

The Periodic Table **Answers**

1. What is an element?

An element is a substance made of only one type of atom.

2. Lithium is an element whose name comes from the Greek word *lithios*, meaning 'stone'. The symbol for lithium is written using the first two letters of its name.

Write down the symbol for lithium.

Li

3. Explain why scientists initially found it difficult to organise the elements.

Not all of the elements had been discovered yet.

4. Scientists continued to make discoveries about elements long after Mendeleev first produced his table. Explain how later discoveries provided evidence to support Mendeleev's organisation of the elements.

When new elements were discovered they filled in the gaps that Mendeleev had left in his table. They also had the same properties that Mendeleev had predicted they would have. This evidence supported Mendeleev's methods for organising the elements.

5. Describe two trends as you move from left to right across a **period**.

1. The atomic number increases.

2. The atomic radius decreases.

6. Explain why this organisation of the elements is known as the periodic table.

Groups of elements with similar properties occur at regular intervals (periodically).

7. An element is a gas at room temperature. It has a low density and is a poor conductor of heat and electricity. The element reacts with virtually all other elements.

Give the name of the group that this element is most likely to be found in.

Group 7/halogens

8. Compare the properties of metals and non-metals.

Metals are typically shiny, whereas non-metals are typically dull.

Metals are usually good conductors of heat and electricity. However, non-metals are usually poor conductors of heat and electricity.

Metals are typically sonorous while non-metals are not.

Metals usually have a high density while non-metals have a low density.

Metal oxides form alkaline solutions. However, non-metal oxides form acidic solutions.

Metals are malleable and ductile, whereas non-metals are brittle.

9. A shiny, grey solid can conduct electricity, is very brittle and has a low density. Explain where this element is likely to be found on the periodic table.

The element is likely to be found near to the stepped line/found with the metalloids because it has properties of both metals and non-metals.

10. Compare the melting and boiling points of the elements found in Group 1, Group 7 and Group 0.

Group 1 elements have the highest melting and boiling points because they are all solids at room temperature.

Group 0 elements have the lowest melting and boiling points because they are all gases at room temperature.

The melting and boiling points of the Group 7 elements are likely to be lower than those of the Group 1 elements and higher than those of the Group 0 elements because Group 7 contains elements that are solids, liquid and gases.

The Periodic Table **Answers**

1. What is an element?

An element is a substance made of only one type of atom.

2. Calcium is an element whose name comes from the Latin term *calx*, meaning 'lime'. The symbol for calcium is written using the first two letters of its name.

What is the symbol for calcium.

Tick **one** box.

ca

cA

Ca

CA

3. Why did scientists find it hard to organise the elements at first?

Tick **one** box.

They did not have the right technology.

There were too many elements.

Not all of the elements had been discovered yet.

They didn't know what the properties of the elements were.

4. Explain how Mendeleev overcame this problem.

Mendeleev left gaps in the periodic table for elements that he thought had not yet been discovered.

5. Complete the sentences to describe the trend in the properties as you move across a period.

The atomic number **increases** as you move from left to right across a period.

The radius of an atom **decreases** as you move from left to right across a period.

6. Describe how elements with similar properties are organised on the periodic table.

Elements with similar properties are organised into columns called groups.

7. An element is a gas at room temperature. It has a low density and is a poor conductor of heat and electricity. The element reacts with virtually all other elements.

Which type of element is this most likely to be?

Tick **one** box.

- actinide
 alkali metal
 halogen
 noble gas

8. A shiny grey metalloid can conduct electricity, is very brittle and has a low density. Tick **one** box in each row to show whether each property is a typical metal property or a typical non-metal property.

Property	Typical Metal	Typical Non-Metal
shiny	✓	
conducts electricity	✓	
brittle		✓
low density		✓

9. Compare the properties of the alkali metals with the properties of the noble gases.
Alkali metals are solids at room temperature, whereas noble gases are gases at room temperature.
Alkali metals are very reactive. However, noble gases are unreactive.
Alkali metals are good conductors of both heat and electricity while noble gases are poor conductors of heat and electricity.
Alkali metals are shiny when cut, whereas noble gases are colourless.

The Periodic Table Questions

1. What is an element?

2. Calcium is an element whose name comes from the Latin term *calx*, meaning 'lime'. The symbol for calcium is written using the first two letters of its name.

What is the symbol for calcium.

Tick **one** box.

 ca cA Ca CA

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4. Explain how Mendeleev overcame this problem.

5. Complete the sentences to describe the trend in the properties as you move across a period.

The atomic number _____ as you move from left to right across a period.

The radius of an atom _____ as you move from left to right across a period.

6. Describe how elements with similar properties are organised on the periodic table.

7. An element is a gas at room temperature. It has a low density and is a poor conductor of heat and electricity. The element reacts with virtually all other elements.

Which type of element is this most likely to be?

Tick **one** box.

- actinide
 alkali metal
 halogen
 noble gas

8. A shiny grey metalloid can conduct electricity, is very brittle and has a low density. Tick **one** box in each row to show whether each property is a typical metal property or a typical non-metal property.

Property	Typical Metal	Typical Non-Metal
shiny		
conducts electricity		
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low density		

9. Compare the properties of the alkali metals with the properties of the noble gases.

The Periodic Table Questions

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2. Lithium is an element whose name comes from the Greek word *lithios*, meaning 'stone'. The symbol for lithium is written using the first two letters of its name.

Write down the symbol for lithium.

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4. Scientists continued to make discoveries about elements long after Mendeleev first produced his table. Explain how later discoveries provided evidence to support Mendeleev's organisation of the elements.

5. Describe two trends as you move from left to right across a **period**.

1. _____

2. _____

6. Explain why this organisation of the elements is known as the periodic table.

7. An element is a gas at room temperature. It has a low density and is a poor conductor of heat and electricity. The element reacts with virtually all other elements.

Give the name of the group that this element is most likely to be found in.

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9. A shiny, grey solid can conduct electricity, is very brittle and has a low density. Explain where this element is likely to be found on the periodic table.

10. Compare the melting and boiling points of the elements found in Group 1, Group 7 and Group 0.

The Periodic Table

What is an Element?

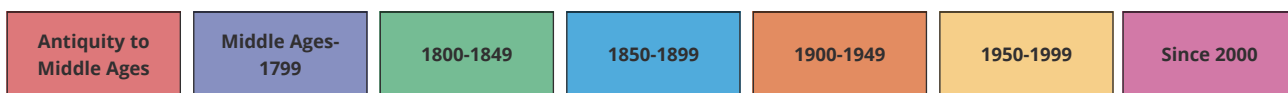
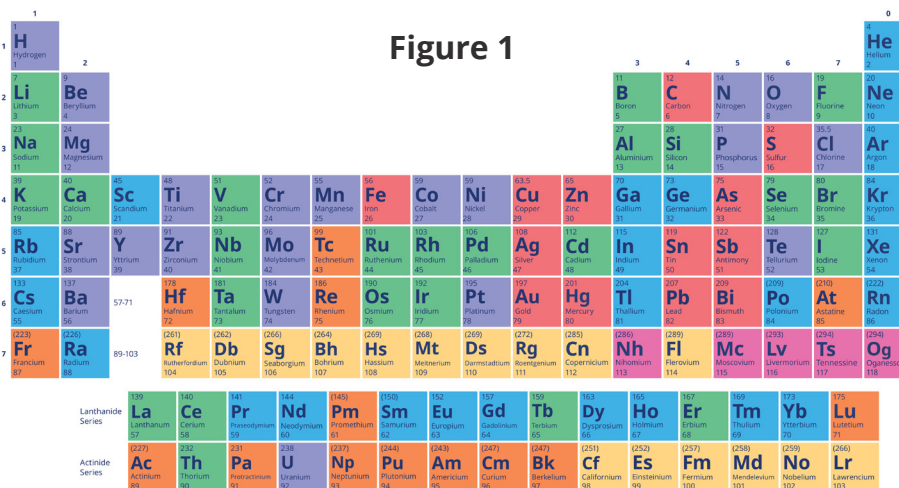
An element is a substance made of only one type of atom. Elements cannot be broken down into other substances.

Each element is represented by a symbol. The symbol comes from the first letter or letters of its name. For elements discovered early on, the symbol usually comes from its Latin or Greek name. For example, the symbol for sodium is Na, which comes from the Latin 'natrium'.

The first letter of the symbol is always capitalised. Any following letters are lower case. The symbol for each element can be found on the periodic table.

Name	Symbol	Origin
bromine	Br	Greek <i>bromos</i> meaning 'stench'.
gold	Au	Latin <i>arum</i> meaning 'shining dawn'.
helium	He	Greek <i>helios</i> meaning 'the sun' (where helium was first found).
lead	Pb	<i>Plumbum</i> , the Latin word for lead. The Romans used lead for making pipes so this is where the word 'plumber' comes from too.
oxygen	O	Greek <i>oxys</i> meaning 'acid' and <i>genes</i> meaning 'forming'.

There are 92 naturally occurring elements, as well as some unstable synthetic elements that have been created by humans. **Figure 1** shows when each element was first discovered.



Developing the Periodic Table

Scientists needed a way to make sense of the chemical and physical properties of the different elements. The earliest attempt to classify the elements was made in 1789. This was followed by several other attempts over the next few decades. The version on which the modern periodic table is based was created in 1869.

Scientists at this time were attempting to group the elements when not all of them had been discovered, as shown in **Figure 1**. This meant that early versions of the periodic table were incomplete.

Dimitri Mendeleev overcame this problem by leaving gaps for elements that he thought had not yet been discovered (**Figure 2**). Elements with properties predicted by Mendeleev were later identified and filled in the gaps (**Figure 3**).

H									
Li	Be	B	C	N	O	F			
Na	Mg	Al	Si	P	S	Cl			
K	Ca		Ti	V	Cr	Mn	Fe	Co	Ni
Cu	Zn		As	Se	Br				
Rb	Sr	Y	Zr	Nb	Mo		Ru	Rh	Pd
Ag	Cd	In	Sn	Sb	Te				
Ce	Ba	La		Ta	W		Os	Ir	Pt
Au	Hg	Tl	Pb	Bi					
			Th		U				

H										
He	Li	Be	B	C	N	O	F			
Ne	Na	Mg	Al	Si	P	S	Cl			
Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni
	Cu	Zn	Ga	Ge	As	Se	Br			
Kr	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd
	Ag	Cd	In	Sn	Sb	Te	I			
Xe	Ce	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt
	Au	Hg	Tl	Pb	Bi	Po	At			
Rn	Fr	Ra	Ac	Th	Pa	U				

Figure 2: Mendeleev's periodic table including gaps.

Figure 3: Elements discovered later filled the gaps.

As of January 2021, scientists have identified 118 elements. These elements are organised in the periodic table based on their properties. Grouping elements in this way helps scientists to identify trends in the elements and understand which elements behave in similar ways.

The Structure of the Periodic Table

A row in the periodic table is called a **period**. There are 7 periods in the periodic table. The atomic number increases as you move from left to right across a period. The radius of an atom decreases as you move from left to right.

The elements in the lanthanide series and actinide series belong to periods 6 and 7. They are positioned underneath the rest of the periodic table, as shown in **Figure 4**.

Figure 4

1 H Hydrogen																	2 He Helium
3 Li Lithium	4 Be Beryllium											5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
11 Na Sodium	12 Mg Magnesium											13 Al Aluminium	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
55 Cs Caesium	56 Ba Barium	57-71 Lanthanide Series	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium	89-103 Actinide Series	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson
		139 La Lanthanum	140 Ce Cerium	141 Pr Praseodymium	144 Nd Neodymium	145 Pm Promethium	150 Sm Samarium	152 Eu Europium	157 Gd Gadolinium	159 Tb Terbium	163 Dy Dysprosium	165 Ho Holmium	167 Er Erbium	169 Tm Thulium	173 Yb Ytterbium	175 Lu Lutetium	
		118 Ac Actinium	119 Th Thorium	120 Pa Protactinium	123 U Uranium	124 Np Neptunium	124 Pu Plutonium	125 Am Americium	126 Cm Curium	127 Bk Berkelium	128 Cf Californium	129 Es Einsteinium	132 Fm Fermium	134 Md Mendelevium	135 No Nobelium	136 Lr Lawrencium	

The table is called a periodic table because elements with similar properties occur at regular intervals (periodically). These groups of elements with similar properties are found in each column.

For this reason, a column in the periodic table is called a **group**. The groups are numbered along the top, from Group 1 to Group 7, with Group 0 on the end, as shown in **Figure 5**.

The middle section is not included in this group system because the elements here behave differently to those in the labelled groups.

Figure 5

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	99 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	57-71	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	89-103	(261) Rf Rutherfordium 104	(262) Db Dubnium 105	(266) Sg Seaborgium 106	(264) Bh Bohrium 107	(269) Hs Hassium 108	(268) Mt Meitnerium 109	(269) Ds Darmstadtium 110	(272) Rg Roentgenium 111	(285) Cn Copernicium 112	(286) Nh Nihonium 113	(289) Fl Flerovium 114	(289) Mc Moscovium 115	(293) Lv Livermorium 116	(294) Ts Tennessine 117	(294) Og Oganesson 118				
Lanthanide Series		139 La Lanthanum 57	140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	(145) Pm Promethium 61	(150) Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	163 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71					
Actinide Series		(227) Ac Actinium 89	232 Th Thorium 90	231 Pa Protactinium 91	238 U Uranium 92	(237) Np Neptunium 93	(244) Pu Plutonium 94	(243) Am Americium 95	(247) Cm Curium 96	(247) Bk Berkelium 97	(251) Cf Californium 98	(252) Es Einsteinium 99	(257) Fm Fermium 100	(258) Md Mendelevium 101	(259) No Nobelium 102	(266) Lr Lawrencium 103					

Group 1 (alkali metals)

- solids at room temperature
- very reactive
- good conductors of heat and electricity
- soft
- shiny when cut
- low density for metals

Group 7 (halogens)

- some solids, a liquid and some gases at room temperature
- very reactive
- poor conductors of heat and electricity
- solids are brittle
- low density

Group 0 (noble gases)

- gases at room temperature
- colourless
- unreactive
- poor conductors of heat and electricity
- low density

The stepped line shown in **Figure 6** divides the metal and non-metal elements. The elements on the left of the stepped line are metals and those on the right are non-metals. The highlighted elements are known as the metalloids: these are elements which have some properties of metals and some of non-metals.

Figure 6

metals																non-metals									
←																→									
1 H Hydrogen																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				
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Properties of Metals

- shiny
- good conductor of heat
- good conductor of electricity
- sonorous
- oxides form alkaline solutions
- high density
- malleable
- ductile

Properties of Non-Metals

- dull
- poor conductor of heat
- poor conductor of electricity
- not sonorous
- oxides form acidic solutions
- low density
- brittle