

# AQA Chemistry A-level

## Topic 1.3 - Bonding

### Flashcards

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# What is ionic bonding?



# What is ionic bonding?

strong electrostatic forces of attraction between oppositely charged ions held in a lattice



Give an example of an  
ionically bonded substance



Give an example of an ionically bonded substance

NaCl (sodium chloride - salt)



How high are ionically bonded substances' bp and mp? Why?



How high are ionically bonded substances' bp and mp? Why?

High - takes lots of energy to break strong electrostatic forces of attraction between oppositely charged ions



# Do ionic compounds conduct electricity? Why?





# Do ionic compounds conduct electricity? Why?

Yes, when molten/in solution as the ions are free to move and carry charge (don't when solid)



# What is simple molecular covalent bonding?



# What is simple molecular covalent bonding?

Strong covalent bonds between atoms, weak van der Waals forces of attraction between molecules



Are there any lone electrons  
in simple covalent bonding?



Are there any lone electrons in simple covalent bonding?

No- all involved in bonding



Can simple molecular  
covalent molecules conduct  
electricity? why?



Can simple molecular covalent molecules conduct electricity? why?

No - all electrons used in bonding and aren't free to move



Do simple molecular substances have a high/low mpt and bpt? why?





Do simple molecular substances have a high/low mpt and bpt? why?

Low - weak van der Waals forces of attraction between molecules that don't take much energy to overcome (these are overcome rather than covalent bonds)



# Describe macromolecular covalent bonding



# Describe macromolecular covalent bonding

Lattice of many atoms held together by strong covalent bonds



Do substances with  
macromolecular covalent  
bonds have high/low mpt  
and bpts? why?



Do substances with macromolecular covalent bonds have high/low mpt and bpts? why?

High, as it takes a lot of energy to overcome many strong covalent bonds



Do substances with  
macromolecular covalent  
bonds conduct electricity?



Do substances with macromolecular covalent bonds conduct electricity?

Most don't as all electrons are used in bonding



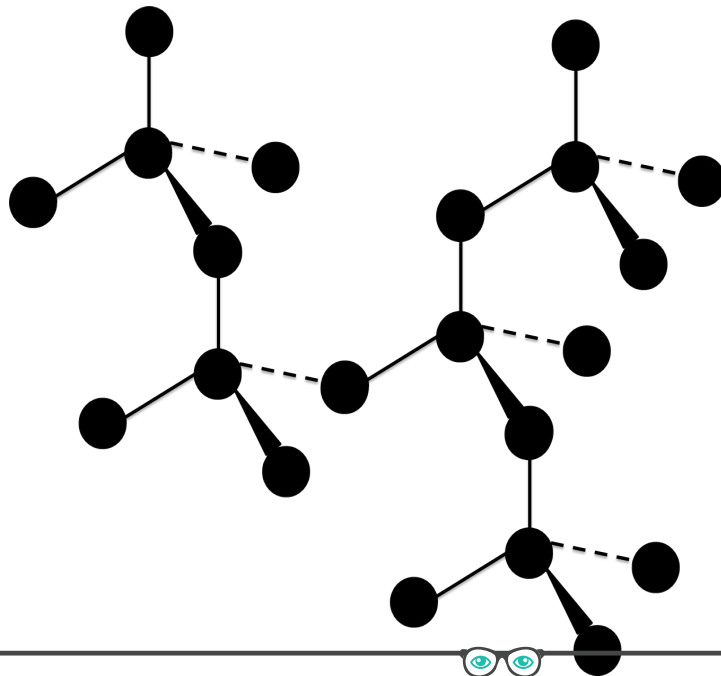
# Draw and describe structure of diamond





# Draw and describe structure of diamond

3D tetrahedral structure of C atoms, with each C atom bonded to four others



# Draw and describe structure of graphite

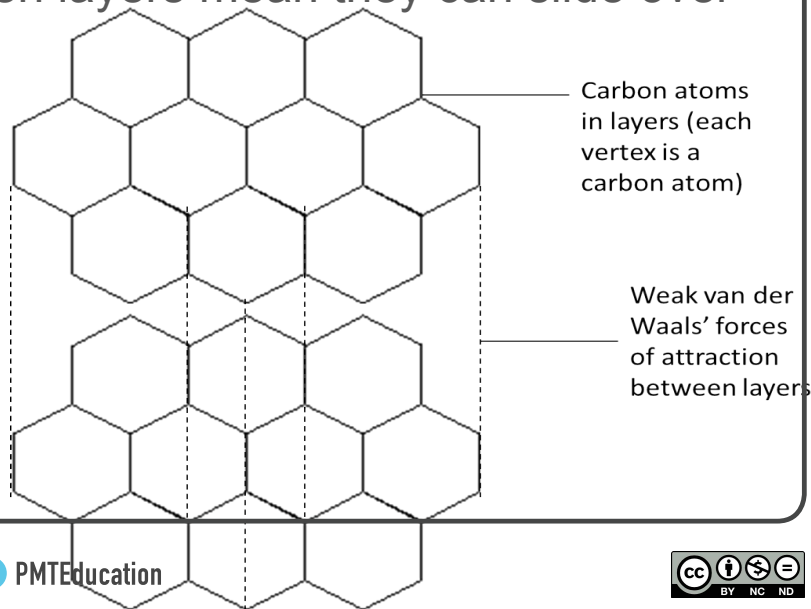


# Draw and describe structure of graphite

Similar to diamond - macromolecular covalent - but each C atom is only bonded to 3 others, so it is in layers

Weak van der Waals forces of attraction between layers mean they can slide over each other → soft, slippery

One electron from each carbon is delocalised and can carry charge → conducts electricity

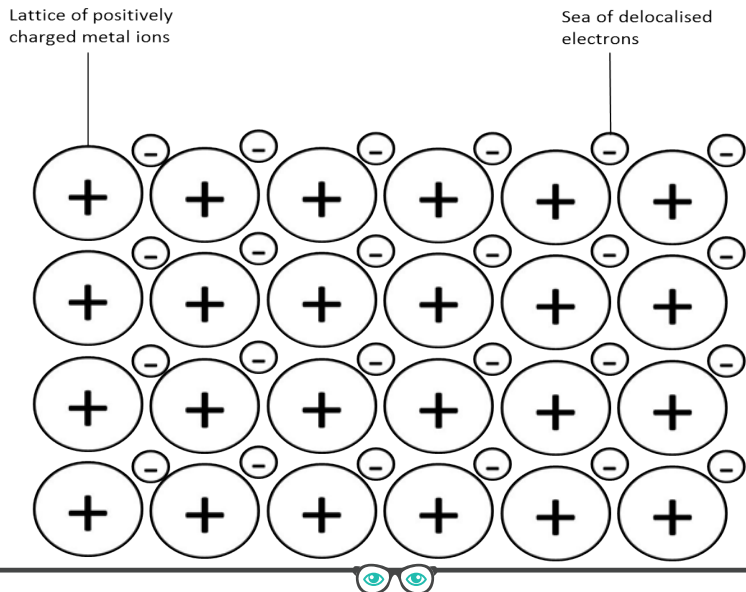


# Describe and draw metallic bonding.



# Describe and draw metallic bonding.

Lattice of positive metal ions strongly attracted to a sea of delocalised electrons.  
Layers can slide over each other - malleable



Do metallic compounds  
have high/low bpt and  
mpts? why?



Do metallic compounds have high/low bpt and mpts?  
why?

High as strong forces of attraction between  
positive metal ions and negatively charged sea of  
delocalised electrons



# Do metallic compounds conduct electricity? why?





Do metallic compounds conduct electricity? why?

Yes as delocalised electrons can move throughout the metal to carry charge



How does the strength of  
metallic bonds change  
across the periodic table?  
Why?



# How does the strength of metallic bonds change across the periodic table? Why?

Increases → higher Melting and boiling points, stronger

Higher charge on metal ions

More delocalised electrons per ion

Stronger force of attraction between them



# Define electronegativity



# Define electronegativity

The ability of an atom to attract the pair of electrons (the electron density) in a covalent bond



# What affects electronegativity? (3)



# What affects electronegativity? (3)

Nuclear charge

Atomic radius

Electron shielding



# What is the most electronegative element?





What is the most electronegative element?

Fluorine (4.0 on Pauling's scale) → largest nuclear charge for its electron shielding, small atomic radius



# How do you get a nonpolar bond?



# How do you get a nonpolar bond?

Both bonding elements have the same electronegativities



# When do you get a polar bond?



# When do you get a polar bond?

Bonding atoms have different electronegativities



# What is the strongest type of inter-molecular force?



What is the strongest type of inter-molecular force?

Hydrogen bonding



# What is the weakest type of inter-molecular force?





What is the weakest type of inter-molecular force?

van der Waals forces



Describe van der Waals'  
forces of attraction.



# Describe van der Waals' forces of attraction.

Temporary dipoles are created by the random movement of electrons → induces dipole in neighbouring molecule → temporary induced dipole-dipole attraction aka van der Waals forces of attraction



Are Van der Waals forces  
greater in smaller or larger  
molecules?



Are Van der Waals forces stronger in smaller or larger molecules?

Larger- more electrons



# Describe permanent dipole-dipole attraction



# Describe permanent dipole-dipole attraction

Some molecules with polar bonds have permanent dipoles → forces of attraction between those dipoles and those of neighbouring molecules



What conditions are needed  
for hydrogen bonding to  
occur?





# What conditions are needed for hydrogen bonding to occur?

O-H, N-H or F-H bond, lone pair of electrons on O, F, N

Because O, N and F are highly electronegative, H nucleus is left exposed

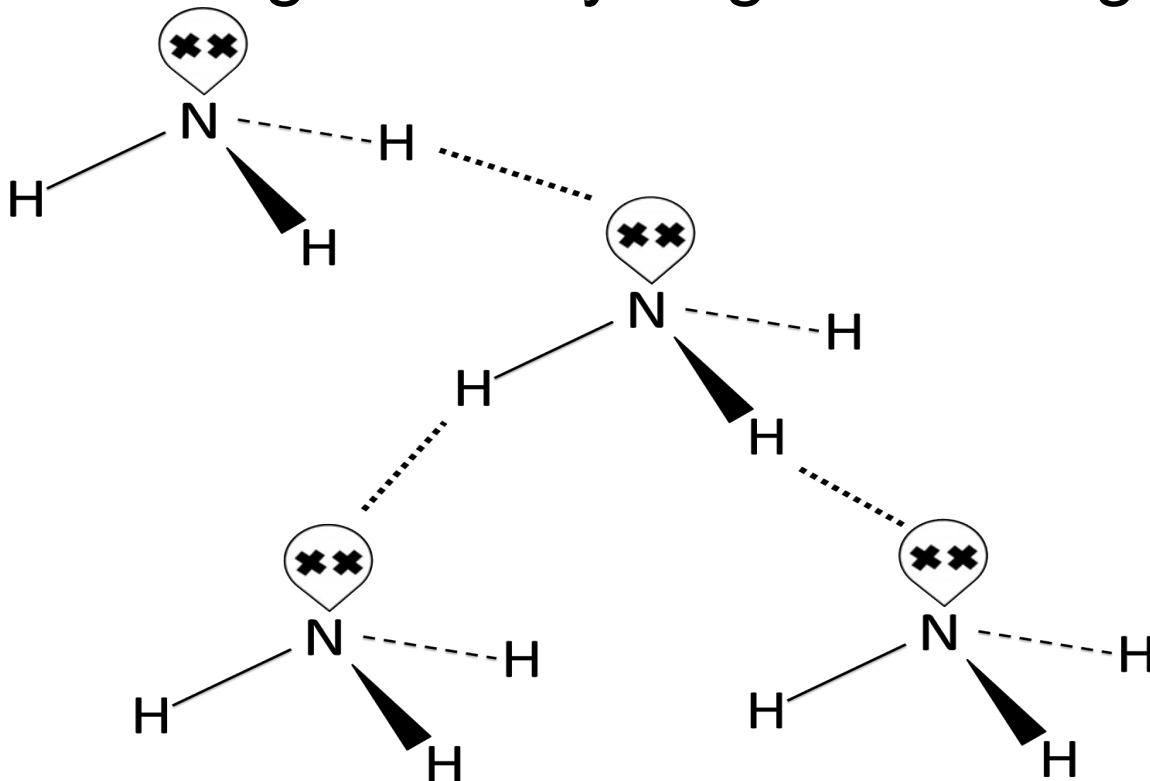
Strong force of attraction between H nucleus and Lone pair of electrons on O, N, F



# Draw a diagram of hydrogen bonding



# Draw a diagram of hydrogen bonding



# Why is ice less dense than liquid water?



# Why is ice less dense than liquid water?

In liquid water, hydrogen bonds constantly break and reform as molecules move about

In ice, the hydrogen bonds hold the molecules in fixed positions; this makes them slightly further apart than in liquid water



# What is a dative/co-ordinate covalent bond? When is it formed?



What is a dative/co-ordinate covalent bond? When is it formed?

Formed when an electron deficient atom/ion accepts a lone pair of electrons from an atom/ion with a lone pair of electrons (not used in bonding)

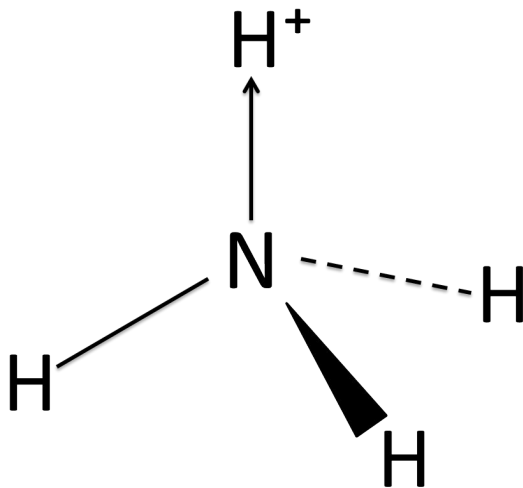


Draw the formation of a  
dative covalent bond in  
ammonia





Draw the formation of a dative covalent bond in ammonia



# What does the shape of molecules depend on?



What does the shape of molecules depend on?

Number of electrons in the valence shell of the central atom

Number of these electrons which are in bonded or lone pairs



# What does the Electron Pair Repulsion Theory state?



# What does the Electron Pair Repulsion Theory state?

that electron pairs will take up positions as far away from each other as possible, to minimise the repulsive forces between them



# Which experience the most repulsion?

Lone pair-lone pair

Lone pair-bonded pair

Bonded pair- bonded pair



Which experience the most repulsion?

LP-LP repulsion strongest

LP-BP repulsion middle

BP-BP repulsion weakest



What is the shape, diagram and bond angle in a shape with 2 bonded pairs and 0 lone pairs?





What is the shape, diagram and bond angle in a shape with 2 bonded pairs and 0 lone pairs?

Linear

$180^\circ$



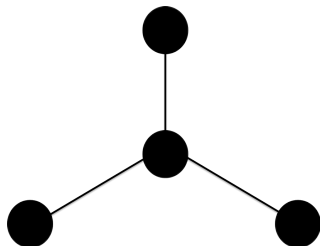
What is the shape, diagram and bond angle in a shape with 3 bonding pairs and 0 lone pairs?



What is the shape, diagram and bond angle in a shape with 3 bonded pairs and 0 lone pairs?

Trigonal planar

$120^\circ$



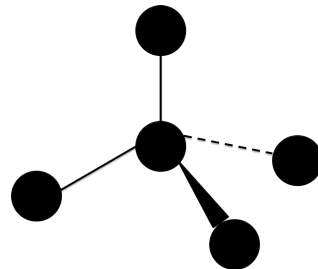
What is the shape, diagram and bond angle in a shape with 4 bonded pairs and 0 lone pairs?



What is the shape, diagram and bond angle in a shape with 4 bonded pairs and 0 lone pairs?

Tetrahedral

$109.5^\circ$



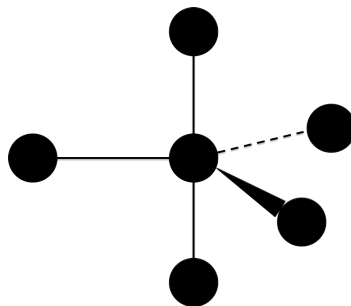
What is the shape, diagram and bond angle in a shape with 5 bonded pairs and 0 lone pairs?



What is the shape, diagram and bond angle in a shape with 5 bonded pairs and 0 lone pairs?

Trigonal bipyramid

$90^\circ$  and  $120^\circ$



What is the shape, diagram and bond angle in a shape with 6 bonded pairs and 0 lone pairs?





What is the shape, diagram and bond angle in a shape with 6 bonded pairs and 0 lone pairs?

Octahedral

$90^\circ$

