



F

Monday 25 June 2012 – Afternoon

## GCSE TWENTY FIRST CENTURY SCIENCE CHEMISTRY A

**A172/01** Modules C4 C5 C6 (Foundation Tier)

\* A 1 3 5 3 6 0 6 1 2 \*

Candidates answer on the Question Paper.  
A calculator may be used for this paper.

**OCR supplied materials:**

None

**Other materials required:**

- Pencil
- Ruler (cm/mm)

**Duration: 1 hour**



Candidate forename					Candidate surname				
--------------------	--	--	--	--	-------------------	--	--	--	--

Centre number						Candidate number			
---------------	--	--	--	--	--	------------------	--	--	--

### INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

### INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✍).
- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.
- The Periodic Table is printed on the back page.
- A list of qualitative tests for ions is printed on page 2.

## TWENTY FIRST CENTURY SCIENCE DATA SHEET

## Qualitative analysis

## Tests for ions with a positive charge

Ion	Test	Observation
calcium $\text{Ca}^{2+}$	add dilute sodium hydroxide	a white precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
copper $\text{Cu}^{2+}$	add dilute sodium hydroxide	a light blue precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
iron(II) $\text{Fe}^{2+}$	add dilute sodium hydroxide	a green precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
iron(III) $\text{Fe}^{3+}$	add dilute sodium hydroxide	a red-brown precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
zinc $\text{Zn}^{2+}$	add dilute sodium hydroxide	a white precipitate forms; the precipitate dissolves in excess sodium hydroxide

## Tests for ions with a negative charge

Ion	Test	Observation
carbonate $\text{CO}_3^{2-}$	add dilute acid	the solution effervesces; carbon dioxide gas is produced (the gas turns lime water from colourless to milky)
chloride $\text{Cl}^-$	add dilute nitric acid, then add silver nitrate	a white precipitate forms
bromide $\text{Br}^-$	add dilute nitric acid, then add silver nitrate	a cream precipitate forms
iodide $\text{I}^-$	add dilute nitric acid, then add silver nitrate	a yellow precipitate forms
sulfate $\text{SO}_4^{2-}$	add dilute acid, then add barium chloride or barium nitrate	a white precipitate forms

**BLANK PAGE**

**Question 1 begins on page 4**

**PLEASE DO NOT WRITE ON THIS PAGE**

Answer **all** the questions.

- 1 Joe watches a DVD that shows how some Group 7 elements react with iron.

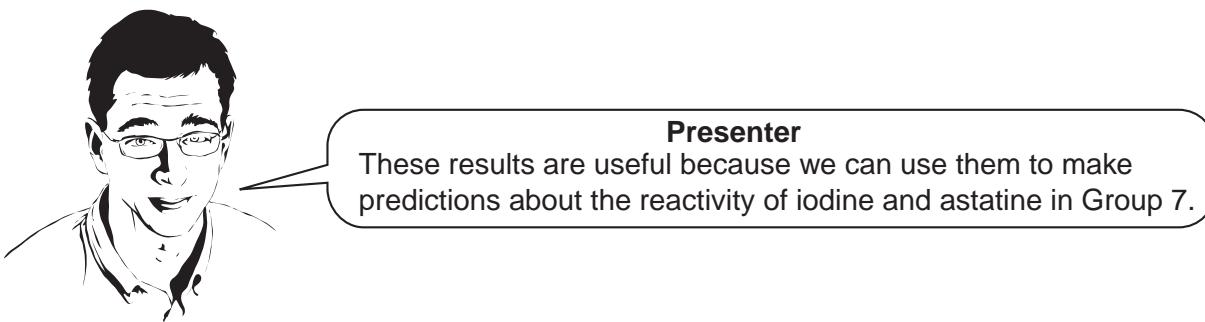
Joe makes some notes about what he sees.

fluorine F	Most reactive element in the group. Explosive reaction with iron.
chlorine Cl	Very bright flame, iron burns away quickly.
bromine Br	Less bright flame, takes longer for reaction with iron to finish.
iodine I	
astatine At	

- (a) What do Joe's notes show about the **trend** in reactivity down Group 7?

.....  
..... [1]

- (b) The presenter on the DVD talks about the results of the experiments.



- (i) Use Joe's notes to predict the reactivity of iodine and astatine.

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

- (ii) Joe writes this in his notes.

I think that these results show that the top element in every group in the Periodic Table is the most reactive.

Do you agree with Joe? Explain your answer.

.....  
.....  
.....  
.....

[2]

[Total: 5]

- 2 The table shows data about the physical properties of some elements.

Element	Appearance at room temperature	Melting point in °C	Boiling point in °C	Does the element conduct electricity?
Chlorine	green gas	-101	-34	no
Bromine	red-brown liquid	-7	59	no
Iodine	dark grey solid	114	184	no
Lithium	shiny solid	180	1342	yes
Sodium	shiny solid	97.8	883	yes
Potassium	shiny solid	63.5	759	yes

Mendeleev put these elements into two groups in the Periodic Table.

He used their similarities and differences to put lithium, sodium and potassium in one group.

He put chlorine, bromine and iodine into another group.

Discuss which data in the table **support**, and which data **do not support**, Mendeleev's idea of organising these elements into the two groups.



The quality of written communication will be assessed in your answer.

---



---



---



---



---



---



---



---



---



---



---

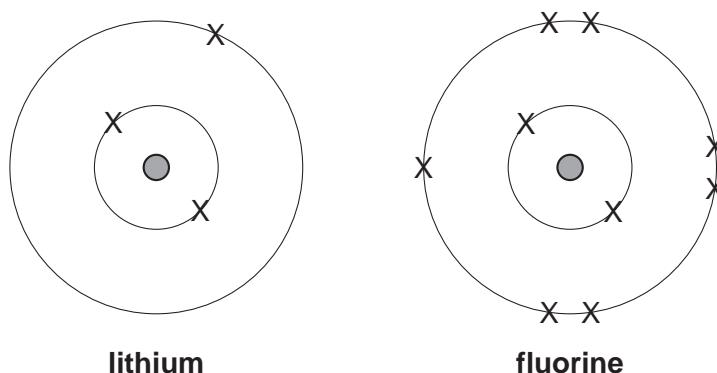


---

[6]

[Total: 6]

- 3 The diagram shows the arrangement of electrons in an atom of lithium and an atom of fluorine.



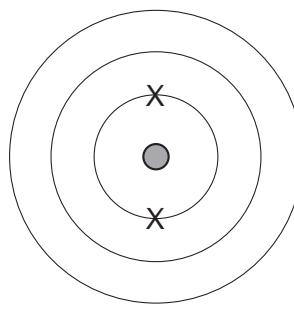
- (a) The electron arrangement of the lithium atom is 2.1.

What is the electron arrangement of the fluorine atom?

electron arrangement = ..... [1]

- (b) Sodium has eleven electrons.

Complete the diagram to show the arrangement of all of the electrons in a sodium atom.



sodium

[1]

- (c) Another element is in the same group of the Periodic Table as fluorine.

It has the electron arrangement 2.8.7.

What is the name of this element?

Use the Periodic Table to help you.

name of element ..... [1]

- (d) Give the names of the two particles found in the nucleus of an atom.

..... and ..... [1]

**[Total: 4]**

4 Eve does an experiment with chlorine.

(a) She reacts chlorine with a metal. The reaction makes sodium chloride.

(i) Write a word equation for the reaction.

..... [2]

(ii) Before Eve does her experiment, she looks at the hazard warning sign for chlorine gas.



Eve needs to use safety precautions when she uses chlorine in her experiment.

Describe these safety precautions and explain why they are necessary.

.....

[2]

(b) Sea salt contains both sodium chloride and potassium chloride.

Which of the following statements about potassium chloride are **true** and which are **false**?

Put a tick (✓) in the correct box for each statement.

	true	false
Potassium chloride gives a coloured flame in a flame test.	<input type="checkbox"/>	<input type="checkbox"/>
Potassium chloride is a gas.	<input type="checkbox"/>	<input type="checkbox"/>
Potassium chloride can be made by reacting potassium with bromine.	<input type="checkbox"/>	<input type="checkbox"/>
Solid potassium chloride contains sodium ions and chloride ions.	<input type="checkbox"/>	<input type="checkbox"/>

[2]

**[Total: 6]**

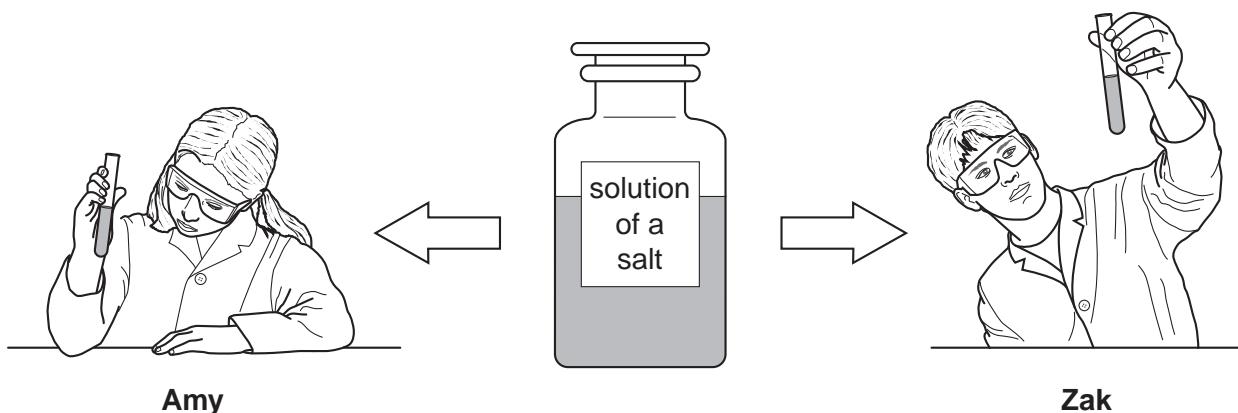
**BLANK PAGE**

**Question 5 begins on page 10**

**PLEASE DO NOT WRITE ON THIS PAGE**

## 10

- 5 Amy and Zak test samples of the same solution of a salt.



They do tests to identify the positive metal ions and the negative ions in the solution.

They use a fresh sample for each test.

They both use dilute sodium hydroxide and dilute silver nitrate to test the solution.

The boxes show the tests they use and their notes.

Amy's notes	
Tests	Notes
Test 1  Add a few drops of dilute sodium hydroxide.	I think the solution contains calcium ions.
Test 2  Acidify and add dilute silver nitrate.	I think the solution contains chloride ions.
My conclusion	
The solution contains calcium chloride.	

Zak's notes	
Tests	Notes
Test 1  Add a few drops of dilute sodium hydroxide...  ...then add more dilute sodium hydroxide.	I think the solution contains zinc ions.
Test 2  Acidify and add dilute silver nitrate.	I think the solution contains chloride ions.
My conclusion	
The solution contains zinc chloride.	

11

Amy and Zak both agree that the salt is a chloride but disagree about the metal ion in the salt.

Use the data sheet on page 2 to help you work out what Amy and Zak saw when they did the tests.

Explain how what they saw led them to their conclusions and who is more likely to be correct.



The quality of written communication will be assessed in your answer.

[6]

.. [6]

[Total: 6]

## 12

- 6 Massicot is a mineral. It contains lead oxide, PbO.

Lead metal is extracted from massicot. Lead is needed for roofing and car batteries.

Jed and Kay live near a lead mine.

- (a) The mass of lead that can be extracted from massicot can be worked out using relative atomic masses.

- (i) Use the Periodic Table to find the relative atomic masses of lead and oxygen.

relative atomic mass of lead = .....

relative atomic mass of oxygen = .....

[1]

- (ii) Use your answers to work out the relative formula mass of lead oxide, PbO.

relative formula mass of PbO = ..... [1]

- (b) The lead mine produces millions of tonnes of lead ore.

Jed and Kay are talking about the advantages and disadvantages of living near the lead mine.



**Jed**

The lead mine affects the surrounding area because they have to blast out 10 tonnes of rock to get less than a tonne of lead ore.



**Kay**

Yes, but the lead mine employs many local people.

- (i) Kay has just moved into the area. She has a young family.

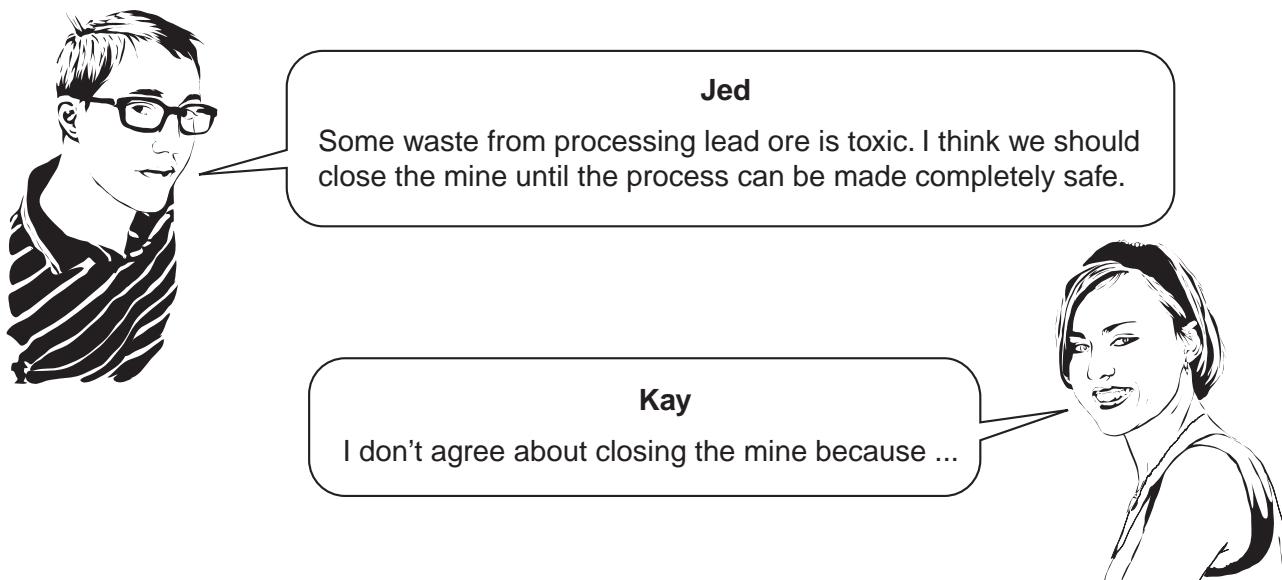
Give one **advantage** and one **disadvantage** to Kay of living near a lead mine.

.....  
.....  
.....

[2]

13

- (ii) Jed and Kay talk about lead processing at the mine.



Suggest reasons that Kay could give for **not** closing the mine.

.....

.....

.....

.....

[2]

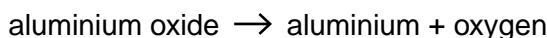
**[Total: 6]**

## 14

- 7 Aluminium is extracted from its ore by electrolysis.

Aluminium ore contains aluminium oxide.

- (a) This is the word equation for the reaction.



The aluminium oxide is reduced.

What does this mean?

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

The aluminium oxide loses oxygen.

The density of the aluminium oxide decreases.

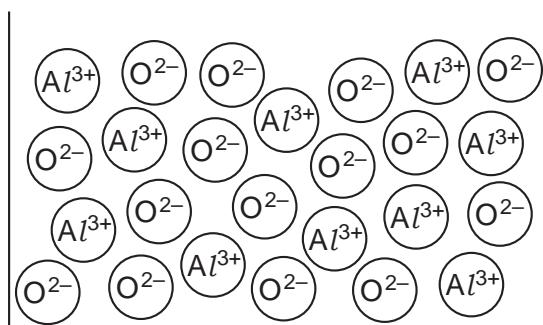
The aluminium oxide loses energy.

The volume of the aluminium oxide decreases.

[1]

- (b) The electrolysis process uses molten aluminium oxide.

The diagram shows the arrangement of particles in molten aluminium oxide.



- (i) Which two words can be used to describe molten aluminium oxide?

Put **rings** around the **two** correct answers.

**covalent**

**gas**

**ionic**

**liquid**

**molecular**

**solid**

[2]

15

- (ii) During the electrolysis, negative ions move to the positive electrode and positive ions move to the negative electrode. A product is made at each electrode.

Draw straight lines to connect each **electrode** with the correct **product made**.

<b>electrode</b>	<b>product made</b>
	aluminium
positive electrode	aluminium oxide
	water
negative electrode	hydrogen
	oxygen

[2]

- (c) Aluminium has many different uses.

The uses of aluminium depend on making the best use of its properties.

Draw four straight lines to connect each **use** with the **most important reason** for that use.

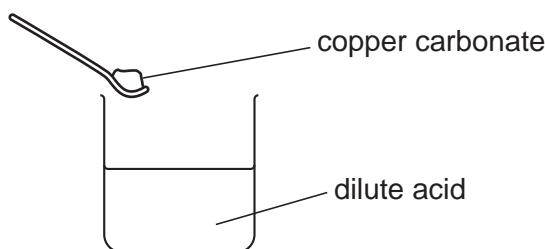
<b>use</b>	<b>most important reason</b>
aircraft parts	low density and can be mixed with other metals to make it strong
power cables	shiny appearance and surface can be coloured using dyes
drinks and food cans	surface is non-toxic and does not react with dilute acids
jewellery	very good electrical conductivity and can be shaped into wires

[2]

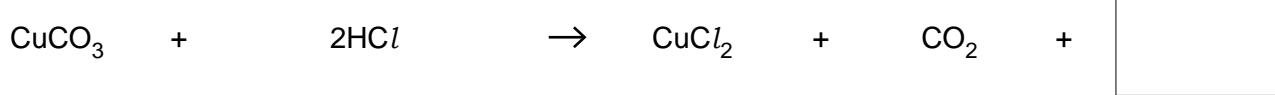
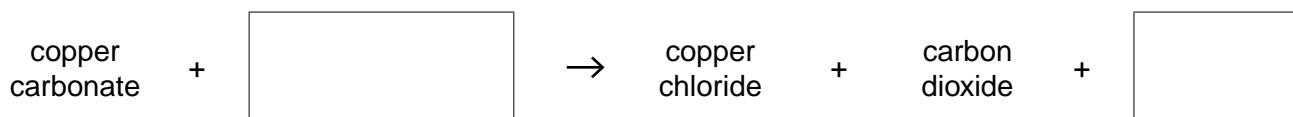
[Total: 7]

## 16

- 8 Sue reacts copper carbonate with a dilute acid to make copper chloride.



- (a) Complete the word and symbol equations for the reaction by filling in the empty boxes.



[2]

- (b) Which other chemicals react with the same dilute acid to form copper chloride?

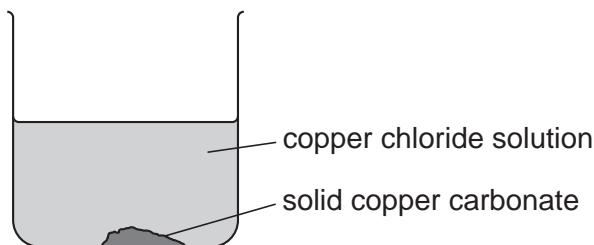
Put **(rings)** around the **two** correct answers.

**copper hydroxide**      **copper nitrate**      **copper oxide**      **copper sulfate**

[1]

- (c) Sue adds solid copper carbonate to the dilute acid until no more solid reacts.

At the end of the experiment, the beaker contains copper chloride solution and some left-over solid copper carbonate.



How can Sue make some **pure, dry** copper chloride **crystals** from the mixture in the beaker?



The quality of written communication will be assessed in your answer.

[6]

. [6]

**18**

- (d) Sue measures the mass of crystals that she has made (her actual yield).

Sue weighs an empty dish.

She puts her crystals into the dish and weighs it again.

These are her results.

mass of empty dish	= 200.0 g
mass of dish and crystals	= 204.5 g

- (i) What is the mass of the crystals (the **actual yield**)?

$$\text{mass} = \dots \text{g} \quad [1]$$

- (ii) The **theoretical yield** for Sue's experiment is 5.0 g.

Sue knows that

$$\text{percentage yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100\%$$

Use the actual yield from part (i) to calculate a percentage yield for Sue's experiment.

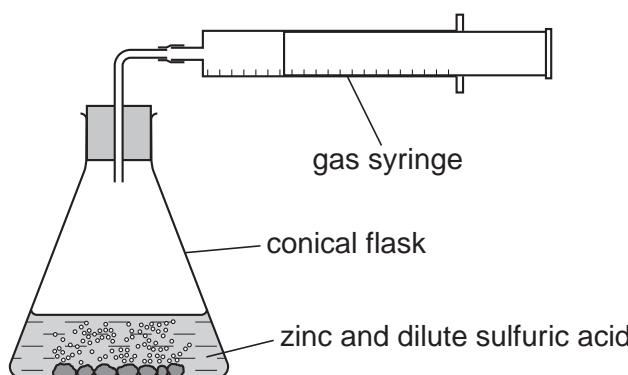
$$\text{percentage yield} = \dots \% \quad [1]$$

[Total: 11]

19

- 9 Alex adds zinc to some dilute sulfuric acid.

He measures the volume of hydrogen gas given off every 30 seconds.



- (a) Draw straight lines to connect each **chemical** to its correct **formula**.

chemical	formula
hydrogen	$\text{H}_2\text{SO}_4$
zinc	Zn
sulfuric acid	$\text{H}_2$

[2]

- (b) What is the name of the salt that forms in the reaction between zinc and sulfuric acid?

Put a (ring) around the correct answer.

**zinc chloride**      **zinc hydroxide**      **zinc nitrate**      **zinc oxide**      **zinc sulfate**

[1]

- (c) Alex thinks that the reaction is too slow.

He does not want to change the mass of the zinc.

Suggest **two** ways that Alex could make the reaction faster.

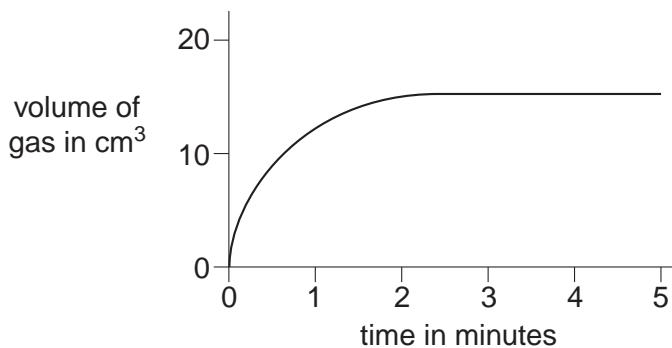
.....  
.....

[2]

**20**

- (d) Alex measures the volume of hydrogen in the gas syringe for 5 minutes.

He plots his results on a graph.



- (i) Which statement is the best description of what is happening at the **start** of the reaction?

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

No reaction is happening.

The reaction rate is at its fastest.

The reaction is slow but getting faster.

The reaction is happening at a constant rate.

**[1]**

- (ii) Which statement is the best description of what is happening after 5 minutes?

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

The reaction has stopped.

The reaction rate is at its fastest.

The reaction is increasing in rate.

Gas is being given off at a constant rate.

**[1]**

**21**

- (e) Alex measures the pH of the contents of the flask at the start and at the end of the reaction.

The pH is very low at the start and increases during the reaction.

Why does the pH change in this way?

.....  
.....

**[2]****[Total: 9]****END OF QUESTION PAPER**

**22**

**BLANK PAGE**

**PLEASE DO NOT WRITE ON THIS PAGE**

**PLEASE DO NOT WRITE ON THIS PAGE**



**Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website ([www.ocr.org.uk](http://www.ocr.org.uk)) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

# The Periodic Table of the Elements

Key	relative atomic mass atomic symbol atomic (proton) number
1 H hydrogen 1	
2 Be beryllium 4	
3 Li lithium 3	
4 Mg magnesium 12	
5 Ca calcium 20	45 Sc scandium 21
6 Na sodium 11	48 Ti titanium 22
7 K potassium 19	51 V vanadium 23
8 Rb rubidium 37	52 Cr chromium 24
9 Cs caesium 55	55 Mn manganese 25
10 Fr francium 87	56 Fe iron 26
11 La lanthanum 57	59 Co cobalt 27
12 Sr strontium 38	63.5 Ni nickel 28
13 Ba barium 56	65 Cu copper 29
14 Ac actinium 89	65 Zn zinc 30
15 Rf rutherfordium 104	70 Ga gallium 31
16 Db dubnium 105	73 Ge germanium 32
17 Sg seaborgium 106	75 As arsenic 33
18 Mt bohrium 107	79 Se selenium 34
19 F fluorine 9	80 Br bromine 35
20 Ne neon 10	84 Kr krypton 36
21 Ar argon 18	127 I iodine 53
22 Rn radon 86	131 Xe xenon 54

24	0 He helium 2	1 H hydrogen 1	2 Be beryllium 4	3 Li lithium 3	4 Mg magnesium 12	5 Ca calcium 20	6 Na sodium 11	7 K potassium 19	8 Rb rubidium 37	9 Cs caesium 55	10 Fr francium 87	11 La* lanthanum 57	12 Sr strontium 38	13 Ba barium 56	14 Ac* actinium 89	15 Rf rutherfordium 104	16 Db dubnium 105	17 Sg seaborgium 106	18 Mt bohrium 107	19 F fluorine 9	20 Ne neon 10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
11 B boron 5	12 C carbon 6	13 N nitrogen 7	14 O oxygen 8	15 P phosphorus 15	16 S sulfur 16	17 Cl chlorine 17	18 Br bromine 35	19 Se selenium 34	20 Te tellurium 52	21 Po polonium 84	22 At astatine 85	23 Rg roentgenium 111	24	25	26	27 Al aluminium 13	28 Si silicon 14	29 Ge germanium 32	30 In indium 49	31 As arsenic 33	32 Sb antimony 51	33 Ga gallium 31	34 Zn zinc 30	35.5 Cl chlorine 17	36 Kr krypton 36																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
55 Mn manganese 25	56 Fe iron 26	57 Co cobalt 27	58 Ni nickel 28	59 Cu copper 29	60 Pd palladium 46	61 Rh rhodium 45	62 Ru ruthenium 44	63 Os osmium 76	64 Ir iridium 77	65 Pt platinum 78	66 Au gold 79	67 Hg mercury 80	68 Tl thallium 81	69 Pb lead 82	70 Bi bismuth 83	71 At astatine 85	72 Rg roentgenium 111	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77	78 Pt platinum 78	79 Au gold 79	80 Hg mercury 80	81 Tl thallium 81	82 Pb lead 82	83 Bi bismuth 83	84 Po polonium 84	85 At astatine 85	86 Rn radon 86	87																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
91 Zr zirconium 40	92 Nb niobium 41	93 Mo molybdenum 42	94 Tc technetium 43	95 Ru ruthenium 44	96 Rh rhodium 45	97 Os osmium 76	98 Ir iridium 77	99 Pt platinum 78	100 Au gold 79	101 Hg mercury 80	102 Tl thallium 81	103 Pb lead 82	104 Bi bismuth 83	105 Po polonium 84	106 At astatine 85	107 Rg roentgenium 111	108 Ag silver 47	109 Cd cadmium 48	110 Ge germanium 32	111 In indium 49	112 Sn tin 50	113 Te tellurium 52	114 Sb antimony 51	115 In indium 49	116 Sn tin 50	117 Te tellurium 52	118 I iodine 53	119 Br bromine 35	120 Kr krypton 36	121 Xe xenon 54	122 I iodine 53	123 Rn radon 86	124																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
133 Cs caesium 55	134 Ba barium 56	135 La* lanthanum 57	136 Sr strontium 38	137 Ba barium 56	138 La* lanthanum 57	139 Sr strontium 38	140 Ba barium 56	141 La* lanthanum 57	142 Sr strontium 38	143 Ba barium 56	144 La* lanthanum 57	145 Sr strontium 38	146 Ba barium 56	147 La* lanthanum 57	148 Sr strontium 38	149 Ba barium 56	150 La* lanthanum 57	151 Sr strontium 38	152 Ba barium 56	153 La* lanthanum 57	154 Sr strontium 38	155 Ba barium 56	156 La* lanthanum 57	157 Sr strontium 38	158 Ba barium 56	159 La* lanthanum 57	160 Sr strontium 38	161 Ba barium 56	162 La* lanthanum 57	163 Sr strontium 38	164 Ba barium 56	165 La* lanthanum 57	166 Sr strontium 38	167 Ba barium 56	168 La* lanthanum 57	169 Sr strontium 38	170 Ba barium 56	171 La* lanthanum 57	172 Sr strontium 38	173 Ba barium 56	174 La* lanthanum 57	175 Sr strontium 38	176 Ba barium 56	177 La* lanthanum 57	178 Sr strontium 38	179 Ba barium 56	180 La* lanthanum 57	181 Sr strontium 38	182 Ba barium 56	183 La* lanthanum 57	184 Sr strontium 38	185 Ba barium 56	186 La* lanthanum 57	187 Sr strontium 38	188 Ba barium 56	189 La* lanthanum 57	190 Sr strontium 38	191 Ba barium 56	192 La* lanthanum 57	193 Sr strontium 38	194 Ba barium 56	195 La* lanthanum 57	196 Sr strontium 38	197 Ba barium 56	198 La* lanthanum 57	199 Sr strontium 38	200 Ba barium 56	201 La* lanthanum 57	202 Sr strontium 38	203 Ba barium 56	204 La* lanthanum 57	205 Sr strontium 38	206 Ba barium 56	207 La* lanthanum 57	208 Sr strontium 38	209 Ba barium 56	210 La* lanthanum 57	211 Sr strontium 38	212 Ba barium 56	213 La* lanthanum 57	214 Sr strontium 38	215 Ba barium 56	216 La* lanthanum 57	217 Sr strontium 38	218 Ba barium 56	219 La* lanthanum 57	220 Sr strontium 38	221 Ba barium 56	222 La* lanthanum 57	223 Sr strontium 38	224 Ba barium 56	225 La* lanthanum 57	226 Sr strontium 38	227 Ba barium 56	228 La* lanthanum 57	229 Sr strontium 38	230 Ba barium 56	231 La* lanthanum 57	232 Sr strontium 38	233 Ba barium 56	234 La* lanthanum 57	235 Sr strontium 38	236 Ba barium 56	237 La* lanthanum 57	238 Sr strontium 38	239 Ba barium 56	240 La* lanthanum 57	241 Sr strontium 38	242 Ba barium 56	243 La* lanthanum 57	244 Sr strontium 38	245 Ba barium 56	246 La* lanthanum 57	247 Sr strontium 38	248 Ba barium 56	249 La* lanthanum 57	250 Sr strontium 38	251 Ba barium 56	252 La* lanthanum 57	253 Sr strontium 38	254 Ba barium 56	255 La* lanthanum 57	256 Sr strontium 38	257 Ba barium 56	258 La* lanthanum 57	259 Sr strontium 38	260 Ba barium 56	261 La* lanthanum 57	262 Sr strontium 38	263 Ba barium 56	264 La* lanthanum 57	265 Sr strontium 38	266 Ba barium 56	267 La* lanthanum 57	268 Sr strontium 38	269 Ba barium 56	270 La* lanthanum 57	271 Sr strontium 38	272 Ba barium 56	273 La* lanthanum 57	274 Sr strontium 38	275 Ba barium 56	276 La* lanthanum 57	277 Sr strontium 38	278 Ba barium 56	279 La* lanthanum 57	280 Sr strontium 38	281 Ba barium 56	282 La* lanthanum 57	283 Sr strontium 38	284 Ba barium 56	285 La* lanthanum 57	286 Sr strontium 38	287 Ba barium 56	288 La* lanthanum 57	289 Sr strontium 38	290 Ba barium 56	291 La* lanthanum 57	292 Sr strontium 38	293 Ba barium 56	294 La* lanthanum 57	295 Sr strontium 38	296 Ba barium 56	297 La* lanthanum 57	298 Sr strontium 38	299 Ba barium 56	300 La* lanthanum 57	301 Sr strontium 38	302 Ba barium 56	303 La* lanthanum 57	304 Sr strontium 38	305 Ba barium 56	306 La* lanthanum 57	307 Sr strontium 38	308 Ba barium 56	309 La* lanthanum 57	310 Sr strontium 38	311 Ba barium 56	312 La* lanthanum 57	313 Sr strontium 38	314 Ba barium 56	315 La* lanthanum 57	316 Sr strontium 38	317 Ba barium 56	318 La* lanthanum 57	319 Sr strontium 38	320 Ba barium 56	321 La* lanthanum 57	322 Sr strontium 38	323 Ba barium 56	324 La* lanthanum 57	325 Sr strontium 38	326 Ba barium 56	327 La* lanthanum 57	328 Sr strontium 38	329 Ba barium 56	330 La* lanthanum 57	331 Sr strontium 38	332 Ba barium 56	333 La* lanthanum 57	334 Sr strontium 38	335 Ba barium 56	336 La* lanthanum 57	337 Sr strontium 38	338 Ba barium 56	339 La* lanthanum 57	340 Sr strontium 38	341 Ba barium 56	342 La* lanthanum 57	343 Sr strontium 38	344 Ba barium 56	345 La* lanthanum 57	346 Sr strontium 38	347 Ba barium 56	348 La* lanthanum 57	349 Sr strontium 38	350 Ba barium 56	351 La* lanthanum 57	352 Sr strontium 38	353 Ba barium 56	354 La* lanthanum 57	355 Sr strontium 38	356 Ba barium 56	357 La* lanthanum 57	358 Sr strontium 38	359 Ba barium 56	360 La* lanthanum 57	361 Sr strontium 38	362 Ba barium 56	363 La* lanthanum 57	364 Sr strontium 38	365 Ba barium 56	366 La* lanthanum 57	367 Sr strontium 38	368 Ba barium 56	369 La* lanthanum 57	370 Sr strontium 38	371 Ba barium 56	372 La* lanthanum 57	373 Sr strontium 38	374 Ba barium 56	375 La* lanthanum 57	376 Sr strontium 38	377 Ba barium 56	378 La* lanthanum 57	379 Sr strontium 38	380 Ba barium 56	381 La* lanthanum 57	382 Sr strontium 38	383 Ba barium 56	384 La* lanthanum 57	385 Sr strontium 38	386 Ba barium 56	387 La* lanthanum 57	388 Sr strontium 38	389 Ba barium 56	390 La* lanthanum 57	391 Sr strontium 38	392 Ba barium 56	393 La* lanthanum 57	394 Sr strontium 38	395 Ba barium 56	396 La* lanthanum 57	397 Sr strontium 38	398 Ba barium 56	399 La* lanthanum 57	400 Sr strontium 38	401 Ba barium 56	402 La* lanthanum 57	403 Sr strontium 38	404 Ba barium 56	405 La* lanthanum 57	406 Sr strontium 38	407 Ba barium 56	408 La* lanthanum 57	409 Sr strontium 38	410 Ba barium 56	411 La* lanthanum 57	412 Sr strontium 38	413 Ba barium 56	414 La* lanthanum 57	415 Sr strontium 38	416 Ba barium 56	417 La* lanthanum 57	418 Sr strontium 38	419 Ba barium 56	420 La* lanthanum 57	421 Sr strontium 38	422 Ba barium 56	423 La* lanthanum 57	424 Sr strontium 38	425 Ba barium 56	426 La* lanthanum 57	427 Sr strontium 38	428 Ba barium 56	429 La* lanthanum 57	430 Sr strontium 38	431 Ba barium 56	432 La* lanthanum 57	433 Sr strontium 38	434 Ba barium 56	435 La* lanthanum 57	436 Sr strontium 38	437 Ba barium 56	438 La* lanthanum 57	439 Sr strontium 38	440 Ba barium 56	441 La* lanthanum 57	442 Sr strontium 38	443 Ba barium 56	444 La* lanthanum 57	445 Sr strontium 38	446 Ba barium 56	447 La* lanthanum 57	448 Sr strontium 38	449 Ba barium 56	450 La* lanthanum 57	451 Sr strontium 38	452 Ba barium 56	453 La* lanthanum 57	454 Sr strontium 38	455 Ba barium 56	456 La* lanthanum 57	457 Sr strontium 38	458 Ba barium 56	459 La* lanthanum 57	460 Sr strontium 38	461 Ba barium 56	462 La* lanthanum 57	463 Sr strontium 38	464 Ba barium 56	465 La* lanthanum 57	466 Sr strontium 38	467 Ba barium 56	468 La* lanthanum 57	469 Sr strontium 38	470 Ba barium 56	471 La* lanthanum 57	472 Sr strontium 38	473 Ba barium 56	474 La* lanthanum 57	475 Sr strontium 38	476 Ba barium 56	477 La* lanthanum 57	478 Sr strontium 38	479 Ba barium 56	480 La* lanthanum 57	481 Sr strontium 38	482 Ba barium 56	483 La* lanthanum 57	484 Sr strontium 38	485 Ba barium 56	486 La* lanthanum 57	487 Sr strontium 38	488 Ba barium 56	489 La* lanthanum 57	490 Sr strontium 38	491 Ba barium 56	492 La* lanthanum 57	493 Sr strontium 38	494 Ba barium 56	495 La* lanthanum 57	496 Sr strontium 38	497 Ba barium 56	498 La* lanthanum 57	499 Sr strontium 38	500 Ba barium 56	501 La* lanthanum 57	502 Sr strontium 38	503 Ba barium 56	504 La* lanthanum 57	505 Sr strontium 38	506 Ba barium 56	507 La* lanthanum 57	508 Sr strontium 38	509 Ba barium 56	510 La* lanthanum 57	511 Sr strontium 38	512 Ba barium 56	513 La* lanthanum 57	514 Sr strontium 38	515 Ba barium 56	516 La* lanthanum 57	517 Sr strontium 38	518 Ba barium 56	519 La* lanthanum 57	520 Sr strontium 38	521 Ba barium 56	522 La* lanthanum 57	523 Sr strontium 38	524 Ba barium 56	525 La* lanthanum 57	526 Sr strontium 38	527 Ba barium 56	528 La* lanthanum 57	529 Sr strontium 38	530 Ba barium 56	531 La* lanthanum 57	532 Sr strontium 38	533 Ba barium 56	534 La* lanthanum 57	535 Sr strontium 38	536 Ba barium 56	537 La* lanthanum 57	538 Sr strontium 38	539 Ba barium 56	540 La* lanthanum 57	541 Sr strontium 38	542 Ba barium 56	543 La* lanthanum 57	544 Sr strontium 38	545 Ba barium 56	546 La* lanthanum 57	547 Sr strontium 38	548 Ba barium 56	549 La* lanthanum 57	550 Sr strontium 38	551 Ba barium 56	552 La* lanthanum 57	553 Sr strontium 38	554 Ba barium 56	555 La* lanthanum 57	556 Sr strontium 38	557 Ba barium 56	558 La* lanthanum 57	559 Sr strontium 38	560 Ba barium 56	561 La* lanthanum 57	562 Sr strontium 38	563 Ba barium 56	564 La* lanthanum 57	565 Sr strontium 38	566 Ba barium 56	567 La* lanthanum 57	568 Sr strontium 38	569 Ba barium 56	570 La* lanthanum 57	571 Sr strontium 38	572 Ba barium 56	573 La* lanthanum 57	574 Sr strontium 38	575 Ba barium 56	576 La* lanthanum 57	577 Sr strontium 38	578 Ba barium 56	579 La* lanthanum 57	580 Sr strontium 38	581 Ba barium 56	582 La* lanthanum 57	583 Sr strontium 38	584 Ba barium 56	585 La* lanthanum 57	586 Sr strontium 38	587 Ba barium 56	588 La* lanthanum 57	589 Sr strontium 38	590 Ba barium 56	591 La* lanthanum 57	592 Sr strontium 38	593 Ba barium 56	594 La* lanthanum 57	595 Sr strontium 38	596 Ba barium 56	597 La* lanthanum 57	598 Sr strontium 38	599 Ba barium 56	600 La* lanthanum 57	601 Sr strontium 38	602 Ba barium 56	603 La* lanthanum 57	604 Sr strontium 38	605 Ba barium 56	606 La* lanthanum 57	607 Sr strontium 38	608 Ba barium 56	609 La* lanthanum 57	610 Sr strontium 38	611 Ba barium 56	612 La* lanthanum 57	613 Sr strontium 38	614 Ba barium 56	615 La* lanthanum 57	616 Sr strontium 38	617 Ba barium 56	618 La* lanthanum 57	619 Sr strontium 38	620 Ba barium 56	621 La* lanthanum 57	622 Sr strontium 38	623 Ba barium 56	624 La* lanthanum 57	625 Sr strontium 38	626 Ba barium 56	627 La* lanthanum 57	628 Sr strontium 38	629 Ba barium 56	630 La* lanthanum 57	631 Sr strontium 38	632 Ba barium 56	633 La* lanthanum 57	634 Sr strontium 38	635 Ba barium 56	636 La* lanthanum 57	637 Sr strontium 38	638 Ba barium 56	639 La* lanthanum 57	640 Sr strontium 38	641 Ba barium 56	642 La* lanthanum 57	643 Sr strontium 38	644 Ba barium 56	645 La* lanthanum 57	646 Sr strontium 38	647 Ba barium 56	648 La* lanthanum 57	649 Sr strontium 38	650 Ba barium 56	651 La* lanthanum 57	652 Sr strontium 38	653 Ba barium 56	654 La* lanthanum 57	655 Sr strontium 38	656 Ba barium 56	657 La* lanthanum 57	658 Sr strontium 38	659 Ba barium 56	660 La* lanthanum 57	661 Sr strontium 38	662 Ba barium 56	663 La* lanthanum 57