

Monday 25 June 2012 – Afternoon**GCSE TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A****A322/02** Unit 2: Modules C4 C5 C6 (Higher Tier)

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: 40 minutes

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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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

- 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 **42**.
- This document consists of **16** pages. Any blank pages are indicated.
- The Periodic Table is printed on the back page.

Answer **all** the questions.

- 1 The table shows data about the properties of some Group 1 elements.

Element	Properties			
	Melting point in °C	Boiling point in °C	Density in g/cm ³	Formula of hydroxide
Lithium	180.0	1330	0.53	LiOH
Sodium	97.8	890	0.97	NaOH
Potassium	63.7	774	0.86	KOH
Rubidium	38.9	688	1.53	RbOH

- (a) Elements in the same group show similarities and trends in their properties.

- (i) What similarities and trends are shown in the table?

.....

.....

.....

..... [3]

- (ii) Which property in the table does **not** show a clear trend? Explain your reasoning.

.....

.....

..... [2]

(b) Caesium is another element in Group 1. It is below rubidium in the Periodic Table.

(i) Which of the statements about caesium are **true** and which are **false**?

Put one tick (✓) in each row.

	true (✓)	false (✓)
Caesium is more reactive than sodium.		
Caesium is a non-metal.		
An atom of caesium has one electron in its outer shell.		
Caesium has fewer protons than lithium.		
Caesium reacts with water to make hydrogen gas.		

[2]

(ii) Predict the formula of caesium hydroxide.

formula [1]

[Total: 8]

2 The table below shows the number of protons and electrons in five particles, **A**, **B**, **C**, **D** and **E**.

Each particle is either an atom or an ion.

Particle	Number of protons	Number of electrons
A	3	3
B	9	9
C	3	2
D	8	10
E	17	17

(a) Use the letters **A**, **B**, **C**, **D** and **E** to answer the following questions.

(i) Which two particles are atoms from Group 7 of the Periodic Table?

answer and [1]

(ii) Which two particles are an atom and an ion of the same element?

answer and [1]

(iii) Which particle is a negative ion?

answer [1]

(b) Particle **C** is an ion.

What is the charge on particle **C**?

answer [1]

[Total: 4]

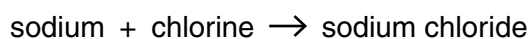
3 Chlorine, bromine and iodine are in Group 7 of the Periodic Table.

(a) Draw straight lines to show the **colour** and **state** of each **element** at room temperature and pressure.

colour	element	state
grey	chlorine	(s)
green	bromine	(l)
red-brown	iodine	(aq)
white		(g)

[2]

(b) Sodium reacts with chlorine gas to form sodium chloride.







Write a balanced symbol equation for this reaction.

..... [2]

[Total: 4]

4 Four gases that are in the air are nitrogen, oxygen, argon and carbon dioxide.

(a) Draw four lines to connect the **name** of each gas to the correct **arrangement of atoms and its relative mass**.

name	arrangement of atoms and relative mass
nitrogen	 relative mass = 32
oxygen	 relative mass = 40
argon	 relative mass = 44
carbon dioxide	 relative mass = 28

[2]

(b) Which of the following statements about gases in the air are **true**?

Put ticks (✓) in the boxes next to the **two** correct answers.

All of the gases in the air are elements.

Air contains only non-metal elements.

There are weak attractions between molecules in the air.

All the gases have high melting points and boiling points.

The gases are good conductors of electricity.

[2]

(c) Molecules in the air contain atoms that are held together by strong covalent bonds.

Which of the following statements are the **best** descriptions of covalent bonds in these molecules?

Put ticks (✓) in the boxes next to the **two** best answers.

A covalent bond is made by sharing electrons.

The atoms gain positive or negative charges when the bond is made.

The atoms are held together by the attractions between the nuclei of the atoms and the electrons between them.

Each atom is surrounded by a sea of electrons that can move.

The atoms are bonded covalently into large, three dimensional structures.

[2]

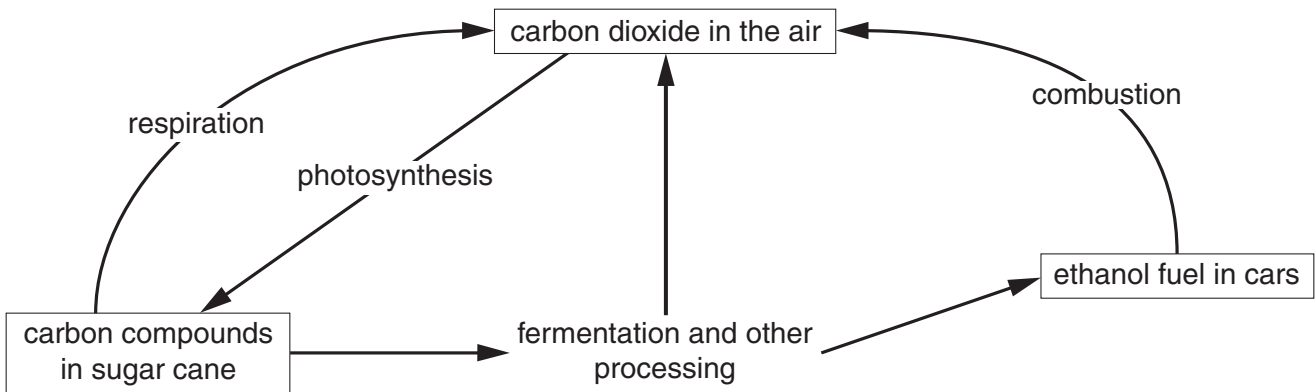
[Total: 6]

5 In some parts of the world ethanol is used as a fuel for cars.

Some people use ethanol because they say it is a **carbon neutral fuel**.

A carbon neutral fuel does not add to the amount of carbon dioxide in the air.

The diagram shows how the ethanol is made and used.



Use the diagram to explain why ethanol is a **carbon neutral fuel**.

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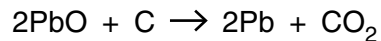
.....

..... [3]

[Total: 3]

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

Lead metal can be extracted from massicot by heating it with carbon.



(a) What is the maximum mass of lead that can be extracted from 446 g of lead oxide?

Look up the relative atomic masses in the Periodic Table.

Start by working out the relative formula mass of lead oxide.

relative formula mass of lead oxide, PbO =

mass of lead that can be extracted from 446 g lead oxide =g
[3]

(b) Aluminium is extracted from aluminium oxide, Al_2O_3 , by electrolysis.

Why is it **not** possible to extract aluminium by heating aluminium oxide with carbon?

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

Too much carbon would be needed.

Aluminium oxide contains more oxygen than other metal oxides.

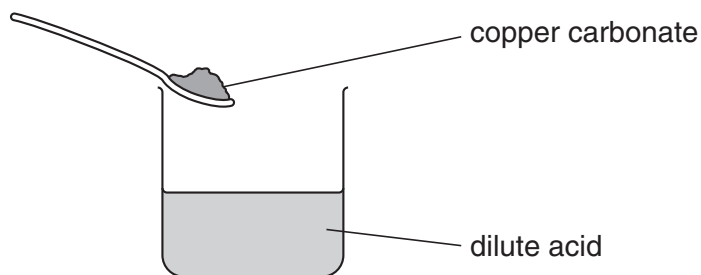
Aluminium is a very reactive metal.

Aluminium oxide has a very high melting point.

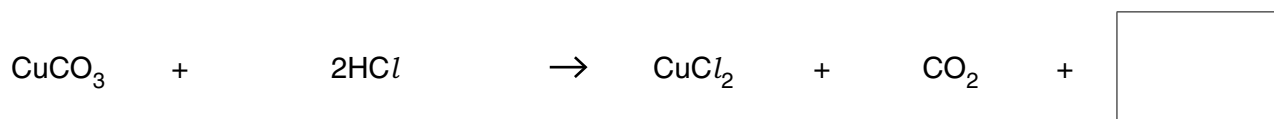
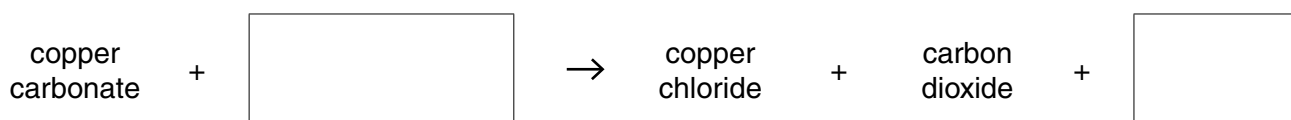
[1]

[Total: 4]

- 7 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 makes crystals from her solution. She makes 4.5 g of dry copper chloride crystals.

- (i) She calculates her percentage yield to be 90%.

What is the **theoretical** yield?

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

0.05% **4.05 g** **5 g** **9 g** **10%** **45%**

[1]

- (ii) Sue did not dry her crystals properly.

Her crystals contain 1.0 g of water.

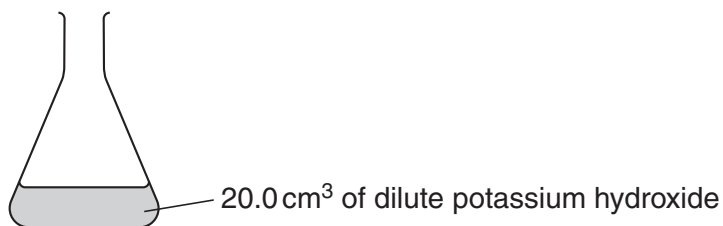
Calculate Sue's percentage yield after she has dried her crystals properly.

percentage yield = % [1]

[Total: 5]

- 8 Alex does a titration to find out the volume of sulfuric acid that reacts with 20.0cm^3 of dilute potassium hydroxide.

(a) Alex measures 20.0cm^3 of dilute potassium hydroxide into a flask.



Alex does titrations to find out the volume of acid that exactly reacts with the 20.0cm^3 of dilute potassium hydroxide.

Describe in detail how Alex does the titrations.

.....

.....

.....

.....

..... [4]

(b) Alex does some more titrations with different concentrations of sulfuric acid.

He uses 20.0cm^3 of the **same concentration of potassium hydroxide** every time.

The table shows some of Alex's results.

Concentration of sulfuric acid in g/dm^3	Volume of sulfuric acid needed to neutralise 20cm^3 potassium hydroxide in cm^3
10.0	80.0
20.0	
40.0	20.0
	13.3
80.0	10.0

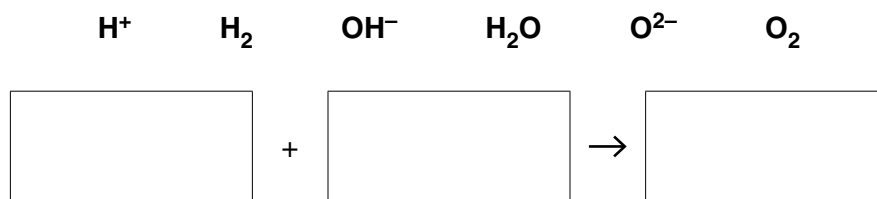
Complete the table by filling in the two empty boxes.

[2]

(c) Alex knows that the reaction between the acid and the alkali is called neutralisation.

Complete the ionic equation for the neutralisation reaction.

Choose formulae from this list.



[2]

[Total: 8]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1	2	3	4	5	6	7	0	
7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	14 N nitrogen 7	15 O oxygen 8	16 F fluorine 9	17 Ne neon 10
19 K potassium 19	20 Ca calcium 20	23 Sc scandium 21	24 Ti titanium 22	25 V vanadium 23	26 Cr chromium 24	27 Mn manganese 25	28 Fe iron 26	29 Co cobalt 27
37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	43 Tc technetium [98]	44 Ru ruthenium 44	45 Rh rhodium 45
55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77
87 Fr francium 87	88 Ra radium 88	89 Ac* actinium 89	104 Rf rutherfordium 104	105 Db dubnium 105	106 Sg seaborgium 106	107 Bh bohrium 107	108 Hs hassium 108	109 Mt meitnerium 109
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77
199 K potassium 19	200 Ca calcium 20	201 Sc scandium 21	222 Ti titanium 22	223 V vanadium 23	224 Cr chromium 24	225 Mn manganese 25	226 Fe iron 26	227 Co cobalt 27
269 Rb rubidium 37	270 Sr strontium 38	271 Y yttrium 39	272 Zr zirconium 40	273 Nb niobium 41	274 Mo molybdenum 42	275 Tc technetium [98]	276 Ru ruthenium 44	277 Rh rhodium 45
337 Cs caesium 55	338 Ba barium 56	339 La* lanthanum 57	372 Hf hafnium 72	373 Ta tantalum 73	374 W tungsten 74	375 Re rhenium 75	376 Os osmium 76	377 Ir iridium 77
409 K potassium 19	410 Ca calcium 20	411 Sc scandium 21	422 Ti titanium 22	423 V vanadium 23	424 Cr chromium 24	425 Mn manganese 25	426 Fe iron 26	427 Co cobalt 27
537 Rb rubidium 37	538 Sr strontium 38	539 Y yttrium 39	572 Zr zirconium 40	573 Nb niobium 41	574 Mo molybdenum 42	575 Tc technetium [98]	576 Ru ruthenium 44	577 Rh rhodium 45
689 Cs caesium 55	690 Ba barium 56	691 La* lanthanum 57	722 Hf hafnium 72	723 Ta tantalum 73	724 W tungsten 74	725 Re rhenium 75	726 Os osmium 76	727 Ir iridium 77
809 K potassium 19	810 Ca calcium 20	811 Sc scandium 21	822 Ti titanium 22	823 V vanadium 23	824 Cr chromium 24	825 Mn manganese 25	826 Fe iron 26	827 Co cobalt 27
1089 Rb rubidium 37	1090 Sr strontium 38	1091 Y yttrium 39	1122 Zr zirconium 40	1123 Nb niobium 41	1124 Mo molybdenum 42	1125 Tc technetium [98]	1126 Ru ruthenium 44	1127 Rh rhodium 45
1379 Cs caesium 55	1380 Ba barium 56	1381 La* lanthanum 57	1422 Hf hafnium 72	1423 Ta tantalum 73	1424 W tungsten 74	1425 Re rhenium 75	1426 Os osmium 76	1427 Ir iridium 77
1649 K potassium 19	1650 Ca calcium 20	1651 Sc scandium 21	1662 Ti titanium 22	1663 V vanadium 23	1664 Cr chromium 24	1665 Mn manganese 25	1666 Fe iron 26	1667 Co cobalt 27
2149 Rb rubidium 37	2150 Sr strontium 38	2151 Y yttrium 39	2182 Zr zirconium 40	2183 Nb niobium 41	2184 Mo molybdenum 42	2185 Tc technetium [98]	2186 Ru ruthenium 44	2187 Rh rhodium 45
2689 Cs caesium 55	2690 Ba barium 56	2691 La* lanthanum 57	2722 Hf hafnium 72	2723 Ta tantalum 73	2724 W tungsten 74	2725 Re rhenium 75	2726 Os osmium 76	2727 Ir iridium 77
3249 K potassium 19	3250 Ca calcium 20	3251 Sc scandium 21	3262 Ti titanium 22	3263 V vanadium 23	3264 Cr chromium 24	3265 Mn manganese 25	3266 Fe iron 26	3267 Co cobalt 27
4149 Rb rubidium 37	4150 Sr strontium 38	4151 Y yttrium 39	4182 Zr zirconium 40	4183 Nb niobium 41	4184 Mo molybdenum 42	4185 Tc technetium [98]	4186 Ru ruthenium 44	4187 Rh rhodium 45
5049 Cs caesium 55	5050 Ba barium 56	5051 La* lanthanum 57	5082 Hf hafnium 72	5083 Ta tantalum 73	5084 W tungsten 74	5085 Re rhenium 75	5086 Os osmium 76	5087 Ir iridium 77
5849 K potassium 19	5850 Ca calcium 20	5851 Sc scandium 21	5862 Ti titanium 22	5863 V vanadium 23	5864 Cr chromium 24	5865 Mn manganese 25	5866 Fe iron 26	5867 Co cobalt 27
7749 Rb rubidium 37	7750 Sr strontium 38	7751 Y yttrium 39	7782 Zr zirconium 40	7783 Nb niobium 41	7784 Mo molybdenum 42	7785 Tc technetium [98]	7786 Ru ruthenium 44	7787 Rh rhodium 45
8649 Cs caesium 55	8650 Ba barium 56	8651 La* lanthanum 57	8682 Hf hafnium 72	8683 Ta tantalum 73	8684 W tungsten 74	8685 Re rhenium 75	8686 Os osmium 76	8687 Ir iridium 77
9549 K potassium 19	9550 Ca calcium 20	9551 Sc scandium 21	9562 Ti titanium 22	9563 V vanadium 23	9564 Cr chromium 24	9565 Mn manganese 25	9566 Fe iron 26	9567 Co cobalt 27
12449 Rb rubidium 37	12450 Sr strontium 38	12451 Y yttrium 39	12482 Zr zirconium 40	12483 Nb niobium 41	12484 Mo molybdenum 42	12485 Tc technetium [98]	12486 Ru ruthenium 44	12487 Rh rhodium 45
15349 Cs caesium 55	15350 Ba barium 56	15351 La* lanthanum 57	15382 Hf hafnium 72	15383 Ta tantalum 73	15384 W tungsten 74	15385 Re rhenium 75	15386 Os osmium 76	15387 Ir iridium 77
16149 K potassium 19	16150 Ca calcium 20	16151 Sc scandium 21	16162 Ti titanium 22	16163 V vanadium 23	16164 Cr chromium 24	16165 Mn manganese 25	16166 Fe iron 26	16167 Co cobalt 27
21049 Rb rubidium 37	21050 Sr strontium 38	21051 Y yttrium 39	21082 Zr zirconium 40	21083 Nb niobium 41	21084 Mo molybdenum 42	21085 Tc technetium [98]	21086 Ru ruthenium 44	21087 Rh rhodium 45
23949 Cs caesium 55	23950 Ba barium 56	23951 La* lanthanum 57	2402 Hf hafnium 72	2403 Ta tantalum 73	2404 W tungsten 74	2405 Re rhenium 75	2406 Os osmium 76	2407 Ir iridium 77
24749 K potassium 19	24750 Ca calcium 20	24751 Sc scandium 21	24762 Ti titanium 22	24763 V vanadium 23	24764 Cr chromium 24	24765 Mn manganese 25	24766 Fe iron 26	24767 Co cobalt 27
32049 Rb rubidium 37	32050 Sr strontium 38	32051 Y yttrium 39	32082 Zr zirconium 40	32083 Nb niobium 41	32084 Mo molybdenum 42	32085 Tc technetium [98]	32086 Ru ruthenium 44	32087 Rh rhodium 45
39949 Cs caesium 55	39950 Ba barium 56	39951 La* lanthanum 57	4002 Hf hafnium 72	4003 Ta tantalum 73	4004 W tungsten 74	4005 Re rhenium 75	4006 Os osmium 76	4007 Ir iridium 77
40749 K potassium 19	40750 Ca calcium 20	40751 Sc scandium 21	40762 Ti titanium 22	40763 V vanadium 23	40764 Cr chromium 24	40765 Mn manganese 25	40766 Fe iron 26	40767 Co cobalt 27
53049 Rb rubidium 37	53050 Sr strontium 38	53051 Y yttrium 39	53082 Zr zirconium 40	53083 Nb niobium 41	53084 Mo molybdenum 42	53085 Tc technetium [98]	53086 Ru ruthenium 44	53087 Rh rhodium 45
61949 Cs caesium 55	61950 Ba barium 56	61951 La* lanthanum 57	6202 Hf hafnium 72	6203 Ta tantalum 73	6204 W tungsten 74	6205 Re rhenium 75	6206 Os osmium 76	6207 Ir iridium 77
62749 K potassium 19	62750 Ca calcium 20	62751 Sc scandium 21	62762 Ti titanium 22	62763 V vanadium 23	62764 Cr chromium 24	62765 Mn manganese 25	62766 Fe iron 26	62767 Co cobalt 27
81049 Rb rubidium 37	81050 Sr strontium 38	81051 Y yttrium 39	81082 Zr zirconium 40	81083 Nb niobium 41	81084 Mo molybdenum 42	81085 Tc technetium [98]	81086 Ru ruthenium 44	81087 Rh rhodium 45
89949 Cs caesium 55	89950 Ba barium 56	89951 La* lanthanum 57	9002 Hf hafnium 72	9003 Ta tantalum 73	9004 W tungsten 74	9005 Re rhenium 75	9006 Os osmium 76	9007 Ir iridium 77
90749 K potassium 19	90750 Ca calcium 20	90751 Sc scandium 21	90762 Ti titanium 22	90763 V vanadium 23	90764 Cr chromium 24	90765 Mn manganese 25	90766 Fe iron 26	90767 Co cobalt 27
119049 Rb rubidium 37	119050 Sr strontium 38	119051 Y yttrium 39	119082 Zr zirconium 40	119083 Nb niobium 41	119084 Mo molybdenum 42	119085 Tc technetium [98]	119086 Ru ruthenium 44	119087 Rh rhodium 45
127949 Cs caesium 55	127950 Ba barium 56	127951 La* lanthanum 57	12802 Hf hafnium 72	12803 Ta tantalum 73	12804 W tungsten 74	12805 Re rhenium 75	12806 Os osmium 76	12807 Ir iridium 77
128749 K potassium 19	128750 Ca calcium 20	128751 Sc scandium 21	128762 Ti titanium 22	128763 V vanadium 23	128764 Cr chromium 24	128765 Mn manganese 25	128766 Fe iron 26	128767 Co cobalt 27
167049 Rb rubidium 37	167050 Sr strontium 38	167051 Y yttrium 39	167082 Zr zirconium 40	167083 Nb niobium 41	167084 Mo molybdenum 42	167085 Tc technetium [98]	167086 Ru ruthenium 44	167087 Rh rhodium 45
175949 Cs caesium 55	175950 Ba barium 56	175951 La* lanthanum 57	17602 Hf hafnium 72	17603 Ta tantalum 73	17604 W tungsten 74	17605 Re rhenium 75	17606 Os osmium 76	17607 Ir iridium 77
176749 K potassium 19	176750 Ca calcium 20	176751 Sc scandium 21	176762 Ti titanium 22	176763 V vanadium 23	176764 Cr chromium 24	176765 Mn manganese 25	176766 Fe iron 26	176767 Co cobalt 27
215049 Rb rubidium 37	215050 Sr strontium 38	215051 Y yttrium 39	215082 Zr zirconium 40	215083 Nb niobium 41	215084 Mo molybdenum 42	215085 Tc technetium [98]	215086 Ru ruthenium 44	215087 Rh rhodium 45
223949 Cs caesium 55	223950 Ba barium 56	223951 La* lanthanum 57	22402 Hf hafnium 72	22403 Ta tantalum 73	22404 W tungsten 74	22405 Re rhenium 75	22406 Os osmium 76	22407 Ir iridium 77
224749 K potassium 19	224750 Ca calcium 20	224751 Sc scandium 21	224762 Ti titanium 22	224763 V vanadium 23	224764 Cr chromium 24	224765 Mn manganese 25	224766 Fe iron 26	224767 Co cobalt 27
263049 Rb rubidium 37	263050 Sr strontium 38	263051						