

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**  
**TWENTY FIRST CENTURY SCIENCE**  
**CHEMISTRY A**

UNIT 2 – Modules C4 C5 C6 (Foundation Tier)

**SAMPLE ASSESSMENT MATERIALS**  
**(from 2010 onwards)**

Time: 40 minutes

Candidates answer on the question paper

**Additional materials (enclosed):**

None

Calculators may be used.

**Additional materials:** Pencil  
 Ruler (cm/mm)

Candidate  
 Forename

--

Candidate  
 Surname

--

Centre  
 Number

--	--	--	--	--

Candidate  
 Number

--	--	--	--

**INSTRUCTIONS TO CANDIDATES**

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

**INFORMATION FOR CANDIDATES**

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **42**.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.

**FOR EXAMINER'S  
 USE**

Qu.	Max.	Mark
1	6	
2	9	
3	5	
4	5	
5	5	
6	6	
7	6	
<b>TOTAL</b>	<b>42</b>	

This document consists of **16** printed pages.

Answer **all** the questions.

- 1 Elements in Group 7 are called the halogens. The table gives some information about the physical properties of three of the halogens.

halogen	proton number	melting point in °C	boiling point in °C	state at 25 °C	colour
chlorine	17	-101	-35		pale green
bromine	35	-7	59	liquid	deep red
iodine	53	114	184	solid	dark grey

- (a) The halogens show trends in physical properties with increasing proton number.

Use information from the table to help you answer these questions.

- (i) Finish the sentence about the trend in melting point.

As the proton number ..... the melting point ..... [1]

- (ii) What is the state of chlorine at 25 °C?

Put a ring around the correct answer.

**gas                  liquid                  solid**

[1]

- (iii) **Astatine** is a halogen. The proton number of astatine is 85.

The halogens get darker in colour as the proton number increases.

Predict the colour of **astatine**.

Put a ring around the correct answer.

**yellow                  orange                  black**

[1]

- (b) The halogens also show a trend in reactivity.

This can be shown by the displacement reactions when halogens are added to solutions of halides.

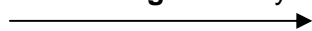
A student made the following observations.

- When chlorine is added to potassium bromide solution, red bromine appears.
- When bromine is added to potassium iodide solution, brown iodine appears.
- When bromine is added to potassium chloride solution, there is no displacement.

(i) What is the correct order of reactivity for these halogens?

Put a tick (✓) in the box next to the correct answer.

**decreasing** reactivity



bromine      chlorine

chlorine      bromine

iodine      bromine

[1]

(ii) Fluorine is a halogen with proton number 9.

Which statement describes the displacement reactions of fluorine?

Put a tick (✓) in the box next to the correct answer.

Fluorine displaces chlorine, bromine and iodine.

Fluorine displaces iodine but not chlorine or bromine.

Fluorine displaces chlorine and bromine but not iodine.

Fluorine displaces bromine and iodine but not chlorine.

[1]

(c) Hazard symbols are used to show the dangers involved in handling some chemicals.



A



B



C



D

Iodine is **harmful**. Which hazard symbol, **A**, **B**, **C** or **D**, should be placed on a container of iodine?

answer ..... [1]

**Total [6]**

2 This diagram shows part of the Periodic Table.

					He
Li	Be		C		Ne
Na	Mg			Cl	Ar
K	Ca			Br	

(a) (i) Which three elements shown in the diagram are in the same **group**?

Put a tick (✓) in the box next to the correct answer.

Be	C	He	<input type="checkbox"/>
Na	Mg	Ar	<input type="checkbox"/>
He	Be	Ar	<input type="checkbox"/>
Li	Na	K	<input type="checkbox"/>

[1]

(ii) Which three elements shown in the diagram are in the same **period**?

Put a tick (✓) in the box next to the correct answer.

Na	Mg	Ar	<input type="checkbox"/>
Li	Na	Ca	<input type="checkbox"/>
He	Ne	Ar	<input type="checkbox"/>
Na	Ca	Br	<input type="checkbox"/>

[1]

- (b) A small piece of potassium is dropped into a trough of cold water.

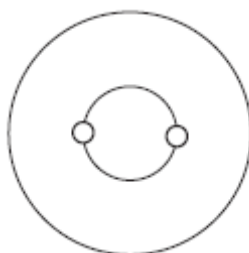
Describe what you would **see** as the potassium reacts.

.....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 ..... [4]

- (c) Finish the diagram to show the arrangement of electrons in an atom of the element **carbon**.

Use a circle  $\bigcirc$  to show the position of each electron.

The positions of two electrons have already been drawn to help you.



[1]

- (d) The table shows the arrangement of electrons in sodium atoms and chlorine atoms.

Complete the table to show the arrangement of electrons in sodium ions and chloride

sodium atom Na	sodium ion Na <sup>+</sup>	chlorine atom Cl	chloride ion Cl <sup>-</sup>
2.8.1		2.8.7	

[2]

**Total [9]**

3 The table gives information about ions dissolved in sea water.

ion	symbol	percentage by mass of the total dissolved solids (%)
chloride	$\text{Cl}^-$	55
sodium	$\text{Na}^+$	30
sulfate	$\text{SO}_4^{2-}$	8
magnesium	$\text{Mg}^{2+}$	4
calcium	$\text{Ca}^{2+}$	1
potassium	$\text{K}^+$	1
carbonate	$\text{CO}_3^{2-}$	0.5
bromide	$\text{Br}^-$	0.2

These ions enter the sea water when crystals of ionic compounds in rocks dissolve.

Each of these ionic compounds is made up of one type of positive ion and one type of negative ion shown in the table.

(a) One compound that dissolved from the rocks into the water is magnesium sulfate.

Suggest the name of one **other** ionic compound that dissolved from the rocks into the water.

Use information from the table to help you.

..... [1]

(b) What holds together the ions in the crystals of ionic compounds?

Put a tick (✓) in the box next to the correct answer.

sharing of pairs of electrons

attraction between ions of opposite charge

attraction between ions of the same charge

[1]

(c) Sea water conducts electricity.

Use ideas about ions to explain why this happens.

.....  
.....  
..... [2]

(d) When a sample of sea water is evaporated to dryness, a white solid is left. This is a mixture of several ionic compounds.

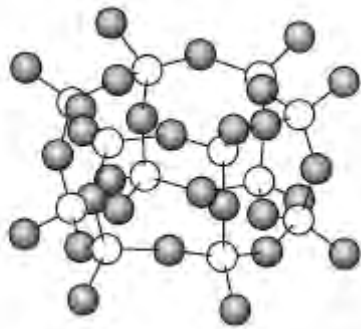
Look at the **percentage by mass of the total dissolved solids** column in the table.

Use the information to name the ionic compound that makes up **most** of the white solid.

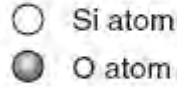
..... [1]  
[Total: 5]

4 All of the materials in the world are made up of elements.

(a) Much of the elements oxygen and silicon are in the compound silicon dioxide.



key



Here are some sentences about **silicon dioxide**.

Finish these sentences by putting a tick (✓) in the box next to the correct word in each pair.

Silicon dioxide is a giant 

ionic	<input type="checkbox"/>
covalent	<input type="checkbox"/>

 structure.

It is very 

soft	<input type="checkbox"/>
hard	<input type="checkbox"/>

low	<input type="checkbox"/>
high	<input type="checkbox"/>

 and has melting and boiling points.

Silicon dioxide is 

soluble	<input type="checkbox"/>
insoluble	<input type="checkbox"/>

 in water and 

does	<input type="checkbox"/>
does not	<input type="checkbox"/>

 conduct electricity.

[4]

(b) The compounds in living organisms are made **mainly** of four elements. Two of these elements are **carbon** and **hydrogen**.

Which are the other **two** elements?

Put a ring around each of the **two** correct answers.

calcium

nitrogen

oxygen

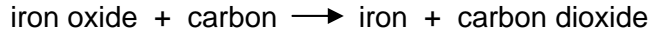
sodium

[1]

[Total: 5]



5 The ore haematite contains iron oxide. Iron is extracted from this ore by reaction with carbon.



(a) Oxidation **and** reduction take place in this reaction.

What is the name of the substance that has been **oxidised**?

..... [1]

(b) Which **two** of the metals below are also extracted by reaction with carbon?

Put a ring around each of the **two** correct answers.

**copper**

**potassium**

**sodium**

**zinc**

[2]

(c) The ore bauxite contains aluminium oxide.

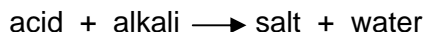
Carbon is not used to extract aluminium from this ore.

Explain why carbon is used to extract iron from haematite but is not used to extract aluminium from bauxite.

.....  
 .....  
 .....  
 ..... [2]

[Total: 5]

6 An acid and an alkali react to form a salt and water.



(a) What type of reaction is this?

Put a **ring** around the correct answer.

- decomposition**          **neutralisation**          **oxidation**          **polymerisation**

[1]

(b) You are given a solution of an alkali of known concentration and a solution of an acid of unknown concentration.

Briefly describe how you would carry out a titration accurately to find the concentration of the acid.

.....

.....

.....

.....

.....

.....

.....

.....

.....

[4]

(c) Acids also react with metals.



A piece of zinc is added to 20 cm<sup>3</sup> of dilute hydrochloric acid.

Bubbles of hydrogen gas appear.

What is the formula of **hydrogen gas**?

Put a **ring** around the correct answer.

- H**          **2H**          **H<sub>2</sub>**

[1]

[Total: 6]

**BLANK PAGE**

**Question 7 starts on page 12**

**PLEASE DO NOT WRITE ON THIS PAGE**

7 Magnesium sulfate is one of the chemicals in detergent powder.

Mary makes some magnesium sulfate using this reaction.

magnesium carbonate + sulfuric acid  $\longrightarrow$  magnesium sulfate + water + carbon dioxide



She measures out 100 cm<sup>3</sup> of dilute sulfuric acid and adds solid magnesium carbonate until no more bubbles appear.

(a) Some solid magnesium carbonate is left in the solution.

What technique can Mary use to remove the solid from the solution?

..... [1]

(b) Mary works out the theoretical yield to be 12.0 g.

(i) To make this calculation Mary uses the relative formula mass of magnesium carbonate and magnesium sulfate.

She uses these relative atomic masses: C = 12; Mg = 24; O = 16; S = 32.

Use this information to work out these relative formula masses.

relative formula mass of magnesium carbonate, MgCO<sub>3</sub> = .....

relative formula mass of magnesium sulfate, MgSO<sub>4</sub> = .....

[2]

(ii) The theoretical yield for Mary's experiment is 12.0 g.

Mary dries and weighs the magnesium sulfate she makes. This is her actual yield.

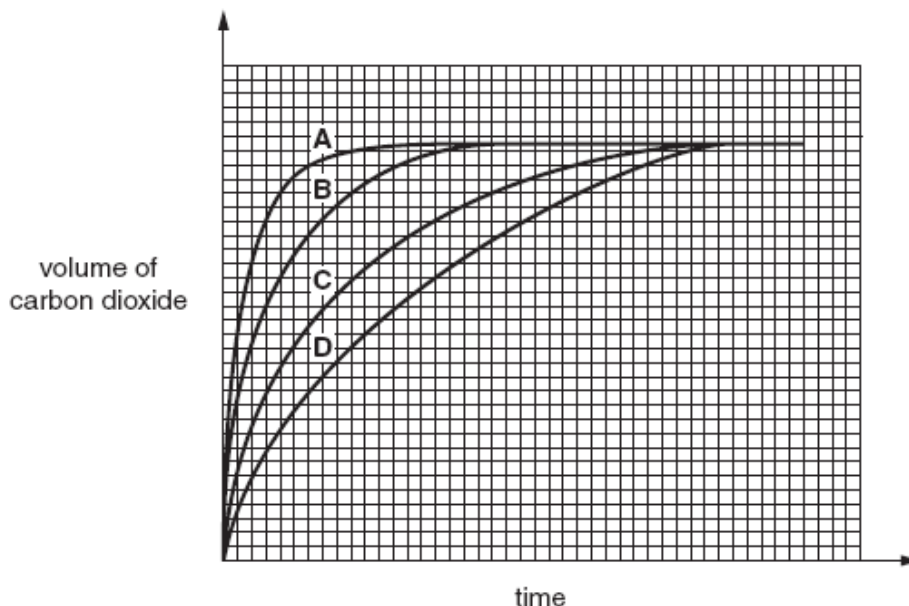
Actual yield = 10.8 g.

Work out the percentage yield for Mary's experiment.

Percentage yield = ..... [1]

- (c) Mary investigates the rate of this reaction using the same sulfuric acid solution with different sized lumps of magnesium carbonate.

She measures the volume of carbon dioxide given off at time intervals and plots her results on a grid.



- (i) How do these graphs show that Mary used the same mass of magnesium carbonate for each experiment?

Put a tick (✓) in the box next to the correct answer.

Each line is a curve.

Each line begins at the origin.

Each line finishes at the same time.

Each line finishes at the same volume.

[1]

- (ii) Which line, **A**, **B**, **C** or **D**, shows results from:  
the fastest rate of reaction?

answer .....

the largest lumps of magnesium carbonate?

answer ..... [1]

Total [6]

END OF QUESTION PAPER

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# The Periodic Table of the Elements

1		2												3	4	5	6	7	0				
												<div style="border: 1px solid black; padding: 5px; text-align: center;"> <b>1</b>  <b>H</b>                      hydrogen                      1                 </div>											<div style="border: 1px solid black; padding: 5px; text-align: center;"> <b>4</b>  <b>He</b>                      helium                      2                 </div>
										<div style="border: 1px solid black; padding: 5px;"> <b>Key</b>                      relative atomic mass                      atomic symbol                      name                      atomic (proton) number                 </div>													
7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4											11 <b>B</b> boron 5	12 <b>C</b> carbon 6	14 <b>N</b> nitrogen 7	16 <b>O</b> oxygen 8	19 <b>F</b> fluorine 9	20 <b>Ne</b> neon 10						
23 <b>Na</b> sodium 11	24 <b>Mg</b> magnesium 12											27 <b>Al</b> aluminium 13	28 <b>Si</b> silicon 14	31 <b>P</b> phosphorus 15	32 <b>S</b> sulfur 16	35.5 <b>Cl</b> chlorine 17	40 <b>Ar</b> argon 18						
39 <b>K</b> potassium 19	40 <b>Ca</b> calcium 20	45 <b>Sc</b> scandium 21	48 <b>Ti</b> titanium 22	51 <b>V</b> vanadium 23	52 <b>Cr</b> chromium 24	55 <b>Mn</b> manganese 25	56 <b>Fe</b> iron 26	59 <b>Co</b> cobalt 27	59 <b>Ni</b> nickel 28	63.5 <b>Cu</b> copper 29	65 <b>Zn</b> zinc 30	70 <b>Ga</b> gallium 31	73 <b>Ge</b> germanium 32	75 <b>As</b> arsenic 33	79 <b>Se</b> selenium 34	80 <b>Br</b> bromine 35	84 <b>Kr</b> krypton 36						
85 <b>Rb</b> rubidium 37	88 <b>Sr</b> strontium 38	89 <b>Y</b> yttrium 39	91 <b>Zr</b> zirconium 40	93 <b>Nb</b> niobium 41	96 <b>Mo</b> molybdenum 42	[98] <b>Tc</b> technetium 43	101 <b>Ru</b> ruthenium 44	103 <b>Rh</b> rhodium 45	106 <b>Pd</b> palladium 46	108 <b>Ag</b> silver 47	112 <b>Cd</b> cadmium 48	115 <b>In</b> indium 49	119 <b>Sn</b> tin 50	122 <b>Sb</b> antimony 51	128 <b>Te</b> tellurium 52	127 <b>I</b> iodine 53	131 <b>Xe</b> xenon 54						
133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56	139 <b>La*</b> lanthanum 57	178 <b>Hf</b> hafnium 72	181 <b>Ta</b> tantalum 73	184 <b>W</b> tungsten 74	186 <b>Re</b> rhenium 75	190 <b>Os</b> osmium 76	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	197 <b>Au</b> gold 79	201 <b>Hg</b> mercury 80	204 <b>Tl</b> thallium 81	207 <b>Pb</b> lead 82	209 <b>Bi</b> bismuth 83	[209] <b>Po</b> polonium 84	[210] <b>At</b> astatine 85	[222] <b>Rn</b> radon 86						
[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	[227] <b>Ac*</b> actinium 89	[261] <b>Rf</b> rutherfordium 104	[262] <b>Db</b> dubnium 105	[266] <b>Sg</b> seaborgium 106	[264] <b>Bh</b> bohrium 107	[277] <b>Hs</b> hassium 108	[268] <b>Mt</b> meitnerium 109	[271] <b>Ds</b> darmstadtium 110	[272] <b>Rg</b> roentgenium m 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated												

\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number





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GCSE Unit

MARK SCHEME

2010 Sample Paper

**Chemistry A (J634)**  
**Modules C4, C5 and C6**  
**Foundation Tier**

**A322/01**

Maximum Mark: 42

Paper set date: 25/01/08

## Guidance for Examiners

Additional Guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, e.g. mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

/	= alternative and acceptable answers for the same marking point
(1)	= separates marking points
<b>not/reject</b>	= answers which are not worthy of credit
<b>ignore</b>	= statements which are irrelevant - applies to neutral answers
<b>allow/accept</b>	= answers that can be accepted
(words)	= words which are not essential to gain credit
<u>words</u>	= underlined words must be present in answer to score a mark
ecf	= error carried forward
AW/owtte	= alternative wording
ORA	= or reverse argument

E.g. mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1)

work done = 0 marks

work done lifting = 1 mark

change in potential energy = 0 marks

gravitational potential energy = 1 mark

5. If a candidate alters his/her response, examiners should accept the alteration.
6. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.
7. The list principle:  
If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

8. Marking method for tick boxes:

Always check the additional guidance.

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.

If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses.

Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

E.g. If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third should be blank (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	x	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	x		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

Question			Expected Answers	Marks	Rationale				
1	a	i	increases increases / decreases decreases (1)	1	<b>allow</b> either increases and increases for one mark or decreases and decreases for one mark  allow pairs of words with the same meaning eg smaller smaller / larger larger / rises rises / falls falls / gets higher gets higher / gets lower gets lower				
	a	ii	gas (1)	1	<b>allow</b> in table more than one circled = 0				
		iii	black (1)	1	more than one circled = 0				
	b	i	chlorine bromine iodine <div style="display: inline-block; vertical-align: middle;"> <table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px;">✓</td></tr> <tr><td style="width: 20px; height: 20px;"></td></tr> </table> </div> (1)		✓		1	2 <sup>nd</sup> box	
✓									
		ii	chlorine, bromine and iodine <div style="display: inline-block; vertical-align: middle;"> <table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td style="width: 20px; height: 20px;">✓</td></tr> <tr><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px;"></td></tr> </table> </div> (1)	✓				1	1 <sup>st</sup> box
✓									
	c		C (1)	1	more than one letter = 0				
<b>Total</b>				<b>6</b>					

Question			Expected Answers	Marks	Rationale
2	a	i	<p style="text-align: center;"> <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; margin-bottom: 2px;"></span> <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; margin-bottom: 2px;"></span> <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; margin-bottom: 2px;"></span> <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; margin-bottom: 2px;"></span> </p> <p style="text-align: center;">Li Na K <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; vertical-align: middle; text-align: center;">✓</span> (1)</p>	1	4 <sup>th</sup> box
		ii	<p style="text-align: center;"> <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; vertical-align: middle; text-align: center;">✓</span> (1) </p> <p style="text-align: center;"> <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; margin-bottom: 2px;"></span> <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; margin-bottom: 2px;"></span> <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; margin-bottom: 2px;"></span> </p>	1	1 <sup>st</sup> box
	b		bubbles (1) moves around on surface (1) melts (1) flame (1)	4	
	c		four electrons drawn on or touching the outer shell or circle (1)	1	<b>allow</b> electrons drawn singly or in pairs / x for electron extra shell with electron(s) / extra electrons in inner shell = 0
	d		2.8 (1) 2.8.8 (1)	2	<b>allow</b> 2.8.0 and 2.8.8.0 <b>ignore</b> + or - symbols
<b>Total</b>				<b>9</b>	

Question		Expected Answers	Marks	Rationale
3	a	sodium chloride / sodium sulfate / sodium carbonate / sodium bromide / potassium chloride / potassium sulfate / potassium carbonate / potassium bromide / magnesium chloride / magnesium carbonate / magnesium bromide / calcium chloride / calcium sulfate / calcium carbonate / calcium bromide	1	<b>not</b> magnesium sulphate formula = 0
	b	between ions of opposite charge <div style="display: inline-block; border: 1px solid black; padding: 2px; margin-left: 10px;"> <input type="checkbox"/>  <input checked="" type="checkbox"/>  <input type="checkbox"/> </div>	1 (1)	2 <sup>nd</sup> box
	c	sea water contains charged ions / sea water contains positive and negative ions (1)  the ions in sea water can move (1)	2	
	d	sodium chloride (1)	1	<b>allow</b> Na Cl/ ignore + or - symbols <b>reject</b> sodium chlorine / (common) salt
<b>Total</b>			<b>5</b>	

Question		Expected Answers	Marks	Rationale
4	a	covalent hard high insoluble does not	4	4 correct (3) 3 correct (2) 2 correct (1)
	b	nitrogen and oxygen (1)	1	<b>both</b> answers required for (1) mark more than two circled = 0
<b>Total</b>			<b>5</b>	

Question		Expected Answers	Marks	Rationale
5	a	carbon (1)	1	formula = 0
	b	copper (1) zinc (1)	2	each additional circle above 2 loses one mark
	c	i	carbon is more reactive than iron (1) carbon is less reactive than aluminium (1)	2 Ora ora  allow 'aluminium is more reactive than iron 'for one mark only
<b>Total</b>			<b>5</b>	

Question		Expected Answers	Marks	Rationale
6	a	neutralisation (1)	1	
	b	measure a volume of the alkali into a flask (1) add an indicator (1) add acid from a burette until colour changes stop adding when colour changes (1)	4	.allow alkali in burette and acid in flask with no loss of marks
	c	H <sub>2</sub> (1)	1	more than one circled = 0
<b>Total</b>			<b>6</b>	



Question		Expected Answers	Marks	Rationale					
7	a	filtration / filtering / filter / decantation / decant (1)	1						
	b	i	84 (1) 120 (1)	2	ignore units				
		ii	90 (1)	1	ignore units				
	c	i	finishes at the same volume <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td>✓</td></tr></table> (1)				✓	1	4 <sup>th</sup> box
✓									
		ii	A D	1	<b>both</b> answers required for one mark must be in the correct order				
		<b>Total</b>		<b>6</b>					
		<b>Section total</b>		<b>42</b>					