(b)	soil is (very) fertile / crops grow better / AW (1)	1	<p>allow soil has many nutrients present ignore soil is good unless qualified, eg can grow bigger crops or soil good for crops would be sufficient to gain a mark</p> <p>allow provide geothermal energy / used to heat water / cheap source of heat / because people may want to study the volcano / want to live in same place (as rest of family) / housing may be cheap / take advantage of tourists</p> <p>ignore because there is nowhere else to go / for warmth</p>								
	(c)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>reacting particle model</td> <td><input type="checkbox"/></td> </tr> <tr> <td>electrolysis</td> <td><input type="checkbox"/></td> </tr> <tr> <td>neutralisation</td> <td><input type="checkbox"/></td> </tr> <tr> <td>plate tectonics</td> <td><input checked="" type="checkbox"/></td> </tr> </table>	reacting particle model	<input type="checkbox"/>	electrolysis	<input type="checkbox"/>	neutralisation	<input type="checkbox"/>	plate tectonics	<input checked="" type="checkbox"/>	1	more than one tick = 0 marks
reacting particle model	<input type="checkbox"/>											
electrolysis	<input type="checkbox"/>											
neutralisation	<input type="checkbox"/>											
plate tectonics	<input checked="" type="checkbox"/>											
Total			3									

Question		Answer	Marks	Guidance
9	(a)	<p>[Level 3] Describes some of the costs of making ammonia and explains why some costs will change when using a lower pressure. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Describes two or more of the costs involved in making ammonia. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Describes one cost involved in making ammonia. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science such as repeating the question. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to C</p> <p>Indicative scientific points at Level 3 may include:</p> <ul style="list-style-type: none"> • lower pressure will reduce plant costs / ora • lower pressure will reduce safety costs / ora • lower pressure will reduce energy costs / ora <p>Indicative scientific points at Levels 1, 2 & 3 may include:</p> <p>costs</p> <ul style="list-style-type: none"> • energy / gas / electricity / heating / lighting • raw materials / starting materials / nitrogen and hydrogen • labour / wages / salaries / staff / workers • equipment / plant / maintenance • marketing • taxes / rates / rent • safety / H&S • pollution control • how quickly the new substance can be made / cost of catalyst <p>ignore R&D, distribution, transport, packaging, advertising, storage</p>

Question			Answer	Marks	Guidance
9	(b)		$2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$ formulae correct (1) balancing (1) balancing mark is conditional on correct formulae	2	allow = instead of \rightarrow not and / & / instead of + allow any correct multiples, including fractions allow one mark for correct balanced equation with minor errors of case, subscript and superscript eg $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$
			Total	8	

Question			Answer	Marks	Guidance
10	(a)	(i)	fertiliser (solution) (1)	1	allow (tube) 4
		(ii)	idea that no water in test tube 2, no rust (1) idea that no oxygen in test tube 3, no rust (1)	2	if no other mark awarded, allow one mark for the idea that without water there is no rust and without oxygen there is no rust without reference to tubes 2 and 3
	(b)		aluminium coated with oxide layer or aluminium oxide layer (which does not flake off) (1)	1	ignore aluminium does not rust
	(c)		any two from: (aluminium) can be used again (1) saves natural resources (1) reduces disposal problems (1) saves money (1) saves energy (1) reduces litter (1)	2	allow aluminium won't be wasted / no shortage of aluminium / aluminium won't be in short supply eg less 'dumps' needed (1) ignore vague references to the environment or pollution
			Total	6	

Question	Answer	Marks	Guidance
11 (a)	calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide (1)	1	<p>allow = instead of → not and / & / instead of +</p> <p>allow correct formulae but equation does not need to balance eg $\text{CaCO}_3 + \text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ allow mix of correct formulae and words</p>
(b) (i)	48 (1)	1	unit not needed
(ii)	all hydrochloric acid is used up / all tablet (X) or calcium carbonate is used up (1)	1	allow reactant used up
(iii)	<p>all points plotted correctly (1)</p> <p>best curve through points (1)</p>	2	<p>points plotted to within $\pm 1\text{cm}^3$ and $\pm 0.05\text{min}$</p> <p>not dot to dot not if line above 74cm^3</p> <p>marking points are independent</p>

Question	Answer	Marks	Guidance
(c)	levels off at lower gas volume / gives off less carbon dioxide (1)	1	<p>assume unqualified comment refers to tablet X</p> <p>allow ora for specific reference to tablet Y eg Y gives more gas</p> <p>ignore references to rate or time answer must be a comparison</p>
(d)	<p>any four from:</p> <p>increase temperature of acid (1) particles move faster or particles have more energy (1) more (frequent or effective) collisions (1)</p> <p>use powdered or crushed calcium carbonate (1) has more surface area (1) more (frequent) collisions (1)</p> <p>stir / shake (1) more (frequent) collisions (1)</p> <p>use a catalyst (1) idea that particles need less energy to react / reaction has lower activation energy (1)</p>	4	<p>must be at least two explanation marks to gain full credit any explanation MUST relate to method</p> <p>ignore particles vibrate more ignore faster collisions</p> <p>ignore use smaller particles ignore faster collisions</p> <p>ignore faster collisions</p>
	Total	10	

Question			Answer	Marks	Guidance
12	(a)	(i)	ammonia is needed in large amounts / ammonia is needed in high demand / AW (1) drugs or medicines are made on a relatively small scale / easy to switch to making a different drug / drugs are needed in small amounts / AW (1)	2	allow ammonia needed all year round allow demand for drug may be seasonal allow a batch can be re-called if there is a problem
		(ii)	chromatography (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank
	(b)	(i)	percentage yield = $\frac{\text{actual yield}}{\text{predicted yield}} \times 100$ (1) but $\frac{6.0}{8.0} \times 100$ (2)	2	allow $\frac{\text{am}}{\text{pm}} \times 100$ (1) or $\frac{6.0}{8.0} = 0.75$ (1) 0.75 x 100 (1) No mark for 75%
		(ii)	loss in evaporation / loss in heating / loss in transferring liquids (1)	1	
	(c)	(i)	$\text{NaOH} + \text{HNO}_3 \rightarrow \text{NaNO}_3 + \text{H}_2\text{O}$	1	allow any correct multiple, including fractions allow = / \rightleftharpoons instead of \rightarrow not and / & / '+ energy'
		(ii)	idea that mass of reactants equals mass of products / $4.0 + 6.3 = 1.8 + \text{mass of sodium nitrate}$ / $10.3 = 1.8 + \text{mass of sodium nitrate}$ (1) but mass of sodium nitrate = 8.5 (g) (2)	2	
Total				9	

Question	Answer	Marks	Guidance
13	<p>[Level 3] A description of a method that will enable the energy transferred by the fuels to be compared and data correctly analysed to identify, with reason, propanol as best fuel to use. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] A description of a method that is correct or identifies propanol as the best fuel to use with a limited explanation. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] A limited description of a method that involves using fuel to heat water or identifies propanol as the best fuel to use (without explanation). Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to E</p> <p>Indicative scientific points may include:</p> <ul style="list-style-type: none"> • use of a spirit burner • heating water in a copper can or calorimeter • measuring the temperature change of the water • fair test – same mass or volume or amount of water in copper can / same distance between burner and copper can / use same burner each time / same copper can / same size flame or wick <p>ignore same mass of fuel</p> <p>higher level answers may refer to need to repeat the experiment to obtain reliable results</p> <p>higher level answers may refer to calculation of energy transferred using the formula $E = mc\Delta T$</p> <p>marks can be awarded from a labelled diagram or written answer</p> <ul style="list-style-type: none"> • propanol is the best fuel to use because it has the highest temperature change or temperature rise
	Total	6	

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