

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
TWENTY FIRST CENTURY SCIENCE  
CHEMISTRY A**

**A322/01**

Unit 2: Modules C4 C5 C6 (Foundation Tier)

**Wednesday 19 January 2011  
Morning**

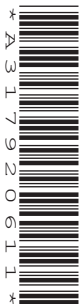
**Duration: 40 minutes**

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)



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. Pencil may be used for graphs and diagrams only.
- 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).
- Answer **all** the questions.
- 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**.
- The Periodic Table is printed on the back page.
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** the questions.

1 Gemma makes science films for schools.

She is making a film about the reactions of Group 1 elements.

(a) Gemma wants to show the names and symbols of the Group 1 elements.

She includes this table in her film.

(i) Complete the table by filling in the two bits of missing information.

name of element	proton number	symbol
.....	11	Na
potassium	19	K
rubidium	37	Rb
caesium	55	.....

[2]

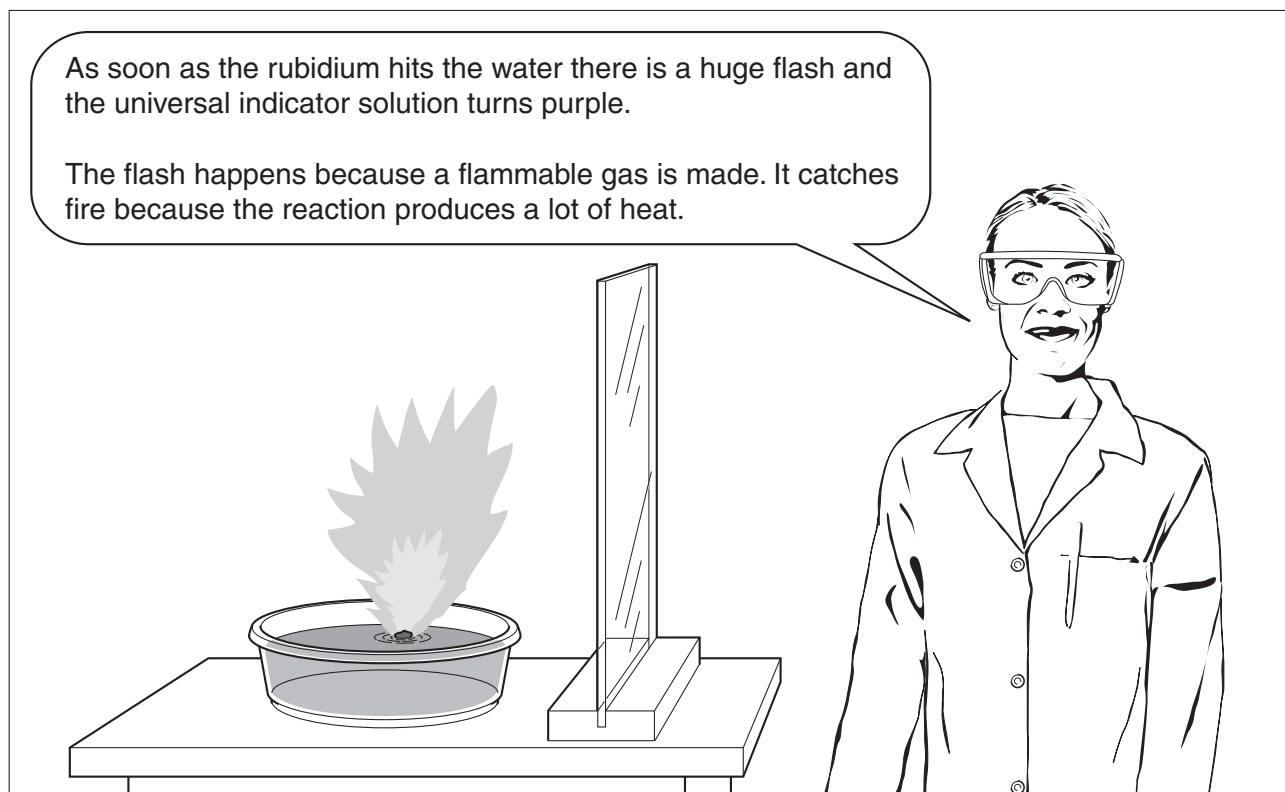
(ii) Give the name of another Group 1 element that is **not** shown in the table.

..... [1]

(b) Gemma films the reactions of Group 1 elements with water.

She adds universal indicator solution to a bowl of water.

The film shows what happens when she drops a small piece of rubidium into the water.



(i) What is the name of the gas that is formed in the reaction?

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

**carbon dioxide**

**hydrogen**

**nitrogen**

**sulfur dioxide**

[1]

(ii) Why does the universal indicator solution turn purple?

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

The reaction makes an acid.

The rubidium neutralises the water.

An alkali is made.

The temperature increases.

[1]

- (c) Gemma makes another film. This time she adds caesium to the water instead of rubidium.

When caesium hits the water, there is an explosion and the glass bowl breaks.

Why do caesium and rubidium react differently with water?

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

Caesium is more reactive than rubidium.

Caesium is not a metal.

Rubidium reacts much faster than caesium.

Caesium has a lower mass than rubidium.

[1]

- (d) Gemma then adds a small piece of potassium to a bowl of water that contains universal indicator solution.

- (i) Describe what she will see.

Your answer should include

- how the reaction is similar to the reaction of the other Group 1 elements
- any differences between the reaction of potassium and the other Group 1 elements.

.....

.....

.....

..... [3]

- (ii) Gemma used a safety screen when she was carrying out these experiments.

Explain why this was necessary.

.....

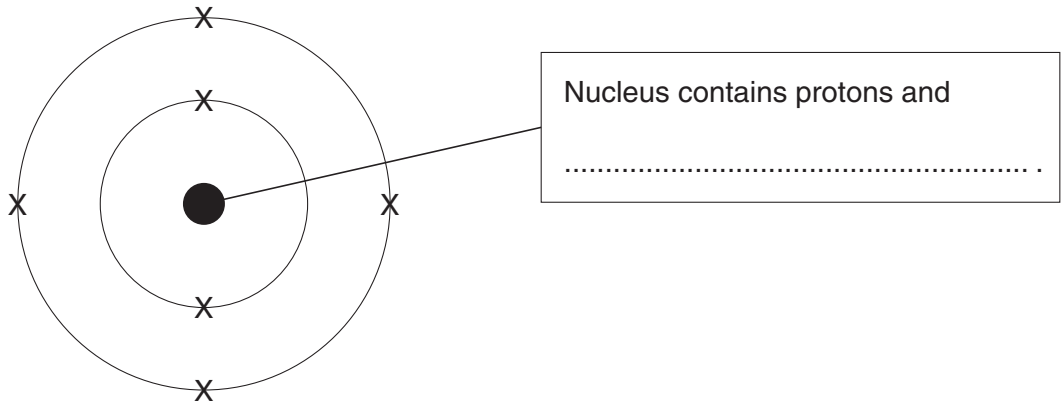
.....

..... [2]

[Total: 11]

2 (a) The diagram shows the structure of an atom of an element in Group 4 of the Periodic Table.

(i) Complete the label on the diagram by filling in the box.



[1]

(ii) What is the electronic arrangement of the atom?

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

- 6      4.2      2.4      2.2.2

[1]

(iii) How many **protons** are in the nucleus of the atom?

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

- 2      4      6      12

[1]

(b) The atom contains electrons and protons.

Draw straight lines to join each type of **particle** to its correct **relative mass** and correct **charge**.

One line has been drawn for you.

relative mass	particle	charge
0	electron	-1
1	proton	0
2		+1

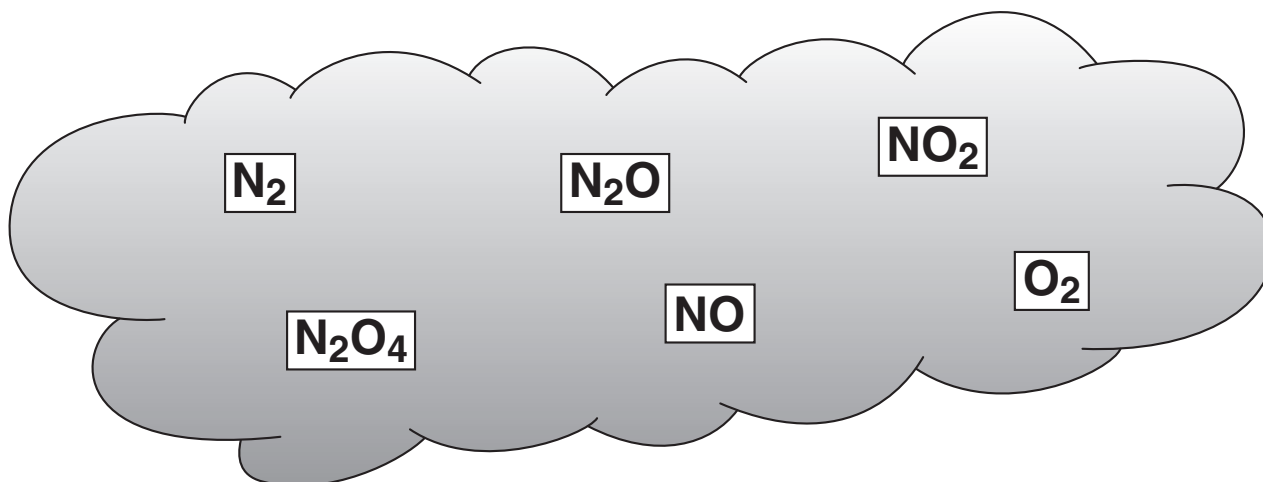
[1]

[Total: 4]

Turn over

3 Some gases in air contain nitrogen and oxygen atoms.

The formulae of these gases are shown in the boxes.



(a) Which **two** gases are elements?

Put a (ring) around each correct answer.



[1]

(b) Which gas molecule contains the largest number of atoms?

Put a (ring) around the correct answer.



[1]

(c) Put a (ring) around the correct word to complete each of the following sentences.

The melting points of these gases are **above** / **below** room temperature.

Their boiling points are **above** / **below** room temperature.

Gases in the air have **molecular** / **ionic** structures.

They have **strong** / **weak** forces between their molecules.

[2]

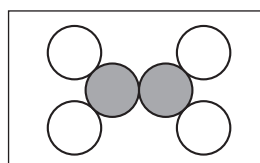
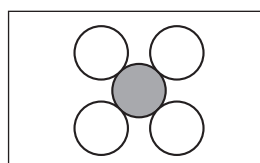
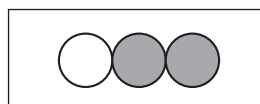
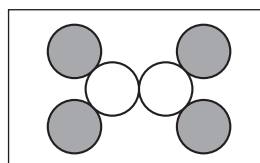
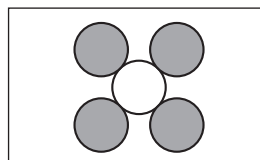
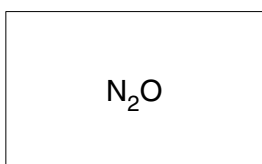
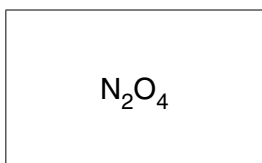
(d) Look at this diagram of a molecule of  $\text{NO}_2$ .



Draw straight lines to join each **formula** to the correct **diagram**.

**formula**

**diagram**



[2]

[Total: 6]

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4 Read the information in the box.

**Molecules in living things**

Molecule **A** and molecule **B** are both amino acids. You can see how similar they are by looking at the atoms in their molecules.

$$\begin{array}{c} \text{COOH} \\ | \\ \text{H}_2\text{N}-\text{C}-\text{H} \\ | \\ \text{H} \end{array}$$

**molecule A**

$$\begin{array}{c} \text{COOH} \\ | \\ \text{H}_2\text{N}-\text{C}-\text{H} \\ | \\ \text{CH}_2 \\ | \\ \text{SH} \end{array}$$

**molecule B**

(a) The formula for molecule **B** is  $\text{C}_3\text{H}_7\text{NO}_2\text{S}$ .

What is the formula for **molecule A**?

..... [2]

(b) Look at the **elements** in molecules **A** and **B**.

(i) In what ways are molecules **A** and **B** typical of those that come from living things?

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

(ii) Write down two **differences** between molecule **A** and molecule **B**.

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

(c) Which of the following chemicals are made by living things?

Put a ring around each of the **two** correct answers.

**carbohydrates**

**minerals**

**proteins**

**quartz**

**silicon**

[2]

[Total: 8]

5 Joe investigates vinegar.

(a) Joe knows that vinegar is an acid.

One way of showing that vinegar is an acid is by using an indicator.

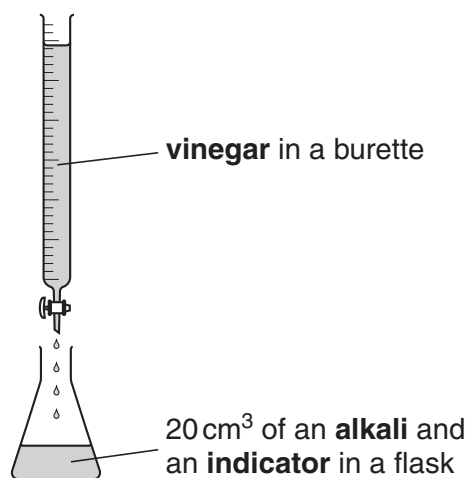
What else can Joe use to show that vinegar is an acid?

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

- |                  |                          |
|------------------|--------------------------|
| iodine           | <input type="checkbox"/> |
| a pH meter       | <input type="checkbox"/> |
| a lighted splint | <input type="checkbox"/> |
| a burette        | <input type="checkbox"/> |
| limewater        | <input type="checkbox"/> |

[1]

(b) Joe does a titration to find the concentration of acid in the vinegar.



(i) What chemical could be used as the alkali in the flask?

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

- |                   |                          |
|-------------------|--------------------------|
| calcium carbonate | <input type="checkbox"/> |
| sodium chloride   | <input type="checkbox"/> |
| sulfuric acid     | <input type="checkbox"/> |
| sodium hydroxide  | <input type="checkbox"/> |

[1]

(ii) Write down a set of instructions to tell Joe how to do the titration.

.....

.....

.....

.....

.....

..... [3]

(c) Joe tests vinegar that he collects from different places.

Here is a table showing his results.

	<b>chip shop vinegar</b>	<b>supermarket vinegar</b>	<b>cafe vinegar</b>	<b>canteen vinegar</b>
volume of vinegar that reacts with 20 cm <sup>3</sup> alkali	15 cm <sup>3</sup>	21 cm <sup>3</sup>	19 cm <sup>3</sup>	25 cm <sup>3</sup>

(i) Which vinegar contains the highest concentration of acid?

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

- chip shop vinegar
- supermarket vinegar
- cafe vinegar
- canteen vinegar

[1]

(ii) Joe calculates the concentration of acid in each vinegar.

His first step is to work out the relative formula mass of the acid in the vinegar.

Complete Joe's working to find the relative formula mass of the acid.

Use the Periodic Table to help you to find the missing relative atomic masses.

<b>formula of acid compound</b>			$\text{CH}_3\text{COOH}$
<b>relative atomic masses</b>	carbon, C	=	12
	hydrogen, H	=	.....
	oxygen, O	=	.....
<b>relative formula mass of <math>\text{CH}_3\text{COOH}</math></b>		=	.....

[2]

(iii) What other information does Joe need to work out the concentration of the acid in the vinegar?

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

an equation for the reaction

the cost of each bottle of vinegar

the concentration of alkali used

the temperature of the room

the rate of the reaction

[1]

[Total: 9]

- 6 Old copper coins are often covered with a layer of corrosion.



The corrosion contains copper carbonate.

Sulfuric acid can be used to clean the coin.

- (a) Sulfuric acid reacts with copper carbonate to form a salt and two other products.

- (i) What is the **name** of the salt that is formed when sulfuric acid reacts with copper carbonate?

..... [1]

- (ii) What are the formulae of the two **other** products of the reaction?

Put a **ring** around each of the **two** correct answers.



[1]

- (b) Eve uses sulfuric acid to remove copper carbonate from old coins.

She finds that the rate of reaction is very slow.

How can she speed up the reaction?

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

Add more water to the acid.

Heat the acid.

Add sodium chloride to the acid.

Add an alkali to the acid.

Use a higher concentration of acid.

[2]

[Total: 4]

END OF QUESTION PAPER

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# The Periodic Table of the Elements

1	2	3	4	5	6	7	0	
7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	11 <b>Na</b> sodium 11	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	
23 <b>Al</b> aluminum 13	24 <b>Mg</b> magnesium 12	27 <b>Al</b> aluminum 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	70 <b>Ga</b> gallium 31	75 <b>As</b> arsenic 33	79 <b>Se</b> selenium 34	80 <b>Br</b> bromine 35	84 <b>Kr</b> krypton 36	
85 <b>Rb</b> rubidium 37	88 <b>Sr</b> strontium 38	89 <b>Y</b> yttrium 39	115 <b>In</b> indium 49	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	204 <b>Tl</b> thallium 81	209 <b>Pb</b> lead 82	207 <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	Elements with atomic numbers 112-116 have been reported but not fully authenticated					
55 <b>Mn</b> manganese 25	56 <b>Fe</b> iron 26	59 <b>Co</b> cobalt 27	65 <b>Zn</b> zinc 30	63.5 <b>Cu</b> copper 29	108 <b>Ag</b> silver 47	112 <b>Cd</b> cadmium 48	131 <b>Xe</b> xenon 54	
59 <b>Ni</b> nickel 28	59 <b>Co</b> cobalt 27	103 <b>Rh</b> rhodium 45	192 <b>Hg</b> mercury 80	197 <b>Au</b> gold 79	199 <b>Pt</b> platinum 78	201 <b>Hg</b> mercury 80	209 <b>Pb</b> lead 82	
101 <b>Ru</b> ruthenium 44	103 <b>Rh</b> rhodium 45	106 <b>Pd</b> palladium 46	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[271] <b>Ds</b> darmstadtium 110	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
186 <b>Re</b> rhenium 75	186 <b>Re</b> rhenium 75	186 <b>Os</b> osmium 76	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
[98] <b>Tc</b> technetium 43	101 <b>Ru</b> ruthenium 44	106 <b>Pd</b> palladium 46	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
52 <b>Cr</b> chromium 24	56 <b>Fe</b> iron 26	106 <b>Pd</b> palladium 46	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
48 <b>Ti</b> titanium 22	56 <b>Fe</b> iron 26	106 <b>Pd</b> palladium 46	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
91 <b>Zr</b> zirconium 40	101 <b>Ru</b> ruthenium 44	106 <b>Pd</b> palladium 46	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
178 <b>Hf</b> hafnium 72	186 <b>Os</b> osmium 76	192 <b>Rh</b> rhodium 45	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
[261] <b>Rf</b> rutherfordium 104	186 <b>Os</b> osmium 76	192 <b>Rh</b> rhodium 45	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
[262] <b>Db</b> dubnium 105	186 <b>Os</b> osmium 76	192 <b>Rh</b> rhodium 45	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
[266] <b>Sg</b> seaborgium 106	186 <b>Os</b> osmium 76	192 <b>Rh</b> rhodium 45	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
184 <b>W</b> tungsten 74	186 <b>Os</b> osmium 76	192 <b>Rh</b> rhodium 45	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
96 <b>Mo</b> molybdenum 42	186 <b>Os</b> osmium 76	192 <b>Rh</b> rhodium 45	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
51 <b>V</b> vanadium 23	186 <b>Os</b> osmium 76	192 <b>Rh</b> rhodium 45	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
45 <b>Sc</b> scandium 21	186 <b>Os</b> osmium 76	192 <b>Rh</b> rhodium 45	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
93 <b>Nb</b> niobium 41	186 <b>Os</b> osmium 76	192 <b>Rh</b> rhodium 45	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
41 <b>Ti</b> titanium 22	186 <b>Os</b> osmium 76	192 <b>Rh</b> rhodium 45	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	
22 <b>Ti</b> titanium 22	186 <b>Os</b> osmium 76	192 <b>Rh</b> rhodium 45	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	[268] <b>Mt</b> meitnerium 109	[272] <b>Rg</b> roentgenium 111	[222] <b>Rn</b> radon 86	

1	<b>H</b> hydrogen 1
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relative atomic mass
atomic symbol
name
atomic (proton) number

Key

\* 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.