

**GCSE**

**Chemistry B**

Unit **B742/02**: Modules C4, C5, C6 (Higher Tier)

General Certificate of Secondary Education

**Mark Scheme for June 2015**

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.

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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.

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Annotation	Meaning
	correct response
	incorrect response
<b>BOD</b>	benefit of the doubt
<b>NBOD</b>	benefit of the doubt <b>not</b> given
<b>ECF</b>	error carried forward
	information omitted
<b>I</b>	ignore
<b>R</b>	reject
<b>CON</b>	contradiction
<b>L1</b>	Level 1
<b>L2</b>	Level 2
<b>L3</b>	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.**

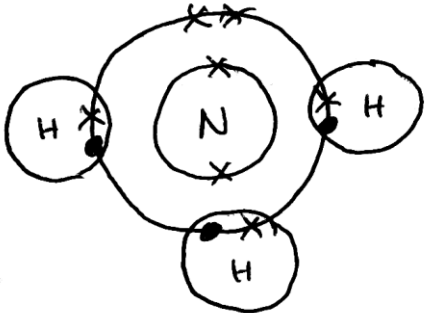
It is vitally important that all parts of the candidate's answer are marked.

### 15. 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
<b>allow</b>	=	answers that can be accepted
<b>not</b>	=	answers which are not worthy of credit
<b>reject</b>	=	answers which are not worthy of credit
<b>ignore</b>	=	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

Mark each blank page and the periodic table with the 'seen' annotation.

Question	Answer	Marks	Guidance
1 a i	W (1)	1	<b>allow</b> sodium / Na
ii	Z (1)	1	<b>allow</b> argon / Ar
iii	W and Y (1)	1	both required but order is unimportant <b>allow</b> sodium or Na <b>and</b> chlorine or Cl
b	At least one pair of electrons shared correctly between nitrogen and hydrogen (1)  remainder of structure correct (1)  	2	can use all dots or all crosses  <b>not</b> ionic structures = 0 for the question  <b>allow</b> Lewis diagrams i.e. without circles  <b>allow</b> lone pair electrons as two single electrons  <b>ignore</b> inner electrons on nitrogen
c	solid – ions not free / ions cannot move / ions held in a lattice / ions in a giant structure (1)  dissolved in water – ions can move (1)	2	<b>ignore</b> electrons / particles cannot move in a solid  <b>allow</b> has free ions  <b>not</b> electrons can move in a liquid  <b>ignore</b> particles can move in a liquid
<b>Total</b>		<b>7</b>	

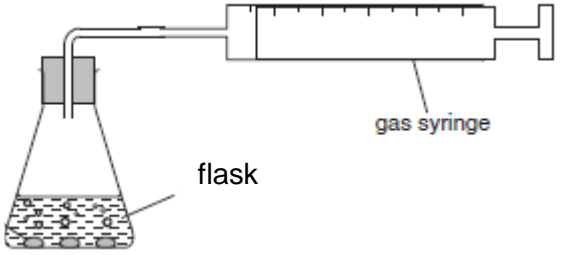
Question	Answer	Marks	Guidance												
2 a	<table border="1" data-bbox="318 233 1003 496"> <thead> <tr> <th></th> <th>Chlorine atom</th> <th>Oxide ion</th> </tr> </thead> <tbody> <tr> <td>Number of protons</td> <td>17</td> <td>8</td> </tr> <tr> <td>Number of neutrons</td> <td>20</td> <td>8</td> </tr> <tr> <td>Number of electrons</td> <td>17</td> <td>10</td> </tr> </tbody> </table> <p>chlorine - number of protons <b>and</b> number of neutrons correct (1)</p> <p>oxide ion – number of neutrons correct (1)</p> <p>- number of electrons correct (1)</p>		Chlorine atom	Oxide ion	Number of protons	17	8	Number of neutrons	20	8	Number of electrons	17	10	3	
	Chlorine atom	Oxide ion													
Number of protons	17	8													
Number of neutrons	20	8													
Number of electrons	17	10													
b	<p>J J Thomson - discovered the electron (1)</p> <p>Bohr suggested - that electrons occupy orbits / electrons in shells / electrons in energy levels (1)</p>	2	<p><b>ignore</b> reference to plum pudding model</p> <p><b>allow</b> discovered that atoms have electrons</p> <p><b>not</b> electrons were found in the nucleus / discovered that electrons orbit the nucleus / reference to ions</p> <p><b>not</b> discovered neutrons or protons</p> <p>negative particles in shells is <b>not</b> sufficient</p> <p><b>allow</b> reference to orbitals</p> <p><b>ignore</b> reference to other aspects of atomic structure e.g. protons and neutrons</p>												
<b>Total</b>		<b>5</b>													

Question	Answer	Marks	Guidance
3	<p><b>Level 3</b> Candidate applies knowledge to predict the name of both products AND predicts a reaction time for rubidium AND writes a correctly balanced symbol equation. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>Level 2</b> <b>EITHER</b> Candidate applies knowledge to predict the names of both products AND predicts a reaction time for rubidium <b>OR</b> predicts a reaction time for rubidium AND attempts a symbol equation. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>Level 1</b> <b>EITHER</b> Candidate applies knowledge to predict the names of both products <b>OR</b> predicts a reaction time for rubidium and the name of one product <b>OR</b> candidate attempts a symbol equation. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>Level 0</b> Insufficient or irrelevant science. Answer not worthy of credit. (0marks)</p>	6	<p>This question is targeted at grades up to A*.</p> <p><b>Indicative scientific points may include:</b></p> <p><b>Names of Products</b></p> <ul style="list-style-type: none"> <li>hydrogen must be stated but can be in a word equation</li> <li>rubidium hydroxide must be stated but can be in a word equation</li> </ul> <p><b>Reaction Time</b></p> <ul style="list-style-type: none"> <li>any time less than 7 seconds / reaction time less than potassium</li> </ul> <p><b>Equation</b></p> <ul style="list-style-type: none"> <li><math>2\text{Rb} + 2\text{H}_2\text{O} \rightarrow 2\text{RbOH} + \text{H}_2</math> or correct multiple</li> </ul> <p><b>note</b> <math>\text{Rb} + \text{H}_2\text{O} \rightarrow</math> product / formula is an attempt to write an equation</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
		6	

Question	Answer	Marks	Guidance
4 a	(purification processes) do not remove dissolved or soluble substances (1)	1	<b>allow</b> they are soluble / they are dissolved
b	large energy requirement (1) expensive (1)	2	<b>allow</b> heat for energy <b>allow</b> high cost of equipment <b>allow</b> issues related to scaling up / needs lots of water (1) <b>ignore</b> takes a long time
c	Pete is right about <b>A</b> but wrong about <b>B</b> (no mark)  <b>A</b> contains copper (ions) because it gives a blue (ppt) with sodium hydroxide (1)  <b>A</b> contains sulfate (ions) because it gives a white (ppt) with barium chloride (1)  <b>B</b> contains iron(III) (ions) because it gives a brown (ppt) with sodium hydroxide (1)  <b>B</b> does <b>not</b> contain sulfate (ions) as it does <b>not</b> give a white (ppt) with barium chloride (1)	4	<b>allow</b> Pete is wrong  <b>not</b> Pete is wrong about <b>A</b> for marks about <b>A</b>  <b>not</b> Peter is correct for <b>B</b> for marks about <b>B</b>  copper sulfate goes blue with sodium hydroxide is <b>not</b> sufficient  copper sulfate goes white with barium chloride is <b>not</b> sufficient  iron(III) sulfate goes brown with sodium hydroxide is not sufficient  <b>B</b> is not iron(III) sulfate because it does not go white with barium chloride is not sufficient  <b>allow</b> <b>B</b> does not contain sulfate as it does not give a ppt  <b>allow</b> <b>A</b> and <b>B</b> both cannot be sulfates since they do not both go white with barium chloride (2)
	<b>Total</b>	<b>7</b>	



Question	Answer	Marks	Guidance									
5 a	239 (1)	1										
b	<b>FIRST LOOK AT THE ANSWER IF ANSWER = 33% AWARD 2 MARKS</b>  0.33 g (1)  33 (%) (1)	2	<b>allow</b> ecf from wrong mass									
c	C <sub>2</sub> H <sub>5</sub> (1)	1	<b>allow</b> any order of symbols  <b>not</b> C <sup>2</sup> H <sup>5</sup> / C2H5 / or use of lower case H									
d	<b>FIRST LOOK AT THE ANSWER IF ANSWER = Fe<sub>2</sub>O<sub>3</sub> AWARD 3 MARKS</b>  <table border="1" data-bbox="318 756 1019 1027"> <thead> <tr> <th>symbols</th> <th>Fe</th> <th>O</th> </tr> </thead> <tbody> <tr> <td>mole ratio</td> <td><math>\frac{70}{56}</math> or 1.25</td> <td><math>\frac{30}{16}</math> or 1.875</td> </tr> <tr> <td>simplest mole ratio</td> <td><math>\frac{1.25}{1.25}</math> or 1</td> <td><math>\frac{1.875}{1.25}</math> or 1.5</td> </tr> </tbody> </table> mole ratio (1)  simplest mole ratio (1)  empirical formula is Fe <sub>2</sub> O <sub>3</sub> (1)	symbols	Fe	O	mole ratio	$\frac{70}{56}$ or 1.25	$\frac{30}{16}$ or 1.875	simplest mole ratio	$\frac{1.25}{1.25}$ or 1	$\frac{1.875}{1.25}$ or 1.5	3	If fraction is the wrong way around = 0 marks for the question  If divide by atomic number = 0 marks for the question  If just use ratio of masses = 0 for the question  <b>allow</b> ecf from mole ratio  <b>allow</b> ecf from simplest ratio  <b>allow</b> FeO <sub>1.5</sub> = 2 marks for the question
symbols	Fe	O										
mole ratio	$\frac{70}{56}$ or 1.25	$\frac{30}{16}$ or 1.875										
simplest mole ratio	$\frac{1.25}{1.25}$ or 1	$\frac{1.875}{1.25}$ or 1.5										
<b>Total</b>		<b>7</b>										

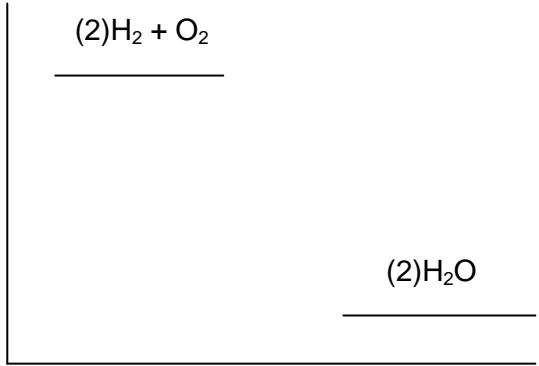
Question	Answer	Marks	Guidance
6 a	<p>any two from:</p> <p>correct piece of apparatus to collect and measure gas e.g. (gas) syringe, upturned measuring cylinder with water or upturned burette with water (1)</p> <p>workable and gas tight (1)</p>	2	 <p>The diagram shows a conical flask containing a reaction mixture. A delivery tube is inserted into the flask, passing through a stopper. The tube is connected to a gas syringe. The syringe is graduated and has a plunger. Labels 'flask' and 'gas syringe' are present.</p> <p>The measuring apparatus must be graduated and does not need to be assembled. The apparatus does not need to be named if there is no ambiguity from the diagram</p> <p><b>allow</b> even if the syringe / measuring cylinder is not graduated</p> <p><b>allow</b> the tube can be a single line</p> <p><b>ignore</b> if tube does not appear to go through the stopper</p> <p><b>not</b> the delivery tube must not go in the reaction mixture</p>

Question	Answer	Marks	Guidance
6 b	<p><b>Level 3</b> Describes the difference between strong and weak acids <b>AND</b> explains the different shapes of the graphs in terms of collision frequency and hydrogen ions Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>Level 2</b> <b>EITHER</b> Describes the difference between strong and weak acids <u>and</u> explains the different shapes of the graphs in terms of rate of reaction and strength of acid <b>OR</b> explains the different shapes of the graphs in terms of collision frequency or hydrogen ions Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>Level 1</b> <b>EITHER</b> Describes the difference between strong and weak acids <b>OR</b> explains the different shapes of the graphs in terms of rate of reaction and strength of acid Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>Level 0</b> Insufficient or irrelevant science. Answer not worthy of credit. (0marks)</p>	6	<p><b>This question is targeted at grades up to A.</b></p> <p><b>Indicative scientific points at level 3 must include:</b></p> <p><b>Shapes of graph</b></p> <ul style="list-style-type: none"> <li>reference to hydrogen ions e.g. nitric acid has more hydrogen ions / greater concentration of hydrogen ions</li> <li>reference to collision frequency e.g. nitric acid has more collisions per second / collisions more often / greater collision frequency</li> </ul> <p><b>allow</b> references to increased chance of collision, collisions more often, collisions more likely, as alternatives to increased collision frequency <b>allow</b> ora for propanoic acid</p> <p><b>Indicative scientific points at all levels may include:</b></p> <p><b>Strength of acid</b></p> <ul style="list-style-type: none"> <li>strong acid completely dissociates / ionises completely</li> <li>weak acid partially dissociates / does not completely ionise</li> </ul> <p><b>Shapes of graph</b></p> <ul style="list-style-type: none"> <li>nitric acid faster than propanoic acid</li> <li>nitric acid has more reacting particles / greater concentration of reacting particles</li> <li>nitric acid has more collisions</li> <li>nitric acid has particles closer together</li> </ul> <p><b>allow</b> ora for propanoic acid <b>ignore</b> comments about similarities of the graph</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
6 c i	Moles = $0.0025 / 2.5 \times 10^{-3}$ (1)	1	

Question	Answer	Marks	Guidance
ii	Mass = 0.25 (g) / $2.5 \times 10^{-1}$ (1)	1	<b>allow</b> ecf from number of moles, i.e. moles $\times$ 100
	<b>Total</b>	<b>10</b>	

Question	Answer	Marks	Guidance
7 a	<p>The rate of the forward reaction is faster than the rate of the backward reaction <input type="checkbox"/></p> <p>The position of equilibrium will not change if more product is added <input type="checkbox"/></p> <p>The concentration of the reactants does not change <input checked="" type="checkbox"/></p> <p>The rate of the forward reaction is the same as the rate of the backward reaction <input checked="" type="checkbox"/></p> <p>The concentration of the reactants is the same as the concentration of the products <input type="checkbox"/></p> <p>The position of equilibrium moves to the left when product is removed from the equilibrium <input type="checkbox"/></p> <p><b>one</b> correct answer (1) <b>but</b> <b>two</b> correct answers (2)</p>	2	
b	<p>(yes) it is exothermic because the percentage yield goes down as <b>temperature</b> increases (1)</p> <p>(no) there are less moles on right hand side because the percentage yield goes up as <b>pressure</b> increases (1)</p>	2	<p><b>Answers must refer to yield, or amount of product</b> <b>reference to only position of equilibrium is not sufficient</b></p> <p><b>ignore</b> references to bond making and bond breaking</p> <p><b>allow</b> ora if specified</p>
<b>Total</b>		<b>4</b>	

Question	Answer	Marks	Guidance
8 a	collision frequency (between ions) is high (1)	1	<p><b>allow</b> large number of collisions (between ions) every second / lots of collisions (between ions) per unit time / high chance of collision (between ions) / highly likelihood of collisions (between ions)</p> <p><b>not</b> collision frequency between atoms or molecules is high</p> <p><b>allow</b> collision frequency between <math>\text{Pb}^{2+}</math> and <math>\text{I}^-</math> is high</p> <p><b>allow</b> positive and negative <b>ions</b> attract / oppositely charged ions attract</p> <p><b>allow</b> has a low activation energy</p> <p><b>ignore</b> ions cancel out</p>
b	idea of ion that is in the solution at start and at the end of the reaction (1)	1	<p><b>allow</b> an ion present that takes no part in the reaction / ion that does not react / they do not contribute towards the reaction</p> <p><b>ignore</b> they do not change state during the reaction</p>
c	<p><b>Any two from:</b></p> <p>idea of results can be replicated / allows peer review (1)</p> <p>idea that further evidence can be collected / can be used by other scientists to develop the work (1)</p> <p>to gain funding (1)</p> <p>idea of recognition (1)</p>	2	<p><b>allow</b> so the work can be checked</p> <p><b>allow</b> so other scientists can help</p>
<b>Total</b>		<b>4</b>	

Question	Answer	Marks	Guidance
9 a	$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$  correct formulae (1) balancing (1) balancing mark is conditional on correct formulae	2	<b>allow</b> any correct multiple e.g. $4\text{H}_2 + 2\text{O}_2 \rightarrow 4\text{H}_2\text{O}$ (2)  <b>allow</b> = or =for arrow <b>not</b> 'and' or & for +  <b>allow</b> one mark for correct balanced equation with minor errors in case, subscript and superscript e.g. $2\text{h}_2 + \text{O}^2 \rightarrow 2\text{H}_2\text{o}$ (1)
b	horizontal line on the LHS is above the horizontal line on RHS (1)           reactants i.e. hydrogen and oxygen and products i.e. water correctly labelled (1)  	2	<b>ignore</b> any labelling on the lines  <b>ignore</b> any lines linking the reactants and products  <b>ignore</b> transition states or free atoms in the middle of the diagram – focus on reactants and products only  <b>this mark is independent of the first marking point</b>  <b>allow</b> words instead of formulae / reactant and product  <b>allow</b> H—H and O—O
c	provides water that astronauts can use / light / lightweight / low density / compact / no moving parts (1)	1	<b>allow</b> idea that makes a usable product i.e. water (for astronauts) / can be used as drinking water <b>ignore</b> efficient / reliable

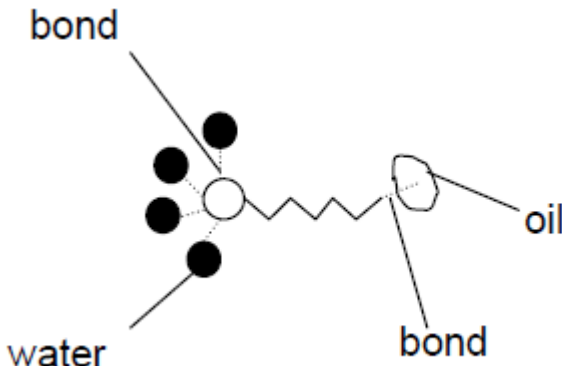
Question	Answer	Marks	Guidance
<b>d</b>	<p>idea that fuel cells contain poisonous catalysts (which need to be disposed of) (1)</p> <p>(idea of pollution) from the <b>burning</b> of fossil fuels associated with fuel cell production or manufacture of raw materials (1)</p>	2	<p><b>allow</b> catalyst could be pollutants (when disposed of) / contain harmful catalysts</p> <p><b>ignore</b> dangerous catalysts</p> <p><b>allow</b> makes waste when they are thrown away</p> <p><b>allow</b> mining for some of the materials used in a fuel cell (will cause pollution)</p>
	<b>Total</b>	<b>7</b>	



Question	Answer	Marks	Guidance
10 a	<p>X- temporary Y- permanent Z- temporary and permanent / both (types of hardness)</p> <p>all <b>three</b> correct (2) <b>but</b> any <b>two</b> correct (1)</p> <p><b>then any two from:</b></p> <p><b>X</b> is temporary as hardness removed (by boiling) (1)</p> <p><b>Y</b> is permanent as no hardness removed (by boiling) (1)</p> <p><b>Z</b> contains both temporary and permanent as some hardness is removed (by boiling) (1)</p>	4	<p>These marks are dependent on correct identification of <b>X</b>, <b>Y</b> or <b>Z</b></p> <p><b>allow X</b> is temporary since volume of soap goes down (to that of distilled water)</p> <p><b>allow Y</b> is permanent since the volume of soap does not go down (after boiling) / permanent does not change from 20 cm<sup>3</sup> (1)</p> <p><b>allow Z</b> contains both temporary and permanent as volume does go down but not to volume of distilled water / does not go down to minimum volume of soap</p>
b	<p>reacts with calcium or magnesium ions (to make calcium carbonate or magnesium carbonate) (1)</p> <p>calcium carbonate or magnesium carbonate are insoluble / are formed as a precipitate (1)</p>	2	<p><b>allow</b> reacts with calcium or magnesium salts or compounds</p> <p><b>allow</b> reacts with named soluble calcium or magnesium salt or compound</p> <p><b>allow</b> removes calcium ions or magnesium ions</p> <p><b>allow</b> calcium ions removed by forming insoluble carbonate</p>
<b>Total</b>		<b>6</b>	

Question	Answer	Marks	Guidance
11	<p><b>Level 3</b> Analyses table to evaluate advantages AND disadvantages of <u>all three</u> types of treatment AND explains fully how attaching magnesium to iron helps to prevent rusting.</p> <p>Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>Level 2</b> <b>EITHER</b> Analyses table to evaluate advantages AND disadvantages of <u>all three</u> types of treatment <b>OR</b> Analyses table to evaluate advantages AND disadvantages of <u>two</u> types of treatment AND attempts to explain how attaching magnesium to iron helps to prevent rusting.</p> <p>Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>Level 1</b> <b>EITHER</b> Analyses table to evaluate an advantage AND a disadvantage of <u>one</u> type of treatment <b>OR</b> attempts to explain how attaching magnesium to iron helps to prevent rusting.</p> <p>Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>Level 0</b> Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p><b>This question is targeted at grades up to A/A*.</b></p> <p><b>Indicative scientific points may include:</b></p> <p><b>Evaluations</b></p> <ul style="list-style-type: none"> <li>• idea that painting is cheap but does not last long</li> <li>• idea that alloying is the best method of rust prevention but is the most expensive</li> <li>• idea that alloying is difficult to do</li> <li>• idea that attaching magnesium is expensive but lasts a long time</li> </ul> <p><b>How attaching magnesium to iron helps prevent rusting</b></p> <ul style="list-style-type: none"> <li>• idea that magnesium is a sacrificial metal</li> <li>• idea that magnesium is more reactive than iron and so reacts instead of the iron</li> <li>• magnesium loses electrons in preference to iron</li> <li>• magnesium is a better reducing agent</li> <li>• magnesium is easier to oxidise</li> </ul> <p><b>ignore</b> reference to magnesium rusting</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
		6	

Question	Answer	Marks	Guidance
12 a	formula <b>C</b> (1)  because it contains (a) carbon to carbon double bond(s) (1)	2	<b>allow</b> contains C=C (double bonds) (1)  must be clear it is a carbon-carbon double bond and not a carbon-oxygen double bond  <b>ignore</b> carbon double bond / double carbon bond
b	<b>any two from:</b>  saponification involves reacting (a fat or oil) with sodium hydroxide (1)  soap is made (1)  glycerol is made (1)  it is a hydrolysis reaction (1)	2	<b>allow</b> caustic soda / potassium hydroxide instead of sodium hydroxide   <b>allow</b> propane-1,2,3-triol instead of glycerol  <b>allow</b> marks to be awarded from a word equation even if equation is incorrect e.g. fat or oil + sodium hydroxide → soap + glycerol (2)  <b>allow</b> correct products from <b>A</b> , <b>B</b> or <b>C</b> if specified e.g. saponification of <b>A</b> gives methanol and soap  <b>ignore</b> reference to enzymes

Question	Answer	Marks	Guidance
c	<p><b>any two from:</b></p> <p>hydrophobic tail (1)</p> <p>(hydrophobic end) attracted to fat or oil / bonds to fat or oil / intermolecular attraction with fat or oil (1)</p> <p>(hydrophilic) head attracted to water / intermolecular attraction with water (1)</p> <p>idea that <b>tail</b> lifts off grease (1)</p> <p>idea that detergent molecules surround grease <b>and</b> so prevent it returning to clothes (1)</p>	2	<p><b>marks may be awarded from a labelled diagram</b></p> <p><b>allow</b> stain = oil or fat in the context of the question</p> <p><b>allow</b> hydrophobic end or hydrophobic head (1)</p> <p><b>allow</b> attached to / sticks to / binds to</p> <p>dissolved in or goes into <b>not</b> sufficient</p> <p><b>allow</b> hydrophilic end bonds with water / attached to water / sticks to water / binds to water (1)</p> <p>dissolved in or goes into <b>not</b> sufficient</p> 
<b>Total</b>		<b>6</b>	

Question	Answer	Marks	Guidance
13 a	NO <sub>x</sub> (1)  greatest (negative) gradient (1)	2	The second marking point is <b>dependent</b> on the correct pollutant  <b>allow</b> greatest (negative) slope / steepest graph  <b>allow</b> correct comparison of mass change shown by quoting values e.g. 190, 80 and 20 (within ±1 square)  has greatest change in mass is not sufficient unless supported by data – one piece of data is sufficient
b i	$\frac{52}{3600} \times 100$ (1)  1.44 (%) (1)	2	<b>FIRST LOOK AT ANSWER</b> <b>IF ANSWER = 1.44 or 1.4 AWARD 2 MARKS</b>  <b>do not allow</b> 1 / 1.45
ii	Other countries make more than their share (of ammonia) / Sweden makes less (ammonia) than expected / Sweden makes less (ammonia) per million of population (1)	1	<b>allow</b> Sweden has better anti-pollution laws  <b>ignore</b> values are roughly the same  <b>allow</b> Sweden makes less than average  <b>allow</b> ecf from percentage above 1.9% in (b)(i)
iii	<b>FIRST LOOK AT ANSWER</b> <b>IF ANSWER = 25 AWARD 2 MARKS</b>  $\frac{974}{39}$ (1)  25 (1)	2	<b>allow</b> 24.974 correctly rounded up for the first mark

Question	Answer	Marks	Guidance
iv	Poland makes more (sulfur dioxide) than expected / Poland makes more (sulfur dioxide) than the average / Poland makes more (sulfur dioxide) per million of population (1)	1	<p><b>allow</b> Poland uses a fuel that makes lots of sulfur dioxide  <b>allow</b> fewer pollution control laws in Poland / Poland cannot afford (modern) pollution controls  <b>allow</b> some countries produce less than the average</p> <p><b>allow</b> pollution instead of sulfur dioxide</p> <p><b>allow</b> ecf from (b)(iii) if below 9.1</p>
v	<p>Quotes some evidence that indicates a higher population gives more pollutants / ora e.g. Germany has a higher population than Estonia <b>and</b> makes more pollutants (1)</p> <p>Quotes some evidence that indicates a higher population gives less pollutants / ora e.g. UK has a higher population than Poland <b>and</b> makes less pollutants (1)</p>	2	<p><b>The data quoted must be able to be checked to see if it is correct and not ambiguous</b></p> <p><b>allow</b> the higher populated countries like Germany Poland and the UK produces a lot more pollution</p>
	<b>Total</b>	<b>10</b>	

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