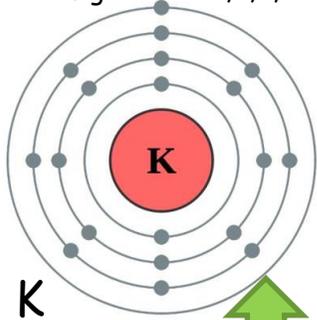


Y8 Bonding, Structure and Properties Foundation

Position in the Periodic Table:

- The number of electrons in the outer shell tells us the group in the periodic table
- Potassium 2,8,8,1 and Lithium 2,1 both have 1 electron in their outer shell and are both found in group 1

Electron configuration: 2,8,8,1



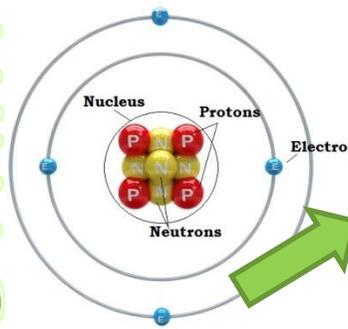
Mass number = 39
Atomic number = 19
Protons = 19
Electrons = 19
Neutrons = 4

Rules for electron shells:

- The first shell will only hold 2 electrons
- Shells after the first one will have up to 8 electrons
- Electrons try to move as far away from each other as possible
- Once the 4 points are filled up then the electron's will pair up
- We write the electron configuration, which tells us how many electrons are in each shell



START



Particle	Charge	Mass
Electron	-1	0
Proton	+1	1
Neutron	0	1

Element

All the same type of atom

Compound

More than one type of atom chemically bonded together

Mixture

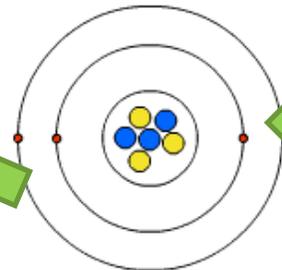
More than one type of element or compound not chemically bound together

Key words:

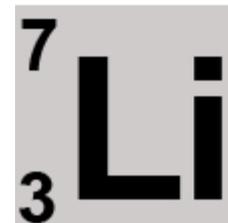
- Proton:** Found inside the nucleus of an atom, have a positive charge
- Electron:** Found in rings orbiting the nucleus, have a negative charge
- Neutrons:** Found in the nucleus of an atom, have no charge
- Nucleus:** The centre of an atom, made up of protons and neutrons
- Mass number:** The mass of the atom, made up of protons and neutrons
- Atomic number:** The number of protons in an atom
- Element:** All the same type of atom chemically bonded together
- Compound:** More than one type of atom chemically bonded together
- Mixture:** More than one type of element or compound not chemically bound together
- Electron Shell:** A ring surrounding the nucleus containing the electrons

Li

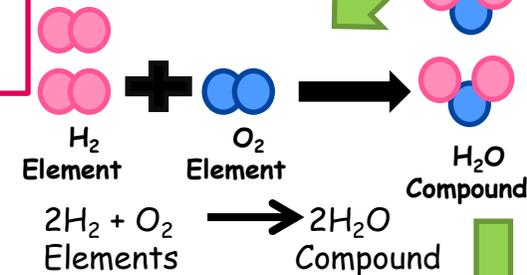
Electron configuration: 2,1



Mass number = 7
Atomic number = 3
Protons = 3
Electrons = 3
Neutrons = 4



- Mass number = protons + neutrons
 $7 = 3 + \text{neutrons}$
 $7 - 3 = \text{neutrons} = 4$
- Atomic number = no. of protons
Protons = 3
- no. of electrons = no. of protons
Electrons = 3



Rules:

- Mass number = protons + neutrons
- Atomic number = no. of protons
- no. of electrons = no. of protons

Y8 Bonding, Structure and Properties Foundation

Elements in the periodic table are split into metals and non-metals.

Properties of Metals

Properties of Non-Metals

- Malleable
- Ductile
- High Melting Point
- Hard
- Strong
- Conducts Heat
- Conducts Electricity
- Magnetic (iron, cobalt and nickel ONLY)
- Solids
- High Density

- Brittle
- Low Melting Point
- Soft
- Weak
- Does not Conduct Heat
- Does not Conduct Electricity
- Solids, Liquids or Gases
- Low Density

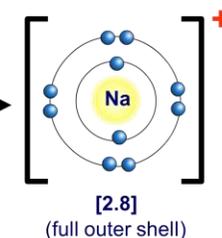
Ions are formed when atoms lose or gain electrons. They do not have equal numbers of protons and electrons.

Positive ions are made when atoms lose electrons. Negative ions are made when atoms gain electrons.

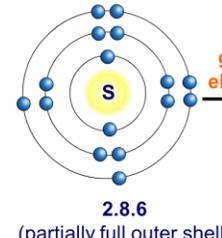
Sodium atom:
11 protons = +11
11 electrons = -11
Total charge = 0



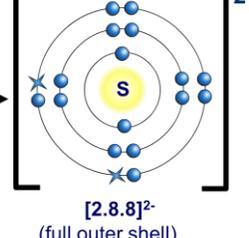
Sodium ion:
11 protons = +11
10 electrons = -10
Total charge = +1



Sulfur atom:
16 protons = +16
16 electrons = -16
Total charge = 0



Sulfide ion:
16 protons = +16
18 electrons = -18
Total charge = -2

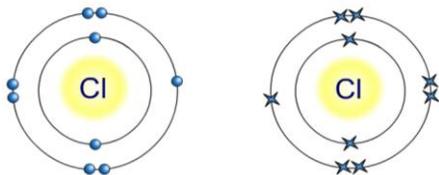


When atoms join together a bond is formed. Ions of opposite charge can form compounds by attracting to one another. This is called ionic bonding. It always happens between a metal and a non-metal atom.

Covalent Bonding

During ionic bonding electrons are transferred from one atom to another, covalent bonding is different. Two non-metal atoms share electrons equally between them.

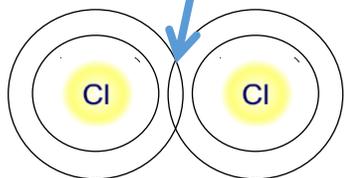
All atoms want **full** outer shells of **electrons**. This makes them more **stable**. If they have space in their outer shell they can fill this by either giving away electrons, accepting electrons or **sharing** electrons. When **non-metal** atoms bond they share electrons - this type of bonding is called **covalent** bonding.



Each chlorine atom has **seven** electrons in its outer most shell. Each chlorine needs **one** more electron to gain a full outer shell and be stable.

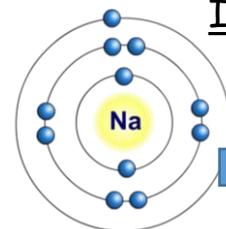
The chlorine on the left needs to share **one** electron to the chlorine on the right and the chlorine on the right needs to share **one** electron to the chlorine on the left - there should always be even numbers of shared electrons.

"sharing zone"

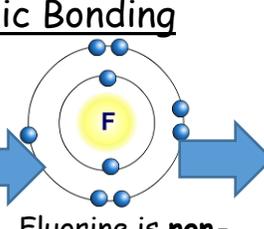


Fill in the shells:

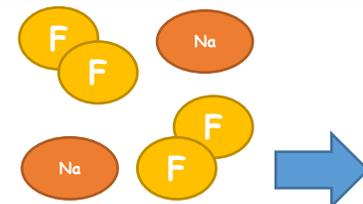
Ionic Bonding



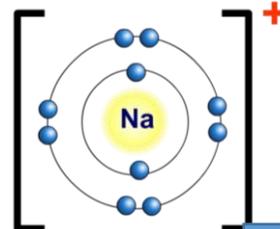
Sodium is a **metal** atom. It has one electron in its outer shell.



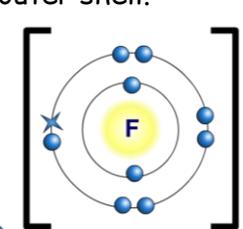
Fluorine is **non-metal** atom. It has seven electrons in its outer shell.



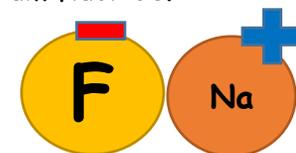
Fluorine and sodium atoms are mixed together and chemical reaction occurs to form an **ionic compound** of sodium fluoride.



The sodium atom **loses its outer electron**. This makes it positively charged. It now has a **full outer shell**.

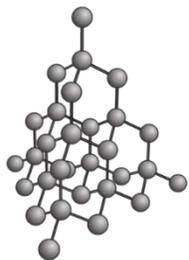


Fluorine **gains an electron from sodium**. This makes it negatively charged. It too now has a **full outer shell**.



The **opposite charges are strongly attracted** to one another. This forms a very strong ionic bond.

Diamond



- Very hard
- Strong
- High Melting point
- Many strong covalent bonds
- Does not conduct electricity



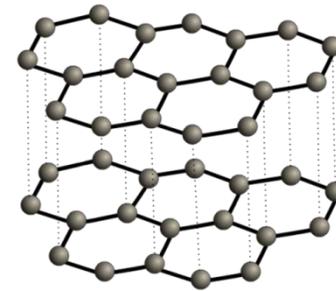
Can you use the structure and bonding of diamond to explain why it would be used for tipping drills?

Can you use the structure and bonding of graphite to explain why it would be used for making pencils?

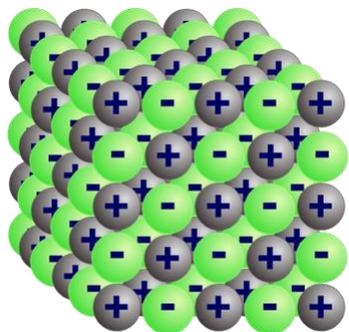


Softer than diamond
Less covalent bonds
Layers
Weak forces between layers
Layers to slide over one another.
Conducts electricity

Graphite



Ionic Lattice



- A lattice - layers of ions in an ordered structure.
- Strong bonds between ions.
- High melting point

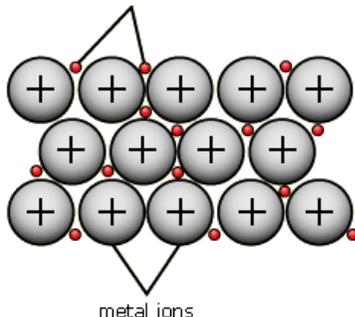


Metals

This is what the structure of a metal could look like. The positive metal atoms are in layers called a lattice. The electrons are free to move around. Conducts electricity.

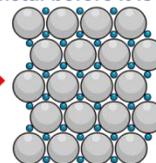
Strong bonds give metals a very high melting point.

free electrons from outer shells of metal atoms



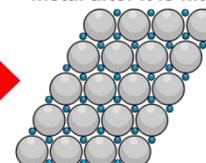
force

metal before it is hit



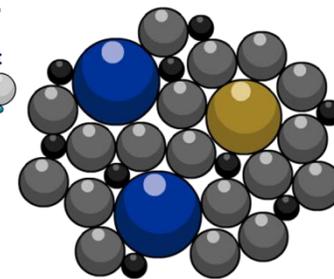
force

metal after it is hit



- In pure metals the atoms are all the same size.
- They form organised layers - lattice
- These layers can easily slide so the metal changes shape more easily.

- In alloys, metals are mixed with other elements.
- The atoms are different sizes so there are no longer nice neat layers.
- The layers cannot easily slide making the alloy harder.



Alloys

Questions

1. Draw a labelled diagram of an atom. Describe its different parts.
2. Draw the electronic structure of Oxygen, Calcium, Sulphur.
3. Describe the difference between an element, compound and a mixture.
4. Calculate the numbers of protons, neutrons and electrons in oxygen, calcium and sulphur.
5. Describe how a positive ion is formed.
6. Describe how a negative ion is formed.
7. Describe how ions are different from atoms.
8. What is a giant structure?
9. What is a molecule?
10. What is a lattice structure. Give two examples.
11. What happens to bonds when a substance is melted?
12. Describe the structure of diamond.
13. Describe the structure of graphite.
14. Describe the arrangement of atoms in metals.
15. What is an alloy.