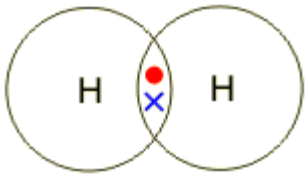
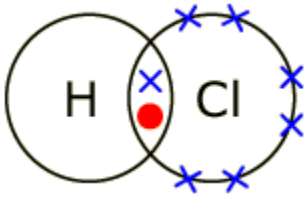
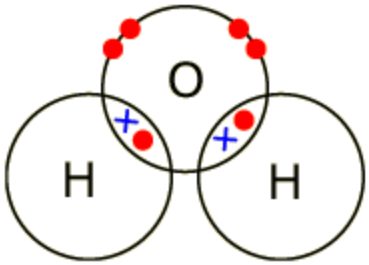
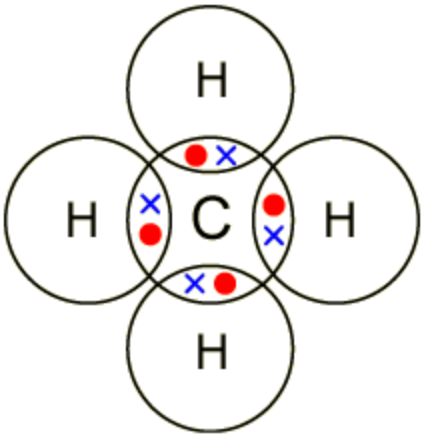
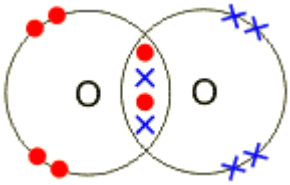
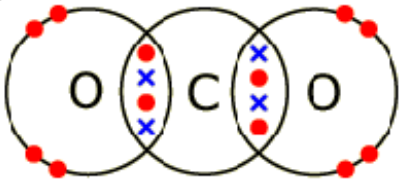
2.1 2.2	<u>Describe</u> how **atoms** form **compounds** (2) • <u>Explain</u> what happens to **electrons** in an **ionic bond** (2)	• **Atoms** of different **elements** (1) combine by the formation of chemical **bonds** (1) (either **ionic, covalent** or **metallic bond**). • **Electron transfer** (1) from a **metal atom** to a **non metal atom** (1)
2.3a 2.3b 2.3c	a) What is an **ion**? b) What charge do **anions** have? (1) how do they get this charge? (1) c) What charge do **cations** have? (1) how do they get this charge? (1)	a) An **atom** or group of atoms that has a charge (1) b) **Negative** charge by gaining **electrons** from another **atom** (transferred from another atom) c) **Positive** charge by losing **electrons** (transferred to another atom)
2.4a 2.4b 2.4c	<u>By referring to</u> **electron structure** <u>describe</u> how: a) a sodium **atom** forms a sodium **ion** and give the charge of the **ion** (3) b) a chlorine **atom** forms a chloride **ion** & give the charge of the **ion** (3) c) an oxygen **atom** forms an **oxide ion** and give the charge of the **ion** (3)	a) Sodium has one **electron** in it's outer shell (1), this is removed (1) (transferred to another atom), leaving a **positive ion** Na^+ (1) b) Chlorine has 7 **electrons** in it's outer shell (1), it gains one **electron** (1) (transferred from another atom) leaving a **negatively charged ion** Cl^- c) Oxygen has 6 **electrons** in its outer shell (1) it gains 2 **electrons** (1 leaving a negatively charged **ion** O^{2-}
2.5a 2.5b 2.6	a) What does the ending **'ide'** tell you about a **compound**? b) What does the ending **'ate'** tell you about a **compound**? • <u>Use the **formula**</u> of the **ions** below to <u>work out</u> the **formula** of the following **compounds**: i) Sodium oxide ii) Magnesium oxide iii) Calcium hydroxide (Na^+ sodium, Li^+ lithium, Ca^{2+} calcium, Mg^{2+} magnesium, Al^{3+} aluminium, O^{2-} oxide, OH^- hydroxide, Cl^- chloride, Br^- bromide, I^- iodide, NO_3^- nitrate, CO_3^{2-} carbonate and SO_4^{2-}sulfates)	a) It's made from two **elements,** at least one of them is a non-metal (1) (*the non metal changes the ending of it's name to 'ide'. Example sodium oxide)* b) It's made from three **elements**, one of which is **oxygen** (1) i) Na_2O (two Na^+ ions cancel the O^{2-} charge) ii) MgO iii) $Ca(OH)_2$

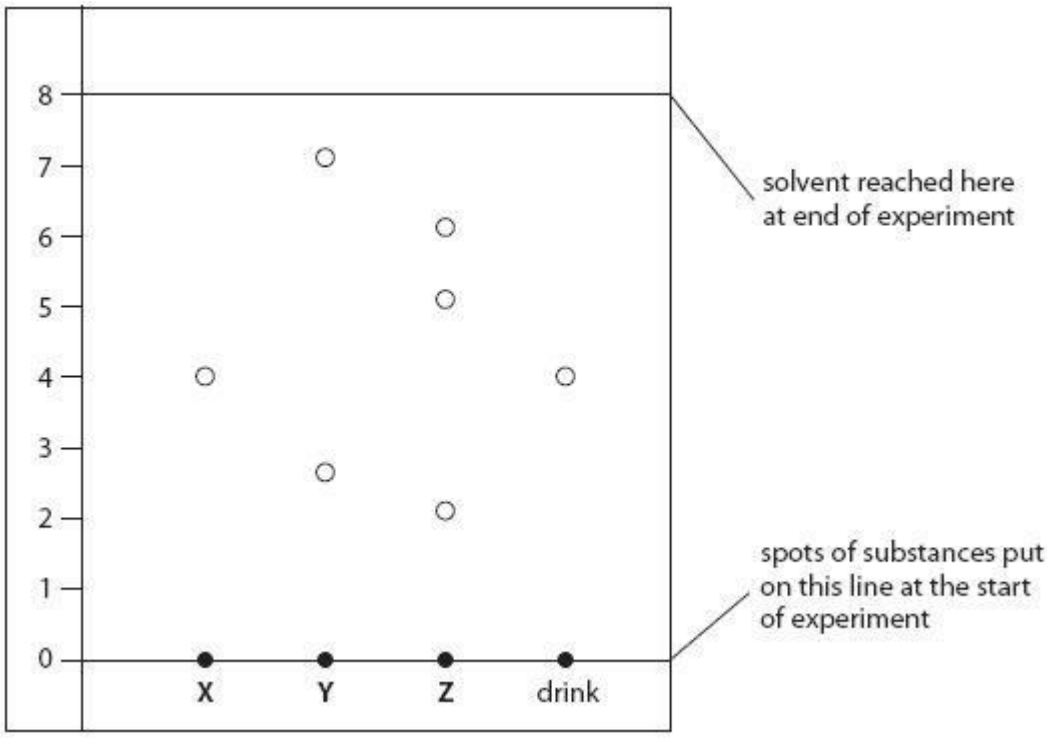
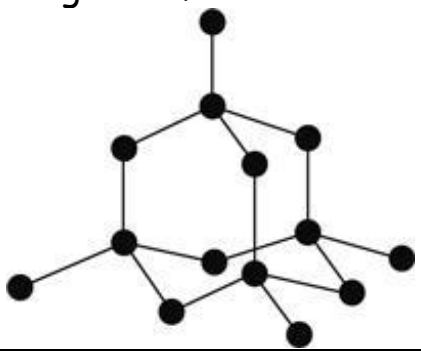
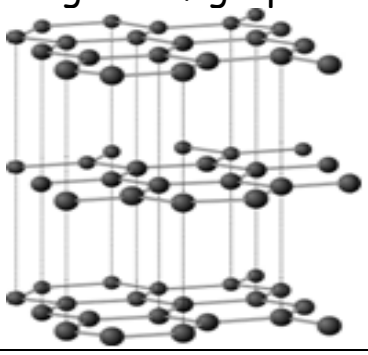
2.7 2.8	*Describe the structure of ionic compounds and explain what holds the ions together (2)* Describe and explain the **properties** of **ionic substances** like sodium chloride and magnesium oxide (refer to ability to **conduct electricity** when solid and when liquid, and to **melting and boiling points**) (6)	• ***Lattice structure**(1) (regular pattern of ions in rows), held together by strong **electrostatic** force of attraction between oppositely charged ions (1)* • Do not **conduct electricity** when solid (1) **Ions** held by **strong bonds** so can't move to conduct electricity (1); will conduct when liquid- **melted** or **dissolved** (1) because the charged **ions** are free to move (1); high melting and boiling point (1) as lots of **strong bonds** take a lot of **energy** to break down bonds to allow the **ions** to move (1)
2.9 2.13	Recall the rules of **solubility** for common salts of: **a) Sodium, potassium, ammonium and nitrates** **b) chlorides,** **c) sulfates,** d) **carbonates** and **hydroxide.** a) Is potassium sulphate soluble? b) Is lead chloride soluble? c) Is silver chloride soluble?	a) All common **salts** of **Sodium, potassium, ammonium and all nitrates** are **soluble**. b) All common **chlorides** are **soluble** except those of **silver** and **lead** c) Most **sulfates** are **soluble** except lead, barium and calcium d) Most are **insoluble** except those of **sodium, potassium and ammonium**. e) Yes f) Yes g) No
2.10 2.11 & 2.12	• Predict how to make an **insoluble salt** from two **soluble salts** as a **precipitate** in a reaction between two solutions. • Describe how to prepare a pure dry sample of an **insoluble salt**	sodium chloride (aq) + silver nitrate(aq) → silver chloride(s) + sodium nitrate(aq) • There are lots of other examples, remember: (s) = solid (aq) = **aqueous**- dissolved in water • Add two **solutions** that make a **precipitate**, swirl to mix, **filter** to remove the **precipitate**, dry the **precipitate.**
2.14	a) Recall a use for the **insoluble salt barium sulphate** (1) b) Explain 2 reasons why it's used for this purpose (2)	a) **barium meal** (1) used to identify problems with digestive system b) **X rays** can't pass through it (opaque to x rays) so it shows up the digestive system (1), it's **insoluble** so doesn't get taken into the blood (1)

2.15	a) Recall the colour of **flame tests** for: **Sodium , potassium, calcium and copper** (4) b) Describe how to test for **carbonates** CO_3^{2-} (3) c) Describe how to test for **sulphate ions** SO_4^{2-}(2) d) Describe how to test for **chloride ions** Cl^- (2)	a) **Sodium** = yellow **Potassium** = lilac **Calcium** = red **Copper** = green b) Add acid (1), bubble carbon dioxide gas through **lime water** (1), which goes cloudy (1) c) Add **hydrochloric acid** and **barium chloride** (1), forms a white **precipitate** (1) d) Add **nitric acid** and **silver nitrate** (1) forms a white **precipitate** (1)
2.16	a) Describe how to carry out a **flame test** (4) b) Describe what **spectroscopy** is and what it's used for (2) c) Name an **element** that has been discovered using **spectroscopy** (1)	a) Dip a metal loop in the **compound** to be tested (1), put in a blue Bunsen flame (1), observe colour of flame (1), dip metal loop in acid to clean the wire (1). b) A high tech flame test carried out by a machine (1) that can detect very small quantities of an element(1 c) **Rubidium** or **caesium** (1)
3.1 3.2	• Describe a **covalent bond** in terms of **electrons (2)** a) What does **covalent bonding** usually result in the formation of? b) Define a **molecule (1)**	• Shared pair of electrons (2). Shared electrons (1 mark only) a) Molecules (1) b) Group of atoms bonded together by covalent bonds (1)
3.4	a) Describe how to classify a chemical as having **ionic or covalent bonds** by looking at their **physical properties** (4) • Apply your knowledge of the properties of chemicals to predict the type of bonding in: bi) A chemical that melts at 65°C and does not conduct electricity bii) A chemical that melts at 650°C and conducts electricity when melted biii) A chemical that does not conduct electricity when solid, but when dissolved in water it does.	a) Chemicals with **ionic bonds** have **high melting points** (1), do not **conduct electricity** when solid (1), do conduct electricity when melted or dissolved-liquid (1). Chemicals with **covalent bonds** have low melting points (1), do not conduct electricity when solid or liquid (1) bi) Covalent bonding bii) ionic bonding biii) ionic bonding You're expected to work out: *sodium chloride, magnesium sulphate & copper sulphate have ionic bonding as contain a metal & a non- metal. Hexane, liquid paraffin, silicon(IV) oxide & sucrose (sugar)have covalent bonding as they're made from only non-metals.*

3.3 a, b,c	<u>Draw</u> **dot and cross diagrams** to show **covalent bonding** in the following **molecules**: a) hydrogen (1) b) hydrogen chloride (1) c) water (2) Remember you only need to draw the outer electrons for each atom. Also use dots for the electrons of one atom and crosses for the other atom.	a) Must have **shared pair of electrons** in the over lapped section. Hydrogen H_2  b) Hydrogen chloride HCl  C) Must have a shared pair of electrons between the hydrogen and the oxygen. Water H_2O 
3.3 d, e, f	<u>Draw</u> **dot and cross diagrams** to show **covalent bonding** in the following **molecules**: d) methane (2) *e) **oxygen (2)*** *f) **carbon dioxide (2)*** Remember you only need to draw the outer electrons for each atom. Also use dots for the electrons of one atom and crosses for the other atom.	d) Methane, CH_4  ***e) Must have two shared pairs of electrons. This is a double bond. Oxygen O_2***  ***f) Carbon dioxide CO_2*** 

3.5	a) Describe the physical properties of **simple molecular covalent** chemicals (2) b) Explain why **simple molecular covalent** chemicals have low melting and boiling points (2) and why they don't conduct electricity (2)	a) Low melting and boiling points (1) do not conduct electricity (1) b) **Weak inter molecular bond** between **molecules** (1) little energy needed to separate molecules (1) Molecules are **neutral** (1) and there are no free (**delocalised)** electrons, so can't conduct electricity (1).
3.6	a) Describe the physical properties of **giant molecular covalent** structures. (2) b) Explain why they have these properties. (3) c) Give an example of material that has a **giant molecular covalent structure.**	a) High melting point (1), do not conduct electricity (1) (the exception to this is graphite- see number 3.7 b) High melting point because contain lots of strong bonds (1), takes a lot of energy to break down the structure (1). Do not conduct electricity as neutral molecule with no free (delocalised) electrons (1) c) Diamond, graphite, silicon dioxide.
3.7	a) Describe what **diamond** and **graphite** both have in common. (1) b) Explain why diamond can be used as a cutting tool. (4) c) Explain why graphite is used to make electrodes and as a lubricant. (5)	a) Both made from the **element carbon** b) Diamond has a **giant molecular structure**, where each carbon atom has 4 strong **covalent bonds** (1), so lots of strong bonds hold the carbon atoms in place (1), a lot of energy is needed to break down the structure (1), so diamond is a very hard substance (1) c) in Graphite each carbon atom has 3 strong covalent bonds within layers, but a **weak delocalised electron** between layers (1), layers of atoms can slide past each other (1) so it's used as lubricant and in pencils (1). The delocalised electron can also move between layers (1) allowing a flow of charge and hence it conducts electricity (1) **see diagrams 3.7**

3.8	a) Name an example of two **immiscible** liquids (1) b) Describe what **immiscible** means (1) c) Describe how to separate two **immiscible** liquids (3)	a) Oil and water (1) b) Two liquids that do not mix, and so separate out (1) c) Use a **separating funnel** (1) the more **dense** liquid- could be water sinks to the bottom, open a tap to run off the bottom layer (1). Close tap, get a new container and open tap to run off the less dense liquid- could be oil (1)
3.9	a) Name an example of two **miscible liquids** (1) b) Describe what miscible means (1) c) Describe how to separate two **miscible liquids** (1) and explain how it works (3) d) Explain how **fractional distillation** is used to separate oxygen and nitrogen from the gases in air (4) For info, no need to learn- first gas to evaporate from the cooled liquid as it warms up from -200°C is **nitrogen -196°C**, then argon -186°C, **oxygen -183°C**, krypton -153°C and xenon -108°C	a) Water and hydrochloric acid (any two liquids that mix together) (1) b) Liquids that will mix together c) Use **fractional distillation** (1). Each liquid has a different boiling point (1), heat until all **evaporates** (1) then cool and each liquid **condenses** at a different temperature so can separated and collected (1) d) **Filter** air to remove any solid dust particles (1) Cool air down and remove liquid water and carbon dioxide (1) (other wise it would solidify at the cold temps used and block the pipes), cooled down to -200°C, where all gases condense except neon and argon, these are removed (1) rest of liquid is allowed to warm up & gases evaporate as temperature reaches their boiling point (1)
3.10	a) Recall what **chromatography** is used for (1) b) Describe how to carry out **chromatography** using ink or food colourings	a) Separate a mixture of colours in ink or food colourings (1) b) Draw a pencil line approx. 1cm from the bottom of a piece of filter paper, add crosses fro each colour to be tested and label with pencil. (1) Add a drop of ink to each cross and place in a container with a small amount of water - below pencil line (1) as water soaks up paper and colours separate out (1)

3.11	a) <u>Interpret chromatograms</u> & b) <u>Recall</u> the equation for Rf values and apply it <u>calculate</u> Rf values for a given chromatogram. See question below: a) Some food colourings are a mixture of coloured substances. Paper chromatography can be used to separate the coloured substances in food colourings. Charles carried out a chromatography experiment to test which food colouring was present in a coloured drink. He used samples of three food colourings, **X**, **Y** and **Z**. He also tested a sample of the colouring in the drink. Charles obtained this chromatogram.  	
	ai) <u>State</u> all the food colourings that contain more than one coloured substance. aii) <u>What substance</u> does the drink contain? (1) bi) <u>How do you calculate</u> the **Rf** value for a substance? (1) bii) <u>Calculate</u> the **Rf** value for substance x	ai) Y and z (1) as they have more than one dot above the spots where the substances were put at the start aii) x (1) as the dot above the line is at the same height bi) Rf = <u>height of substance above the base line</u> height of solvent above the base line bii) height of solvent above base line = Height of solvent above base line = Rf = / =
3.7	Diagram of diamond 	Diagram of graphite 

Examples of ionic bonding