Topic 2: Bonding, Structure And Properties Of Matter

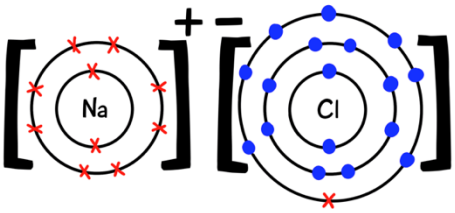
- Atoms with incomplete outer shell need to gain or lose e^- to become full = stable.
- Metals LOSE e^- ➡ (+) – CATIONS
- Non-metals GAIN e- ➡ (-) – ANIONS

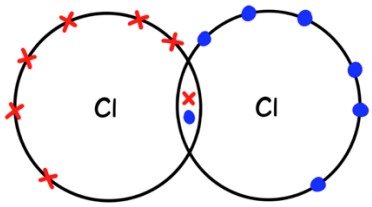
$(+)\ Na \rightarrow Na^+ + e^-$

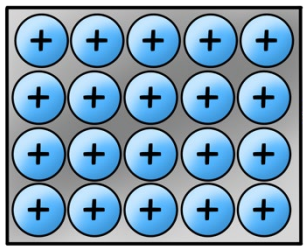
$(-)\ O_2 + 4e^- \rightarrow 2O^{-2}$

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 0
+!	+2	+3	Share	-3	-2	-1	full

Types of Bonds







IONIC	COVALENT	METALLIC
Metals and Non-metals	Non-metals	Metals
Electrostatic attraction between oppositely charged ions	Sharing of a pair of electrons	Metal ions and sea of delocalised electrons

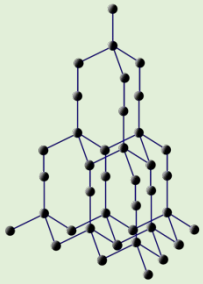
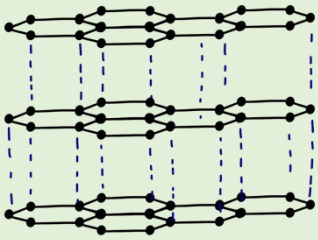
PROPERTIES		
IONIC	COVALENT	METALIC
• Lattice structure • High BP/MP due strong ionic bonds • Does not conduct electricity when solid - ions can't move • Does when molten/dissolved in water – ions CAN move	• Simple Molecular - O_2 / H_2O / NH_3 • Low BP (weak IMF) • X conduct electricity as e^- used in bonding (no free e^-)	• - High MP/BP (strong metallic bonds • Conducts electricity (delocalised electrons) • Malleable (layers slide) • Can mix with other metals to form ALLOYS – (no layers) = harder

Polymers

- Made up of repeating units (aka MONOMERS)
- That are bonded together
- To form a long chain
- Longer polymers = more I.M.F = higher BP

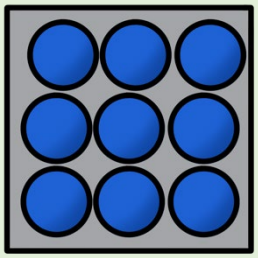
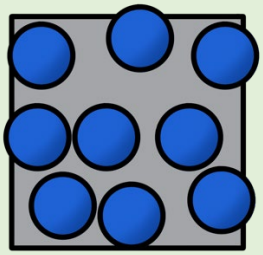
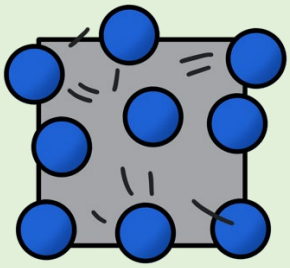
Allotropes

- Different structural forms of the SAME element Allotropes of CARBON!!

Diamond	Graphite	Graphene	Fullerenes
			
• 4 bonds • Tetrahedral shape • Hardest material • Doesn't conduct electricity (no free e^-)	• 3 bonds/ 1 free • Hexagonal rings • Layers (slide) making it slippery • Does conduct electricity (delocalised e^-)	• One layer of graphite • Strong and light • Used in electronics	• Balls/Tubes made of a few HUNDRED atoms only • Huge SA:V ratio • Drug delivery • Catalysts • Lubricants

States of Matter

Particle Theory Model

SOLID	LIQUID	GAS
		
• Strong forces • Vibrate in fixed positions • Definite S/V	• Weak forces • Move freely randomly • Definite S • Indefinite V	• No forces • Indefinite S/V • Pressure increases when heated

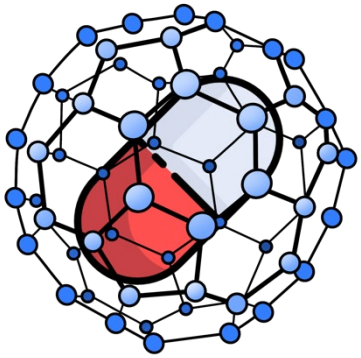
Problems with particle model (above):

- Real particles aren't spheres, they are atom, ions, or molecules
- Doesn't show strength of forces

Changing State

Melting/Boiling	Freezing/Condensing
• Particles are heated • Gain energy • Move faster • Forces weaken	• Particles are cooled • Loose energy • Move slower • Bonds form

Nanoparticles



- Between 1-100 (nanometres/nm)
- Large SA:V ratio
- Many uses:
    1) Catalysts
    2) Drug Delivery
    3) Computer electronics
    4) Silver antibacterial dressings
    5) Cosmetics
- Public don't always approve of new technologies as they don't know the long-term effects of nanoparticles.
- Products should be clearly labelled so that public can make informed decision about buying.