AQA GCSE Chemistry

Topic 2: Bonding, structure, and the properties of matter

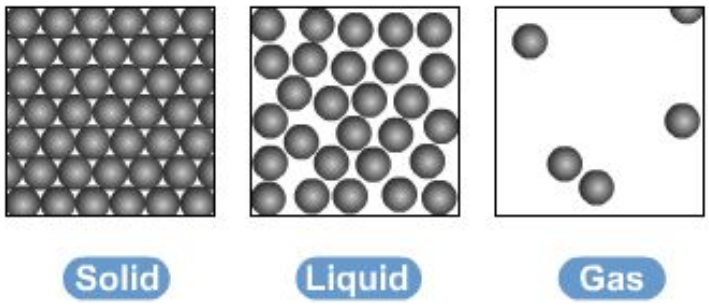
How bonding and structure are related to the properties of substances

Notes

(Content in bold is for Higher Tier only)

The three states of matter

- They are solid, liquid and gas
- Melting and freezing take place at the melting point
- Boiling and condensing take place at the boiling point



- Particle theory can help to explain melting, boiling, freezing and condensing…
    - The amount of energy needed to change state from solid to liquid and from liquid to gas depends 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.
- **Limitations of the simple model above include that in the model there are no forces, that all particles are represented as spheres and that the spheres are solid.**

State symbols

- In chemical equations, the three states of matter are shown as: solid (s), liquid (l), gas (g) and (aq) for aqueous solutions.

Properties of ionic compounds

- Ionic compounds have regular structures (giant ionic lattices) in which there are strong electrostatic forces of attraction in all directions between oppositely charged ions.
- They have high melting and boiling points, because a lot of energy is required to break the many strong bonds.
- When melted or dissolved in water, ionic compounds conduct electricity because the ions are free to move and carry current. But they can’t conduct electricity when solid because the ions are fixed in place.

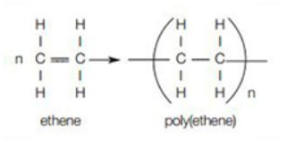
Properties of small molecules

- Substances that consist of small molecules are usually gases or liquids that have low boiling and melting points.

- They have weak intermolecular forces between the molecules. These are broken in boiling or melting, *not the covalent bonds*.
    - The intermolecular forces increase with the size of the molecules, so larger molecules have higher melting and boiling points.
- Substances that consist of small molecules don't conduct electricity, because small molecules do not have an overall electric charge.

Polymers

- Have very large molecules
- Atoms in the polymer molecules are linked to other atoms by strong covalent bonds
- Intermolecular forces between polymer molecules are relatively strong and so these substances are solids at room temperature



Giant Covalent Structures

- Substances that consist of giant covalent structures are solids with very high melting points.
    - All of the atoms in these structures are linked to other atoms by strong covalent bonds.
        - These bonds must be overcome to melt or boil these substances.
- examples include: diamond and graphite (forms of carbon) and silicon dioxide (silica)

Properties of metals and alloys

- Metals have giant structures of atoms with strong metallic bonding.
    - Most metals have high melting and boiling points.
    - The layers of atoms in metals are able to slide over each other, so metals can be bent and shaped, which can make them less useful for certain things
- Alloys are made from 2 or more different types of metals.
    - The different sized atoms distort the layers in the structure, making it harder for them to slide over each other. So alloys are harder than pure metals.

metals as conductors

- Good conductors of electricity because the delocalised electrons in the metal carry electrical charge through the metal
- Good conductors of thermal energy because energy is transferred by the delocalised electrons