OCR
Oxford Cambridge and RSA

GCSE

Chemistry B

Unit **B741/02**: Modules C1, C2, C3 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2015

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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
R	reject
CON	contradiction
L1	Level 1
L2	Level 2
L3	Level 3

ADDITIONAL OBJECTS: You **must** assess and annotate the additional objects for each script you mark. Where credit is awarded, appropriate annotation must be used. If no credit is to be awarded for the additional object, please use annotation as agreed at the SSU.

When you open the script if the message appears that there are additional objects you must check these additional objects.

The additional objects are normally additional sheets of answers that must be marked. You should immediately link each extra answer with the appropriate question using the paper clip icon.

PLEASE ASK YOUR TEAM LEADER IF YOU DO NOT KNOW HOW TO DO THIS.

It is vitally important that all parts of the candidate's answer are marked.

Subject-specific Marking Instructions

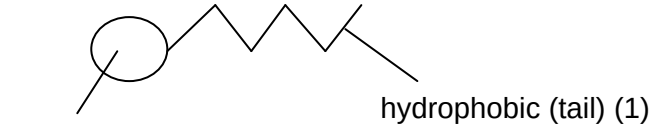
Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/	=	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

Question	Answer	Marks	Guidance
1 a	contains carbon and hydrogen (1) only / aw (1)	2	**allow** (formula) has only (1) C and H (1) the only is **not** an independent mark and must be linked to the carbon and hydrogen **not** contains carbon and hydrogen **molecules** = 0 marks for the question **not** contains a **mixture** of carbon and hydrogen = 0 marks for the question **not** an **element** containing carbon and hydrogen = 0 marks for the question **not** hydro atoms
b	**all** (carbon-carbon) bonds are single bonds / contains **only** single bonds (1)	1	**allow** does not contain a double bond (1) **ignore** has maximum number of bonds **ignore** has the maximum number of hydrogen atoms
c	idea that hydocarbons have different boiling points (1) **and any two from:** larger molecules or longer chains have higher boiling points / ora (1) larger molecules or longer chains have stronger intermolecular forces / ora (1) idea that stronger intermolecular forces results in higher boiling point / ora (1)	3	**allow** hexadecane for larg**er** molecules or hexane for small**er** molecules throughout the question **ignore** melting points **allow** molecules with higher mass have higher boiling points / ora (1) **allow** larger molecules or longer chains have more intermolecular forces / ora (1) **allow** idea that stronger intermolecular forces results in more energy needed (to boil) / ora (1)

Question	Answer	Marks	Guidance
d	$2C_6H_{14}$ + **19**O_2 → **12**CO_2 + **14**H_2O right hand side correct (1) left hand side correct (1)	2	
e	hexane + oxygen → carbon + water **or** hexane + oxygen → carbon monoxide + water **or** hexane + oxygen → carbon + carbon monoxide + water (1)	1	**allow** correct formula instead of names C_6H_{14}, O_2, C, H_2O and CO **allow** mix of names and correct formulae symbol equation, if given, does not need to be balanced **ignore** soot **not** '+ carbon dioxide' in products **not** '+ energy'
	Total	**9**	

Question	Answer	Marks	Guidance
2 a	nine (1)	1	**more than one tick scores 0**
b	**Level 3** **Explains why the polymer has a low melting point in terms of intermolecular forces** **AND** **gives two suitable properties, with reasons, for the polymer** Quality of communication does not impede communication of science at this level. (5 - 6 marks) **Level 2** **Explains why the polymer has a low melting point in terms of intermolecular forces** **OR** **gives two suitable properties, with reasons, for the polymer** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** **Attempts to explain why the polymer has a low melting point in terms of intermolecular forces** **OR** **gives one suitable property, with a reason, for the polymer** **OR** **gives two suitable properties** Quality of communication impedes communication of the science at this level. (1 – 2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to A* Indicative scientific points at level 3 must include: • weak intermolecular forces between polymer molecules • does not need much energy to overcome or break the intermolecular forces **do not allow** break covalent bonds **Suitable properties may include**: • insoluble in water or waterproof so drink does not leak out • unreactive so it doesn't react with the contents or doesn't break down • flexible or bendy so can be made into different shapes • non-biodegradable so it will not decompose while still in use • non-toxic so drink does not get contaminated • low density or lightweight so that the bottle isn't heavy (to carry or transport) • strong so it contains the pressure or doesn't break when dropped **ignore** rigid / can be recycled / transparent **Use the L1, L2, L3 annotations in Scoris. Do not use ticks.**
	Total	**7**	

Question	Answer	Marks	Guidance
3 a	**B** (1) not poisonous (1) no smell (1)	3	**A** or **C** scores 0 for the question **allow** ora, eg A is not suitable as it is poisonous (1) **allow** ora, eg D is not suitable as it has a smell (1) **allow D** since it is not poisonous (1)
b i	 	2	**allow** one mark if the correct labels are swapped around **allow** a straight line for the tail **ignore** water loving / water hating
ii	**any two from:** **cell** walls rupture (1) (resulting in) loss of (rigid) structure / a softer texture (1) starch grains swell up (1)	2	 **allow cell** walls break down or burst (1) **ignore** cellulose breaks down **allow** potato becomes softer (1) **allow** starch (molecules) swell up (1) **ignore** cells swell up **ignore** references to surface area **ignore** references to denaturing **ignore** references to proteins
	Total	**7**	

Question	Answer	Marks	Guidance
4	**any two from:** idea that results on animals not (necessarily) same as with humans (1) animals do not have a choice of being tested (1) idea that may harm or hurt the animal / testing is cruel (1)	2	 **allow** idea that animals have rights / morally wrong / unethical (1) **ignore** references to alternative methods of testing cosmetics
	Total	**2**	

Question	Answer	Marks	Guidance
5 a	sand and water ☐ limestone and sand ☐ limestone and clay ✓ limestone and granite ☐ sand and clay ☐	1	**more than one tick scores 0**
b i	**any two from:** steel is strong (under tension) (1) steel is (more) flexible (1) steel stops the concrete stretching / cracking / breaking (1) concrete is hard (1) concrete is strong **under compression** (1)	2	**Assume unqualified answers refer to reinforced concrete** **allow** steel gives concrete (more) strength (1) **allow** concrete cracks (without steel reinforcing) (1) **allow** combines the strength and flexibility of steel with the hardness of concrete (2) **ignore** reinforced concrete is a composite material **if no other mark awarded**, **allow** reinforced concrete is stronger or reinforced concrete is more flexible (1)
b ii	(**C** because) **any two from:** strong**est** (1) (very good) resistance to corrosion (1) easily shaped (1) low density (1) other properties more important than high cost (1)	2	**marks are for explanation** **if A or B chosen scores 0** **allow** doesn't corrode (1) **ignore** light, but **allow** lightweight (1)
	Total	**5**	

Question	Answer	Marks	Guidance
6 a	(no because) **hastelloy** is more resistant to corrosion at **high(er) concentrations** of acid (at 20°C) / ora (1) but (yes because) all (three) metals are more resistant to corrosion at **low(er) temperatures** / ora (1)	2	**marks are for explanations**
b i	0.6 (cm^3/hour) (1)	1	
b ii	(pH) 6	1	
c	$2Al + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2$ formulae (1) balancing (1)	2	balancing mark is conditional on correct formulae **allow** any correct multiple e.g. $4Al + 6H_2SO_4 \rightarrow 2Al_2(SO_4)_3 + 6H_2$ **allow** = or ⇌ for arrow **not** 'and' or & for + **allow** one mark for correct balanced equation with incorrect use of upper and lower case formulae e.g. $2Al + 3H_2SO4 \rightarrow Al2(So_4)_3 + 3H_2$
	Total	**6**	

Question	Answer	Marks	Guidance
7 a	hydrogen (1)	1	**allow** correct answer ticked, circled or underlined in list if answer line is blank
b	chlorine is reactive (and may react with the electrode)/ so that the products don't react with the electrode (1)	1	**allow** electrode product reacts with electrode / hydrogen reacts with electrode (1) **ignore** so electrodes do not react with sodium chloride (solution) / so electrodes do not react with solution or electrolyte
c i	$\mathbf{2}Cl^- - \mathbf{2}e^- \rightarrow Cl_2$ (1)	1	**allow** any correct multiple, including fractions
c ii	oxidation because electrons are lost (1)	1	**allow** oxidation number of Cl increases / oxidation number of Cl goes from -1 to 0 (1) **not** chlor**ine** loses electrons or chlor**ine** ions lose electrons
	Total	**4**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>8 a</td><td>argument for:
(world) population is rising /
(so) need to produce more food (1)

argument against:
eutrophication or death of aquatic organisms (from excessive use of fertilisers) /
idea of pollution of water supplies (from excessive use of fertilisers) (1)</td><td>2</td><td>must have an argument for and an argument against the use of fertilisers for 2 marks

allow increasing population to feed (1)
allow fertilisers increase crop yield (1)
allow higher level answers
eg replace essential elements (used by a previous crop) (1)
ignore crops grow bigger or faster or idea of better crops

ignore cost</td></tr>
<tr><td>b i</td><td><table><tr><th>Atom</th><th>Number</th></tr><tr><td>N</td><td>3</td></tr><tr><td>H</td><td>12</td></tr><tr><td>P</td><td>1</td></tr><tr><td>O</td><td>4</td></tr></table>all four correct scores (2)
two or three correct scores (1)
one correct scores (0)</td><td>2</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
b ii	**Level 3** **States the name of the acid <u>and</u> the alkali needed to make ammonium phosphate** **AND** **fully describes how ammonium phosphate can be made.** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **Level 2** **States the name of the acid <u>and</u> the alkali needed to make ammonium phosphate** **AND** **attempts to describe how ammonium phosphate can be made.** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** **States the name of the acid <u>and</u> the alkali needed to make ammonium phosphate** **OR** **attempts to describe how ammonium phosphate can be made.** Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A** **Indicative scientific points may include:** **Acid** needed is phosphoric acid / H_3PO_4 **Alkali** needed is ammonia / ammonium hydroxide / NH_3 / NH_4OH **ignore** ammonia hydroxide **To make ammonium phosphate:** • titrate the acid with the alkali, using an indicator / add the acid to the alkali (or vice versa), using an indicator • repeat the titration until consistent results are obtained • use the titration result to add the correct amounts of acid and alkali together without the indicator / decolourise indicator with carbon • evaporate (most of) the solution • leave the remaining solution to crystallise **allow** add excess ammonia to phosphoric acid and then heat the mixture to drive off the excess ammonia **Use the L1, L2, L3 annotations in Scoris. Do not use ticks.**
	Total	**10**	

Question	Answer	Marks	Guidance
9 a i	all atoms in reactants end up in the product (1)	1	**allow** only hydrogen peroxide is made / only one product made / no waste products / no unwanted products (1) **ignore** no product is wasted **ignore** same number of atoms on each side of the equation / all reactants have been converted into products
ii	reduce the production of unwanted **products** / reduces amount of waste **products** (1) makes the process more sustainable (1)	2	reduces waste is **not** sufficient more cost effective / makes more profit is **not** sufficient **allow** makes the process greener (1) **ignore** better for the environment
b i	idea that 2 g of H_2 makes 34 g of H_2O_2 (1) idea that 100 g of H_2 is 50 x 2 g so mass of H_2O_2 is 34 x 50 (1)	2	**allow** $\frac{34}{2} \times 100$ (2) **eg** $H_2 + O_2 \rightarrow H_2O_2$ (1) 2x 50 = 100 34 x 50 = 1700 **allow** 32 x 50 = 1600g O_2 (1) **and** 100g H_2 + 1600g O_2 = 1700g H_2O_2 (1) **but** 100g + 1600g = 1700g scores 0 if no evidence of other relevant calculation

Question	Answer	Marks	Guidance
ii	**LOOK FOR ANSWER FIRST OF ALL** **IF percentage yield = 90 AWARD 2 MARKS** $\frac{1530}{1700} \times 100$ (1) 90 (1)	2	**allow** $\frac{actual}{predicted} \times 100$ **or** $\frac{am}{pm} \times 100$ (1)
c	**LOOK FOR ANSWER FIRST OF ALL** **IF atom economy = 12.7(34) OR 13 AWARD 2 MARKS** $\frac{34}{169+98} \times 100$ **or** $\frac{34}{267} \times 100$ **or** $\frac{34}{34+233} \times 100$ (1) 12.7 (1)	2	**allow** $\frac{M_r \text{ of desired product}}{\text{sum of } M_r \text{ of all products}} \times 100$ (1)
	Total	**9**	

Question	Answer	Marks	Guidance
10 	**Level 3** **Complete evaluation including some information from the graph** **AND** **explanation using reacting particle model that must mention the idea of collision frequency** Quality of communication does not impede communication of science at this level. (5 - 6 marks) **Level 2** **Complete evaluation including some information from the graph <u>AND</u> explanation using reacting particle model that must mention the idea of collisions** **OR** **explanation using reacting particle model that must mention the idea of collision frequency** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** **Complete evaluation including some information from the graph** **OR** **explanation using reacting particle model that must mention the idea of collisions** Quality of communication impedes communication of the science at this level. (1 – 2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A** **Indicative scientific points may include:** **Evaluation** • results support the analysis • idea that as concentration increases reaction time decreases and the rate of reaction increases **Reacting particle model** • as acid is more concentrated particles (of acid) are more crowded • as acid is more concentrated particles (of acid) are closer together • as acid is more concentrated more particles (of acid) per unit volume • as acid is more concentrated there are more collisions • as acid is more concentrated there are more collisions per second **allow** collisions more often, more chance of collision, increases collision frequency for more collisions per second **allow** reverse argument with as acid gets less concentrated **Use the L1, L2, L3 annotations in Scoris. Do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
11 a	**any one from:** idea of easier for quality control / idea that batches can be traced and recalled (1) idea of matching seasonal demand (1) often only a small amount of the drug is needed / not in high demand / ora (1) idea that you can switch to making a different drug (1)	1	**allow** idea of fluctuating demand (1) **allow** (drugs) aren't needed all the time (1) **allow** idea that made in batches so that they don't go out of date (1) **ignore** references to cost
b	**any two from:** takes a long time to research or test the drug (1) raw materials may be rare (1) purification procedures may be expensive / quality control is expensive (1) may be difficult to automate so expensive labour costs (1) idea that strict safety laws have to be met (1)	2	**allow** idea that many tests need to be carried out (in developing a drug) (1) **allow** raw materials are difficult to extract (from plants) (1) **ignore** raw materials are expensive **allow** idea of high wages for skilled workers / scientists (1)
	Total	**3**	

Question	Answer	Marks	Guidance
12 a	**LOOK FOR ANSWER FIRST OF ALL** **IF final temperature = 37.2 AWARD 3 MARKS** **IF final temperature = 37. 23809523809524 / 37 / or any value correctly rounded up to 2 or more decimal places AWARD 2 MARKS** $\Delta T = \frac{1600}{25 \times 4.2}$ (1) $\Delta T = 15.23809523809524$ (1) Final temperature = 37.2 (1)	3	**allow** $\Delta T = \frac{q}{c \times m}$ (1) q = energy transferred c = specific heat capacity m = mass **allow** any answer correctly rounded up only **allow** this mark if quoted to one decimal place **allow** ecf from wrong temperature rise calculated
b	bond breaking absorbs or takes in energy **AND** bond making releases or gives out energy (1) idea that energy released is greater than energy absorbed (1)	2	**Second marking point is dependent on the first** **allow** bond breaking is endothermic **AND** bond making is exothermic (1) **allow** more energy associated with bond making than with bond breaking (1) **BUT** more energy released on forming bonds than absorbed in breaking bonds (2)
	Total	**5**	

Question	Answer	Marks	Guidance
13 a	slippery (1)	1	**allow** weak bonds or forces **between layers** (1) **allow layers** can slide over each other (1)
b	has delocalised electrons / free electrons / electrons can move (1)	1	**ignore** spare electrons **not** ions can move
	Total	**2**	

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