Chemistry Notes

Edexcel IGCSE

Chapter 1g – Covalent Bonding

1g – Covalent bonding

1.44 – Know that a covalent bond is formed between atoms by the sharing of a pair of electrons

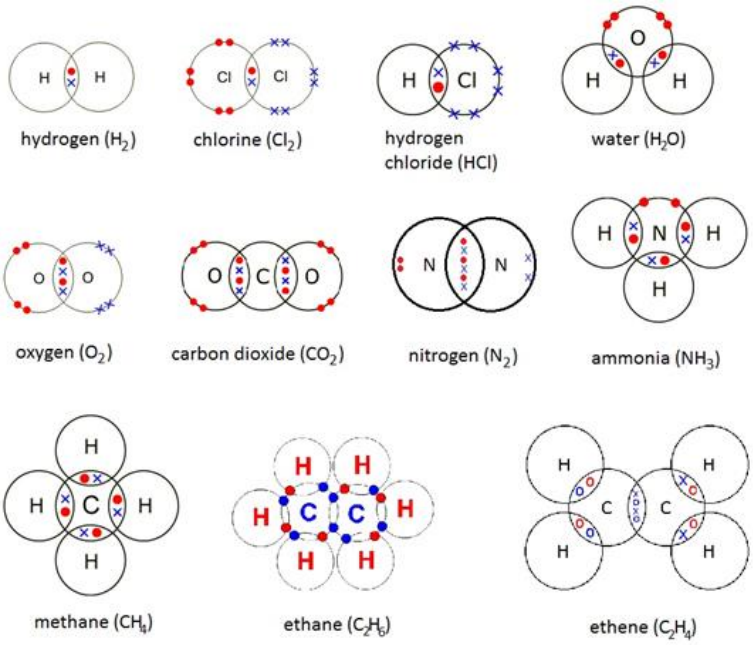
- Happens in atoms with 4 outer shell electrons = further from a full shell = not energy efficient to ionically bond eg. Carbon, Oxygen in some cases

1.45 – Understand covalent bonds in terms of electrostatic attractions

- Covalent bond is a shared pair of electrons = no individual charge. It is held because the pair is attracted to both nuclei
- However weaker than ionic bonds if consider just the bond

1.46 – Understand how to use dot-and-cross diagrams to represent covalent bonds in:

- ***Diatomic molecules, including hydrogen, oxygen, nitrogen, halogens and hydrogen halides***
- ***Inorganic molecules including water, ammonia and carbon dioxide***
- ***Organic molecules containing up to two carbon atoms, including methane, ethane, ethene and those containing halogen atoms***



- Example of common dot-and-cross diagrams – just practice past paper questions

1.47 – Explain why substances with a simple molecular structure are gases or liquids, or solids with low melting and boiling points

- ***The term intermolecular forces of attraction can be used to represent all forces between molecules***

- Atoms **within** the molecule held together by strong covalent bonds, but…
- Between the molecules, there are only weak intermolecular attractions, which take little energy to overcome
  - Thus, low melting and boiling pts = generally gas or liquid at room temp

1.48 – Explain why the melting and boiling points of substances with simple molecular structures increase, in general, with increasing relative molecular mass

- Must overcome ALL the intermolecular attractions for state change as well
- Larger molecules have more intermolecular attractions = more to overcome

1.49 – Explain why substances with giant covalent structures are solids with high melting and boiling points

- All atoms are bonded together in a giant lattice – strong covalent bonds throughout the structure. Note this is NOT A MOLECULE
  - Eg Diamond, Graphite
- To melt/boil, all the strong covalent bonds must be broken = ++ heat = high temp needed

1.50 – Explain how the structures of diamond, graphite and C_{60} fullerene influence their physical properties, including electrical conductivity and hardness

- All are **allotropes** of carbon (different physical forms of one element)

	Structure	Properties
Diamond	Tetrahedral, each Carbon bonded to 4 others, Giant Covalent	High melting/boiling pt bc very strong C-C covalent bonds and giant structure Hard bc strong covalent bonds means atoms hard to removed Not conductive bc electrons held tightly in covalent bonds = no free-moving charge carriers
Graphite	Layered lattice, each Carbon bonded to 3 others with 4th electron **delocalized**, Giant Covalent	High melting/boiling pt bc very strong C-C covalent bonds and giant structure within each layer Soft bc 'intermolecular' attractions between layers are weak = can slide over each other and be flaked off Conductive bc delocalized electrons = free moving charge carriers
C_{60} Fullerene	Spherical, each Carbon bonded to 3 others with 4th electron **delocalized,** Simple molecular	Low melting/boiling pt bc weak intermolecular forces between C_{60} molecules Slippery bc weak intermolecular forces Conductive bc delocalized electrons = free moving charge carriers

1.51 – Know that covalent compounds do not usually conduct electricity

- As per spec – this is because no delocalized electrons – electrons held tightly in the covalent structure, while the molecules or giant structures are **not** charged overall as no electron transfer has occurred