

1 Atomic structure and periodic trends

– Part 2

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)
nucleus	原子核	_____
electron configuration	电子排布	_____
valence electrons	价电子	_____
atomic radius	原子半径	_____
ionization energy	电离能	_____
electronegativity	电负性	_____
cations	阳离子	_____
anions	阴离子	_____
ionic compound	离子化合物	_____

Recall

You already know a lot about atoms and the periodic table:

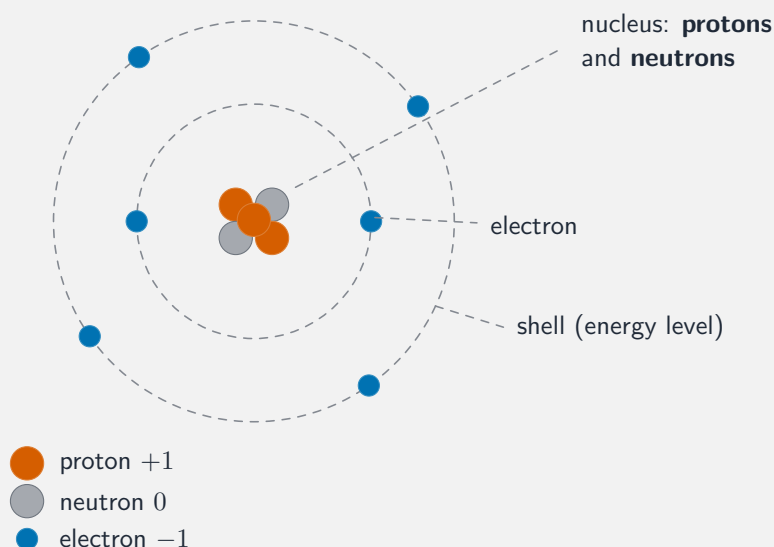
- An atom has a tiny central **nucleus** with electrons around it.
- Electrons sit in **shells**; the outer ones decide how the atom reacts.
- The periodic table groups elements with similar behaviour.

This sheet links these ideas up for AP. Each idea has a worked example.

New ideas

■ 1 Inside the atom

An atom has a tiny **nucleus** 原子核 (protons and neutrons) surrounded by electrons in shells and subshells (s, p, d).



The **electron configuration** 电子排布 lists how the electrons fill up, lowest energy first, e.g. $1s^2 2s^2 2p^6$.

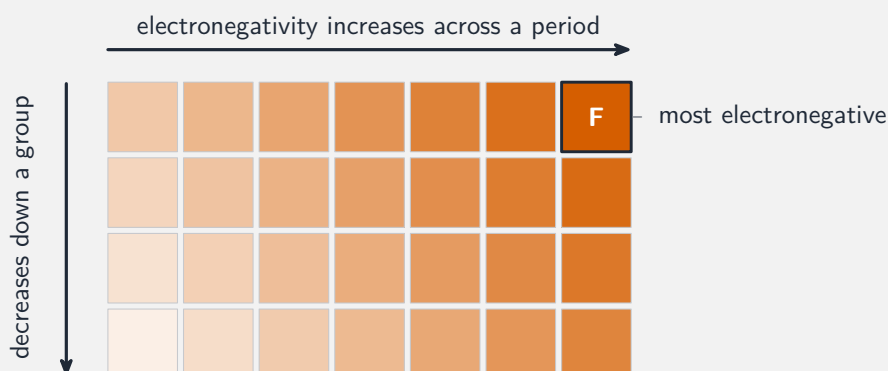
Worked example. Sulfur ($Z = 16$) fills to $1s^2 2s^2 2p^6 3s^2 3p^4$ –its 16 electrons placed in order.

■ 2 Valence electrons

The outer **valence electrons** 价电子 control an atom's chemistry: they are the ones gained, lost, or shared in reactions.

■ 3 Periodic trends

Across and down the table, three trends follow from nuclear pull and shielding:



- **atomic radius** 原子半径: smaller across a period, larger down a group.

- **ionization energy** 电离能 (energy to remove an electron): larger across, smaller down.
- **electronegativity** 电负性 (pull on shared electrons): larger across and up, toward fluorine.

■ 4 Ions and ionic compounds

Metals lose electrons to form positive **cations** 阳离子; nonmetals gain electrons to form negative **anions** 阴离子. Opposite charges attract into an **ionic compound** 离子化合物, whose formula balances the charges.

Worked example. Aluminium (3+) and oxide (2-) combine as Al_2O_3 , so the +6 and -6 cancel.

Watch out: atomic radius and ionization energy go in **opposite** directions – a small atom holds its electrons tightly (high ionization energy), a large atom holds them loosely (low ionization energy).

Practice

Try these in order. The methods are all above.

2.1 Write the electron configuration of oxygen ($Z = 8$). [2]

2.2 State what "valence electrons" are and why they matter. [2]

2.3 State how atomic radius changes (a) across a period, (b) down a group. [2]

2.4 Sodium loses one electron and chlorine gains one. Write the formula of the compound they form, and state the charges. [2]

2.5 Magnesium (2+) combines with chloride (1−). Write the formula of the compound.[2]