Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4462/02

W15-4462-02

SCIENCE A/CHEMISTRY

CHEMISTRY 1
HIGHER TIER

A.M. TUESDAY, 13 January 2015

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**8**	
2.	**10**	
3.	**6**	
4.	**6**	
5.	**11**	
6.	**7**	
7.	**6**	
8.	**6**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.
Do not use gel pen or correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

If you run out of space, use a standard 4-page continuation booklet. Number the question(s) clearly and put your continuation booklet in this question-and-answer booklet. No other style of answer booklet should be used.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

Assessment will take into account the quality of written communication (QWC) in your answers to questions **3** and **8**.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

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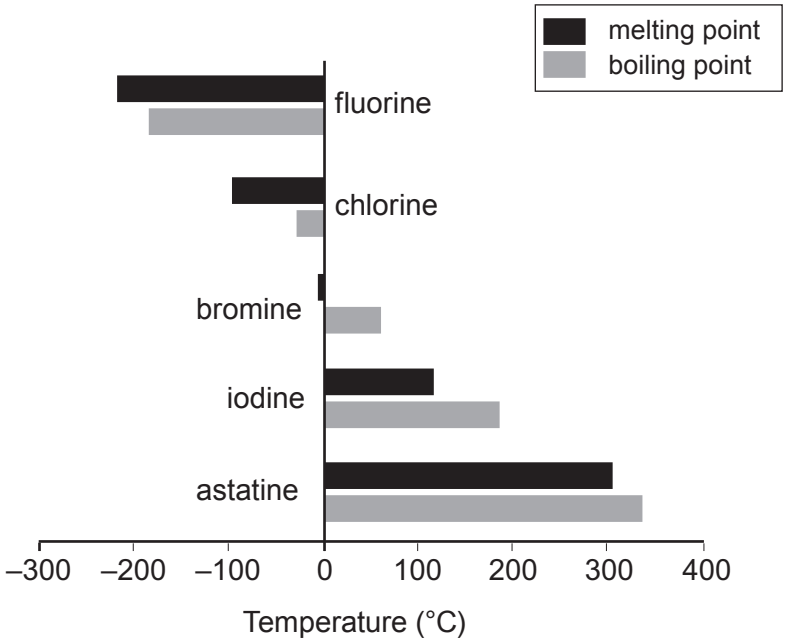
Answer **all** *questions*.

1. *(a)* The following chart shows the melting points and boiling points of the elements in Group 7.



Give the state (solid, liquid or gas) of bromine at room temperature giving the reasons for your answer. [2]

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(b) The following table shows the observations made when some Group 7 elements react with hydrogen.

Element	Observations
chlorine	explodes in sunlight
bromine	violent reaction when heated
iodine	reacts when heated strongly

Describe the trend in reactivity within the group and use this trend to predict how astatine would react with hydrogen. [2]

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Examiner only

(c) Group 7 elements also react with iron. Balance the following symbol equation that shows the reaction of iron and fluorine. [1]

$$\square\ Fe + \square\ F_2 \longrightarrow \square\ FeF_3$$

(d) Chlorine and iodine can be extracted from seawater by electrolysis.

(i) Balance the following electrode equation showing how chlorine is formed. [1]

$$\square\ Cl^- - \square\ e^- \longrightarrow Cl_2$$

(ii) Chlorides make up 55% of the salts present in seawater and it is therefore economically viable to extract chlorine from seawater. Suggest a reason why iodine is no longer extracted in this way. [1]

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(iii) State the property of chlorine and iodine that make them suitable for use in disinfectants and antiseptics. [1]

.....

8

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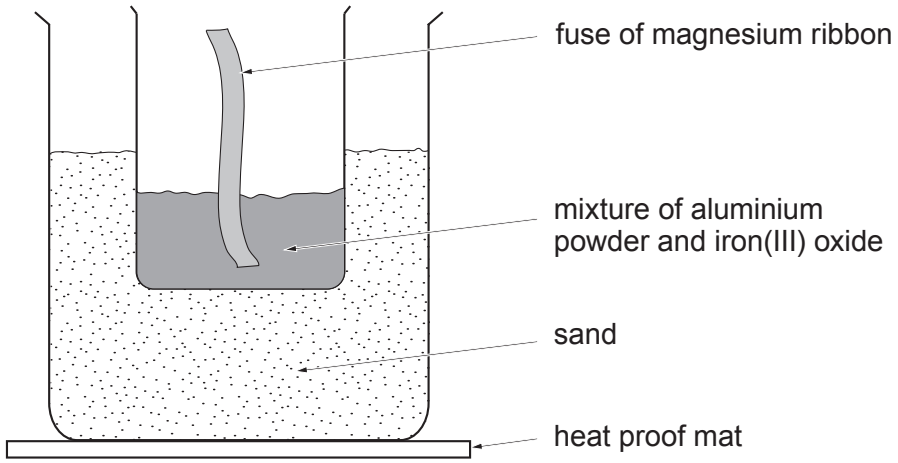
2. *(a)* When a mixture of iron(III) oxide and aluminium powder (thermite) is heated in the apparatus shown below, there is a violent reaction. There is a bright flame, sparks are produced and molten iron is formed.



(i) Write a **word** equation for the reaction taking place. [2]

..... + ... ⟶ ..... + ...

(ii) Explain this reaction in terms of reactivity. [2]

.....

.....

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(iii) State how the observations would be different if the mixture were replaced with a mixture of copper powder and aluminium oxide. [1]

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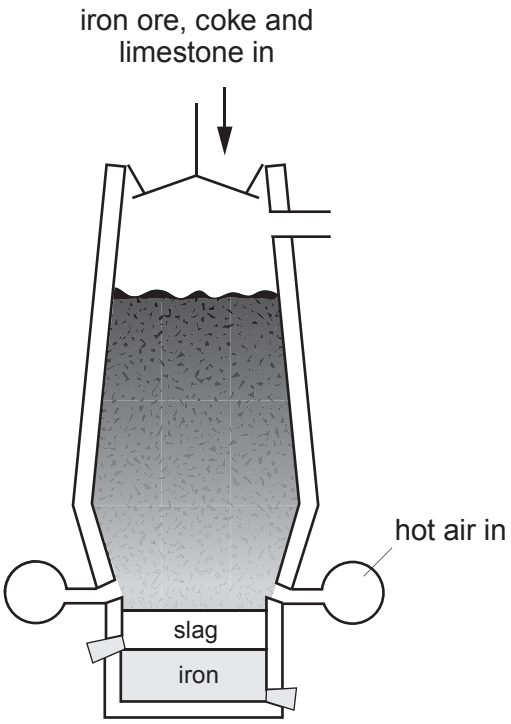
Examiner only

(b) Iron is extracted from its ore in a blast furnace.



(i) State the purpose of the following raw materials. [3]

Iron ore

.....

.....

Coke

.....

.....

Limestone

.....

.....

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(ii) The following equation shows the reaction taking place.

$$Fe_2O_3 + \square\ CO \longrightarrow \square\ Fe + \square\ CO_2$$

I. Balance the equation. [1]

II. Iron(III) oxide is reduced during the reaction. Give the meaning of *reduction*. [1]

.....

.....

10

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3. Describe the properties of metals and relate these properties to the uses of **two** metals of your choice. [6 QWC]

6

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4. The diagram below shows the early form of the Periodic Table developed by Dmitri Mendeleev.

I	II	III	IV	V	VI	VII			
H 1.01									
Li 6.94	**Be** 9.01	**B** 10.8	**C** 12.0	**N** 14.0	**O** 16.0	**F** 19.0			
Na 23.0	**Mg** 24.3	**Al** 27.0	**Si** 28.1	**P** 31.0	**S** 32.1	**Cl** 35.5		VIII	
K 39.1	**Ca** 40.1		**Ti** 47.9	**V** 50.9	**Cr** 52.0	**Mn** 54.9	**Fe** 55.9	**Co** 58.9	**Ni** 58.7
Cu 63.5	**Zn** 65.4			**As** 74.9	**Se** 79.0	**Br** 79.9			
Rb 85.5	**Sr** 87.6	**Y** 88.9	**Zr** 91.2	**Nb** 92.9	**Mo** 95.9		**Ru** 101	**Rh** 103	**Pd** 106
Ag 108	**Cd** 112	**In** 115	**Sn** 119	**Sb** 122	**Te** 128	**I** 127			
Ce 133	**Ba** 137	**La** 139		**Ta** 181	**W** 184		**Os** 194	**Ir** 192	**Pt** 195
Au 197	**Hg** 201	**Ti** 204	**Pb** 207	**Bi** 209					
			Th 232		**U** 238				

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(a) State what information Mendeleev used to arrange the elements. [2]

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.....

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(b) State **one** difference and **one** similarity in the appearance of Mendeleev's table and today's Periodic Table. [2]

Similarity

.....

.....

Difference

.....

.....

(c) Complete the following table that shows the position of some elements in the modern Periodic Table. [2]

Element	Symbol	Group	Period
helium	.....	0	1
chlorine	Cl	7	.....
calcium	Ca	.....	.....

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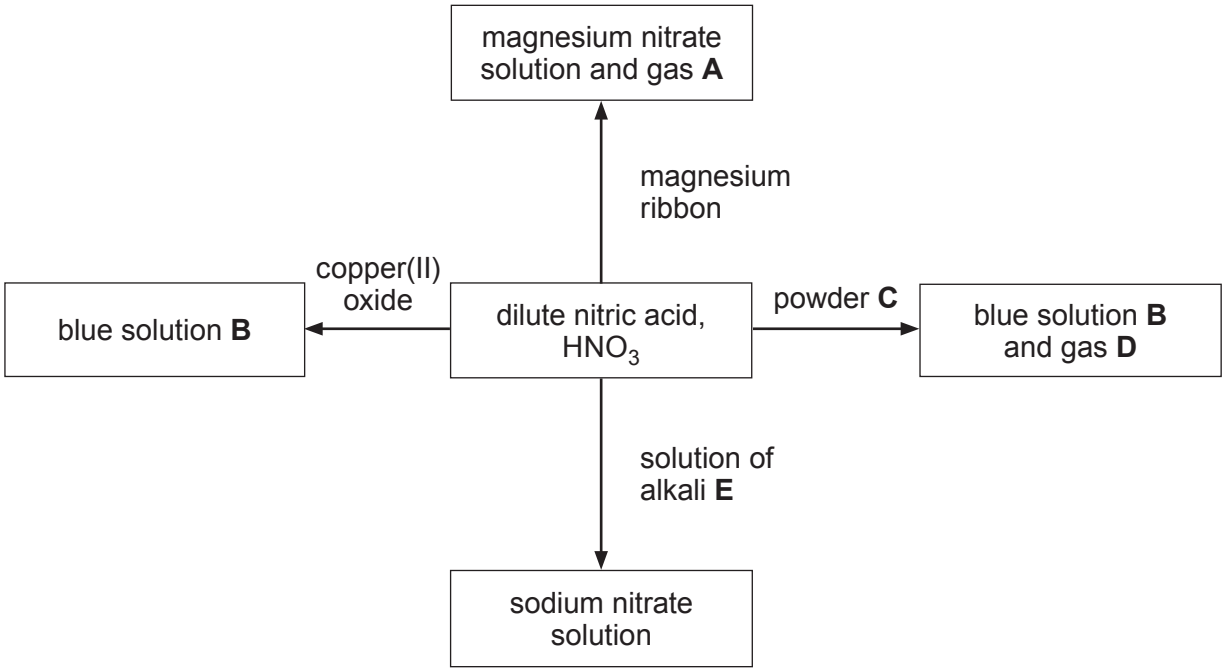
5. *(a)* The following diagram shows some reactions of dilute nitric acid.



(i) Name the following substances. [3]

Powder **C** .....

Solution **B** .....

Alkali **E** .....

(ii) Name gases **A** and **D** and describe how they can be identified. [4]

Gas **A**

.....

.....

Gas **D**

.....

.....

Examiner only

(b) When sodium hydroxide reacts with sulfuric acid a solution of sodium sulfate is produced.

(i) Give the formula of sodium sulfate. ..... [1]

(ii) Describe how crystals of sodium sulfate can be obtained from a solution of sodium sulfate. [2]

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(c) Phosphoric acid can be used to remove rust, Fe_2O_3. Balance the equation for the reaction taking place. [1]

$$Fe_2O_3 + \square\ H_3PO_4 \longrightarrow \square\ FePO_4 + \square\ H_2O$$

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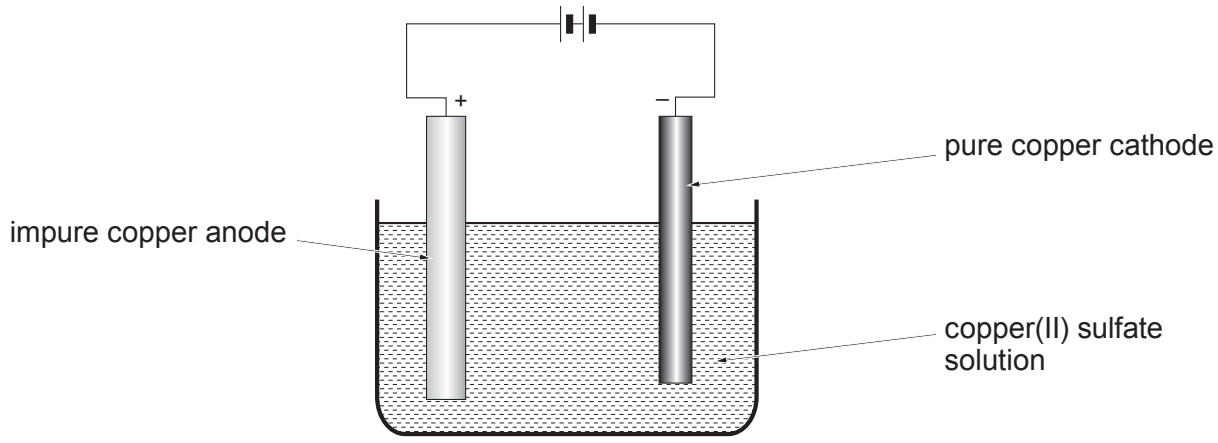
6. Copper can be purified by electrolysis using the apparatus shown below.



(a) During the process copper(II) ions move to the cathode where they become copper atoms.

(i) Explain why copper(II) ions move towards the cathode. [2]

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.....

(ii) Complete and balance the following electrode equation that shows how copper forms at the cathode. [1]

..... + $\square$ e^- ⟶ Cu

Examiner only

(b) A student carried out an investigation to find out how the amount of copper deposited on the cathode varied with the voltage used. He weighed the cathode at the beginning and then after 1 minute. He repeated the experiment 3 times at 5 different voltages. The results obtained are shown below.

Voltage (V)	Mass of copper deposited after 1 minute (g)			
	1	2	3	Mean
1.0	0.12	0.13	0.11	0.12
2.0	0.13	0.13	0.14	0.13
3.0	0.16	0.10	0.16	0.16
4.0	0.18	0.18	0.17	0.18
5.0	0.19	0.21	0.29	.....

(i) Using only the reliable results, calculate the mean mass of copper deposited on the cathode at 5.0 V. [1]

Mean mass of copper deposited = ... g

(ii) Calculate the percentage error of the unreliable result at 5.0 V. [1]

$$\text{Percentage error} = \frac{\text{difference between result and mean}}{\text{mean result}} \times 100\,\%$$

Percentage error = ... %

(iii) Use the results to predict the mass of copper deposited after 1 minute when a voltage of 8.0 V is applied. Give a reason for your answer. [2]

Mass deposited ..... g

Reason .....

.....

7

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7. Crude oil can be separated into fractions using fractional distillation.

(a) Explain why it is possible to separate crude oil using this process. [2]

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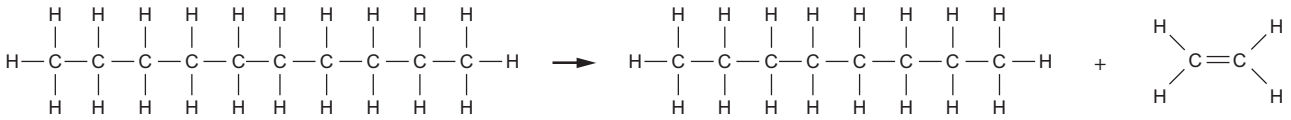
(b) Naphtha is one fraction not usually used as a fuel. It contains decane, $C_{10}H_{22}$, which can be further processed by cracking as shown below.

decane ⟶ octane + ethene

$C_{10}H_{22}$ ⟶ C_8H_{18} + C_2H_4



State how the process is carried out and explain why it is important. [4]

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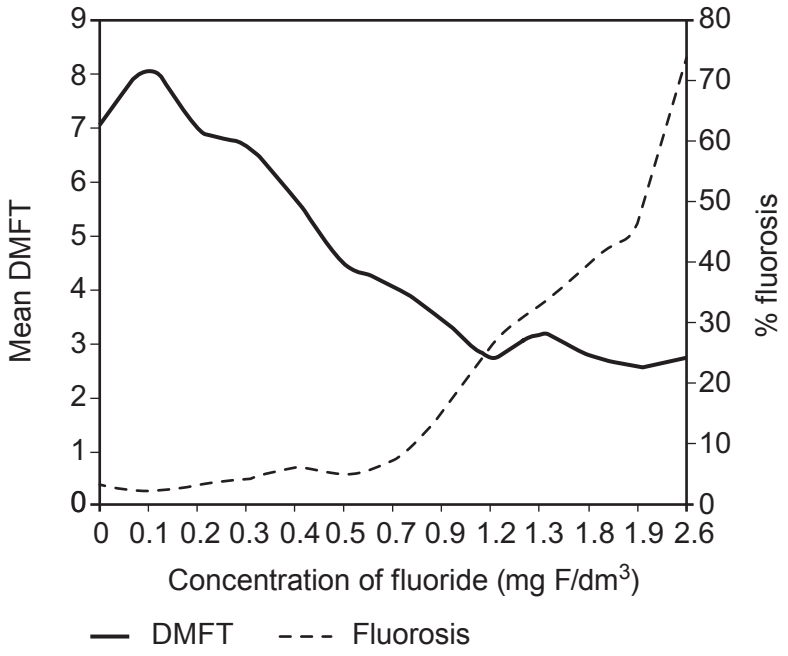
8. Sodium fluoride is added to drinking water in some areas.

The following graph shows the effect of different levels of fluoride in drinking water on the number of decayed, missing and filled teeth (DMFT) as well as the percentage of people suffering from dental fluorosis.



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Use the graphs to discuss whether fluoride should be added to drinking water. [6 QWC]

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END OF PAPER

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FORMULAE FOR SOME COMMON IONS

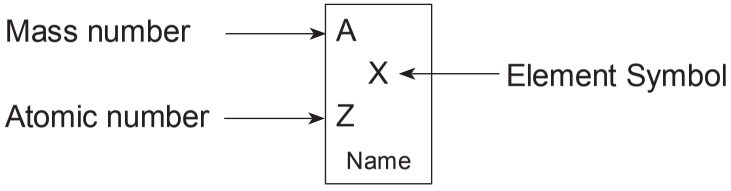
POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^{+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

PERIODIC TABLE OF ELEMENTS

20

1	2	Group									3	4	5	6	7	0
																$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium										$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium										$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulfur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radium	$^{227}_{89}$Ac Actinium															

Key:



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