

# ATOMS AND IONS

ATOMS

IONS

OCTET RULE

PERIODIC TABLE



*Answer all the questions below as fully as you can then check your answers*

- 1. What are the three subatomic particles found in an atom?*
- 2. Where in an atom are the protons and neutrons located?*
- 3. What is the relative charge of an electron?*
- 4. Explain the difference between an atom and an ion.*
- 5. How many electrons can the first electron shell of an atom hold?*
- 6. Why are atoms neutral?*
- 7. What is an ion?*
- 8. Explain why metals form positively charged ions and non-metals form negatively charged ions.*
- 9. What is the octet rule?*
- 10. Why do noble gases not react easily with other elements?*
- 11. Explain why ions form.*

12. Complete the table below to show the connection between the group in the periodic table and the charge formed by ions.

Group in periodic table	1	2	3	4	5	6	7	0
Charge on ion								

13. How many protons, neutrons and electrons are in each of the following atoms and ions?



14. Write the symbol (similar to the ones above) for the following atoms and ions:

- an ion with 13 protons, 10 electrons and 14 neutrons.
- an ion with 20 protons, 18 electrons and 20 neutrons.
- an ion with 9 protons, 10 electrons and 10 neutrons.
- an ion with 11 protons, 10 electrons and 12 neutrons.
- an ion with 15 protons, 18 electrons and 16 neutrons.

15. An atom of sodium has 11 protons and 11 electrons. Explain how a sodium ion ( $\text{Na}^+$ ) is formed.

A sodium ion is formed when the atom loses one electron, leaving it with 11 protons and only 10 electrons. This gives it an overall charge of +1.

16. Explain why an atom of chlorine forms an ion with a  $-1$  charge.

Chlorine has 7 electrons in its outer shell. It's more energetically favorable to gain one electron to complete its outer shell (giving it a stable 8) than to lose all 7. This gain of one electron results in a  $-1$  charge.

17. Potassium (K) and chlorine (Cl) react to form potassium chloride (KCl).

Describe how the electron arrangement of each atom changes during this reaction.

Explain why this reaction occurs.

Potassium: Loses one electron from its outer shell, achieving a stable full outer shell.

Chlorine: Gains one electron in its outer shell, also achieving a stable full outer shell.

Why: Atoms react to gain a stable electron configuration (usually a full outer shell).

Potassium is highly reactive as it readily loses one electron, and chlorine is highly reactive as it readily gains one electron, making this a favourable reaction.

18. Compare and contrast cations and anions.

Cations are positively charged ions formed by losing electrons, typically from metal atoms. Anions are negatively charged ions formed by gaining electrons, typically by non-metal atoms. Cations are smaller than their parent atoms because they have lost electrons, while anions are larger because they have gained electrons.



## Answers

1. What are the three subatomic particles found in an atom?

Protons, neutrons, and electrons.

2. Where in an atom are the protons and neutrons located?

In the nucleus.

3. What is the relative charge of an electron?

-1

4. Explain the difference between an atom and an ion.

An atom has an equal number of protons and electrons (neutral charge). An ion has gained or lost electrons, giving it a positive or negative charge.

5. How many electrons can the first electron shell of an atom hold?

2 electrons

6. Why are atoms neutral?

They contain equal numbers of positively charged protons and negatively charged electrons.

7. What is an ion?

A charged particle.

8. Explain why metals form positively charged ions and non-metals form negatively charged ions.

Metal atoms when they react tend to lose electrons, this means they end up with more positively charged protons than negatively charged electrons. So overall they have a positive charge.

Non-metal atoms gain electrons when they react, so they end up with more negatively charged electrons than positively charged protons. So overall they have a negative charge.

9. What is the octet rule?

Atoms react in such a way that they end up with full last shells. This usually means 8 electrons in their outer electron shell. Or in the case of elements from period 1 such as hydrogen or helium they end up with 2 electrons in their outer shell, but this is still a full last shell.

10. Why do noble gases not react easily with other elements?

They already have full outer shell of electrons.

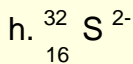
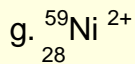
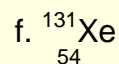
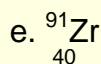
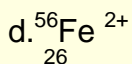
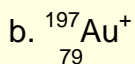
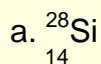
11. Explain why ions form.

Ions form when atoms lose or gain electrons to end up with full outer electron shells.

12. Complete the table below to show the connection between the group in the periodic table and the charge formed by ions.

Group in periodic table	1	2	3	4	5	6	7	0
Charge on ion	+1	+2	+3	Forms covalent bonds, not ions	3-	2-	1-	Do not react under normal conditions.

13. How many protons, neutrons and electrons are in each of the following atoms and ions?



a. 14p, 14e, 14n

b. 79p, 78e, 118n

c. 9p, 10e, 10n

d. 26p, 24e, 30n

e. 40p, 40e, 51n

f. 54p, 54e, 77n

g. 28p, 26e, 31n

h. 16p, 18e, 16n

14. Write the symbol (similar to the ones above) for the following atoms and ions:

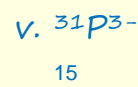
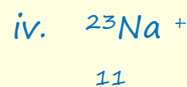
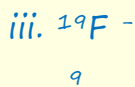
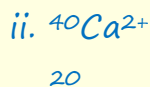
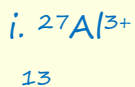
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