



**GCSE**

**Chemistry B**

Unit **B742/01**: Modules C4, C5, C6 (Foundation Tier)

General Certificate of Secondary Education

**Mark Scheme for June 2016**

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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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## Annotations

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

**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

Question	Answer	Marks	Guidance
1 a i	17 (1)	1	
ii	7 (1)	1	
iii	3 (1)	1	
b	atoms with the same atomic number / same number of protons / same proton number (1)  but different mass numbers / different numbers of neutrons (1)	2	<b>allow</b> an element with the same atomic number (1) but different mass number (1)  <b>allow</b> atoms with same number of protons but different mass for (2)
	<b>Total</b>	<b>5</b>	

Question	Answer	Marks	Guidance
2 a	lithium / rubidium / caesium / francium (1)	1	<b>allow</b> Li / Rb / Cs / Fr (1)
b	<b>any two from:</b> bubbles or gas or hydrogen given off (1) (sodium) reacts quickly (1) (sodium) melts (1) (sodium) skates across surface of water (1) (sodium) floats (1)	2	<b>allow</b> fizz (1)  <b>allow</b> (yellow) flame observed (1) <b>allow</b> sodium gets smaller or disappears (1) <b>allow</b> forms a colourless solution (1)
c	potassium hydroxide (1) hydrogen (1)	2	order unimportant <b>allow</b> correct formulae i.e. H <sub>2</sub> (1) and KOH (1) <b>not</b> H
	<b>Total</b>	<b>5</b>	

Question	Answer	Marks	Guidance
3 a i	aluminium and boron (1)	1	<b>both</b> required <b>allow</b> Al and B (1)
ii	potassium and bromine (1)	1	<b>both</b> required <b>allow</b> K and Br (1)
iii	silver (1)	1	<b>allow</b> Ag (1)
b	<b>any two from:</b>  arranged elements in order of atomic mass (1)  left gaps for elements not yet discovered (1)  predicted properties of elements (1)  arranged elements in periods (1)  arranged elements in groups (1)	2	<b>allow</b> predicted properties of 'missing' elements for (2)  <b>allow</b> arranged elements together with similar chemical properties (1)
	<b>Total</b>	<b>5</b>	

Question	Answer	Marks	Guidance
4	<p><b>[Level 3]</b>  <b>Identifies compounds A and B, with explanations AND constructs the word equation</b>  Quality of written communication does not impede communication of the science at this level.  (5 – 6 marks)</p> <p><b>[Level 2]</b>  <b>Identifies either compound A or B, <u>or</u> the elements or ions present in either A or B AND constructs the word equation</b>  <b>OR</b>  <b>Identifies both compounds A and B, or the elements or ions present in both A or B, with explanations</b>  Quality of written communication partly impedes communication of the science at this level.  (3 – 4 marks)</p> <p><b>[Level 1]</b>  <b>Identifies one element or ion present in either A or B OR constructs the word equation</b>  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 C</b></p> <p><b>Indicative scientific points may include:</b></p> <p><b>Word equation</b>  potassium chloride + silver nitrate → silver chloride + potassium nitrate</p> <p><b>allow</b> correct formulae or mix of words and formulae</p> <p><b>allow</b> <math>KCl + AgNO_3 \rightarrow AgCl + KNO_3</math></p> <p><b>Compound A</b></p> <ul style="list-style-type: none"> <li>compound A contains sodium (ions)</li> <li>compound A contains chloride (ions)</li> <li>compound A is sodium chloride</li> </ul> <p><b>Reasons</b></p> <ul style="list-style-type: none"> <li>because sodium gives a yellow flame test colour</li> <li>because chloride ions give a white ppt with silver nitrate</li> </ul> <p><b>Compound B</b></p> <ul style="list-style-type: none"> <li>compound B contains iron(II) (ions)</li> <li>compound B contains bromide (ions)</li> <li>compound B is iron(II) bromide</li> </ul> <p><b>Reasons</b></p> <ul style="list-style-type: none"> <li>iron(II) (ions) give a green ppt with sodium hydroxide</li> <li>bromide (ions) give a cream ppt with silver nitrate</li> </ul> <p><b>allow</b> solid instead of ppt</p> <p><b>Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.</b></p>
		6	

Question	Answer	Marks	Guidance
5 a	halogens (1)	1	
b i	<b>any two from:</b> idea of water sterilisation (1) (making) plastics (1) (making) pesticides (1) (making) bleach or disinfectant (1) (making) pharmaceuticals (1) (making) solvents (1)	2	ignore cleaning water
ii	antiseptics or to sterilise wounds (1)	1	
	<b>Total</b>	<b>4</b>	

Question	Answer	Marks	Guidance
6 a	<b>any two from:</b>  medicines – idea of avoiding overdose / avoiding harm (1) idea of getting correct concentration (1)  baby milk – idea of (to get correct concentration) to avoid harming the baby (1)	2	<b>ignore</b> can have too many chemicals or preservatives <b>ignore</b> progressively dilute heroin to wean addicts off the drug  <b>allow</b> idea that doses are weaker or could be harmful if left undiluted (1)
b	96 (1)	1	
	<b>Total</b>	<b>3</b>	

Question	Answer	Marks	Guidance
7	<b>A – chloride (ions)</b> <b>B – iodide (ions) and sulfate (ions)</b> <b>C – sulfate (ions)</b> <b>all correct (2)</b> <b>BUT</b> <b>one or two correct (1)</b>  <b>then any two from:</b> white ppt with lead nitrate indicates chloride (ions) (1)  yellow ppt with lead nitrate indicates iodide (ions) (1)  white ppt with barium chloride indicates sulfate (ions) (1)	4	<b>allow</b> chlorine and iodine (ions) <b>ignore</b> names of compounds  <b>allow</b> lead ions rather than lead nitrate  <b>allow</b> barium ions rather than barium chloride
	<b>Total</b>	<b>4</b>	


Question	Answer	Marks	Guidance
<b>8 a</b>	sulfur (1)	1	<b>allow</b> S (1)
<b>b</b>	$2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$ formulae (1) balancing conditional on correct formulae (1)	2	<b>allow</b> any correct multiple e.g. $4\text{SO}_2 + 2\text{O}_2 \rightarrow 4\text{SO}_3$ (2)  <b>allow</b> = or $\rightleftharpoons$ 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. $2\text{So}_2 + \text{O}^2 \rightarrow 2\text{SO}_3$ (1)
<b>c i</b>	(as temperature decreases so yield) increases (1)	1	<b>allow</b> ora if specified
<b>ii</b>	25 - 40 (1)	1	<b>allow</b> anywhere in range
	<b>Total</b>	<b>5</b>	

Question	Answer	Marks	Guidance
<b>9 a i</b>	50 (cm <sup>3</sup> ) (1)	1	
<b>ii</b>	any value between 48 and 50 (seconds) (1)	1	
<b>b</b>	idea that acid runs out or magnesium runs out (1)	1	<b>allow</b> idea that reactant(s) run(s) out (1) <b>ignore</b> no more gas given off <b>ignore</b> graph levels off
<b>c i</b>	sulfuric acid – 6.12 (g) (1)  hydrogen – 0.16 (g) (1)	2	
<b>ii</b>	<b>LOOK FOR ANSWER FIRST OF ALL IF mass = 50 g AWARD 2 MARKS</b>  idea of $1 \times 10 / 2 \times 5 / 0.5 \times 20$ (1)	2	<b>allow</b> $10 \times 10/2$ or $10 \times 5/1$ or $10 \times 2.5/0.5$ (1)
	<b>Total</b>	<b>7</b>	

Question	Answer	Marks	Guidance
10	<p><b>[Level 3]</b>  <b>Complete description of a titration to include detection of endpoint and safety precautions</b>            Quality of written communication does not impede communication of the science at this level.            (5 – 6 marks)</p> <p><b>[Level 2]</b>  <b>Description of a titration to include detection of endpoint</b>            Quality of written communication partly impedes communication of the science at this level.            (3 – 4 marks)</p> <p><b>[Level 1]</b>  <b>Rudimentary description of a titration</b>            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 E</b></p> <p><b>Indicative scientific points at level 3 may include:</b></p> <ul style="list-style-type: none"> <li>• many of the points at levels 1 and 2 and in addition</li> <li>• idea of repeating to obtain concordant results</li> <li>• use pipette filler to avoid sucking alkali or acid into mouth</li> <li>• safety goggles as liquids are corrosive</li> <li>• fill burette above eye level</li> </ul> <p><b>Indicative scientific points at level 2 may include:</b></p> <ul style="list-style-type: none"> <li>• acid in burette, alkali in flask (or vice versa)</li> <li>• use pipette to accurately measure alkali (or acid)</li> <li>• add acid to alkali (or vice versa)</li> <li>• use of an indicator</li> <li>• named indicator such as methyl orange, litmus or phenolphthalein</li> <li>• colour changes at end point or when solution is neutral</li> <li>• use of pH meter</li> <li>• idea of measuring titre</li> </ul> <p><b>Indicative scientific points at level 1 may include:</b></p> <ul style="list-style-type: none"> <li>• acid in burette, alkali in flask (or vice versa)</li> <li>• add acid to alkali (or vice versa)</li> <li>• use of safety goggles</li> <li>• use of pipette filler</li> </ul> <p><b>Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.</b></p>
		6	

Question	Answer	Marks	Guidance
11 a i	$x = 3$ $y = 8$ $z = 3$  all correct (1)	1	
ii	contains oxygen / does not contain carbon and hydrogen <b>only</b> (1)	1	<b>allow</b> has O in the formula / contains three elements (1) <b>allow</b> C and H for carbon and hydrogen (1)  <b>not</b> contains an oxygen <b>molecule</b> (in the formula) <b>not</b> is not a <b>mixture</b> of carbon and hydrogen only <b>not</b> does not contain carbon and hydrogen <b>molecules</b> or <b>compounds</b> only <b>not</b> does not contain carbon and hydro only
b i	contains a (carbon-carbon) double bond (1)	1	<b>allow</b> has a C=C in its formula (1)  <b>allow</b> (has a) double bonded carbon (1)
ii	bromine (water) (1)  goes (from brown to) colourless / is decolourised (1)	2	<b>allow</b> Br <sub>2</sub> (1) <b>not</b> bromide  this marking point is <b>dependent</b> on correct reagent or bromide  <b>allow</b> colour fades (1)  <b>allow</b> any colour from orange-red, orange, brown-red, brown for colour of bromine (1)  <b>ignore</b> clear  <b>not</b> if wrong starting colour of bromine is given  <b>not</b> discoloured

Question	Answer	Marks	Guidance
<b>c</b>	<b>any two from:</b>  (making) biodiesel (1)  (making) margarine (1)  (making) soap (1)	<b>2</b>	<b>allow</b> butter / cooking oil / cooking for <b>one</b> mark  <b>ignore</b> used in foods
	<b>Total</b>	<b>7</b>	

Question	Answer	Marks	Guidance
12 	<p><b>[Level 3]</b>  <b>Answer gives some properties of CFCs that makes them suitable for use as a propellant</b>  <b>AND</b>  <b>Explains why CFCs have now been banned in the UK</b>  Quality of communication does not impede communication of science at this level.  (5-6 marks)</p> <p><b>[Level 2]</b>  <b>Answer gives one property of CFCs that make it suitable for use as a propellant <u>and</u> explains why CFCs have now been banned in the UK</b>  <b>OR</b>  <b>Answer gives some properties of CFCs that makes them suitable for use as a propellant</b>  Quality of written communication partly impedes communication of the science at this level.  (3 – 4 marks)</p> <p><b>[Level 1]</b>  <b>Answer gives one property of CFCs that make it suitable for use as a propellant</b>  <b>OR</b>  <b>States a reason why CFCs have now been banned in the UK</b>  Quality of 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 C</b></p> <p><b>Indicative scientific points about properties may include:</b></p> <ul style="list-style-type: none"> <li>• non-flammable</li> <li>• inert / unreactive</li> <li>• non-toxic / not poisonous</li> <li>• low boiling point / gas / evaporates easily</li> <li>• insoluble in water</li> </ul> <p><b>Indicative scientific points about banning may include:</b></p> <ul style="list-style-type: none"> <li>• causes ozone depletion</li> <li>• increased risk of skin cancer</li> <li>• increased risk of cataracts</li> <li>• increased ageing of skin</li> <li>• increased risk of sunburn</li> <li>• society or government have accepted evidence from scientists</li> </ul> <p><b>Use the L1, L2, L3 annotations in RM Assessor, do not use ticks</b></p>
	<b>Total</b>	<b>6</b>	

Question	Answer	Marks	Guidance
13 a	copper <b>and</b> iron(II) sulfate (1)  only reaction in which there is no change in observation (1)	2	<b>Mark independently</b>  <b>allow</b> Cu <b>and</b> FeSO <sub>4</sub> (1)  <b>allow</b> solution stays green / solution does not change colour (1)
b	magnesium, iron, copper, silver (1)  <b>AND</b>  <b>any two from:</b>  magnesium will displace iron or magnesium reacts with iron(II) sulfate so magnesium is more reactive than iron (1)  iron will displace copper so iron reacts with copper(II) sulfate so iron is more reactive than copper (1)  magnesium will displace copper or magnesium reacts with copper(II) sulfate so magnesium is more reactive than copper (1)  copper will displace silver or copper reacts with silver nitrate so copper is more reactive than silver (1)	3	<b>allow</b> Mg, Fe, Cu, Ag (1)
	<b>Total</b>	<b>5</b>	

Question	Answer	Marks	Guidance
14	No  there is no change with any results with washing-up liquid (1)  volume of lather decreases with hard water using soap (1)	2	<b>No marks for no, marks are for explanation</b> If <b>yes</b> no marks for this question  <b>allow</b> volume of lather stays at 60 cm <sup>3</sup> (1)  <b>allow</b> idea that volume of lather changes with hard water (1) <b>BUT</b> do not allow volume of lather increases with hard water <b>allow</b> volume of lather with hard water is less than 30 cm <sup>3</sup> (1)
	<b>Total</b>	<b>2</b>	

Question	Answer	Marks	Guidance
15 a i	7.5 (g) (1)	1	<b>allow</b> 7.4 to 7.6 (1)
ii	75 (g) (1)	1	<b>allow</b> ecf from (i) i.e. 10 x answer to (i)
b i	potassium (1)  bromine (1)	2	<b>allow</b> K (1)  <b>allow</b> Br <sub>2</sub> (1) <b>do not allow</b> bromide
ii	ions can move / ions go to electrodes (1)	1	<b>allow</b> ions move to anode / ions move to cathode (1) <b>do not allow</b> electrons can move
	<b>Total</b>	<b>5</b>	

Question	Answer	Marks	Guidance
<b>16 a i</b>	1500 (1)	1	units <b>not</b> needed
<b>ii</b>	decreases / gets smaller / gets less (1)	1	<b>allow</b> goes up to start with and then goes down / AW (1)
<b>b</b>	<b>any three from:</b> (UK decreases but) world is increasing (1) world uses more fertilisers than UK / AW (1) both UK and world use less phosphorus than nitrogen / ora (1) idea that 'blip' on graph for UK in 1997 not shown in the world / AW (1)	3	<b>allow</b> graph (a) for UK and graph (b) for world
<b>c i</b>	<b>E</b> because idea that uses smallest amount of pesticides (1) idea that uses smallest amount of fertilisers (1)	2	<b>No marks for E, marks are for explanation</b> <b>allow</b> cannot tell because the figures give are mean values and so other countries may use lots of fertilisers and pesticides on some fields and none on others for (2) <b>allow</b> other countries with correct justification
<b>ii</b>	$1.4 \times 10^9$ / 1 400 000 000 (1)	1	unit <b>not</b> needed
<b>d</b>	nitrous oxide (1) largest source from farming (1)	2	$\text{N}_2\text{O}$ (1) it is 88% is <b>not</b> sufficient but <b>allow</b> 88% from farming (1) <b>allow</b> fertilisers contain nitrogen and this gas contains nitrogen (1) <b>ignore</b> just quoting numbers
	<b>Total</b>	<b>10</b>	

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