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Oxford Cambridge and RSA

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Thursday 19 May 2016 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE CHEMISTRY A/SCIENCE A

A171/01 Modules C1 C2 C3 (Foundation 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: 1 hour

* A 1 7 1 0 1 *

* 5 9 5 6 7 8 9 3 6 4 *

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. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- The Periodic Table is printed on the back page.
- 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 **20** pages. Any blank pages are indicated.

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PLEASE DO NOT WRITE ON THIS PAGE

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Answer **all** the questions.

1 Welding is used to join pieces of metal together.
The metal is melted by heating it to a very high temperature.
Ethyne is a gas used in welding.
Burning this gas in oxygen gives a flame that is extremely hot.

(a) Suggest why ethyne is burned in oxygen rather than in air.

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

Oxygen makes up 10% of the air. ☐

Fuels burn faster in oxygen than air. ☐

Burning fuels are reduced. ☐

Fuels do not burn in air. ☐

[1]

(b) Ethyne molecules contain only **carbon** and **hydrogen** atoms.

What type of compound is ethyne?

Put a (ring) around the correct answer.

carbonate **hydrocarbon** **particulate** **hydroxide**

[1]

(c) When ethyne burns completely in oxygen **two** substances are made.

What are these **two** substances?

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

argon **carbon dioxide** **chlorine** **nitrogen** **sulfur dioxide** **water**

[2]

[Total: 4]

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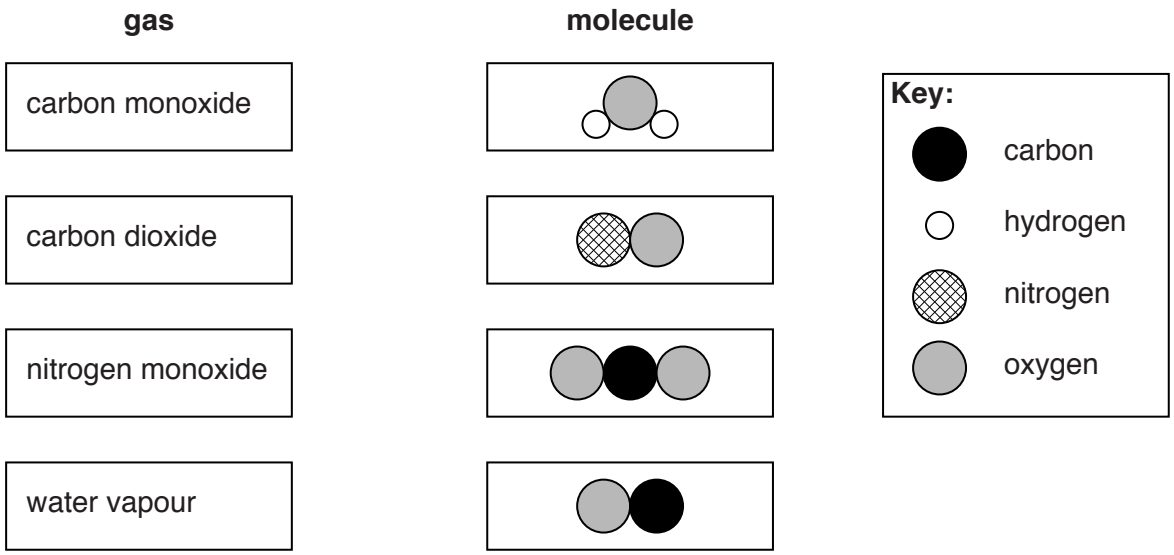
2 The air contains some gases that are emitted by cars.

(a) Some gases in the air are listed below.
Diagrams of their molecules are also shown.

Draw a straight line from each **gas** to its correct **molecule**.



[3]

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(b) Scientists measure the pollutants in the exhaust gases from 2 cars.

The cars are the same except for the fuel they use (petrol or diesel).

	Pollutant (grams per km travelled)	
	Nitrogen dioxide	**Carbon particulates**
Petrol car	6.0	none
Diesel car	9.0	0.5

Pollutants from cars build up in towns and can be harmful to human health.

Explain why each pollutant in the table is harmful and decide which car is better for use in towns.

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

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..... **[6]**

[Total: 9]

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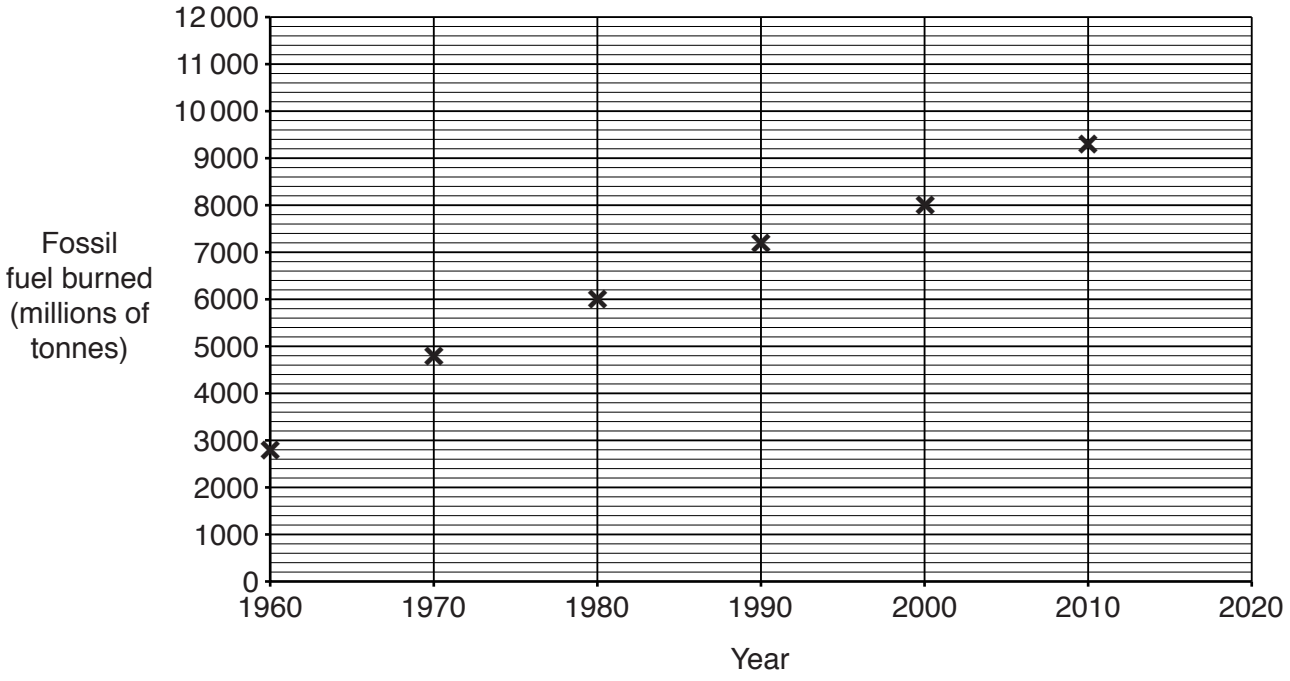
3 John looks at a graph that shows the amount of fossil fuels burned in the world between 1960 and 2010.



(a) (i) John says that the amount of fossil fuels burned has increased by the same amount every ten years.

Is he correct?
Use data from the graph to justify your answer.

.....

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

(ii) Estimate the amount of fossil fuels that will be burned in 2020.

..... millions of tonnes **[1]**

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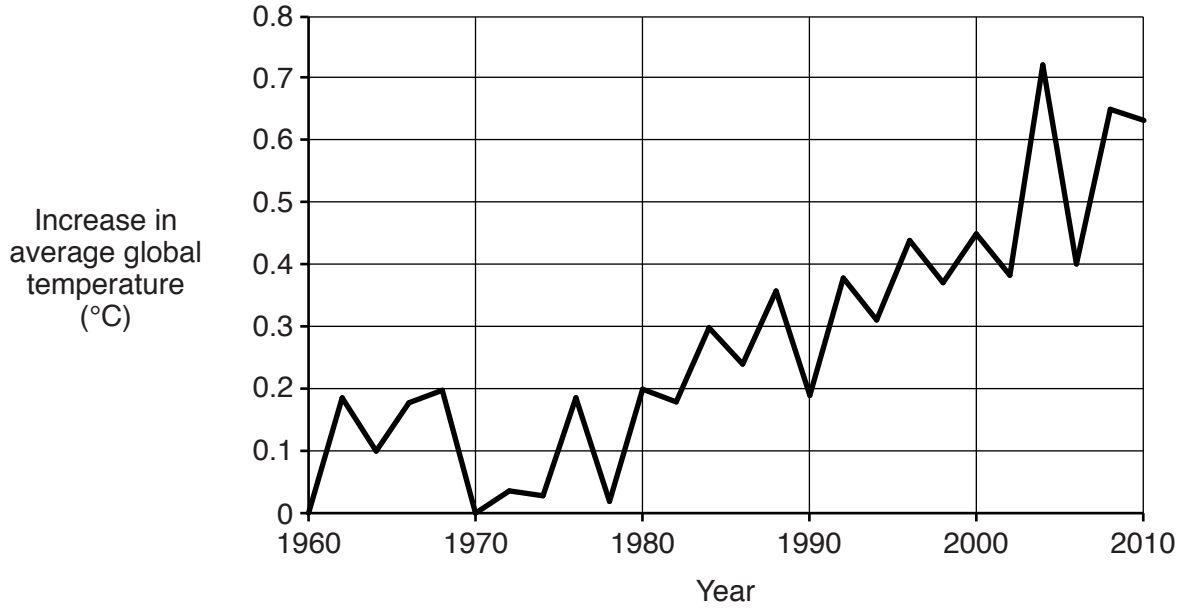
(b) John also looks at the changes in average global temperature over the same time.



(i) What does the graph show about changes in average global temperature?

.....

.....

.....

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

(ii) Complete these sentences about the **two** graphs.
Choose from the words in the list. You may use each word once, more than once or not at all.

cause	**correlation**	**decreased**
increased	**reaction**	**stayed the same**

From 1960–2010, the amount of fossil fuels burned has ..... and the average global temperature has ..... .

This means there is a ..... between the amount of fossil fuels burned and the average global temperature. **[3]**

[Total: 8]

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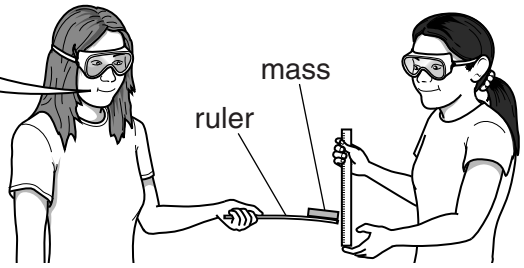
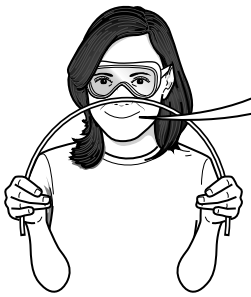
4 Some students investigate the stiffness of plastic rulers.

This is how three students plan their investigation.

Jane

I will hold the ruler at one end and put a mass on the other end. I will measure how much it bends and get my friend to repeat the test.



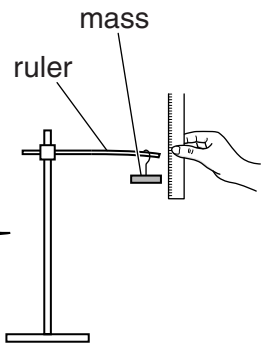


Katya

I will measure how far I can bend the ruler before it breaks. I will bend and break the rulers myself so that the test is fair.

Matt

I will use rulers that are the same length. I will hang the same mass to the end of each ruler and measure the distance it bends. I will do each test four times and work out the mean.



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(a) Which plan is best? Explain why this plan is better than the other two plans.

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

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..... **[6]**

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(b) Here are the measurements for one ruler.

Test number	**1**	**2**	**3**	**4**	**5**
Bend (mm)	23	26	13	19	24

(i) What is the range of **all** these measurements?

.....

[1]

(ii) These measurements include an outlier.

Which measurement is the outlier?

.....

[1]

(iii) What could the students do to decide whether or not to include the outlier when calculating the best estimate of the true value from their measurements?

.....

.....

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

(iv) **Include** the outlier and work out the best estimate of the true value of their measurements.

Show your working.

[2]

[Total: 11]

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5 Plastic has been used to replace many other materials.

(a) A hundred years ago most buckets were made of metal.
Now most buckets are made of plastic.

Give **one** property of plastic that makes it a better material than metal for buckets, and explain why it is better.

.....

.....

.....

.....

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

(b) **(i)** Name **another** material that has been replaced by plastic.

.....

Write down a **use** of this material.

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

(ii) Give **two** reasons why plastic is better for this use than the material you have named.

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

[Total: 5]

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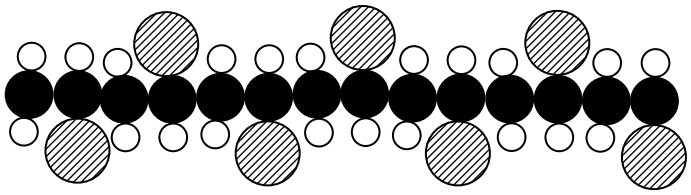
6 The diagram shows part of a molecule of PVC.



(a) PVC contains carbon, hydrogen and one other element.

What is that other element?

Put a (ring) around the correct answer.

chlorine **nitrogen** **oxygen** **sulfur**

[1]

(b) **Seven** monomers have been joined together to make the polymer in the diagram above.

Which diagram shows a monomer of PVC?

Put a (ring) around the correct answer.

[1]

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(c) Plasticizers are small molecules. They are added to PVC to make it more flexible.

(i) Explain how adding plasticizers makes PVC more flexible.

Put ticks (✓) in the boxes to complete these sentences.

Plasticizers

move the PVC chains further apart.	
link the PVC chains.	
tangle the PVC chains together.	

This means the forces between the molecules are

stronger.	
the same.	
weaker.	

So the molecules

are held together and cannot move.	
can slide over each other.	
move out of their solid structure and become a liquid.	

[3]

(ii) PVC, which contains plasticizers, can be used for wrapping food. Plasticizers may leach out of the PVC.

Suggest why this could be harmful.

.....

.....

.....

.....

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

[Total: 7]

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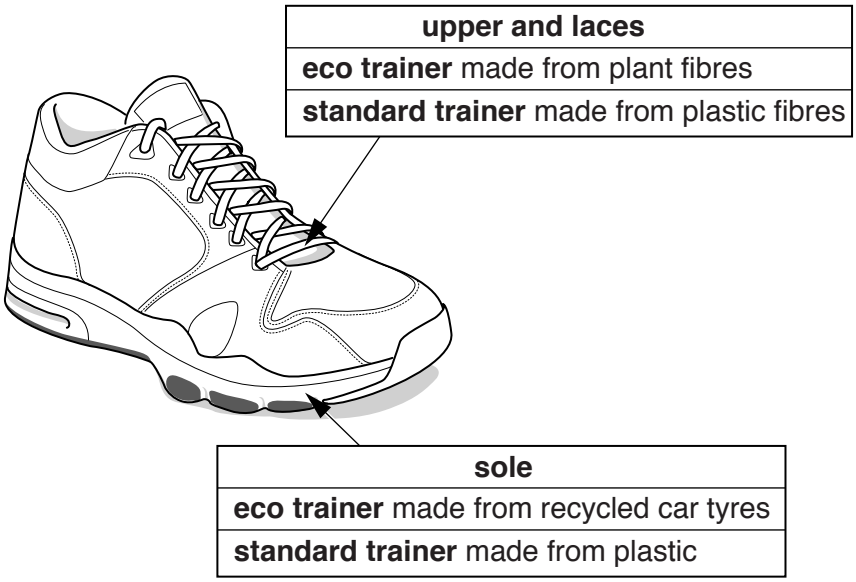
7 A company makes a **standard** trainer using plastics made from crude oil.

They make a new **eco trainer** from plant fibres and recycled car tyres.

The table shows the data for the Life Cycle Assessment (LCA) of each type of trainer.



	Eco trainers		Standard trainers	
	Energy (MJ)	**Greenhouse gases made (kg CO_2)**	**Energy (MJ)**	**Greenhouse gases made (kg CO_2)**
Making materials for the trainers	1.6	0.1	6.0	4.2
Making the trainers from the materials	1.4	1.0	4.2	3.7
Disposing of the trainers	0.8	.....	0.8	0.6
Total of the three stages	.....	**1.7**	**11.0**	**8.5**

(a) (i) Complete the table above. **[2]**

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(ii) The company says that the eco trainers are less harmful to the environment and are more sustainable.

Are they correct?
Use data from the table to justify your answer.

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

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..... **[6]**

[Total: 8]

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8 Salt has many uses.

(a) Salt is added to food.
Some scientists say that the amount of salt in food should be lowered.

Give an **advantage** and a **disadvantage** of adding salt to food.

Advantage .....

.....

.....

Disadvantage .....

.....

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

(b) In some parts of the UK, layers of rock salt are found under the ground.
Rock salt can be dug out from under the ground using machines.
Salt can also be extracted by pumping water down to the rock. This is called solution mining.

Why is solution mining used when making salt to add to food?

.....

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

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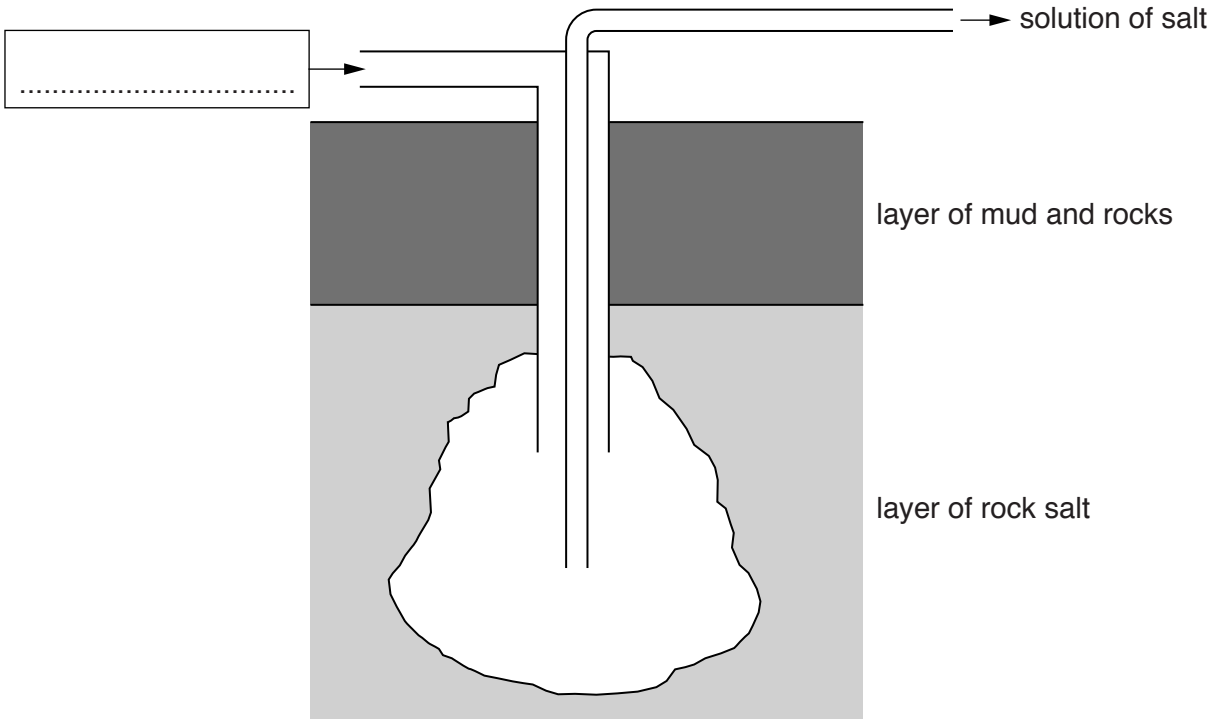
(c) This is a diagram of solution mining of salt.



(i) Complete the label on the diagram and use the diagram to describe how a solution of salt is obtained from rock salt.

.....

.....

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..... **[3]**

(ii) Electrolysis of salt solution makes chlorine and two other products.

Name the **two** other products.

1 .....

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

[Total: 8]

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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The Periodic Table of the Elements

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

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** 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.