Paper 1

Chapter 2 — Bonding

Bonding Colour each bonding type with the correct information

Ionic Bonding	Covalent Bonding	Metallic Bonding
Share delocalised electrons	Oppositely charged ions	Share pairs of electrons
Metals combined with non-metals	Non-metallic elements and in compounds of non-metals	Metallic elements and alloys

Complete the state symbols

(s) (l)

(g) (aq)

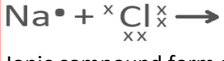
Ionic Bonding

Metal atoms gain/lose outer shell electrons to become positively/negatively charged ions. Non-metal atoms gain/lose electrons to become positively/negatively charged ions. The ions produced by Groups 1/2/3/4/5/6/7/8 have full outer shells like the noble gases.

What charge would the following ions have
Calcium (group 2) Fluorine (group 7)

What is the empirical formula of Calcium Fluoride?

Complete the dot and cross diagram for the ionic compound sodium chloride



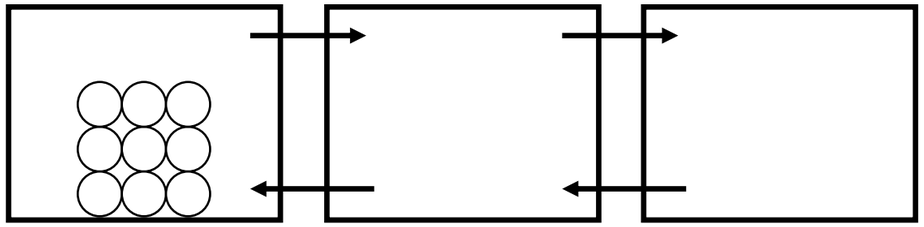
Ionic compound form a g_____ r_____ structures called a l_____. Strong e_____ forces of attraction in all directions hold the ions together. Ionic compounds have _____ melting and boiling points because _____ amounts of _____ are needed to break the strong bonds.

Ionic compounds conduct electricity when m_____ or d_____ in water because the ions are f___ t_ m____ and so charge can flow.

States of Matter

Draw the spheres for the simple particle model for liquid and gas

Add labels to the arrows to name the changes of state



What temperature will...

Ice melt Water freeze Water Boil Steam condense

In which state(s) are the particles... ...arranged at random? ...in fixed positions
...have the highest energy ...are far apart ...free to move

(HT) Simple Particle Model Limitations Give 3 limitations of the particle model

1.) 2.) 3.)

Covalent Bonding

Name/Formula	Stick Diagram	Dot and Cross	Ball and stick
Oxygen O_2			
Water H_2O			
Ammonia NH_3			
Methane CH_4			

Atoms can make strong/weak Covalent bonds by swapping/sharing pairs of electrons

Small Molecule vs Giant Covalent structure

Highlight each statement to match type e.g. red = giant covalent, blue = small molecule

usually gases or liquids, low melting points and boiling points, usually solids, do not conduct electricity, very high melting and boiling points, include diamond graphite and silicon dioxide

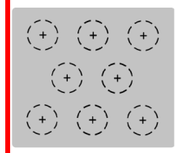
Why do simple molecular substances e.g. carbon dioxide have low melting and boiling points when the have strong covalent bonds?

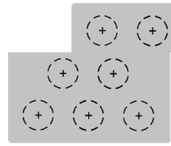
Alloys and Metals

Why do metals usually have high melting and boiling points?

Why are metals good conductors of electricity?

Why are metals good conductors of thermal energy?

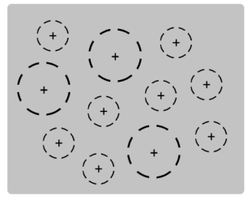




In pure metals the atoms are arranged in _____.

This allows metals to be b____ and s_____ easily.

Metals can be mixed with other metals to make _____. They are harder than pure metals because...



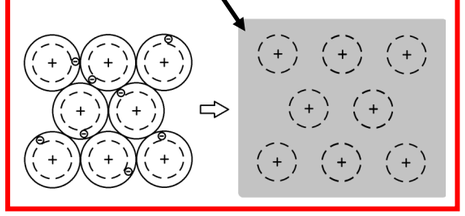
Carbon

Name	Diamond	Graphite	Graphene	Fullerenes	Carbon Nanotubes
Covalent bonds per					
Shape/Structure					
Delocalised electrons?					
Heat/Electrical conductivity					
Uses/Useful properties					
Diagram					

Metallic Bonding

Metals are found in (simple/giant) structures. The atoms arranged in a (random/regular) pattern. The outer shell electrons are (fixed/delocalised). Metallic bonds are (strong/weak). The delocalised electrons make metals good conductors of _____ and _____.

What is the grey colour representing?

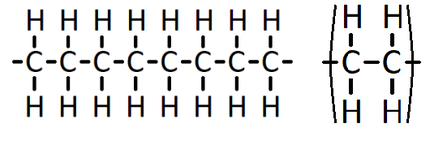


Polymers

Polymers have very (small/large) molecules.

Polymers atoms are linked by (strong/weak) (covalent/ionic/metallic bonds).

The intermolecular forces between polymer molecules are relatively (strong/weak) so these substances are usually (solid/liquid/gas) at room temperature.



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Share delocalised electrons	Oppositely charged ions	Share pairs of electrons
Metals combined with non-metals	Non-metallic elements and in compounds of non-metals	Metallic elements and alloys

Complete the state symbols

(s) solid (l) liquid

(g) gas (aq) aqueous

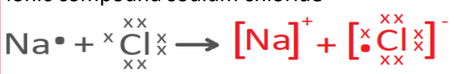
Ionic Bonding

Metal atoms gain/lose outer shell electrons to become positively/negatively charged ions. Non-metal atoms gain/lose electrons to become positively/negatively charged ions. The ions produced by Groups 1/2/3/4/5/6/7/8 have full outer shells like the noble gases.

What charge would the following ions have
Calcium (group 2) 2+ Fluorine (group 7) -

What is the empirical formula of Calcium Fluoride? CaF_2

Complete the dot and cross diagram for the ionic compound sodium chloride



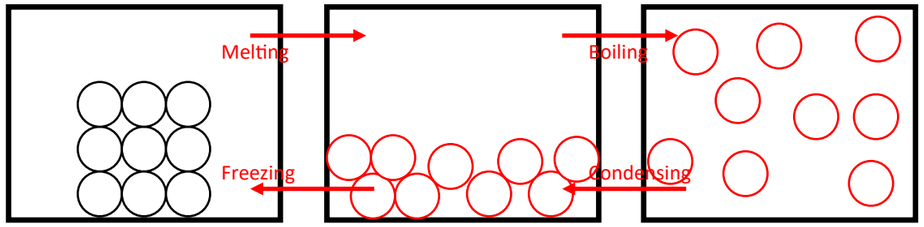
Ionic compound form a giant regular structures called a lattice. Strong electrostatic forces of attraction in all directions hold the ions together. Ionic compounds have high melting and boiling points because large amounts of energy are needed to break the strong bonds.

Ionic compounds conduct electricity when melted or dissolved in water because the ions are free to move and so charge can flow.

States of Matter

Draw the spheres for the simple particle model for liquid and gas

Add labels to the arrows to name the changes of state



What temperature will...

Ice melt 0°C Water freeze 0°C Water Boil 100°C Steam condense 100°C

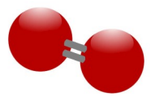
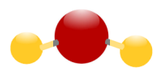
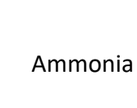
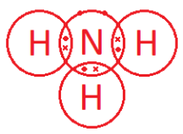
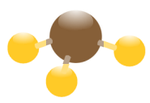
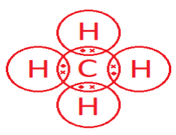
In which state(s) are the particles... ...arranged at random? L + G ...in fixed positions S

...have the highest energy G ...are far apart G ...free to move L + G

(HT) Simple Particle Model Limitations Give 3 limitations of the particle model

1.) No forces are shown 2.) All particles are spheres 3.) Spheres are all solid

Covalent Bonding

Name/Formula	Stick Diagram	Dot and Cross	Ball and stick
Oxygen O_2	O=O		
Water H_2O	H-O-H		
Ammonia NH_3			
Methane CH_4			

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Small Molecule vs Giant Covalent structure

Highlight each statement to match type e.g. red = giant covalent, blue = small molecule

usually gases or liquids, low melting points and boiling points, usually solids, do not conduct electricity, very high melting and boiling points, include diamond graphite and silicon dioxide

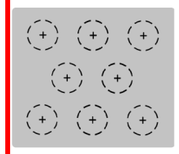
Why do simple molecular substances e.g. carbon dioxide have low melting and boiling points when the have strong covalent bonds? Weak forces between the molecules that are overcome, not the strong covalent bonds, when the substance melts or boils.

Alloys and Metals

Why do metals usually have high melting and boiling points? Strong metallic bonds to overcome

Why are metals good conductors of electricity? Delocalised electrons carry charge

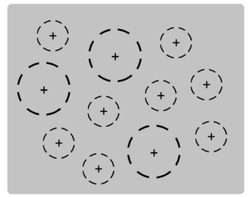
Why are metals good conductors of thermal energy? Delocalised electrons transfer energy



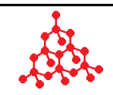
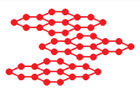
In pure metals the atoms are arranged in layers

This allows metals to be bent and shaped easily.

Metals can be mixed with other metals to make alloys. Alloys are harder than pure metals because... the layers are distorted by the different sized atoms so do not slide easily into new shapes.



Carbon

Name	Diamond	Graphite	Graphene	Fullerenes	Carbon Nanotubes
Covalent bonds per	4	3	3	3	3
Shape/Structure	Giant covalent lattice	Sliding layers of hexagon	Single layer of hexagons	Spherical (ball) shape	Cylindrical tubes
Delocalised electrons?	No	Yes	Yes	Yes	Yes
Heat/Electrical conductivity	Poor	Good	Good	Good	Good
Uses/Useful properties	Jewellery/Saws	In pencils	Touchscreens and composites	Delivering drugs, Lubricants, Catalysts	High length to diameter ratio, High tensile strength
Diagram					

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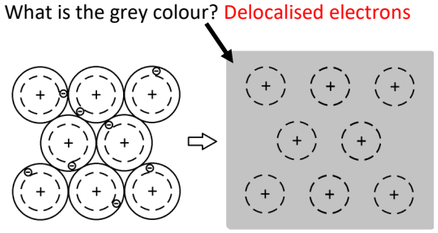
What is the grey colour? Delocalised electrons



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