CIE Chemistry A-Level

Topic 4 - States of Matter

Flashcards

What kinetic assumptions are made when dealing with an ideal gas?

What kinetic assumptions are made when dealing with an ideal gas?

1. The gas contains a large number of molecules moving in random directions at random speeds.
2. Electrostatic forces between molecules is negligible, except during collisions.
3. Collisions are perfectly elastic.
4. Time of collisions between molecules is negligible compared to time between collisions.
5. The molecules of a gas occupy negligible volume compared to the total volume of the gas.

What are the conditions necessary for a gas to approach ideal behaviour?

What are the conditions necessary for a gas to approach ideal behaviour?

- Low pressure
- High temperature

What are the limitations of an ideal gas at very low temperatures and very high pressures?

What are the limitations of an ideal gas at very low temperatures and very high pressures?

- Intermolecular forces are no longer negligible and have to be considered.
- Molecular size is also no longer negligible and has to be considered.

What is the ideal gas equation?

What is the ideal gas equation?

$pV = nRT$

p - pressure (Pa)

V - volume (m^3)

n - number of moles (mol)

R - gas constant (8.314 J K^{-1} mol^{-1})

T - temperature (K)

The ideal gas equation can be used with which other equation to find molecular mass?

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$M = m/n$

M - molecular mass

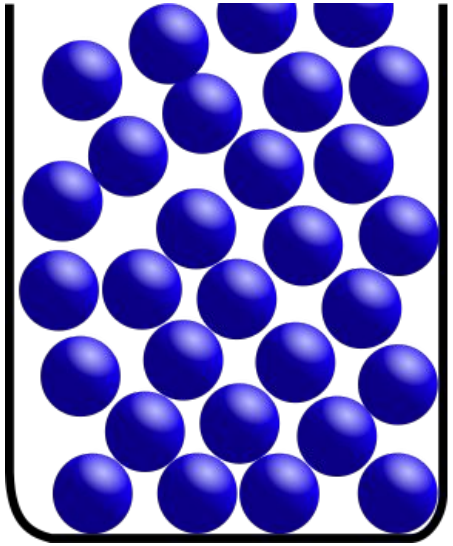
n - number of moles (mol)

m - mass (g)

Use the kinetic-molecular model to describe the liquid state

Use the kinetic-molecular model to describe the liquid state

- Particles are close together but not regularly arranged.
- Particles have a little more kinetic energy than in a solid.
- There are fewer electrostatic forces between particles than in a solid, allowing particles to move past each other and flow.



In terms of the kinetic-molecular model, what happens during melting?

In terms of the kinetic-molecular model, what happens during melting?

- Solid → Liquid
- Increasing the temperature of the surroundings causes particles to absorb energy meaning they gain more kinetic energy.
- Eventually, the particles gain enough energy to disrupt the regular arrangement and become a liquid.

How do particles act during vaporisation?

How do particles act during vaporisation?

- Liquid → Gas
- Heat energy causes particles in a liquid to move fast enough to break all forces of attraction between them and become a gas.

What is vapour pressure?

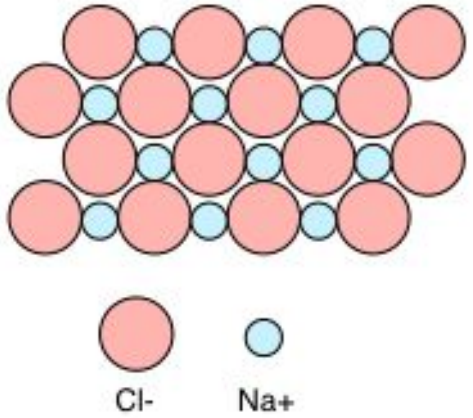
What is vapour pressure?

When a liquid evaporates in a closed container, the gaseous particles move around above the liquid. When these particles collide with the walls of the container, they exert a pressure called the vapour pressure.

Describe the structure of a solid ionic compound

Describe the structure of a solid ionic compound

- Regular, repeating arrangement (lattice).
- Caused by the electrostatic attraction between the oppositely charged ions.



Describe the lattice structure of iodine

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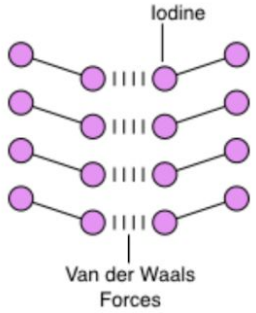
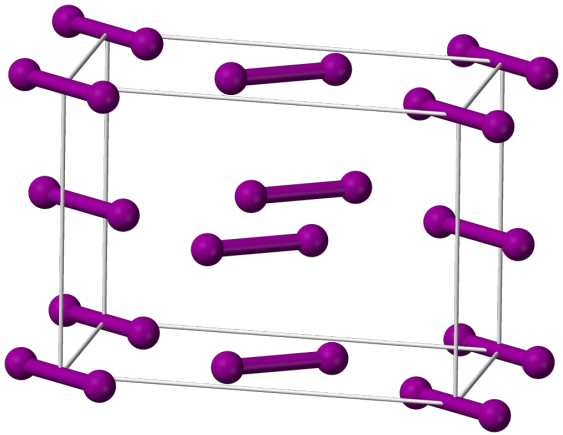


- Iodine is an example of a simple molecular lattice.
- Iodine, I_2 molecules form a larger structure due to intermolecular forces (Van der Waals Forces) between molecules.
- The structure is described as face centred cubic.



What is an allotrope?

What is an allotrope?

Allotropes are different physical forms of an element in the same state.

Describe the structure of a fullerene

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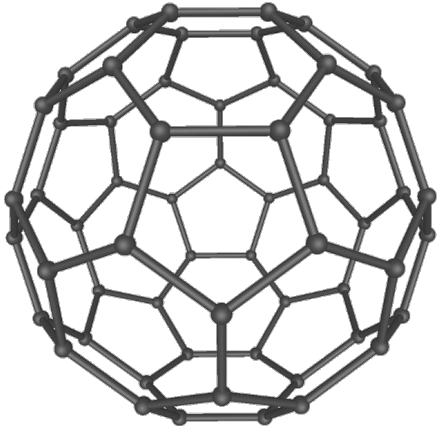
Lattice structure

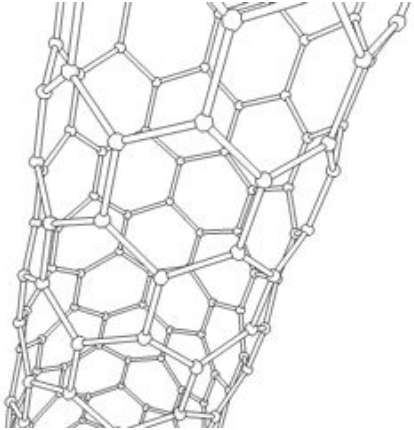
E.g. a buckminsterfullerene (C_{60}) is a molecule consisting of 60 carbon atoms arranged in pentagons and hexagons.



What is a nanotube?

What is a nanotube?

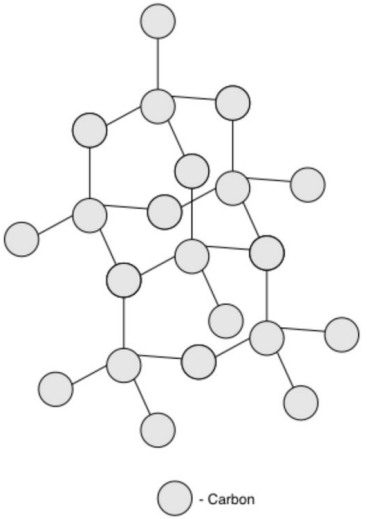
A graphene sheet rolled up into a tube (single sheet of carbon atoms covalently bonded together)



Describe the structure of diamond

Describe the structure of diamond

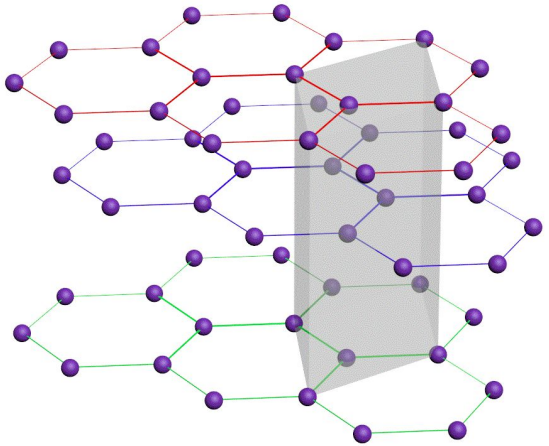
- Giant covalent lattice.
- Each carbon atom is covalently bonded to four other carbon atoms.
- Extremely strong structure.
- Bond shape and angle around each carbon: Tetrahedral, 109.5°.



Describe the structure of graphite

Describe the structure of graphite

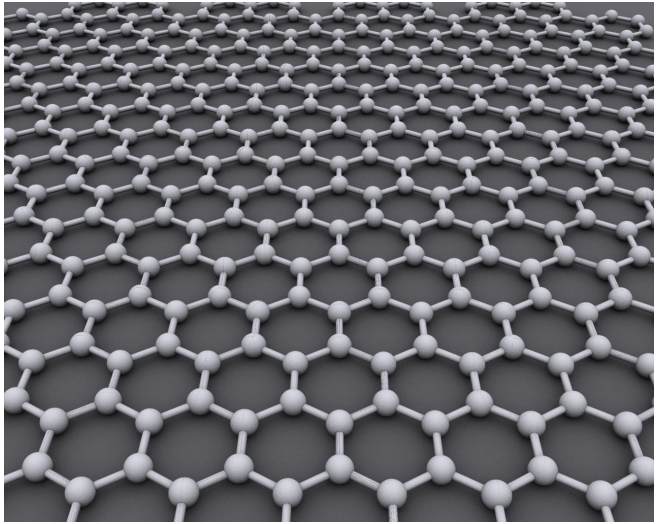
- Giant covalent lattice.
- Made from layers of carbon arranged in hexagonal rings.
- There are weak london forces between layers.
- Each carbon atom bonds covalently to 3 other carbon atoms.
- One delocalised electron per carbon.



Describe the structure of graphene

Describe the structure of graphene

- Giant covalent lattice.
- Single layer of graphite.
- Each carbon atom is bonded to 3 other carbon atoms to create a hexagonal ringed structure.
- One delocalised electron per carbon.



Describe the structure of silicon(IV) oxide

Describe the structure of silicon(IV) oxide

- Similar 3D structure to diamond.
- Silicon and oxygen atoms covalently bonded together.

Describe the structure of ice

Describe the structure of ice

- Open lattice structure.
- Hydrogen bonds hold water molecules apart in hexagonal rings.

Describe the structure of a metal (e.g. copper)

Describe the structure of a metal (e.g. copper)

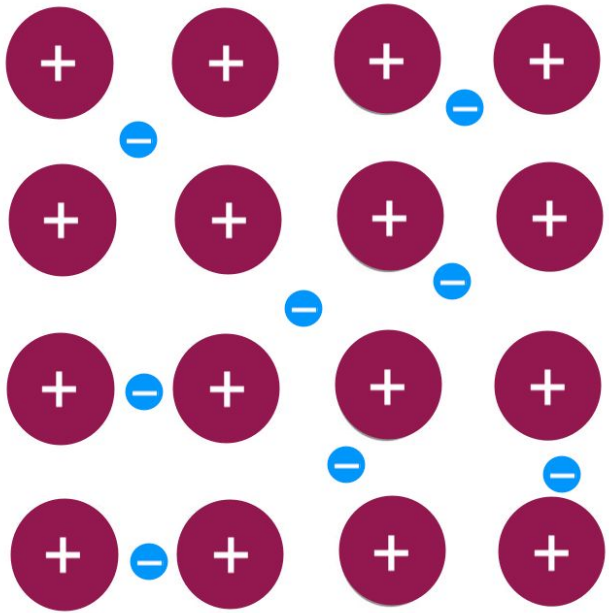
Giant metallic lattice with positive ions packed closely together with delocalised electrons.

In copper, each atom is surrounded by 12 other copper atoms.

What does a diagram of metallic bonding look like?

What does a diagram of metallic bonding look like?

- Positive charges = ions
- Negative charges = electrons



What is a finite resource?

What is a finite resource?

A resource that is used up faster than it is replaced. This resource will run out if it is continually used.

Why is recycling important?

Why is recycling important?

- To conserve finite resources for as long as possible by reducing the rate at which the are used.
- Reduces greenhouse gas emissions (which cause global warming).
- May reduce costs and other environmental impacts of a material.

How does hydrogen bonding affect the boiling and melting points of a substance?

How does hydrogen bonding affect the boiling and melting points of a substance?

Hydrogen bonding is the strongest type of intermolecular bond and hence requires a lot of energy to overcome when boiling/ melting a substance. As a result, structures that contain hydrogen bonding often have higher melting and boiling points than expected.

How does hydrogen bonding affect the viscosity of a substance?

How does hydrogen bonding affect the viscosity of a substance?

Hydrogen bonds increase viscosity of a substance because these bonds (as well as any other intermolecular forces) make the substance more resistant to flow.

How does hydrogen bonding create surface tension in water?

How does hydrogen bonding create surface tension in water?

Hydrogen bonding increases surface tension.

Water molecules at the surface of the liquid are attracted more strongly to other water molecules around them than the layers of water molecules below, creating tension at the surface of the liquid.

What does boiling point suggest about structure and bonding?

What does boiling point suggest about structure and bonding?

A high boiling point indicates a giant structure (ionic metallic or giant covalent).

A low boiling point indicates simple molecules (or atoms for noble gases).

What does solubility suggest about structure and bonding?

What does solubility suggest about structure and bonding?

Compounds that are soluble in water tend to be ionic.

If a soluble compound has a low boiling point, it may be small and very polar or able to form hydrogen bonds.

What does electrical conductivity suggest about structure and bonding?

What does electrical conductivity suggest about structure and bonding?

If a solid substance conducts electricity, it is likely to be a metal, graphene or graphite.

If a substance only conducts when molten or dissolved, it is an ionic compound.

What do appearance/ malleability suggest about structure and bonding?

What do appearance/ malleability suggest about structure and bonding?

If a substance is brittle, it is likely to be ionic or giant covalent.

If a substance is shiny, malleable and ductile, it is likely to be a metal.