OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry B

General Certificate of Secondary Education

Unit **B741/01:** Modules C1, C2, C3 (Foundation Tier)

Mark Scheme for January 2013

Oxford Cambridge and RSA Examinations

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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.

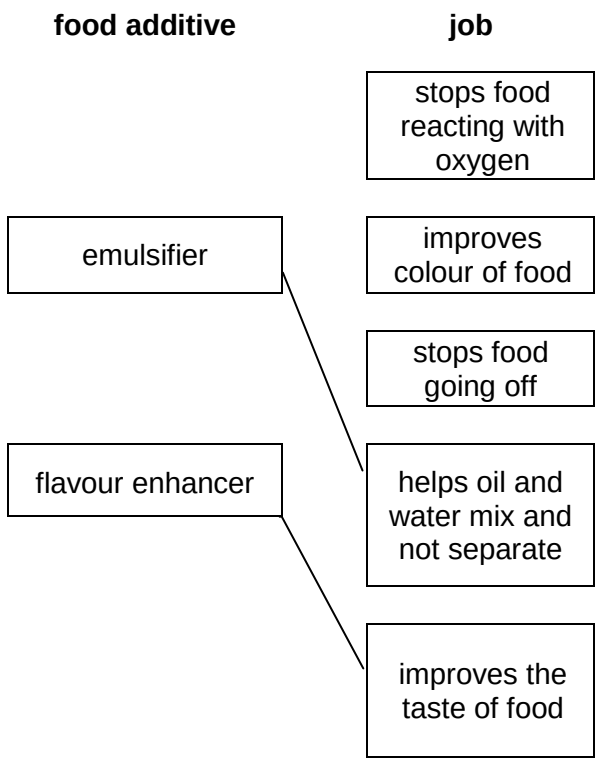
OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Annotations

Annotation	Meaning
	correct response
	incorrect response
BOD	benefit of the doubt
NBOD	benefit of the doubt **not** given
ECF	error carried forward
^	information omitted
I	ignore
L1	Level 1
L2	Level 2
L3	Level 3
R	reject
CON	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)		 line drawn between emulsifier and helps oil and water mix and not separate **and** line between flavour enhancer and improve the taste of food (1)	1	if only 1 line drawn or more than two lines or if one line is incorrect no marks
	(b)	(i)	4 (1)	1	

Question			Answer	Marks	Guidance
		(ii)	lime water / calcium hydroxide (solution) (1) (limewater) turns milky / cloudy / chalky / forms white precipitate / forms white solid (1)	2	result mark cannot be awarded if reagent is incorrect **allow** $Ca(OH)_2$ (1) **allow** goes foggy or misty or creamy (1) **allow** bicarbonate indicator (1) changes from red to yellow (1)
			Total	**4**	

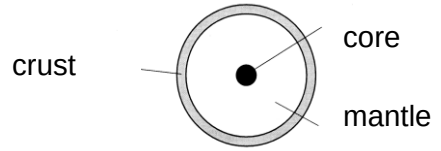
Question			Answer	Marks	Guidance
2	(a)		takes a long time to form (1) are used up faster than they are formed or cannot be made again or finite (1)	2	**allow** takes (many) years to form or thousands or millions of years to form (1) **ignore** takes hundreds of years to form **allow** once it's gone, its gone / can't be replaced (1) **ignore** cannot be used again **allow** runs out eventually / will run out of fossil fuels or named fossil fuel e.g.coal (1)
	(b)		bitumen (1) (bitumen) has the highest boiling point (range) (1)	2	**allow** phonetic spelling this mark is **dependent** on the correct fraction being chosen **allow** hottest boiling point (1) **allow** needs the highest temperature to be boiled (1) **allow** its boiling point is above $350^{o}C$ (1) **allow** it's the highest temperature at the bottom (1) **ignore** it's the hottest
	(c)	(i)	14 (1)	1	
		(ii)	propane and butane contain carbon and hydrogen (atoms) (1) only (1) has (carbon to carbon) single bonds **only** / contains single (covalent) bonds **only** (1)	3	**not** is a mixture of carbon and hydrogen (only) **not** contains carbon and hydrogen molecules Only must be linked to first marking point and is not independent **allow** has no (carbon to carbon) double bonds (1) **allow** they are saturated compounds (1) **allow** has general formula C_nH_{2n+2} (1)
			Total	**8**	

Question			Answer	Marks	Guidance
3	(a)		**C** and **E** (1)	1	both required for 1 mark
	(b)		octane + oxygen → carbon dioxide + water (1)	1	**allow** = instead of → **not** and or & for + **allow** mix of formulae and words but equation does not have to be balanced e.g. $C_8H_{18} + O_2$ → carbon dioxide + H_2O (1)

Question	Answer	Marks	Guidance
(c)	**Level 3 (5–6 marks)** Candidates recall that carbon monoxide is made by incomplete combustion or when there is not enough oxygen supplied to the fuel **AND** recognises a problem of both carbon monoxide **AND** of oxides of nitrogen. Quality of written communication does not impede communication of science at this level. **Level 2 (3–4 marks)** Candidates recall that carbon monoxide is made by incomplete combustion / when there is not enough oxygen supplied to the fuel **AND** recognises a problem of carbon monoxide **OR** of oxides of nitrogen. Quality of written communication partly impedes communication of science at this level. **Level 1 (1–2 marks)** States that carbon monoxide is made from burning petrol / fuel in a car engine **OR** gives a problem caused by carbon monoxide **OR** gives a problem caused by oxides of nitrogen. Quality of written communication impedes communication of science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science such as repeating the question. Answer not worthy of credit.	6	**This question is targeted at grades up to grade E** **Relevant points at levels 2 and 3 may include:** • carbon monoxide is made by incomplete combustion or when there is not enough oxygen supplied to the fuel **AND** • carbon monoxide is poisonous • carbon monoxide can kill humans **AND** • oxides of nitrogen cause photochemical smog • oxides of nitrogen cause acid rain • acid rain kills plants, kills aquatic life, erodes stonework and corrodes metals • oxides of nitrogen or smog causes respiratory problems e.g. asthma **allow** level 2 (3 marks) if answer includes correct problems of both carbon monoxide and oxides of nitrogen but no reference to incomplete combustion. **Relevant points at level 1 may include:** • carbon monoxide and /or oxides of nitrogen made when fuel / petrol / diesel burn • carbon monoxide is poisonous • carbon monoxide can kill humans • oxides of nitrogen cause photochemical smog • oxides of nitrogen cause acid rain **Use the L1, L2 and L3 annotations in scoris; do not use ticks**
	Total	**8**	

Question			Answer	Marks	Guidance
4	(a)		**C** because it is flexible, waterproof and breathable (2)	2	marks are for evaluation, not for choice of **C** but for two marks properties must relate to correct choice of **C** for two marks **all three** properties must be listed **allow** one mark for **C** and **two** properties listed **allow** one mark for **E** and because it is flexible and waterproof ignore reference to not breathable if **E** mentioned.
	(b)		poly(ethene) (1)	1	**allow** polythene (1) **allow** polyethene (1)
			Total	**3**	

Question			Answer	Marks	Guidance
5			idea that thermochromic paints change colour when heated or cooled / the paint is a different colour when hot or cold / the paint is a different colour at different temperatures (1) the colour of the paint or pigment will show when the milk is at the right temperature (to drink) (1)	2	**allow** so you can see if the milk is warm or cold (1) **allow** idea that the milk is safe for the baby to drink (1)
			Total	**2**	

Question			Answer	Marks	Guidance
6	(a)		 core **and** mantle labelled correctly (1)	1	**both** required **allow** inner or outer core
	(b)		volcanoes (1) earthquakes (1)	2	**allow** tsunamis (1) **allow** subduction or correct description of subduction (1) **allow** new land is formed if it is clear that two plates are moving apart (1)
	(c)		magma – (molten rock) beneath Earth's surface or inside the volcano (1) lava – (molten rock) at the Earth's surface or outside the volcano(1)	2	**allow** magma is underground (1)
			Total	**5**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>7</td><td>(a)</td><td></td><td>add universal indicator (paper or solution) (1)

match colour to test card (1)</td><td>2</td><td>allow pH paper
allow use a pH meter (2)

2nd mark is dependent on 1st being awarded
allow colour corresponds to a pH value (1)
allow correct colours in acid and/or alkali (1)
ignore to see what colour it goes</td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><th>acid</th><th>base</th><th>salt</th></tr><tr><td>sulfuric acid</td><td>copper oxide</td><td>copper sulfate</td></tr><tr><td>nitric acid</td><td>sodium carbonate</td><td>sodium nitrate (1)</td></tr><tr><td>hydrochloric acid (1)</td><td>zinc oxide</td><td>zinc chloride</td></tr><tr><td>sulfuric acid</td><td>magnesium oxide / magnesium hydroxide / magnesium carbonate (1)</td><td>magnesium sulfate</td></tr></table></td><td>3</td><td>allow correct formulae i.e.
$NaNO_3$ (1)

HCl (1)

MgO / $Mg(OH)_2$ / $MgCO_3$ (1)</td></tr>
<tr><td></td><td>(c)</td><td></td><td>$CuCl_2$ or H_2O (1)</td><td>1</td><td>allow $CuCl_2$ and H_2O (1)</td></tr>
<tr><td></td><td>(d)</td><td></td><td>benefits – any one from:
increased crop yield (1)
crops grow faster (1)
increased food supply (1)
provides essential elements / provides nitrogen or phosphorus or potassium (1)

problem – any one from:
runs off into rivers and lakes (1)
idea of algal bloom (1)
causes death of water organisms (1)
eutrophication (1)</td><td>2</td><td>allow bigger crops (1)
ignore better crops
ignore to help crops grow (healthy)

allow blue baby syndrome (1)
ignore just ‘causes pollution’

allow correct description of eutrophication (1)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>8</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
8			**Level 3 (5–6 marks)** Applies knowledge of properties to identify at least two correct properties **AND** analyses table of data to choose metal B and fully explains their choice to include references to lowest density. Quality of written communication does not impede communication of science at this level. **Level 2 (3–4 marks)** Applies knowledge of properties to identify at least two sensible properties **AND** metal B is identified or metal D identified based on greatest strength. Quality of written communication partly impedes communication of science at this level. **Level 1 (1–2 marks)** Applies knowledge of properties to identify one sensible property **OR** suggests metal B for making the wings and/or body. Quality of written communication impedes communication of science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to C.** **Relevant points include:** • metal needs to have a low density • metal needs to have high strength • metal must not corrode easily • melting point of metal must not be too low **ignore** references to thermal conductivity Metal **B** is best. This is because: • it has the lowest density or lightest metal • and a high strength • it has the highest melting point.
			Total	**6**	

Question			Answer	Marks	Guidance
9	(a)		reversible reaction / reaction goes both ways (1)	1	**allow** forms an equilibrium (1)
	(b)	(i)	160 atm and 200 ^{o}C (1)	1	**both** required
		(ii)	**any two from:** idea that higher energy cost with higher pressure (1) idea that higher plant costs with higher pressures (1) idea that greater safety risks with higher pressure (1)	2	if in doubt assume answer refers to 70atm **allow** it is cheaper (1) if no other marks awarded **allow** 70atm to avoid breaking the equipment (1) **allow** uses less energy (1)
	(c)		**any two from:** cost of ethene (1) labour costs (1) equipment costs (1) cost of catalyst (1) research costs (1) cost of testing (1) rent or rates or taxes (1) pollution controls (1) storage (1)	2	**allow** extra qualification of costs (1) **allow** safety costs or safety equipment (1) **allow** maintenance costs (1) **ignore** references to energy costs / electricity / gas **ignore** packaging **ignore** transporting ethanol **ignore** marketing
			Total	**6**	

Question			Answer	Marks	Guidance
10	(a)		46 (1)	1	**ignore** units
	(b)		280 (g) (1)	1	unit **not** needed **ignore** incorrect units
	(c)		atom economy = $\frac{60}{60+18}$ / $\frac{60}{46+32}$ / $\frac{60}{78}$ (1) **but** atom economy = $\frac{60}{60+18} \times 100$ / $\frac{60}{46+32} \times 100$ / $\frac{60}{78} \times 100$ (2)	2	**allow** atom economy formula in words for one mark i.e. atom economy = <u>total Mr of desired products</u> x 100 (1) total Mr of all products or atom economy = <u>total Mr of desired products</u> x 100 (1) total Mr of all reactants
	(d)		percentage yield = $\frac{9.5}{9.8}$ (1) **but** percentage yield = $\frac{9.5}{9.8} \times 100$ (2)	2	**allow** percentage yield formula in words for one mark e.g. percentage yield = <u>actual yield</u> x 100 predicted yield or percentage yield = <u>am</u> x 100 pm
	(e)		has high(er) atom economy / 100% atom economy / less atoms are wasted (1)	1	**allow** reverse argument e.g. process 1 has low(er) atom economy (1) **ignore** references to percentage yield **allow** no or less waste products (1) **ignore** no waste
			Total	**7**	

Question			Answer	Marks	Guidance
11	(a)		nitrogen + oxygen → nitrogen monoxide (1)	1	**allow** symbol equation even if not balanced N_2 + O_2 → NO (1) **allow** = for → **not** & or and for +
	(b)		reaction which absorbs energy / reaction which gains energy / reaction which takes in energy (1)	1	**allow** heat or enthalpy for energy **allow** a reaction in which surroundings get colder (1)

Question	Answer	Marks	Guidance
(c)	**Level 3 (5–6 marks)** Identification of at least three ways of making the reaction go faster **AND** applies reacting particle model correctly, including mention of collisions, to explain one way. Quality of written communication does not impede communication of science at this level. **Level 2 (3–4 marks)** Identification of at least two ways of making the reaction go faster **AND** makes an attempt to apply reacting particle theory to one of the ways (theory only partly correct). Quality of written communication partly impedes communication of science at this level. **Level 1 (1–2 marks)** Identification of two ways of making the reaction go faster. Quality of written communication impedes communication of science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science such as repeating the question. Answer not worthy of credit.	6	**This question is targeted at grades up to C.** **Relevant points include:** **Reacting particle theory** • increasing concentration or pressure gives more crowded nitrogen and oxygen molecules / molecules are closer together / more nitrogen and oxygen molecules in the same volume so there is an increased number of collisions (per second) / more collisions • increasing temperature has nitrogen or oxygen molecules moving faster / molecules have more energy so more (successful) collisions (per second) • adding a catalyst means there are more successful collisions (per second). **allow** one correct way of making the reaction go faster and a complete explanation level 2 (4 marks) **Ways of making reaction faster** • increase temperature • increase pressure • increase concentration • add a catalyst.
	Total	**8**	

Question			Answer	Marks	Guidance
12	(a)		**any two from:** hard (1) does not conduct electricity (1) (good) conductor of heat (1) high melting point (1) insoluble in water (1) shiny / lustrous (1) transparent (1)	2	 **ignore** hard to break or cut **ignore** strong
	(b)		conducts electricity (1)	1	**ignore** it is a good conductor **allow** it is inert / has a high melting point (1) **allow** it is insoluble in water (1)
			Total	**3**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>13</td><td>(a)</td><td></td><td>
<table>
<tr><th>fuel</th><th>molecular formula</th><th>number of atoms in a molecule</th><th>temperature increase in °C</th></tr>
<tr><td>methanol</td><td>CH_4O</td><td>6</td><td>9</td></tr>
<tr><td>ethanol</td><td>C_2H_6O</td><td>9</td><td>12</td></tr>
<tr><td>propanol</td><td>C_3H_8O</td><td>12</td><td>14</td></tr>
<tr><td>butanol</td><td>$C_4H_{10}O$</td><td>15</td><td>16</td></tr>
<tr><td>pentanol</td><td>$C_5H_{12}O$</td><td>18</td><td>15</td></tr>
</table>
Correct number of atoms (1)

Correct temperature increases (1)</td><td>2</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>identification of pentanol as odd result (1)

explanation with a correct reason for yes or no (1)</td><td>2</td><td>e.g. the rest of the temperature increases go up with the number of atoms (1)
e.g. pentanol has less of a temperature rise than butanol (2)
e.g. pentanol is an anomaly (1)

allow ecf from table but apply same principles</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
14	(a)		**need to have one point from each section for 1 mark** **continuous process** continuous takes place all the time continuous takes place 24/7 continuous has no down time continuous cannot change what is made **batch process** batch process not done 24/7 batch process is done and later on is done again batch process has down time batch process can change what is made batch process done on demand	1	
	(b)		**any two from:** to see if they have pharmaceutical activity / see if the drug works / aw (1) to test to see if there are any side-effects (1) to find out the dosage needed (1)	2	**allow** idea of checking that drug is safe (1) **allow** references to checking that drug is not harmful or poisonous (1)
			Total	**3**	

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