

Week 16

IGCSE Chemistry

Homework bundle for this week

本周作业合集

exercises.lol

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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.

8.1 Arrangement of elements

Name: _____ Class: _____ Date: _____

Total: 7 marks

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

Objective

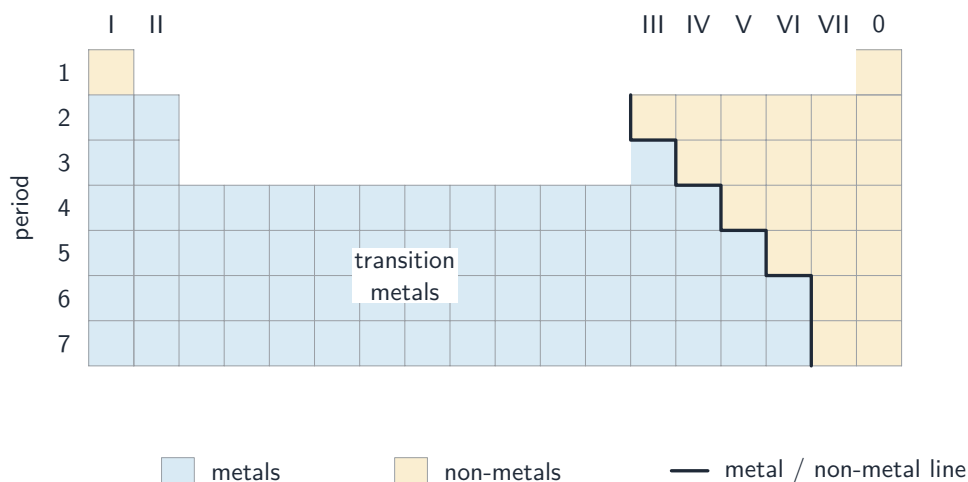
Build the skills to answer exam questions on the **arrangement of elements** 元素排列 — order, **groups** 族 and **periods** 周期, and using position to predict properties.

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

Group I		Group VII
Li	 reactivity increases down	Cl
Na		Br
K		I

Trends in properties across groups and periods

- order = increasing proton number.
- **group number = outer-shell electrons = ion charge** (Group I $\rightarrow +1$, Group VII $\rightarrow -1$).
- same group $\rightarrow$ same outer electrons $\rightarrow$ 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.

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.

8.2 Group I properties

Name: _____ Class: _____ Date: _____

Total: 8 marks

KEY WORDS sodium 钠 • melting point 熔点 • potassium 钾 • density 密度 • reactivity 活泼性

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:

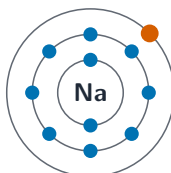
- describe the alkali metals (soft, one outer electron)
- state the trends in melting point, density and reactivity down the group
- predict the properties of an unfamiliar Group I element

1 Worked examples

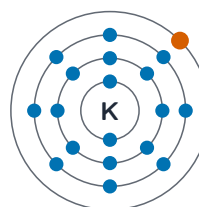
■ Trends down Group I



lithium
2,1



sodium
2,8,1

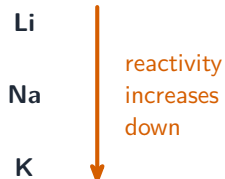


potassium
2,8,8,1

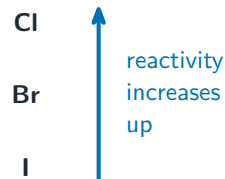
every Group I atom has **one** electron in its outer shell (shown in orange), so they react in similar ways

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

Group I



Group VII



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

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

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]

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]

Solutions

2.1 one.

2.2 reactivity increases.

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.

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

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.

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.

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.

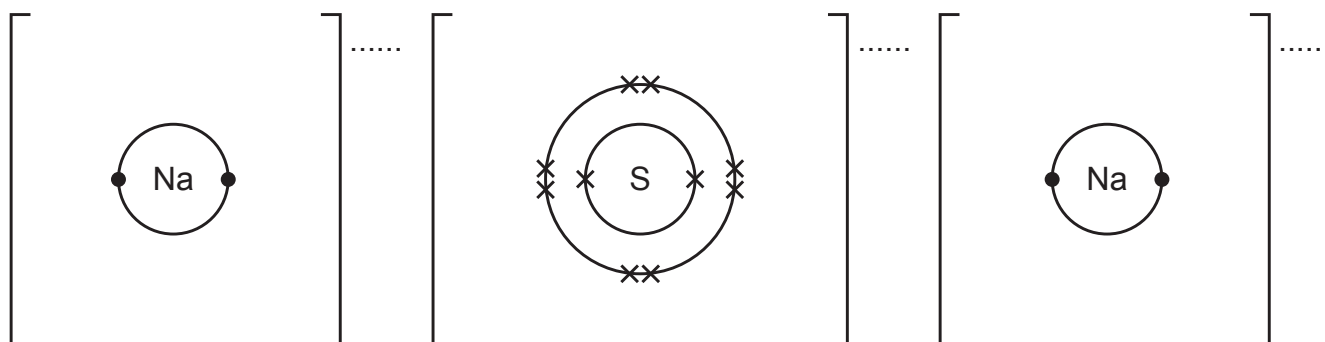


Fig. 5.1

[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	$^{87}\text{Rb}^+$
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]

8.3 Group VII properties

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS chlorine 氯气 • iodine 碘 • bromine 溴 • 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.

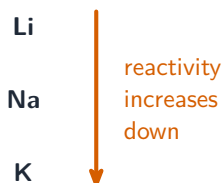
You must be able to:

- 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

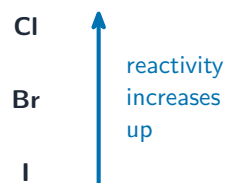
1 Worked examples

■ Displacement

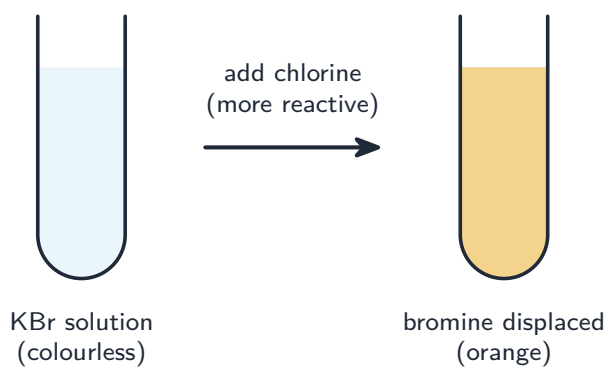
Group I



Group VII



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



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

$\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2$ — chlorine (more reactive) displaces bromine.

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]

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]

Solutions

2.1 a pale yellow-green gas.

2.2 reactivity decreases.

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

3.2 (a) $\text{Cl}_2 + 2\text{KI} \rightarrow 2\text{KCl} + \text{I}_2$.

(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.

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.



[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]

8.4 Transition elements

Name: _____ Class: _____ Date: _____

Total: 8 marks**KEY WORDS** coloured 有色 • variable 可变 • iron 铁 • compounds 化合物 • oxidation numbers 氧化数

Objective

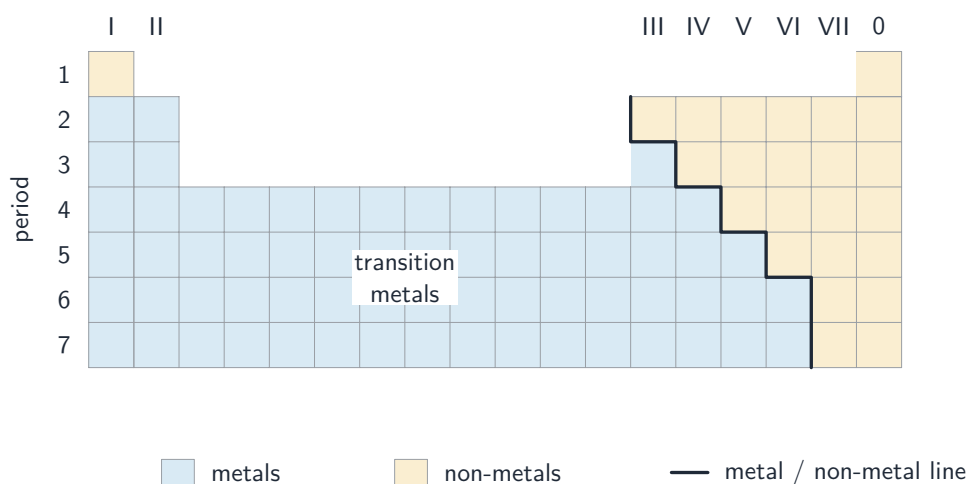
Build the skills to answer exam questions on the **transition elements** 过渡元素 — their properties compared with Group I metals.

You must be able to:

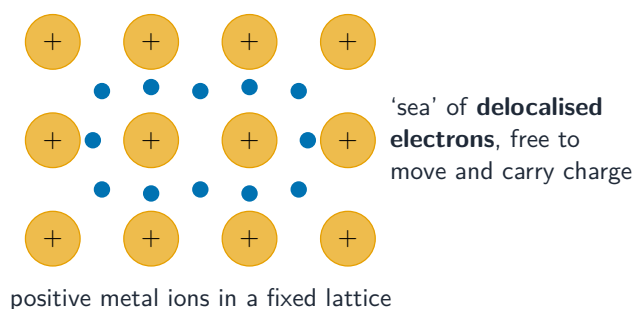
- state the properties of transition elements
- contrast them with Group I metals
- recognise variable oxidation states and coloured compounds

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 Which is a property of transition elements? [1]

- **A** very low density
- **B** they form coloured compounds
- **C** only one oxidation state
- **D** very low melting points

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 B. Transition elements form coloured compounds.

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

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

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 $^{42}\text{Ca}^{2+}$ ion.

Table 5.1

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

[3]

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



- (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]

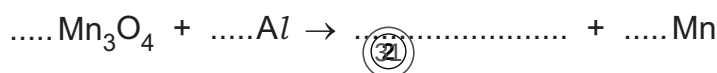
- (c)** Mn_3O_4 is found in an ore of manganese. Manganese metal can be extracted from Mn_3O_4 using aluminium as the reducing agent.

- (i)** Define the term reducing agent.

.....

..... [2]

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



(2)

[2]

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



- (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 $0.200 \text{ mol/dm}^3 \text{ HCl}$.

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]

8.5 Noble gases

Name: _____ Class: _____ Date: _____

Total: 6 marks

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

Objective

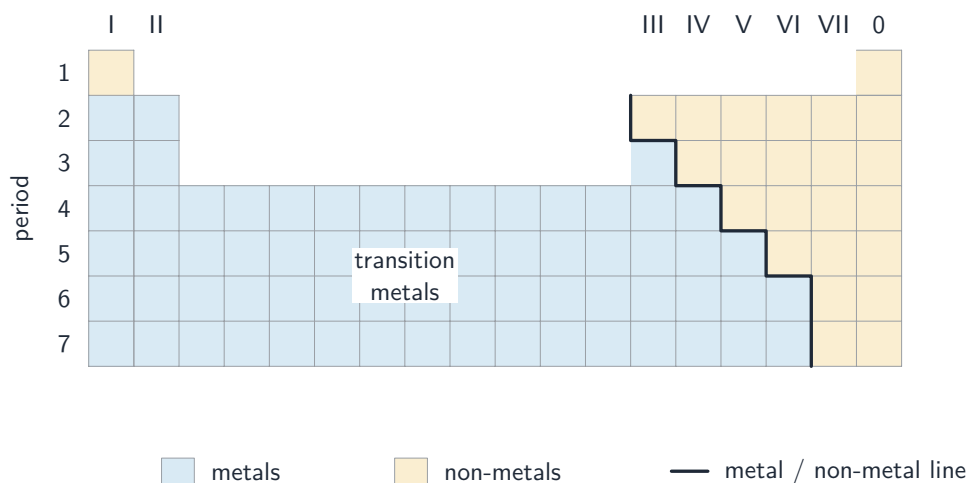
Build the skills to answer exam questions on **Group VIII — the noble gases** 稀有气体 — why they are unreactive.

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.