BONDING

Some useful phrases:

Strong electrostatic forces of attraction between oppositely-charged ions require a lot of energy to break

Weak intermolecular forces of attraction require little energy to break

Giant lattice of positive ions in a sea of delocalized electrons

Electrostatic attraction between positive ions and delocalized electrons

Layers of positive ions slide over each other

Strong electrostatic attraction between a shared ***pair*** of electrons and the nuclei of ***both*** atoms making up the bond

Don't get mixed up:

Ionic substances conduct electricity when molten/in aqueous solution because IONS are free to move

Metals conduct electricity because delocalized ELECTRONS are free to move

Graphite conducts electricity because delocalized ELECTRONS are free to move

Do not:

- Mention the words *molecules/intermolecular* forces when talking about ionic compounds
- Get mixed up between *ammoni**a*** (NH_3 – a covalent molecule) and *ammoni**um*** (NH_4^+ an ion)
- Get mixed up between sulfide (S^{2-}) and sulfate (SO_4^{2-}) or between nitride (N^{3-}) and nitrate (NO_3^-)
- Mention the word 'electrons' when explaining why ionic compounds conduct electricity

Remember:

Intermolecular forces are between *molecules* Covalent bonds are between *atoms*.

If a compound contains a metal it is almost certainly ionic (the only exceptions will be things like ammonium chloride)

Diamond and graphite have giant structures but C_{60} fullerene has a simple molecular structure

Covalent molecular substances with higher relative molecular masses usually have higher melting/boiling points because the intermolecular forces are stronger.

Reactivity increased down Group 1 because the *outer electron* gets further from the nucleus so it is less strongly attracted by the nucleus and more easily lost.

1 positive ions are formed when atoms ……. electrons

negative ions are formed when atoms ……. electrons

2 Draw a dot and cross diagram for the formation of magnesium oxide

3 Work out the formulae of the following compounds:

Sodium oxide	Potassium sulfide	Magnesium nitrate	Lithium nitride	Lead chloride	Iron(III) sulfate	Ammonium carbonate

4 Ionic bonding is a …… electrostatic attraction between

…….. ions

5 Ionic compounds have high melting points because……..

6 Explain under what circumstances ionic compounds conduct electricity

7 An ionic crystal is a ……. three-dimensional ……. structure

held together by the attraction between ……

8 Write an equation for the reaction of sodium with water.

……

Explain why potassium is more reactive than sodium

9 Explain why noble gases are unreactive.

10 What is meant by the term ‘covalent bond’

11 Draw dot and cross diagrams (showing outer electrons only) for

F_2	O_2	NH_3	CO_2

12 Ethene has the formula C_2H_4 – what type of covalent bond is there between the carbon atoms?

13 Explain why substances with a simple molecular structure have low melting and boiling points

14 These are all covalent compounds with simple molecular structures. Try to explain the data.

formula	CH_4	CH_3Cl	CH_3Br	CH_3I
Relative molecular mass	16	50.5	95	142
Boiling point / ^oC	-162	-24	4	43

15 Explain why diamond has a higher melting point than C_{60} fullerene.

16 Explain why diamond is hard but graphite is soft.

17 Explain why graphite conducts electricity.

18 Draw a labelled diagram to show the structure of a metal

19 Describe metallic bonding

20 Explain why metals are malleable

21 Explain why metals conduct electricity

22 What is an alloy?

23 Why are alloys harder than pure metals?

24 Explain the following uses of some metals in terms of properties:

Aluminium in overhead power cables

Mild steel in car bodies

High-carbon steel in knives

Copper in hot water pipes