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 2014

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

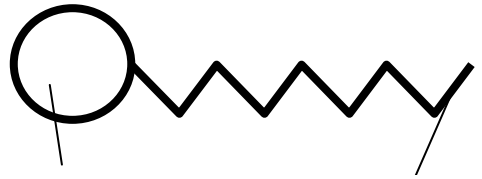
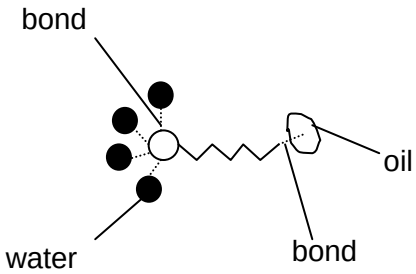
Annotations used in scoris

Annotation	Meaning
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	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

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

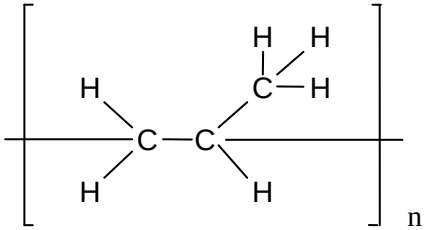
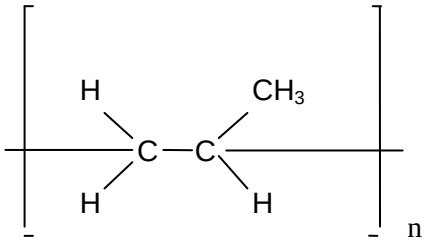
/ = alternative and acceptable answers for the same marking point
(1) = separates marking points
allow = answers that can be accepted
not = answers which are not worthy of credit
reject = answers which are not worthy of credit
ignore = statements which are irrelevant
( ) = words which are not essential 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	C_2H_6 / H_6C_2 (1)	1	the numbers must clearly be subscripts **not** C^2H^6 / C2H6
b	**B** contains carbon and hydrogen (1) only / AW (1) **C** contains oxygen / has oxygen in the formula / does not contain only carbon and hydrogen (1)	3	**allow** (formula) has only (1) H and C (1) the only is **not** an independent mark and must be linked to the carbon and hydrogen **not** contains carbon and hydrogen molecules / contains a mixture of carbon and hydrogen **not** hydro atoms but **ignore** for the third marking point **allow C** has three elements / **C** has three different atoms (1) **not C** contains oxygen molecules
c	**A** and **F** (1)	1	**both needed**
	Total	**5**	

Question	Answer	Marks	Guidance
2 a i	hydrophilic (head) **and** hydrophobic (tail) (1)	1	 **allow** polar (head) and non-polar (tail) (1) **allow** ionic (head) and hydrocarbon (tail) (1) **ignore** water loving and water hating
a ii	hydrophobic end or tail is attracted to oil / hydrophobic end or tail forms intermolecular forces with oil / hydrophobic end or tail bonds to oil (1) hydrophilic end or head is attracted to water / hydrophilic end or head forms intermolecular forces with water / hydrophilic end or head bonds to water (1)	2	**if no other marks awarded allow** tail is surrounded by oil molecules and the head by water molecules **allow** sticks to or attached or joined or combines with as alternative to 'bonds', **but** the hydrophobic end goes into oil is **not** sufficient **ignore** hydrophilic head loves water / hydrophobic tail loves oil **ignore** ideas of repelling water / oil **all** marks can be awarded from a **labelled** diagram but to get two marks must clearly show bonding to rather than surrounded by  **allow** ecf from (a)(i) for 1 mark e.g. hydrophobic head bonds to oil and hydrophilic tail bonds to water, if labels the wrong way round in (a)(i)

Question	Answer	Marks	Guidance
b	protein (molecules) (1) **permanently** change shape / **irreversible** change of shape (1)	2	**allow** polypeptide (molecules) (1) **ignore** enzymes **allow** proteins become cross-linked (2) **allow** molecular structure changes permanently (1) **allow** one mark for denaturing if no other mark awarded
	Total	**5**	

Question	Answer	Marks	Guidance
3 a	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ correct reactants and products (1) balancing – dependent on correct reactants and products (1)	2	**allow** any correct multiple, including fractions **allow** = / ⇌ instead of → **not** and / & balancing mark is dependent on the correct formulae but **allow** 1 mark for a balanced equation with minor errors in subscripts / formulae e.g. CH4 + 2O2 → CO2 + 2H2o
b	(sea water because) **any two from:** removes more of the pollutant / removes 9% more of nitrogen dioxide / 99% of nitrogen dioxide removed (1) does not form a waste product (1) cheap(er) (1) readily available (near the coast) (1) **OR** (limestone because) idea of does not have to be pumped (a long way) from the sea (1) need less mass of material (1)	2	**No marks** for sea water or for limestone – the marks are for the explanation **allow** does not produce waste (1) **allow** only a small amount needed (1)
	Total	**4**	

Question	Answer	Marks	Guidance
4 a	correct atoms and bonds without the double bond (1) brackets and n (1)	2	**second marking point is dependent on the first** **allow** more than 1 repeat unit  **allow** round brackets **allow** 

Question	Answer	Marks	Guidance
4 b	**Level 3** **<u>Two</u> properties needed by the plastic are explained AND** **the flexibility of poly(propene) is explained in terms of the structure and bonding.** Quality of communication does not impede communication of science at this level. (5-6 marks) **Level 2** **The flexibility of poly(propene) is explained in terms of the structure and bonding** **OR** **<u>two</u> properties needed by the plastic are explained** **OR** **<u>one</u> property of the plastic is explained <u>and</u> an attempt to explain why poly(propene) is flexible.** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** **<u>One</u> property needed by the plastic is explained** **OR** **an attempt to explain why poly(propene) is flexible.** 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 for level 3 may include:** • Poly(propene) molecules are attracted to one another by weak intermolecular forces or bonds that are easy to overcome • Poly(propene) molecules need very little energy to be separated • Poly(propene) molecules can slide over each other • Poly(propene) has atoms held together by strong covalent bonds **Indicative scientific points for all levels may include:** • Non-biodegradable so the plastic does not rot or decay • Insoluble in water or waterproof so that the sandwich box can be washed clean / so it will not dissolve / so moist foods can be stored • Non-toxic material so it will not contaminate the food or make the food dangerous to eat • Non-reactive or inert so will not react with chemicals in the food • Non-permeable so water doesn't reach the food **ignore** references to can be coloured / is strong / tough / durable / light or lightweight / hard / easily moulded / insulator / does not melt (in hot water) **Use the L1, L2, L3 annotations in Scoris; do not use ticks**
	Total	**8**	

Question	Answer	Marks	Guidance
5 a	absorbs or takes in energy (in the light) (1) (then) releases or emits energy (in the dark) (1)	2	**allow** stores energy from light in the day (1) **allow** light instead of energy **not** reference to radioactive emissions
b	reacts with oxygen / it is oxidised (1)	1	
	Total	**3**	

Question	Answer	Marks	Guidance
6 a i	transparent (1)	1	**allow** insoluble (in water) / waterproof / does not react with water (1) **allow** clear / see through / colourless (1) **allow** does not biodegrade / does not decompose / does not decay (1) **allow** does not photodegrade (1) **ignore** shatterproof / strong
a ii	(aluminium car body) will corrode less / does not corrode (1)	1	**assume unqualified answer refers to aluminium** **allow** (aluminium car body) will have a longer lifetime (1) **allow** aluminium does not rust (1) but **not** aluminium does not rust as easily (0) **allow** aluminium does not oxidise (in air) (1) **ignore** aluminium is less corrosive **allow** car will have better fuel economy (1) **allow** ora for steel **ignore** aluminium is easier to mould / is more flexible **not** stronger
b	(PVC) has high flexibility / is flexible / aw (1) (PVC) has low (electrical) conductivity / is a poor (electrical) conductor / does not conduct (electricity) / aw (1)	2	**ignore** references to density **allow** is an (electrical) insulator (1)
	Total	**4**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>7 a</td><td><table><tr><th></th><th>Number of atoms</th></tr><tr><td>nitrogen</td><td>2</td></tr><tr><td>hydrogen</td><td>8</td></tr><tr><td>sulfur</td><td>1</td></tr><tr><td>oxygen</td><td>4</td></tr></table>(1)</td><td>1</td><td></td></tr>
<tr><td>b</td><td>names of reactants:
(acid is) sulfuric acid (1)
(alkali is) ammonia / ammonium hydroxide / ammonium carbonate / ammonium hydrogencarbonate (1)

AND

any one from:

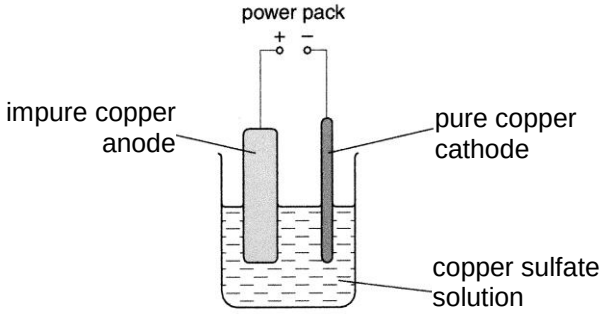
acid is titrated with alkali using an indicator / idea of controlled addition of acid to alkali with use of indicator (1)

(heat to) evaporate water / leave solution to crystallise (1)</td><td>3</td><td>allow correct formulae or mix of formula and name
H_2SO_4
NH_3 / NH_4OH / $(NH_4)_2CO_3$ / NH_4HCO_3
not ammonium / NH_4 / ammonia hydroxide

allow acid is added to alkali (or vice versa) until a neutral solution is obtained (1)
allow idea of controlled addition of acid to alkali with use of pH meter or test with indicator paper (1)</td></tr>
</table>

Question	Answer	Marks	Guidance
c	**[Level 3]** **Answer describes advantages AND disadvantages of conditions used** **AND** **includes the balanced symbol equation for the reaction.** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** **Answer describes an advantage AND a disadvantage of conditions used** **OR** **includes the balanced symbol equation for the reaction.** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** **Answer describes <u>either</u> an advantage <u>or</u> a disadvantage of conditions used** **OR** **includes the symbol equation for the reaction (may not be balanced).** 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:** **Symbol equation** $NH_3 + 2O_2 \rightarrow HNO_3 + H_2O$ **allow** any correct multiple, including fractions **allow** = / ⇌ instead of → **not** and / & instead of '+' **Advantages of conditions listed** • high temperature or temperature of 900°C increases rate of reaction • (platinum) catalyst reduces costs • (platinum) catalyst increases rate of reaction • atmospheric pressure means lower energy costs • atmospheric pressure means lower plant costs **Disadvantages of conditions listed** • high temperature or temperature of 900°C increases energy use or expensive • high temperature reduces percentage yield • (platinum) catalyst is (initially) expensive • atmospheric pressure means slower rate of reaction **allow** answers in terms of position of equilibrium e.g. more moles on LHS so should use higher pressure e.g. if reaction is exothermic equilibrium is on LHS at higher temperature **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**10**	

Question	Answer	Marks	Guidance
8 a	crust is too thick (to drill through) / need to use seismic waves produced by earthquakes/ need to use seismic waves produced by man-made explosions (1)	1	**allow** mantle is too hot / core is too hot / idea that layers below the crust are too hot (1) **allow** ideas of not being able to dig deep enough (1)
b i	**any two from:** (Wegener) suggested **continental drift theory** (1) idea that **continental drift theory** was not accepted by scientists at the time (1) (later) extra evidence obtained such as sea floor spreading or measurement of continental drift (1)	2	 **allow** evidence such as continents fitting together (1) **ignore** references to subduction / earthquakes & volcanoes
b ii	idea that (most scientists now accept the theory as) subsequent research has supported the theory (1)	1	**allow** there's more evidence to support it (1) **allow** examples of extra evidence that supports theory e.g. similar fossils in South America and Africa (1) **ignore** similar animal breeds
	Total	**4**	

Question	Answer	Marks	Guidance
9 a	(copper because) good resistance to corrosion (1) **or** (aluminium because) good resistance to corrosion (1) low density (1) **or** (stainless steel because) good resistance to corrosion (1) strong (1) cheap(est) (1) **or** (titanium because) good resistance to corrosion (1) strong (1) low density (1)	3	**No mark for the metal – the mark is for the correct reason** **ignore** other properties **allow** copper does not rust (1) but **not** copper does not rust as easily **allow** aluminium does not rust (1) but **not** aluminium does not rust as easily **allow** lightweight (1), but **ignore** just light **allow only** £900 per tonne (1) **allow** titanium does not rust (1) but **not** titanium does not rust as easily **allow** lightweight (1), but **ignore** just light
b		2	**all three** labels correct scores 2 marks **one or two** labels correct scores 1 mark
	Total	**5**	

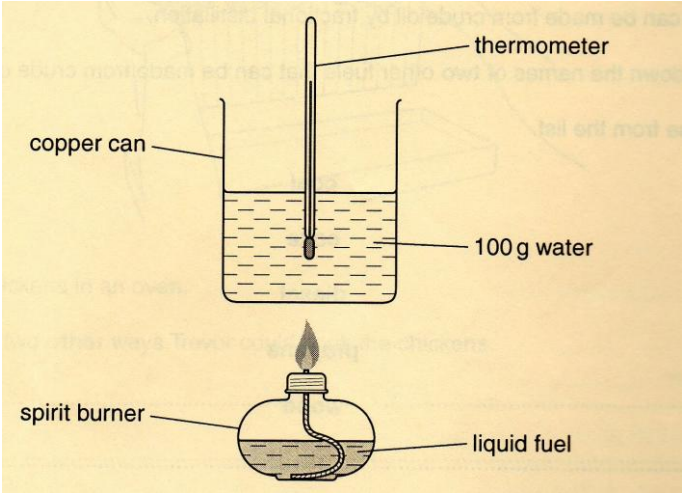
Question	Answer	Marks	Guidance
10 a	**2**Br^- - **2**e^- $\rightarrow$ Br_2 (1)	1	**allow** any correct multiple, including fractions **not** any additional symbols, other than balancing
b	(oxidation because) electrons are lost (from Br^-) (1)	1	**allow** oxidation number of Br increases (1) **not** bromine (atoms) lose electrons **but allow** ions lose electrons (1)
	Total	**2**	

Question	Answer	Marks	Guidance
11 a	slippery / layers can slide over one another (1) (black / grey so) can be seen on the paper (1)	2	**allow** weak forces (of attraction) or weak bonds between layers (1) **allow** leaves mark on the paper / comes off onto the paper (1)
b i	has free electrons / mobile electrons / electrons that can move / delocalised electrons (1)	1	**not** has free ions **ignore** has spare electrons
ii	idea of a giant structure / has **many** covalent bonds (1) idea that strong bonds need to be broken / bonds need lots of energy to break (1)	2	**not** ionic bonds / (strong) intermolecular forces / bonds between carbon molecules – 0 marks for the question **allow** bonds are difficult to break (1) **allow many** strong covalent bonds are broken for 2 marks
	Total	**5**	

Question	Answer	Marks	Guidance
12 a	**[Level 3]** **Explanation that the results (in relation to <u>both</u> volume of acid & mass of magnesium) do not support the prediction with reference to experimental data** **AND** **an explanation *<u>using collision frequency</u>* that reaction in experiment 4 is faster, or has a shorter reaction time, than experiment 3.** Quality of communication does not impede communication of science at this level. (5-6 marks) **[Level 2]** **Explanation that the results (in relation to <u>both</u> volume of acid & mass of magnesium) do not support the prediction with reference to experimental data** **AND** **an explanation that the reaction in experiment 4 is faster, or has a shorter reaction time, than experiment 3 *using idea of more collisions rather than collision frequency*** **OR** **an explanation *<u>using collision frequency</u>* that reaction in experiment 4 is faster or has a shorter reaction time than experiment 3.** Quality of written communication partly impedes communication of the science at this level. (3-4 marks) **[Level 1]** **Explanation that the results (in relation to <u>either</u> volume of acid <u>or</u> mass of magnesium) do not support the prediction with reference to experimental data** **OR** **an explanation that the reaction in experiment 4 is faster or has a shorter reaction time than experiment 3 *using idea of more collisions rather than collision frequency*.** 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 for explanation may include:** • results show as volume increases reaction time does not change • results show that as mass increases reaction time does not change **Indicative scientific points for experiments 3 and 4 may include:** • concentration is higher in experiment **4** • acid particles are more crowded in experiment **4** / acid particles are closer together / more acid particles per unit volume / more acid particles per cm^3 / more acid particles in the same space • more (successful) collisions per second / collisions more often / increased collision frequency / more chance of a collision **Use the L1, L2, L3 annotations in Scoris; do not use ticks**

Question	Answer	Marks	Guidance
12 b	(acid) particles have more energy / (acid) particles are moving faster / more collisions per second (1) more successful collisions / more energetic collisions / more collisions above the activation energy / more effective collisions (1)	2	**ignore** particles vibrate more or vibrate faster **ignore** particles move more **allow** more successful collisions per second / more frequent energetic collisions for two marks **ignore** harder collisions / faster collisions **allow** more collisions (1), if no other mark awarded **allow** rate increases / reaction is faster (1), if no other mark awarded
	Total	**8**	

Question	Answer	Marks	Guidance
13 a	no undesired products made / no waste products made / all the atoms that react end up in the product / only **one** product made (1)	1	**not** the same number of atoms on each side of the equation
b i	idea that 164g of sodium ethanoate makes 120g of ethanoic acid / idea that 82g of sodium ethanoate makes 60g of ethanoic acid (1) **but** mass is 6 (2)	2	units **not** needed
b ii	$\frac{(2\times 60)}{(2\times 60)+142}\times 100$ **or** $\frac{120}{262}\times 100$ **or** $\frac{(2\times 60)}{(2\times 82)+98}\times 100$ **or** $\frac{120}{164+98}\times 100$ (1) **but** 45.8% (2)	2	**allow** full marks for correct answer despite working out **allow** 46% (2)
c i	46 % (2) but 46.2 / 46.15 / 46.154 (1)	2	answer must have **two** sig figs for two marks **allow** one mark for $\frac{2.4}{5.2}\times 100$
ii	waste a lot of starting material / wastes reactants (1)	1	**ignore** waste products **ignore** just 'a lot of waste' **ignore** wastes lots of resources
	Total	**8**	

Question	Answer	Marks	Guidance
14	**any four from:** correct use of a **spirit burner** (1) container of water above (spirit) burner (1) measures the change in temperature of the water (1) idea of measuring the mass of paraffin in the correct context (1) idea of repeating appropriate experiment (1)	4	**if experiment is unsafe, or incorrect experiment, max 1** **allow** paraffin burner **not** Bunsen burner **allow** reference to ΔT or change in temperature in equation (1) **allow** measure the temperature of the water at the start and at the end (1) **allow** marks from a **labelled** diagram 
	Total	**4**	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553