Periodic Table Detectives

Read the clues. Explain the patterns. Check your reasoning.

An original guided workbook for Years 7-9, with clearly marked extension into early GCSE ideas.

6	8	11	17
C	O	Na	Cl

From colouring to understanding

Build from the free activity into atomic structure, electron arrangements, groups, states, data and scientific explanations. Work in pencil, show your thinking and use the answers to improve a response.

Inside this workbook	What learners do
Guided learning	Study examples, then try related questions.
Independent practice	Solve clues, interpret data and correct misconceptions.
Feedback	Check explained answers and a 20-mark checkpoint.
Print extras	Use retrieval cards and a 118-element table.

Name: _____

Start date: _____

Read an atom like a code

Atomic number Z = number of protons. Mass number A = protons + neutrons in one atom. In a neutral atom, electrons = protons.

Particle	Relative charge	Where?
Proton	+1	Nucleus
Neutron	0	Nucleus
Electron	-1	Around the nucleus

Worked example: sodium-23

Z = 11 and A = 23. Protons = 11. Neutrons = 23 - 11 = 12. A neutral atom has 11 electrons. The total charge is zero because +11 and -11 balance.

Important: the decimal relative atomic mass printed on many tables is not the mass number of a single atom. Use the isotope mass number supplied in these questions.

Neutral atom	Z	A	Protons	Neutrons	Electrons
Carbon-12	6	12			
Oxygen-16	8	16			
Magnesium-24	12	24			
Chlorine-35	17	35			

5. Which quantity identifies an element: protons, neutrons or electrons? Explain.

Use data to decide the state

Below the melting point: solid. Between melting and boiling points: liquid. Above the boiling point: gas. Use the supplied rounded data at ordinary atmospheric pressure. Avoid exact boundary temperatures.

Element	Melting point (°C)	Boiling point (°C)
Bromine	-7	59
Mercury	-39	357
Gallium	30	2229
Oxygen	-219	-183

Worked example

At 20°C, bromine is above -7°C but below 59°C, so it is a liquid. “It is a non-metal” is not enough to determine its state.

1. Give the state of each of the four elements at 20°C.

2. What is the state of gallium at 40°C? Use both relevant temperatures.

3. What is the state of bromine at -20°C and at 80°C?

4. Why should a state-of-matter answer specify temperature and pressure?

Paper-based data exercise only. Do not handle these elements. Rounded data: Royal Society of Chemistry periodic table.

Check the sample activities

Read an atom like a code: workbook page 4

Neutral atom	Protons	Neutrons	Electrons
Carbon-12	6	6	6
Oxygen-16	8	8	8
Magnesium-24	12	12	12
Chlorine-35	17	18	17

5. The number of protons identifies an element. Changing the neutron number produces another isotope; changing the electron number changes charge, not element identity.

Use data to decide the state: workbook page 10

1. At 20°C: bromine is liquid; mercury is liquid; gallium is solid; oxygen is gas.

2. Gallium is liquid at 40°C because 40°C is above its rounded melting point of 30°C and below its boiling point of 2229°C.

3. Bromine is solid at -20°C and a gas at 80°C.

4. State depends on conditions. The same substance can have a different state at a different temperature or pressure.

What next?

Choose one answer to explain without looking. The complete 22-page workbook adds further topics, retrieval cards, a checkpoint and explained answers. Visit the activity page for availability and resource updates.

Explore the free activity and workbook information