Week 17

IGCSE Chemistry

Homework bundle for this week

本周作业合集

exercises.lol

Contents 目录

8. The Periodic Table

Starter Quiz · 课前小测

IGCSE Chemistry Name: _____ Score: _____

1. Elements in the Periodic Table are arranged in order of increasing:

   ☐ proton (atomic) number

   ☐ mass only

   ☐ colour

   ☐ discovery date

2. How many electrons are in the outer shell of a Group I element?

   _____

3. How many electrons are in the outer shell of a Group VII element?

   _____

4. Which are properties of transition metals? (Select all that apply.)

   ☐ hard and strong

   ☐ high melting points

   ☐ form coloured compounds

   ☐ very low density

   Tick every correct option.

5. Noble gases are unreactive because they have:

   ☐ a full outer shell of electrons

   ☐ one outer electron

   ☐ seven outer electrons

   ☐ no electrons

6. Elements in the same group have the same number of:

   ☐ outer-shell electrons

   ☐ protons

   ☐ neutrons

   ☐ shells

7. Going down Group I, reactivity:

   ☐ increases

- ☐ decreases
- ☐ stays the same
- ☐ becomes zero

8. Going down Group VII, reactivity:
   - ☐ decreases
   - ☐ increases
   - ☐ stays the same
   - ☐ doubles

9. The period number equals the number of electron shells.

   ☐ True ☐ False

10. Group I metals are soft enough to cut with a knife.

    ☐ True ☐ False

IGCSE Chemistry

1. **proton (atomic) number**

   They are ordered by atomic number.

2. **1**

   Group I elements have one outer electron.

3. **7**

   Halogens have seven outer electrons.

4. **hard and strong; high melting points; form coloured compounds**

   They are dense, not low-density.

5. **a full outer shell of electrons**

   A full outer shell is very stable.

6. **outer-shell electrons**

   Same outer electrons → similar properties.

7. **increases**

   The outer electron is lost more easily down the group.

8. **decreases**

   Halogens get less reactive down the group.

9. **True**

   Each period adds a shell.

10. **True**

    They are soft and have low densities.

IGCSE CHEMISTRY • EXERCISE SHEET

8.1 Arrangement of elements

Name: _____ Class: _____ Date: _____ **Total: 7 marks**

KEY WORDS periodic table 周期表 • elements 元素 • groups 族 • ions 离子 • electrons 电子

Objective

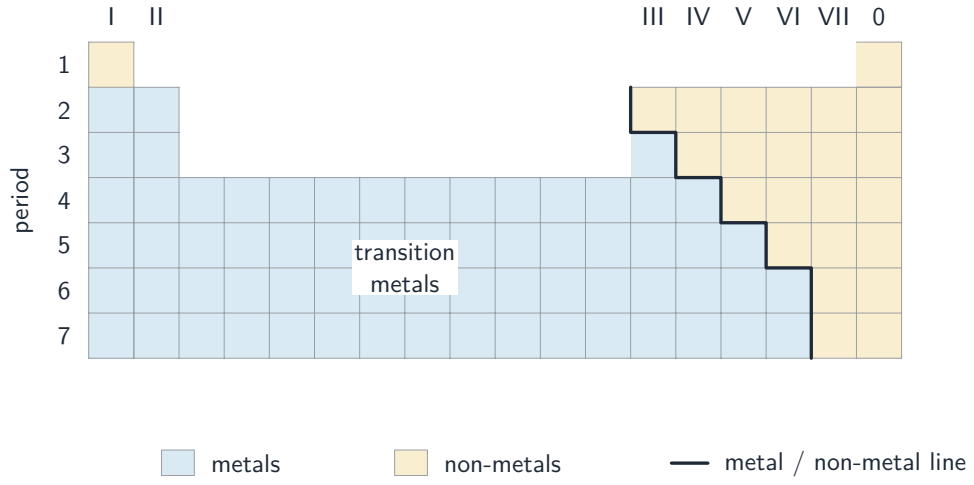
Build the skills to answer exam questions on the **arrangement of elements** 元素排列 — order, **groups** 族 and **periods** 周期, and using position to predict properties.

You must be able to:

- describe the order (increasing proton number) and what groups/periods are
- link group number to ion charge and outer electrons
- explain why elements in a group have similar properties

1 Worked examples

■ Reading the Periodic Table



Groups = columns, periods = rows; metals on the left, non-metals on the right

Trends in properties across groups and periods

- order = increasing proton number.
- **group number = outer-shell electrons = ion charge** (Group I → +1, Group VII → −1).
- same group → same outer electrons → similar properties.

2 Practice

2.1 State what the elements are arranged in order of. [1]

2.2 State the charge of the ion formed by a Group II element. [1]

3 Exam-style questions

3.1 Elements in the same group have similar chemical properties because they have the same: [1]

- **A** number of shells
- **B** number of outer-shell electrons
- **C** mass number
- **D** number of neutrons

3.2 An element is in Group VII, Period 3.

(a) State the number of outer-shell electrons it has. [1]

(b) State the charge of the ion it forms. [1]

3.3 Explain how the Periodic Table lets you predict an element's properties. [2]

Solutions

2.1 increasing proton number (atomic number).

2.2 +2.

3.1 B. Same number of outer-shell electrons gives similar properties.

3.2 (a) 7.
(b) −1.

3.3 elements in the same group have similar properties; so from its position you can predict how it reacts and trends in its group.

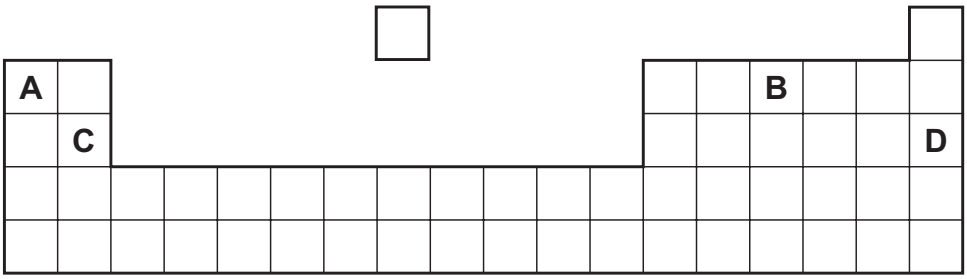
23 The ions formed when element X and element Y react together are shown.

- Element X forms X^- ions.
- Element Y forms Y^{2+} ions.

Which row identifies the position of X and of Y in the Periodic Table?

	X	Y
A	Group I	Group VI
B	Group VII	Group II
C	Group VII	Group VI
D	Group I	Group II

23 The Periodic Table shows the position of four different elements.



Which row is correct?

	element	number of electrons in the outer shell
A	non-metal	1
B	metal	5
C	metal	2
D	non-metal	7

21 The properties of the elements change from left to right across the Periodic Table.

Which statement describes how the properties change across Period 3?

A Elements change from gases to solids.

B Elements change from non-conductors to electrical conductors.

C Elements change from metal to non-metal.

D Elements have a decreasing number of electron shells.

22 Element X is in the same group of the Periodic Table as silicon.

An atom of element X has more protons than a silicon atom.

Which element could be X?

A aluminium

B carbon

C germanium

D phosphorus

25 The elements oxygen and sulfur are in the same group of the Periodic Table.

Which statement about oxygen and sulfur is **not** correct?

A They are non-metals.

B They have giant covalent structures.

C They have six electrons in the outer electron shells of their atoms.

D They react together to form an acidic oxide.

IGCSE CHEMISTRY • EXERCISE SHEET

8.2 Group I properties

Name: _____ Class: _____ Date: _____ **Total: 28 marks**

KEY WORDS sodium 钠 • potassium 钾 • melting point 熔点 • lithium 锂 • density 密度

Objective

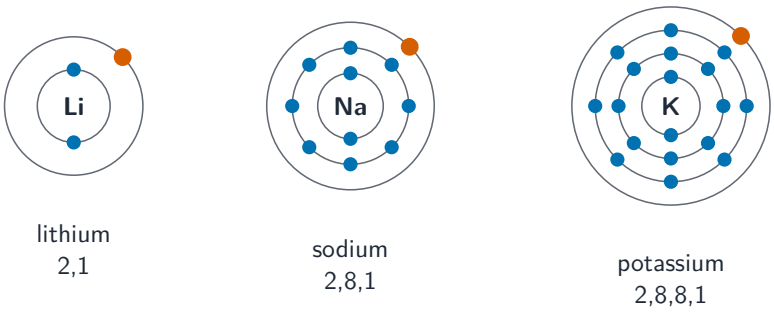
Build the skills to answer exam questions on **Group I — the alkali metals** 碱金属 — their properties, **trends** 趋势 down the group, and reaction with water.

You must be able to:

- describe the alkali metals (soft, one outer electron)
- state the trends in melting point, density and reactivity down the group
- predict the properties of an unfamiliar Group I element

1 Worked examples

■ Trends down Group I



every Group I atom has **one** electron in its outer shell (shown in orange), so they react in similar ways

Every Group I atom has one outer electron — why they react similarly

Down Group I: melting point decreases, density increases, reactivity increases

- react with water → metal hydroxide + hydrogen (more violent down the group).

■ Group I: the trend, and the reason behind it

The **alkali metals** 碱金属 all have **one electron in the outer shell**, which is why they behave alike: each loses that one electron to form a 1+ ion.

Going DOWN Group I	**Trend**	**Reason**
reactivity	**increases**	the outer electron is in a shell further from the nucleus and is shielded by more inner shells, so it is held less strongly and is lost more easily
melting point and density	melting point **decreases**	the metallic bonding weakens as the atoms get larger
atomic radius	increases	one more occupied electron shell each period

Reaction with water, the one the exam asks for. Each metal fizzes, floats and produces hydrogen, and the metal hydroxide formed makes the solution alkaline:

$$2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$$

The **observations** are the marks. Lithium: fizzes steadily and moves slowly. Sodium: melts into a ball, moves quickly across the surface, fizzes rapidly. Potassium: melts, moves very fast, and the hydrogen **ignites with a lilac flame**. Adding universal indicator turns the solution purple, showing an alkali.

Worked example. Predict what rubidium would do with water, and explain. Rubidium is below potassium, so it is more reactive: it would react violently, melt, move very rapidly, and the hydrogen would ignite, possibly explosively. The reason is that its outer electron is in an even more distant, more shielded shell, so it is lost still more easily. The equation is $2\text{Rb} + 2\text{H}_2\text{O} \rightarrow 2\text{RbOH} + \text{H}_2$.

2 Practice

2.1 State the number of outer-shell electrons in a Group I atom. [1]

2.2 State the trend in reactivity going down Group I. [1]

2.3 Write the balanced equation for the reaction of potassium with water. [2]

2.4 Explain, in terms of electrons, why reactivity increases down Group I. [3]

2.5 State two observations when sodium is added to water. [2]

3 Exam-style questions

3.1 Going down Group I, the melting point: [1]

- **A** increases
- **B** decreases
- **C** stays the same
- **D** increases then decreases

3.2 Rubidium is below potassium in Group I.

(a) Predict how its reactivity compares with potassium. [1]

(b) Predict how its melting point compares with potassium. [1]

3.3 Sodium reacts with water.

(a) Name the two products. [2]

(b) Explain why potassium reacts more violently than sodium. [1]

3.4 A student compares lithium, sodium and potassium by adding a small piece of each to water containing universal indicator.

(a) Complete the table by giving one observation for each metal. [3]

Metal	Observation
lithium	
sodium	
potassium	

(b) State the colour of the universal indicator after each reaction, and name the type of compound that causes it. [2]

(c) Write the balanced equation for the reaction of lithium with water. [2]

(d) Explain, in terms of the outer electron, why potassium is more reactive than lithium. [3]

(e) Predict two observations when caesium, which is below potassium, is added to water, and justify your prediction. [3]

Solutions

2.1 one.

2.2 reactivity increases.

2.3 $2K + 2H_2O \rightarrow 2KOH + H_2$.

2.4 Going down the group each atom has one more electron shell, so the outer electron is further from the nucleus; there are more inner shells shielding it from the nuclear charge; the outer electron is therefore held less strongly and is lost more easily, so the metal is more reactive.

2.5 Any two of: it melts into a ball; it moves quickly over the surface; it fizzes rapidly; it disappears; the solution becomes alkaline.

3.1 B. Melting point decreases down Group I.

3.2 (a) more reactive than potassium.
(b) lower melting point than potassium.

3.3 (a) sodium hydroxide; hydrogen.
(b) reactivity increases down the group, so potassium is more reactive than sodium.

3.4 (a) Lithium: fizzes steadily and moves slowly on the surface. Sodium: melts into a ball and moves quickly, fizzing rapidly. Potassium: melts, moves very fast, and the hydrogen ignites with a lilac flame.
(b) Purple, or blue; a metal hydroxide, which is an alkali.
(c) $2Li + 2H_2O \rightarrow 2LiOH + H_2$.
(d) Potassium's outer electron is in a shell further from the nucleus than lithium's; it is shielded by more inner shells; so it is attracted less strongly and is lost more easily, making potassium the more reactive.
(e) Any two of: it reacts violently or explosively; it melts; it moves extremely fast; the hydrogen ignites. Justification: caesium is further down the group, so its outer electron is even further from the nucleus and even more shielded, and is lost most easily of all.

Name:

IGCSE Chemistry: **w25 21**

24 Which properties decrease down the group of alkali metals?

1 melting point

2 density

3 reactivity

A 1 and 2 **B** 1 only **C** 2 and 3 **D** 3 only

IGCSE Chemistry: **w25 22**

23 Which statement about the elements in Group I is correct?

A Hydrogen is produced when Group I elements react with water.

B Ions of Group I elements have a 1– charge.

C Sodium is more reactive than potassium.

D Solid sodium is a poor electrical conductor.

IGCSE Chemistry: **w25 23**

27 Which statement about Group I or Group VII elements is correct?

A Group VII elements are monatomic non-metals.

B Lithium is more reactive with water than caesium.

C The melting point of Group I metals increases down the group.

D Potassium bromide reacts with chlorine to produce an orange solution.

IGCSE Chemistry: **s25 22**

22 Sodium is a Group I metal.

What is a physical property of sodium?

A non-conductor of electricity

B high melting point

C high density

D malleable

21 A Group I metal (lithium or potassium) is reacted with a Group VII element (chlorine or iodine).

Which compound is formed when the Group I metal of highest density reacts with the Group VII element of lowest density?

A potassium chloride

B lithium chloride

C potassium iodide

D lithium iodide

5 Alkali metals are reactive elements.

(a) State the group number of the alkali metals.

..... [1]

(b) Identify the alkali metal which:

(i) has the highest melting point

..... [1]

(ii) has the highest density

..... [1]

(iii) has the lowest reactivity

..... [1]

(iv) burns with a lilac flame

..... [1]

(v) is found in fertilisers to improve plant growth.

..... [1]

(c) Sodium sulfide, Na_2S, is an ionic compound.

Complete Fig. 5.1 to show the electronic configurations of the ions in sodium sulfide.

Show the charges on the ions.

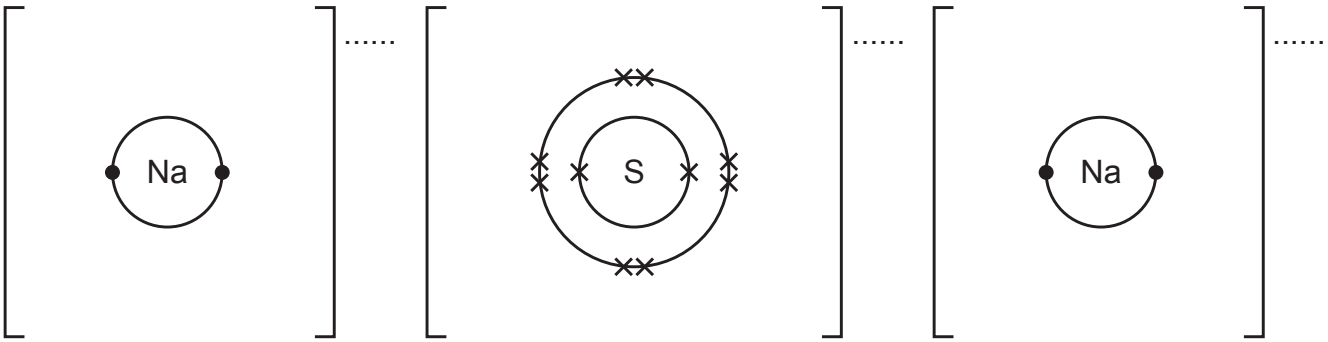


Fig. 5.1

[3]

(d) Rubidium has only two naturally occurring atoms, ^{85}Rb and ^{87}Rb.

(i) State the term given to these naturally occurring atoms of rubidium.

..... [1]

(ii) Complete Table 5.1 to show the number of protons, neutrons and electrons in the atom and ion of rubidium shown.

Table 5.1

	^{85}Rb	$^{87}Rb^{+}$
protons		
neutrons		
electrons		

[3]

(iii) The relative atomic mass of rubidium to one decimal place is 85.5.

Determine the relative abundance of ^{85}Rb in rubidium. Express your answer as a percentage.

.....% [1]

[Total: 14]

IGCSE CHEMISTRY • EXERCISE SHEET

8.3 Group VII properties

Name: _____ Class: _____ Date: _____ **Total: 31 marks**

KEY WORDS chlorine 氯气 • bromine 溴 • iodine 碘 • halogens 卤素 • displacement reaction 置换反应

Objective

Build the skills to answer exam questions on **Group VII — the halogens** 卤素 — their appearance, trends, and **displacement reactions** 置换反应.

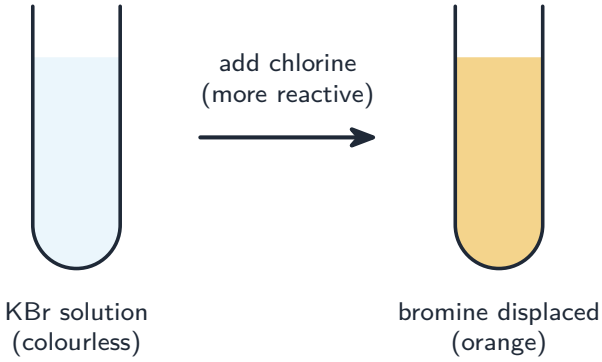
You must be able to:

- describe the halogens (diatomic, colours/states) and the trends down the group
- write and explain a halogen displacement reaction
- predict the products of a displacement

1 Worked examples

Displacement

Down Group VII the reactivity decreases (opposite to Group I)



A more reactive halogen displaces a less reactive halide from its solution

$Cl_2 + 2KBr \rightarrow 2KCl + Br_2$ — chlorine (more reactive) displaces bromine.

■ Group VII: the trend, the reason, and the displacement test

The **halogens** 卤素 all have **seven outer-shell electrons**, so each gains one electron to form a 1− ion.

Going DOWN Group VII	Trend	Appearance at r.t.p.
reactivity	**decreases**	chlorine: pale yellow-green **gas**
colour	gets darker	bromine: red-brown **liquid**
density and melting/boiling point	increase	iodine: grey-black **solid**

Why reactivity DECREASES down the group — the opposite of Group I, and the reason is the mirror image. A halogen atom needs to **gain** one electron. Going down, the outer shell is further from the nucleus and shielded by more inner shells, so the incoming electron is attracted **less strongly** and is gained **less easily**.

Displacement reactions are the evidence, and the rule is simple: **a more reactive halogen displaces a less reactive one from its salt.** So chlorine displaces bromide and iodide; bromine displaces only iodide; iodine displaces neither.

$$Cl_2 + 2KBr \rightarrow 2KCl + Br_2$$

$$Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2 \quad \text{(ionic equation)}$$

The observations are the marks, so learn the colours in solution: chloride solution is colourless, bromine in solution is **orange**, iodine in solution is **brown**. Adding chlorine water to colourless potassium bromide turns it orange — that colour change IS the evidence that displacement happened.

Worked example. Predict, with a reason and an equation, what happens when bromine water is added to potassium iodide solution and to potassium chloride solution.

1. With potassium **iodide**: bromine is above iodine, so it is more reactive and displaces it. The colourless solution turns **brown** as iodine forms. $Br_2 + 2KI \rightarrow 2KBr + I_2$.
2. With potassium **chloride**: bromine is below chlorine, so it is less reactive and cannot displace it. **No reaction**, and the solution stays orange from the bromine added.

△ Displacement is a **redox** reaction: the halogen is **reduced** (it gains electrons) and the halide ion is **oxidised**. Naming which is which is a frequent extra mark.

2 Practice

2.1 State the colour and state of chlorine at room temperature. [1]

2.2 State the trend in reactivity down Group VII. [1]

2.3 State the appearance of chlorine, bromine and iodine at room temperature. [3]

2.4 Explain, in terms of electrons, why chlorine is more reactive than iodine. [3]

2.5 Write the ionic equation for the reaction of chlorine with iodide ions. [2]

3 Exam-style questions

3.1 Which halogen is the most reactive? [1]

- **A** chlorine
- **B** bromine
- **C** iodine
- **D** they are equal

3.2 Chlorine is bubbled into colourless potassium iodide solution.

(a) Write the equation for the reaction. [2]

(b) State and explain the colour change. [2]

3.3 Predict whether bromine will displace chlorine from potassium chloride, and explain your answer. [2]

3.4 A student adds chlorine water, bromine water and iodine solution to separate samples of potassium bromide solution and potassium iodide solution.

(a) Complete the table by writing "reaction" or "no reaction" in each cell. [4]

added to →	**potassium bromide**	**potassium iodide**
chlorine water		
bromine water		
iodine solution		

(b) Describe the colour change the student would see when chlorine water is added to potassium iodide solution. [2]

(c) Write the balanced symbol equation and the ionic equation for that reaction. [3]

(d) Explain, in terms of the outer shell, why reactivity decreases down Group VII. [3]

(e) State which species is oxidised and which is reduced in the reaction in (c), giving a reason for each. [2]

Solutions

2.1 a pale yellow-green gas.

2.2 reactivity decreases.

2.3 Chlorine: pale yellow-green gas; bromine: red-brown liquid; iodine: grey-black solid.

2.4 A halogen reacts by gaining one electron; chlorine's outer shell is closer to the nucleus and shielded by fewer inner shells than iodine's; so chlorine attracts the incoming electron more strongly and gains it more easily.

2.5 $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$.

3.1 **A**. Chlorine is the most reactive (reactivity decreases down the group).

3.2 (a) $Cl_2 + 2KI \rightarrow 2KCl + I_2$.
(b) the solution turns brown/orange; because iodine has been displaced/formed.

3.3 no — bromine will not displace chlorine; because chlorine is more reactive than bromine, so only a more reactive halogen can displace a less reactive one.

3.4 (a) Chlorine water: reaction with both. Bromine water: no reaction with bromide, reaction with iodide. Iodine solution: no reaction with either.
(b) The colourless solution turns brown, because iodine has been displaced.
(c) $Cl_2 + 2KI \rightarrow 2KCl + I_2$; ionic: $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$.
(d) Each halogen reacts by gaining one electron into its outer shell; going down the group that shell is further from the nucleus and shielded by more inner shells; the incoming electron is attracted less strongly, so it is gained less easily and reactivity falls.
(e) Chlorine is reduced, because it gains electrons; the iodide ion is oxidised, because it loses electrons.

IGCSE Chemistry: **w25 21**

25 Some halide ions are displaced from aqueous potassium halides by halogens.

In which mixtures are the halide ions displaced?

1 potassium bromide and chlorine

2 potassium bromide and iodine

3 potassium iodide and chlorine

4 potassium chloride and iodine

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

IGCSE Chemistry: **w25 22**

24 Which row describes the colour and state of iodine at room temperature and pressure?

	colour	state
A	green	liquid
B	grey-black	solid
C	purple	solid
D	red-brown	liquid

IGCSE Chemistry: **s25 21**

22 Which property decreases down Group VII of the Periodic Table, from chlorine to iodine?

A atomic number

B density

C reactivity

D melting point

IGCSE Chemistry: **s25 22**

23 Tennessine (atomic number 117) is a manufactured element that is below astatine in Group VII of the Periodic Table.

What is the expected state of tennessine at room temperature and pressure?

A a diatomic gas

B a liquid

C a monatomic gas

D a solid

24 When chlorine is bubbled into aqueous sodium bromide, a displacement reaction occurs.

Which description of this reaction is correct?

A Chloride displaces bromide.

B Chlorine displaces bromine.

C Chloride displaces bromine.

D Chlorine displaces bromide.

26 Tennessine, Ts, is at the bottom of Group VII of the Periodic Table.

What are the predicted properties of tennessine at room temperature?

A a black solid, more dense than iodine

B a black solid, more reactive than iodine

C a colourless gas, less dense than chlorine

D a colourless gas, less reactive than chlorine

3 The halogens are a group of elements in the Periodic Table.

Chlorine is a member of this group.

(a) State the group number of the halogens.

..... [1]

(b) State how many halogens there are in this group.

..... [1]

(c) Suggest the identity of the halogen which:

(i) has the highest density

..... [1]

(ii) is the most reactive.

..... [1]

(d) State the name of the negative ions (anions) formed by halogens.

..... [1]

(e) State how many occupied electron shells there are in a bromine atom.

..... [1]

(f) Name the noble gas which has the same electronic configuration as a Br^- ion.

..... [1]

(g) Aqueous chlorine, Cl_2, reacts with aqueous potassium iodide, KI.
One of the products formed is iodine, I_2.

(i) Complete and balance the ionic equation for the reaction between Cl_2 and I^- ions.
State symbols are **not** required.

$$Cl_2 + ...I^- \rightarrow ..... + I_2$$

[2]

(ii) Explain why this reaction is defined as a redox reaction.

Give your answer in terms of electron transfer.

.....

..... [2]

(h) Give the colour and state of iodine at room temperature and pressure.

colour .....

state .....

[2]

[Total: 12]

IGCSE CHEMISTRY • EXERCISE SHEET

8.4 Transition elements

Name: _____ Class: _____ Date: _____ **Total: 8 marks**

KEY WORDS coloured 有色 • iron 铁 • compounds 化合物 • variable 可变 • transition elements 过渡元素

Objective

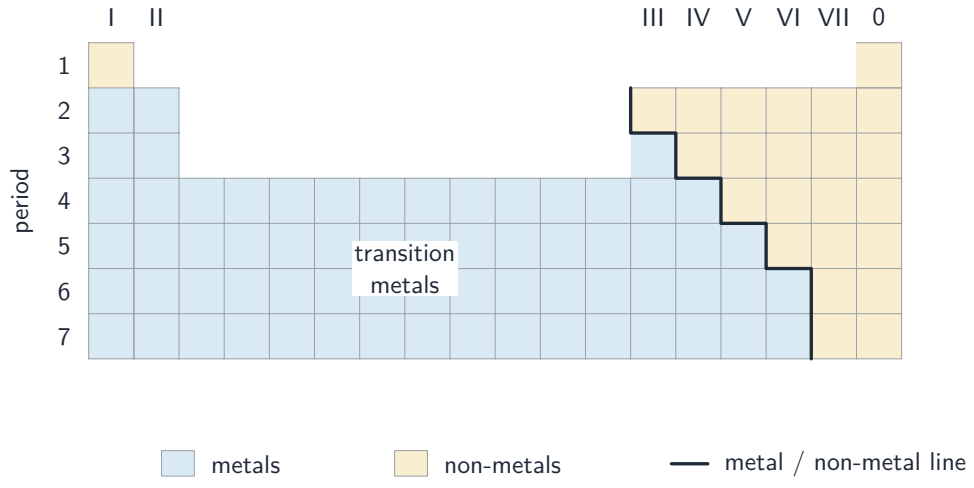
Build the skills to answer exam questions on the **transition elements** 过渡元素 — their properties compared with Group I metals.

You must be able to:

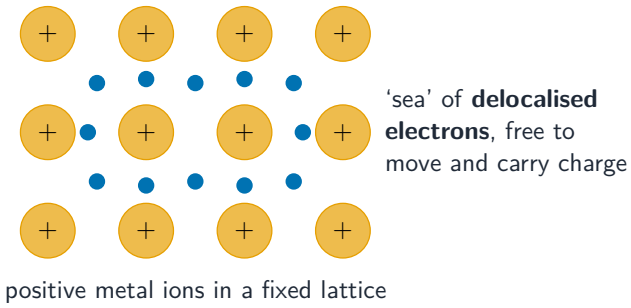
- state the properties of transition elements
- contrast them with Group I metals
- recognise variable oxidation states and coloured compounds

1 Worked examples

■ Transition metal properties



The transition elements are the block of metals in the middle of the table



Transition elements are metals with a sea of electrons

- high density and high melting point.
- form **coloured** compounds; often act as catalysts.
- have **variable oxidation numbers** (e.g. iron(II) and iron(III)).

2 Practice

2.1 State one property of transition metals not shared by Group I metals. [1]

2.2 Give the two common oxidation states of iron. [2]

3 Exam-style questions

3.1 A student compares element X from Group I with element Y from the transition elements. Which row could be correct? [1]

	X	Y
A	forms a white compound, one oxidation state	forms a coloured compound, several oxidation states
B	forms a coloured compound, several oxidation states	forms a white compound, one oxidation state
C	high density, high melting point	low density, low melting point
D	acts as a catalyst	never acts as a catalyst

3.2 Compare a transition metal with a Group I metal.

(a) Give two differences in physical properties. [2]

(b) State one use of transition elements (or their compounds) linked to their special property. [1]

3.3 Iron forms both iron(II) and iron(III) compounds. State what this shows about transition elements. [1]

Solutions

2.1 any of: high density; high melting point; coloured compounds; variable oxidation states; catalytic activity.

2.2 iron(II) and iron(III).

3.1 A. A Group I metal forms white compounds and has one oxidation state, while a transition element forms coloured compounds and has several. B swaps the two, C gives the densities and melting points the wrong way round, and D reverses the catalytic behaviour.

3.2 (a) transition metals have higher density and higher melting points than Group I metals.
(b) used as catalysts (e.g. iron in the Haber process).

3.3 they have variable oxidation numbers (states).

26 Which row identifies a transition element?

	melting point	density at r.t.p.
A	high	high
B	high	low
C	low	high
D	low	low

IGCSE Chemistry: **s25 21**

23 Some properties of elements are listed.

1 They have good electrical conductivity.

2 They have high melting points.

3 They are malleable.

4 They have ions with variable oxidation numbers.

Which properties are correct for **both** iron and lithium?

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

IGCSE Chemistry: **s25 23**

24 Which element is a transition element?

	melting point in °C	density at r.t.p. in g/cm^3	colour of oxide at r.t.p.
A	98	1.0	white
B	328	11.3	yellow
C	651	1.7	white
D	1907	7.2	green

5 Manganese is the element with atomic number 25 in the Periodic Table.
Calcium is the element with atomic number 20 in the Periodic Table.

(a) Complete Table 5.1 to show the number of protons, neutrons and electrons in the ^{55}Mn atom and the $^{42}Ca^{2+}$ ion.

Table 5.1

	^{55}Mn	$^{42}Ca^{2+}$
protons		
neutrons		
electrons		

[3]

(b) Manganese forms several oxides. The formulae of some of these oxides are shown.

MnO
Mn_2O_3
Mn_3O_4
MnO_2
Mn_2O_7

(i) Suggest why manganese is expected to form coloured oxides.

..... [1]

(ii) State which other property of manganese is shown by the formation of several oxides.

..... [1]

(iii) State the formula of manganese(II) oxide.

..... [1]

(c) Mn_3O_4 is found in an ore of manganese. Manganese metal can be extracted from Mn_3O_4 using aluminium as the reducing agent.

(i) Define the term reducing agent.

.....

..... [2]

(ii) Complete the symbol equation by inserting the formula of the missing product and balancing the equation.

$$\text{.....}Mn_3O_4 + \text{.....}Al \rightarrow \text{.....} + \text{.....}Mn$$

[2]

(d) MnO_2 reacts with dilute hydrochloric acid as shown in the equation.

$$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$$

(i) Calculate the volume of chlorine gas formed, in cm^3, at r.t.p. when excess MnO_2 reacts with 50.0 cm^3 of 0.200 mol / dm^3 HCl.

Use the following steps.

- Calculate the number of moles of HCl used.

.....mol

- Determine the number of moles of Cl_2 formed.

.....mol

- Calculate the volume of Cl_2 formed.

..... cm^3
[3]

(ii) Describe a test for chlorine gas.

test .....

observations .....
[1]

(iii) Explain, in terms of collision theory, why decreasing the temperature decreases the rate of this reaction.

.....

.....

.....

.....

.....

..... [3]

[Total: 17]

IGCSE CHEMISTRY • EXERCISE SHEET

8.5 Noble gases

Name: _____ Class: _____ Date: _____ **Total: 6 marks**

KEY WORDS monatomic 单原子 • unreactive 不活泼 • noble gases 稀有气体 • ions 离子 • periodic table 周期表

Objective

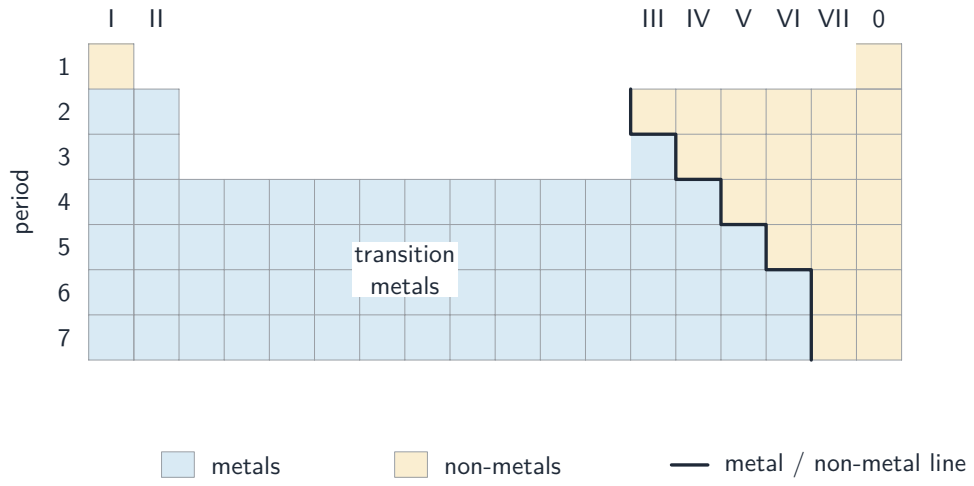
Build the skills to answer exam questions on **Group VIII — the noble gases** 稀有气体 — why they are unreactive.

You must be able to:

- describe the noble gases (monatomic, unreactive)
- explain their lack of reactivity using electron shells

1 Worked examples

■ Why noble gases are unreactive



The noble gases are in Group VIII (0) on the far right

- they are **monatomic** (single atoms) and **unreactive**.
- they have a **full outer shell**, so they don't need to gain, lose or share electrons.

2 Practice

2.1 State why the noble gases are described as monatomic. [1]

2.2 State the position of the noble gases in the Periodic Table. [1]

3 Exam-style questions

3.1 The noble gases are unreactive because they have: [1]

- **A** one outer electron
- **B** seven outer electrons
- **C** a full outer shell of electrons
- **D** no electrons

3.2 Argon is a noble gas.

(a) Explain, using electrons, why argon does not form compounds easily. [2]

(b) State whether argon exists as single atoms or as molecules. [1]

Solutions

2.1 they exist as single atoms (not joined into molecules).

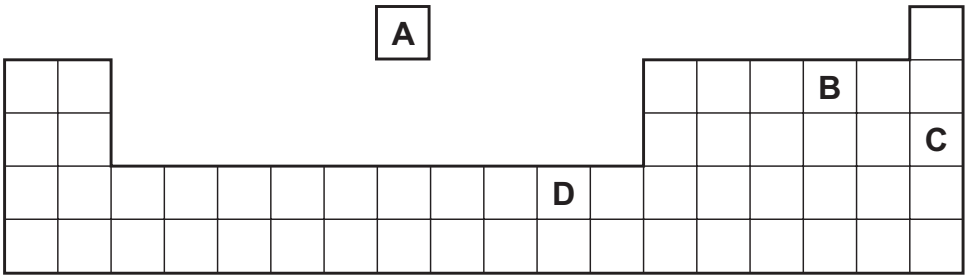
2.2 Group VIII (0), on the far right.

3.1 C. A full outer shell makes them unreactive.

3.2 (a) argon has a full outer shell of electrons; so it does not need to gain, lose or share electrons, making it stable/unreactive.
(b) single atoms.

25 Part of the Periodic Table is shown.

Which element is an inert gas?



24 Two statements about noble gases are listed.

1 Noble gases are reactive, monatomic gases.

2 Noble gases all have a full outer shell of electrons.

Which statements about noble gases are correct?

A Both statements are correct, and statement 2 explains statement 1.

B Both statements are correct but statement 2 does **not** explain statement 1.

C Statement 1 is correct but statement 2 is **not** correct.

D Statement 2 is correct but statement 1 is **not** correct.

21 The table shows some properties of noble gases.

noble gas	density in g / dm^3	boiling point in °C
helium	0.2	–269
neon	0.9	–246
argon	1.8	–186
krypton		
xenon	5.9	–108

Which row predicts the density and the boiling point of krypton?

	density in g / dm^3	boiling point in °C
A	1.4	–75
B	2.4	–195
C	3.8	–153
D	8.5	–213

23 Which statement about the elements in Group VIII is correct?

A They all form diatomic molecules.

B They all have eight electrons in their outer electron shells.

C They all react with oxygen to form oxides.

D They all are gases at room temperature.