The periodic table

5.1.2.1 · Chemistry · revision notes

How the modern periodic table is arranged (by atomic number, in groups and periods), and why elements in the same group have similar chemical properties. You also need to predict an element's reactions from its position.

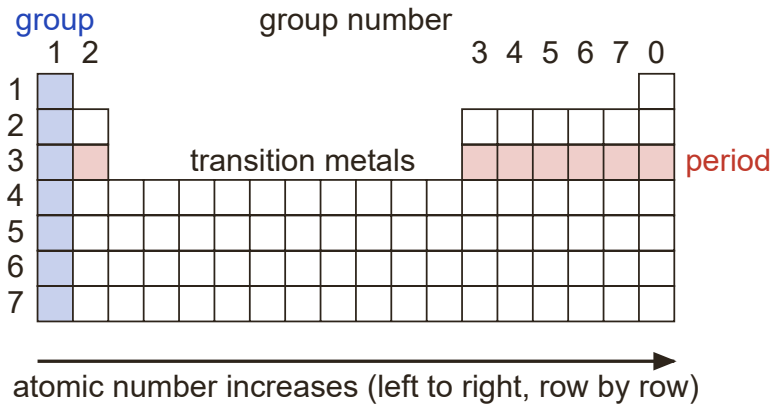
Key facts

- Order: increasing atomic (proton) number
- Period: horizontal row; same number of occupied shells
- Group 0: full outer shell
- Group: vertical column; same number of outer electrons; similar chemical properties
- Group number = number of outer electrons (Groups 1 to 7)
- 'Periodic': similar properties repeat at regular intervals

Notes

How the table is arranged

- The elements are arranged in order of **atomic (proton) number**.
- Elements with similar properties are in the same vertical column, called a **group**.
- The horizontal rows are called **periods**.



Groups are columns (Group 1 in blue). Periods are rows (period 3 in red).

- It is called the **periodic** table because similar properties occur at regular intervals as the atomic number increases.

Groups and electrons

- Elements in the same group have the **same number of electrons in their outer shell**.
- Chemical reactions depend on the outer electrons, so elements in the same group have **similar chemical properties**.
- For Groups 1 to 7, the group number = the number of outer electrons. Group 0 elements have a full outer shell.
- The period number = the number of occupied shells.
- So an element's position depends on the arrangement of its electrons, which depends on its atomic number.

Making predictions

- Use the group to predict the type of reaction: rubidium is in Group 1, so, like sodium, it reacts with water to form an alkaline hydroxide and hydrogen.
- Elements in the same group form compounds with similar formulae: nitrogen forms NH_3, so phosphorus forms PH_3; chlorine is Cl_2, so astatine is At_2.
- Use the trend down the group to predict reactivity: Group 1 elements get more reactive down the group; Group 7 elements get less reactive.
- Metals are on the left and towards the bottom of the table; non-metals are on the right and towards the top.

How to answer each type of question

Recall how the periodic table is arranged 1 mark each **Grade 4**

1. Ordered by atomic number (proton number), not by mass.
2. Columns are groups; rows are periods.

Example. (a) Complete the sentence: the elements in the modern periodic table are arranged in order of .....
(b) What name is given to a vertical column of the periodic table?

Model answer.

(a) atomic number / proton number (1)
(not 'atomic mass')
(b) group (1)

Explain why elements in a group have similar properties 2 marks **Grade 5**

1. State the number of outer electrons they all have.
2. Say that chemical properties depend on the outer electrons.

Example. Lithium, sodium and potassium react with water in similar ways.
Explain why, in terms of electrons.

Model answer. They all have one electron in their outer shell (1). The reactions of an element depend on its outer electrons, so they react in similar ways (1).

Explain an element's position from its atomic number

3 marks | Grade 5

1. Use the atomic number to write the electronic structure.
2. Outer electrons give the group.
3. Number of occupied shells gives the period.

Example. Magnesium has atomic number 12.
Explain why magnesium is in Group 2 and period 3 of the periodic table.

Model answer. Magnesium has 12 electrons, arranged 2,8,2 (1). It has 2 electrons in its outer shell, so it is in Group 2 (1). It has 3 occupied shells, so it is in period 3 (1).

Predict the properties of an element from its position

2 to 4 marks | Grade 7

1. Find the group and recall the trend down it.
2. Compare with the element next to it that you know about.
3. Give the prediction, then the reason (the trend or similarity).

Example. Astatine is below iodine in Group 7.
(a) Predict the state of astatine at room temperature. Give a reason.
(b) Predict whether astatine would displace iodine from potassium iodide solution. Give a reason.

Model answer.

(a) Solid (1). Melting and boiling points increase down Group 7, and iodine is already a solid (1).
(b) No (1). Reactivity decreases down Group 7, so astatine is less reactive than iodine (1).

Don’t lose marks

- Saying the modern table is arranged by atomic mass or atomic weight. That was how the early tables were arranged.
- Saying elements in a group have the same number of electrons. They have the same number of **outer** electrons.
- Mixing up groups (columns) and periods (rows).
- Saying elements in a group have the same properties. Their properties are similar and change gradually down the group.

More tips

Memory tricks

- Periods run across, like lines of writing on a page; groups run down, like columns in a newspaper.
- Group = number of outer electrons; period = number of shells.
- Same group → same number of outer electrons → same kind of reactions.

Exam technique

- In 'explain' questions, the key phrase is 'the same number of electrons in the outer shell'.
- When predicting, give the prediction and the pattern it is based on.
- Use the periodic table on the data sheet: it gives the atomic number and relative atomic mass of every element.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3 — **Identify groups and periods**
Groups are the vertical columns; periods are the horizontal rows.

Grade 4 — **State how the elements are ordered**
In order of atomic (proton) number.

Grade 5 — **Explain why group members react similarly**
They have the same number of electrons in their outer shell.

Grade 5 — **Link position to electronic structure**
Group number = outer electrons (Groups 1 to 7); period = number of occupied shells.

Grade 6 — **Explain why it is called 'periodic'**
Similar properties occur at regular intervals as the atomic number increases.

Grade 7 — **Predict reactions from an element's position**
Use the group's typical reactions and trends, e.g. caesium reacts with water like sodium, but more vigorously.

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