AQA Chemistry GCSE

Topic 2 - Bonding, Structure and the Properties of Matter

Flashcards

What is ionic bonding?

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Ionic bonding is the electrostatic attraction between positive and negative ions.

It is a relatively strong attraction.

How are ionic compounds held together?

How are ionic compounds held together?

- They are held together in a giant lattice.
- It's a regular structure that extends in all directions in a substance.
- Electrostatic attraction between positive and negative ions holds the structure together.

State properties of ionic substances

State properties of ionic substances

- High melting and boiling point (strong electrostatic forces between oppositely charged ions)
- Do not conduct electricity when solid (ions in fixed positions).
- Conduct when molten or dissolved in water - ions are free to move.

Give 5 examples of positive ions and 5 examples of negative ions.

What is important when working out a formula of an ionic compound?

Give 5 examples of positive ions and 5 examples of negative ions (give names of negative anions). What is important when working out a formula of an ionic compound?

E.g. Positive: Na^+, Mg^{2+}, Al^{3+}, Ca^{2+}, Rb^+,

E.g. Negative: Cl^-, Br^-, SO_4^{2-}, NO_3^-, OH^- (chloride, bromide, sulfate, nitrate, hydroxide).

Ionic compounds are electrically neutral, i.e. positive and negative charges balance each other.

How are ionic compounds formed? Explain in terms of MgO case.

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Reaction of a metal with a non-metal.

Electron transfer occurs - metal gives away its outer shell electrons to non-metal.

Mg is in Group II, so has 2 available outer shell electrons.

O is in Group VI, so can accept 2 electrons to get a full outer shell configuration.

Mg becomes Mg^{2+} and O becomes O^{2-} (oxide).

What is a covalent bond?

What is a covalent bond?

Covalent bond is a shared pair of electrons between two atoms.

Describe the structure and properties of simple molecular covalent substances

Describe the structure and properties of simple molecular covalent substances

- Do not conduct electricity (no ions)
- Small molecules
- Weak intermolecular forces, therefore:
- Low melting and boiling points

How do intermolecular forces change as the mass/size of the molecule increases?

How do intermolecular forces change as the mass/size of the molecule increases?

They increase. That causes melting/boiling points to increase as well (more energy needed to overcome these forces).

What are polymers? What are thermosoftening polymers?

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Polymers are very large molecules (>100s, 1000s of atoms) with atoms linked by covalent bonds.

Thermosoftening polymers - special type of polymers; they melt/soften when heated. There are no bonds between polymer chains. Strong intermolecular forces ensure that the structure is solid at room temperature. These forces are overcome with heating - polymer melts.

What are giant covalent substances? Give examples

What are giant covalent substances? Give examples

- Solids, atoms covalently bonded together in a giant lattice.
- High melting/boiling points – strong covalent bonds.
- Mostly don't conduct electricity (no delocalised e^-)
- Diamond, graphite, silicon dioxide.

Describe and explain the properties of allotropes of carbon.

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Diamond

– four, strong covalent bonds for each carbon atom
– very hard (Strong bonds)
– very high melting point (strong bonds)
– does not conduct (no delocalised electrons)

Graphite

– three covalent bonds for each carbon atom
– layers of hexagonal rings
– high melting point
– layers free to slide as weak intermolecular forces between layers; soft, can be used as a lubricant
– conduct thermal and electricity due to one delocalised electron per each carbon atom

Fullerenes

– hollow shaped molecules
– based on hexagonal rings but may have 5/7-carbon rings
– C_{60} has spherical shape, simple molecular structure (Buckminsterfullerene)

Nanotubes

– cylindrical fullerene with high length to diameter ratio
- High tensile strength (strong bonds)
- Conductivity (deloc. electrons)

Graphene - a single layer of graphite.

What is metallic bonding?

What is metallic bonding?

Forces of attraction between delocalised electrons and nuclei of metal ions.

Describe properties of metals

Describe properties of metals

- High melting/boiling points (strong forces of attraction)
- Good conductors of heat and electricity (delocalised electrons)
- Malleable, soft (layers of atoms can slide over each other whilst maintaining the attraction forces)

What are alloys? Why are they harder than pure metals?

What are alloys? Why are they harder than pure metals?

Alloys:

- mixtures of metal with other elements, usually metals
- different sizes of atoms distorts the layers, so they can't slide over each other, therefore alloys are harder than pure metals

Complete the table:

Property	Simple Covalent	Ionic	Giant Covalent	Metallic
boiling and melting points				
conductivity when solid				
conductivity when molten				
general description				

Complete the table:

Property	Simple Covalent	Ionic	Giant Covalent	Metallic
boiling and melting points	low- because of weak **intermolecular** forces between **molecules**	high- because of **giant lattice** of ions with **strong forces between oppositely charged ions.**	high- because of **many strong covalent bonds between atoms** in giant structure	high- strong electrostatic forces between **positive ions** and **delocalised electrons**
conductivity when solid	poor: no **ions** to conduct	poor: **ions** can't move	diamond and sand: poor, because electrons can't move **graphite**: good as **free delocalised electrons between layers** can move through structure	good: **delocalised electrons** are **free to move** through structure
conductivity when molten	poor: no ions	good: **ions** are **free to move**	poor	(good)
general description	mostly gases and liquids	crystalline solids	solids	shiny metal solids

What are the limitations of the simple model?

Higher tier only

What are the limitations of the simple model?

There are no forces between spheres and atoms, molecules and ions are solid spheres – this is not true

Higher Tier Only

What does the amount of energy needed to change state from solid to liquid or liquid to gas depend on?

What does the amount of energy needed to change state from solid to liquid or liquid to gas depend on?

The strength of the forces between the particles of the substance. The nature of the particles involved depends on the type of bonding and the structure of the substance. The stronger the forces between the particles the higher the melting point and boiling point of the substance

A pure substance will melt or boil at…? What about the mixture?

A pure substance will melt or boil at…?

A fixed temperature.

A mixture will melt over a range of temperatures.

What are the three states of matter?

What are the three states of matter?

Solid, liquid and gas

What is nanoscience?

What is nanoscience?

Science that studies particles that are 1 - 100nm in size

State the uses of nanoparticles

State the uses of nanoparticles

- Medicine (drug delivery systems)
- Electronics
- Deodorants
- Sun creams (better skin coverage and more effective protection against cell damage)

What are fine and coarse particles?

What are fine and coarse particles?

- Fine particles (soot), 100-2500 nm diameter
- Coarse particles (dust), 2500-10^5 nm diameter

Why do nanoparticles have different properties to those for the same materials in bulk?

Why do nanoparticles have properties different from those for the same materials in bulk?

High surface area to volume ratio