

Surname	Centre Number	Candidate Number
Other Names		0



**GCSE – NEW**

C410UB0-1



**CHEMISTRY – Component 2**  
**Applications in Chemistry**

**HIGHER TIER**

WEDNESDAY, 13 JUNE 2018 – MORNING

1 hour 15 minutes

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	15	
2.	7	
3.	6	
4.	6	
5.	7	
6.	7	
7.	12	
<b>Total</b>	<b>60</b>	

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**ADDITIONAL MATERIALS**

In addition to this examination paper you will need a:

- calculator and ruler;
- **Resource Booklet.**

**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen.

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 the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

**INFORMATION FOR CANDIDATES**

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

Question 7(a) is a quality of extended response (QER) question where your writing skills will be assessed.

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

**SECTION A**

Read the article in the **Resource Booklet** and answer **all** the questions that follow.

1. (a) Refer to **Figure 1**. Identify the functional group common to all alcohols. [1]

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- (b) Propanol is another alcohol. Draw its displayed formula and give its molecular formula. [2]

Displayed formula

Molecular formula .....

- (c) Use the information to calculate how many million barrels of ethanol were produced in Brazil in 2010. [3]

..... million barrels

- (d) Give the reason why the data collected using the equipment in **Figure 4** gives a smaller energy content value for ethanol than that shown in **Figure 5**. State how the experiment could be improved to give a value closer to the actual value. [2]

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(e) Use **Figure 5** to describe the relationship between the carbon : hydrogen ratio and energy content for the fuels. [3]

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(f) A student looked at **Figure 5** and concluded that “hydrogen is a better fuel than ethanol”.  
Discuss this statement using information from the table and your knowledge of fuels.  
Give advantages and disadvantages of both fuels. [4]

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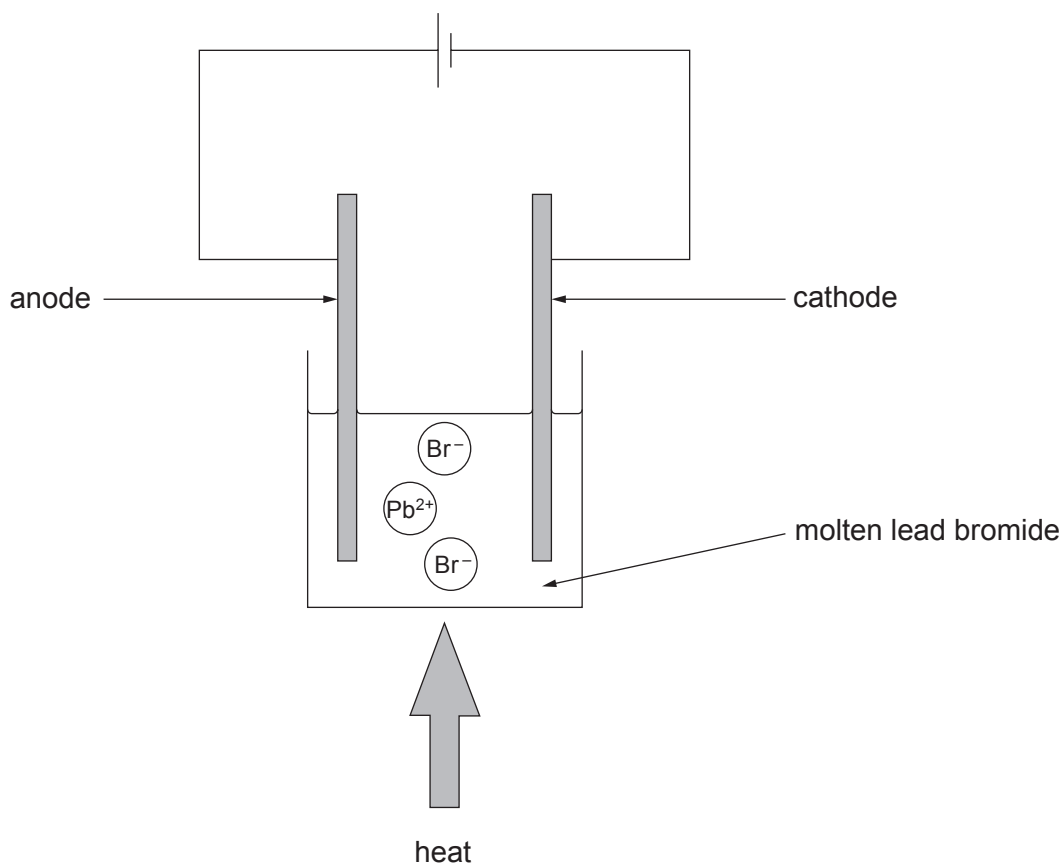
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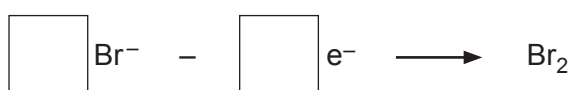
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**SECTION B***Answer all questions.*

2. (a) The diagram shows how the electrolysis of lead bromide can be carried out in the laboratory.



- (i) Give the reason why the lead bromide must be molten for electrolysis to take place. [1]
- 
- (ii) **Draw arrows on the diagram** to show the movement of the lead and bromide ions during electrolysis. [1]
- (iii) Balance the following electrode equation to show what happens to the bromide ions during the process. [1]



- (b) Taylor wanted to find out how the amount of lead produced during the process varied with time. He recorded the mass of lead formed after six different times. His results are shown in the table.

Time (s)	Mass of lead formed (g)
30	0.14
60	0.29
90	0.45
120	0.59
150	0.76
180	0.90

- (i) Describe the trend in the results. [2]

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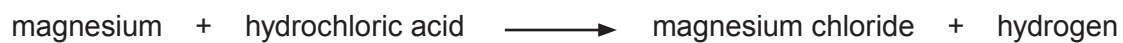
- (ii) Assuming that **all** of the lead was deposited on the electrode, suggest how Taylor was able to determine the mass of lead formed after a given time. [2]

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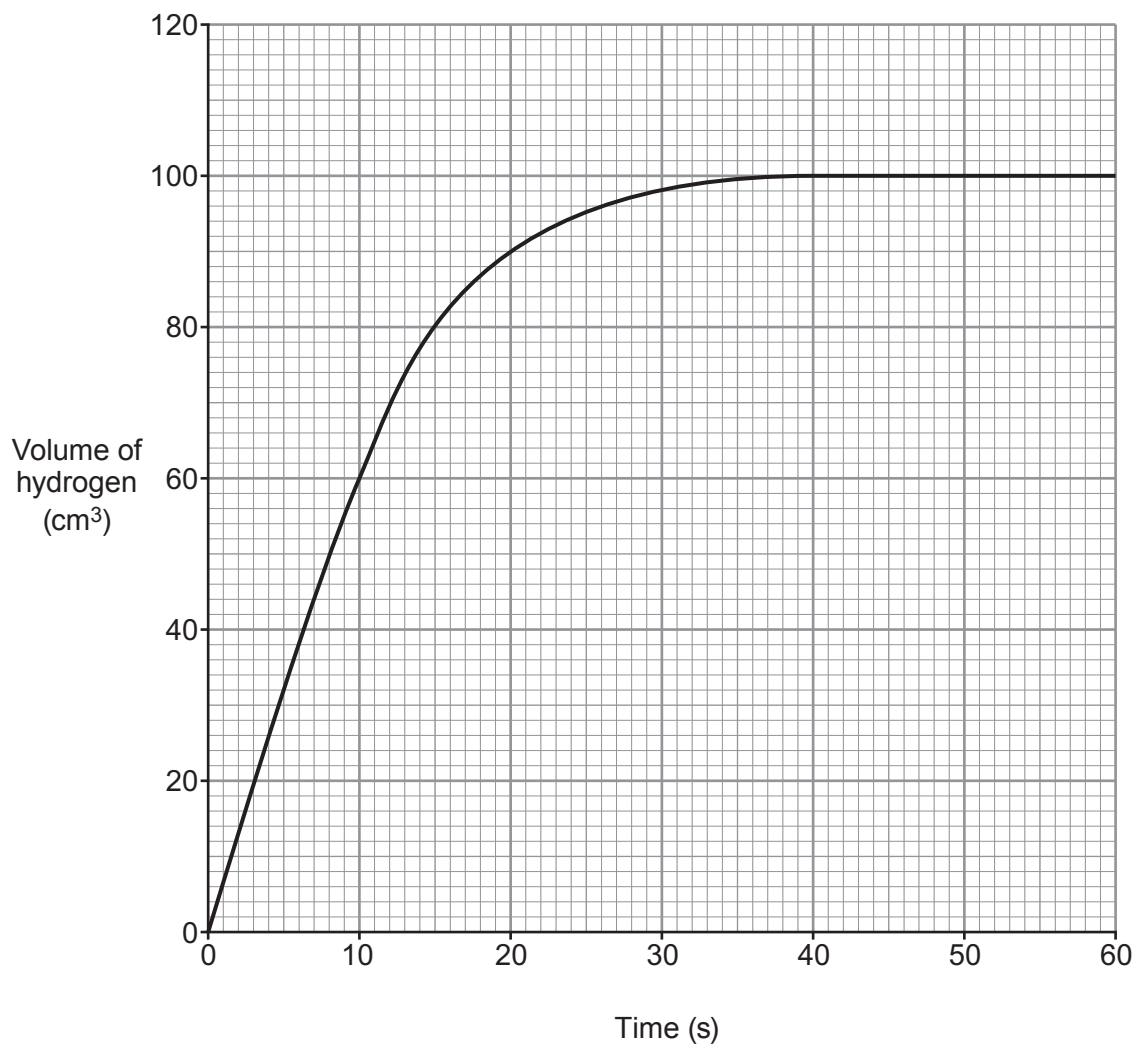
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3. The reaction between magnesium and dilute hydrochloric acid produces hydrogen gas and a solution of magnesium chloride.



The graph shows the volume of hydrogen formed when Casey carried out this reaction using magnesium ribbon and excess dilute hydrochloric acid at 40 °C.



- (a) **Sketch on the grid**, the graph that would be obtained if Casey repeated the experiment using the same length of magnesium ribbon with the dilute hydrochloric acid still in excess but at 20 °C. Explain your graph using particle theory. [3]

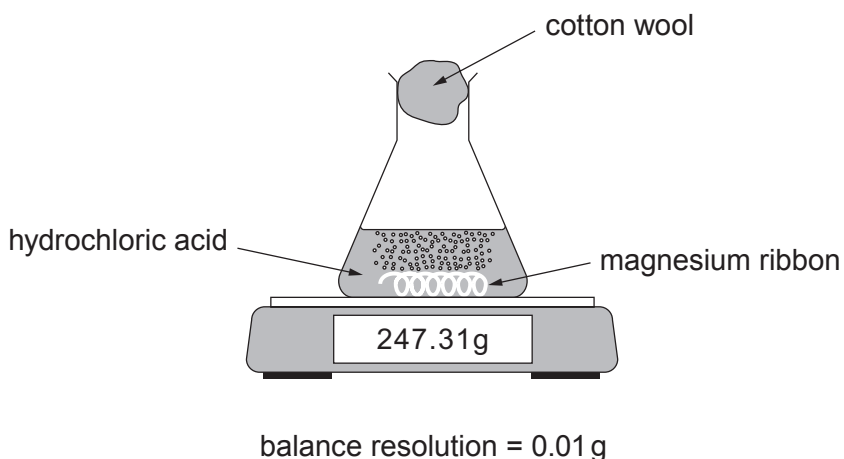
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- (b) Reactions that produce a gas can also be investigated by recording the loss of mass over time.



Calculate the mass of hydrogen gas produced in the initial experiment. Use this answer to evaluate the suitability of the above apparatus for investigating this reaction.

The volume of 1 mol of hydrogen gas is  $24\,000\text{ cm}^3$  at room temperature and pressure. [3]

Mass of hydrogen = ..... g

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4. A teacher wanted her class to investigate the reactivity of the halogens. She gave each group of students the following chemicals.

<b>chlorine water</b>	<b>bromine water</b>	<b>iodine water</b>
<b>sodium iodide solution</b>	<b>sodium chloride solution</b>	<b>sodium bromide solution</b>

- (a) Explain how the students would use these chemicals to show the order of reactivity of the halogens. Include the expected results in your answer. [4]

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- (b) Explain, in terms of their electronic structures, the trend in reactivity of the halogens. [2]

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5. You have been given an unlabelled bottle thought to contain iron(III) sulfate solution.

- (a) Describe how you would identify the iron(III) ions in the solution. Give the ionic equation for the reaction. [4]

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- (b) Describe how you could test for the presence of sulfate ions in the solution. Include the names of **both** products formed. [3]

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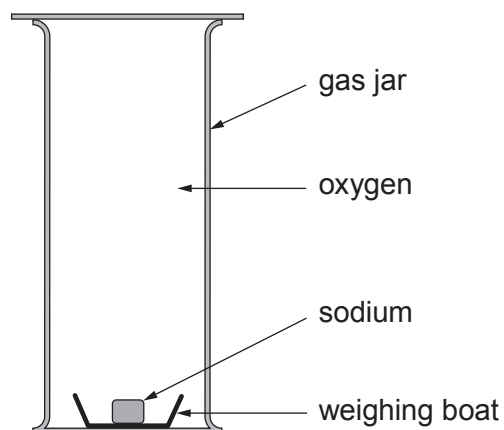
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6. Sodium oxidises when left exposed to the air. The equation for the reaction is shown.



- (a) Cain and James wanted to show experimentally that the formula of sodium oxide is  $\text{Na}_2\text{O}$ . They left a piece of sodium in a gas jar of pure oxygen for one week.



They recorded the mass of the weighing boat and its contents at the start of the experiment and then again after one week.

Mass of weighing boat	5.90 g
Mass of weighing boat and sodium at the start	7.51 g
Mass of weighing boat and contents after one week	7.88 g

- (i) Using the results from the experiment, calculate the simplest formula of sodium oxide. **Show your working.** [3]

Simplest formula .....

- (ii) Describe what Cain and James would need to do to show whether the experiment is reproducible. [2]

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- (b) The correct formula for sodium oxide is  $\text{Na}_2\text{O}$ . If all weighings were correct and no product was lost, suggest **two** reasons that could explain the difference between the correct formula of sodium oxide and the formula calculated in part (a)(i). [2]

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7. (a) Describe and explain the similarities and differences seen when ethanoic acid and hydrochloric acid of equal concentration react with sodium carbonate. Include relevant equations in your answer. [6 QER]

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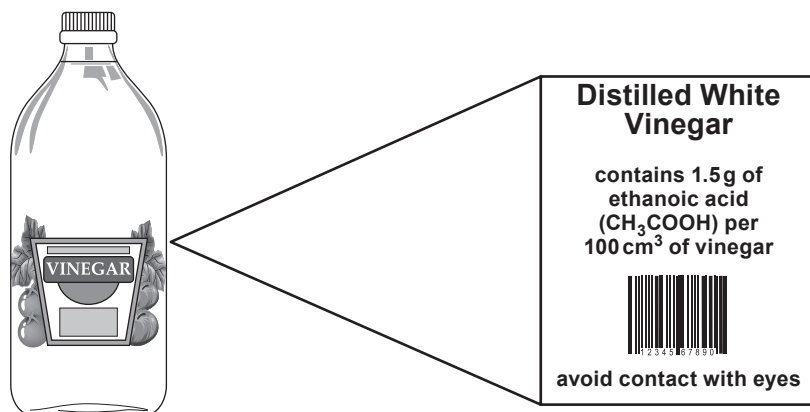
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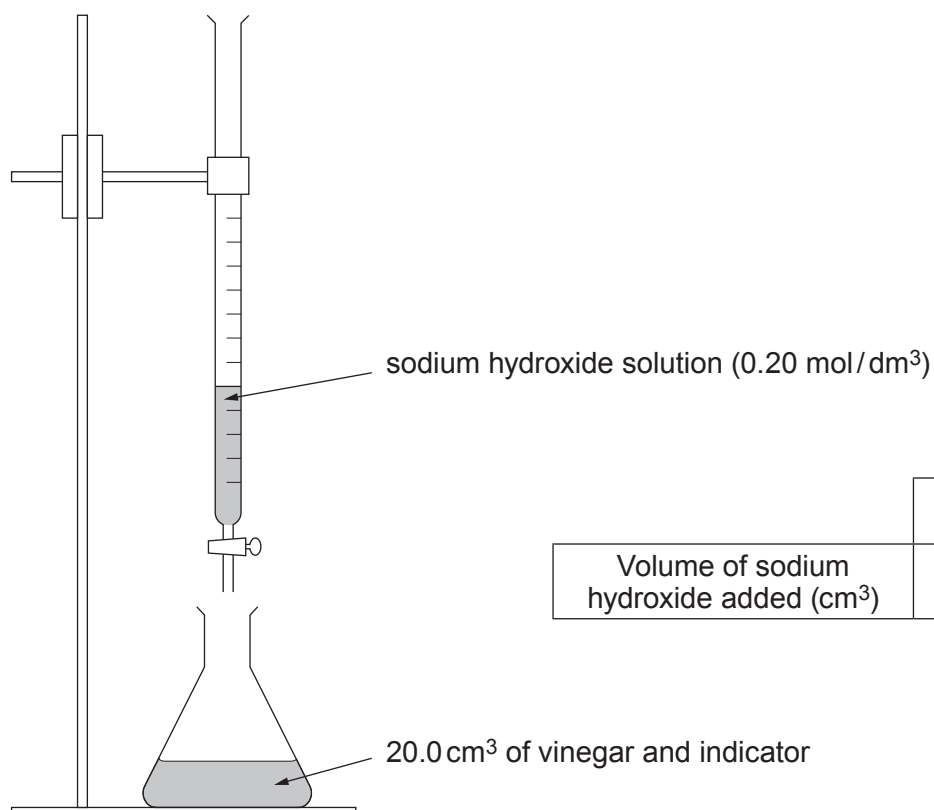
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- (b) A group of students were asked to investigate the concentration of the ethanoic acid,  $\text{CH}_3\text{COOH}$ , in a bottle of white vinegar.



They added sodium hydroxide solution of concentration  $0.20 \text{ mol/dm}^3$  a little at a time to  $20.0 \text{ cm}^3$  of the vinegar and a few drops of indicator until the indicator just changed colour.

The apparatus used and the results collected are shown below.



	Trial	Run 2	Run 3
Volume of sodium hydroxide added ( $\text{cm}^3$ )	26.4	24.9	25.1

Ethanoic acid in the vinegar reacts with sodium hydroxide solution as shown in the following equation.



- (i) Use this information, together with the results collected, to calculate the concentration of the ethanoic acid in  $\text{mol/dm}^3$ . [4]

Concentration = .....  $\text{mol/dm}^3$

- (ii) Use your answer to part (i) to show whether or not the information on the label is correct. [2]

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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	$\text{Al}^{3+}$	bromide	$\text{Br}^-$
ammonium	$\text{NH}_4^+$	carbonate	$\text{CO}_3^{2-}$
barium	$\text{Ba}^{2+}$	chloride	$\text{Cl}^-$
calcium	$\text{Ca}^{2+}$	fluoride	$\text{F}^-$
copper(II)	$\text{Cu}^{2+}$	hydroxide	$\text{OH}^-$
hydrogen	$\text{H}^+$	iodide	$\text{I}^-$
iron(II)	$\text{Fe}^{2+}$	nitrate	$\text{NO}_3^-$
iron(III)	$\text{Fe}^{3+}$	oxide	$\text{O}^{2-}$
lithium	$\text{Li}^+$	sulfate	$\text{SO}_4^{2-}$
magnesium	$\text{Mg}^{2+}$		
nickel	$\text{Ni}^{2+}$		
potassium	$\text{K}^+$		
silver	$\text{Ag}^+$		
sodium	$\text{Na}^+$		
zinc	$\text{Zn}^{2+}$		

# THE PERIODIC TABLE

1 2 3 4 5 6 7 0

Group

7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4	<div style="border: 1px solid black; padding: 5px; display: inline-block;">                     1 <b>H</b> Hydrogen 1                 </div>										4 <b>He</b> Helium 2					
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12	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	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
86 <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	99 <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	179 <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	210 <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															

Key

relative atomic mass

Ar
Symbol
Name
Z

atomic number