	Order	Title and content	Additional Info	Specification number	SMSC/ FBV/ Literacy/ Numeracy	Allenyes Sills for life
	1	Ions	Metal atoms lose electrons to become positively charged ions. Non-metal atoms gain electrons to become negatively charged ions. The ions produced by metals in Groups 1 and 2 and by non-metals in Groups 6 and 7 have the electronic structure of a noble gas (Group 0). Work out the charge on the ions of metals and non-metals from the group number of the element, limited to Groups 1 and 2, 6 and 7. **Draw** the electron configuration of ions	5.2.1.2	Positive and negative numbers	Numeracy
Bonding 1	2	Ionic bonding	When a metal atom reacts with a non-metal atom electrons in the outer shell of the metal atom are transferred. **Draw** dot and cross diagrams for ionic compounds formed by Groups 1 and 2 with Groups 6 and 7. **Deduce** that a compound is ionic from a diagram of its structure in one of the specified forms. **Describe** the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent a giant ionic structure. **Work out** the empirical formula of an ionic compound from a given model or diagram that shows the ions in the structure	5.2.1.2	Positive and negative numbers	Numeracy
	3	Covalent bonding	When atoms share pairs of electrons, they form strong covalent bonds. Covalently bonded substances may consist of small molecules. **Recognise** common substances that consist of small molecules from their chemical formula. Some covalently bonded substances have very large molecules, such as polymers. Some covalently bonded substances have giant covalent structures, such as diamond and silicon dioxide. **Draw** dot and cross diagrams for the molecules of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane. **Represent** the covalent bonds in small molecules, in the repeating units of polymers and in part of giant covalent structures, using a line to represent a single bond. **Describe** the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent molecules or giant structures. **Deduce** the molecular formula of a substance from a given model or diagram in these	5.2.1.4	Counting	Numeracy
	3	Metallic bonding and allloys	**Describe and draw** metallic strcutures (giant structures of atoms arranged in a regular pattern). The electrons in the outer shell of metal atoms are delocalised and so are free to move through the whole structure. The sharing of delocalised electrons gives rise to strong metallic bonds. Metals have giant structures of atoms with strong metallic bonding. This means that most metals have high melting and boiling points. In pure metals, atoms are arranged in layers, which allows metals to be bent and shaped.Metals are good conductors of electricity because the delocalised electrons in the metal carry electrical charge through the metal. Metals are good conductors of thermal energy because energy is transferred by the delocalised electrons. Pure metals are too soft for many uses and so are mixed with other metals to make alloys which are harder. Explain why alloys are harder than pure metals in terms of distortion of the layers of atoms in the structure of a pure metal.	5.2.1.5, 5.2.2.7, 5.2.2.8	Correct use of tier 3 vocabulary	Literacy
	4	Peer STAR drawing bonds	Half an hour to complete the independent practise (closed book exercise). Half an hour to mark and complete STAR feedback sheet		Positive and negative numbers	Numeracy
	5	States of matter inc state symbols	The three states of matter are solid, liquid and gas. Particle theory can help to explain melting, boiling, freezing and condensing.The amount of energy needed to change state from solid to liquid and from liquid to gas depends on the strength of the forces between the particles of the substance. The nature of the particles involved depends on the type of bonding and the structure of the substance. The stronger the forces between the particles the higher the melting point and boiling point of the substance. (HT only) **Explain** the Limitations of the simple model above include: there are no forces, that all particles are represented as spheres and that the spheres are solid. **Predict** the states of substances at different temperatures given appropriate data. **Explain** the different temperatures at which changes of state occur in terms of energy transfers and types of bonding. **Recognise** that atoms themselves do not have the bulk properties of materials. **Use** appropriate state symbols	5.2.2.1, 5.2.2.2	Positive and negative numbers, using number lines	Numeracy

	6	Revision - optional				
	7	Test - Teacher STAR				
	8	Test feedback				
Bonding 2	9	Properties of ionic compounds	Ionic compounds have regular structures (giant ionic lattices) in which there are strong electrostatic forces of attraction in all directions between oppositely charged ions. These compounds have high melting points and high boiling points because of the large amounts of energy needed to break the many strong bonds. When melted or dissolved in water, ionic compounds conduct electricity because the ions are free to move and so charge can flow. Knowledge of the structures of specific ionic compounds other than sodium chloride is not required.	5.2.2.3	Taking measurements	Numeracy
	10	Properties of small molecules inc polymers	Substances that consist of small molecules are usually gases or liquids that have relatively low melting points and boiling points. These substances have only weak forces between the molecules (intermolecular forces). It is these intermolecular forces that are overcome, not the covalent bonds, when the substance melts or boils. The intermolecular forces increase with the size of the molecules, so larger molecules have higher melting and boiling points. These substances do not conduct electricity because the molecules do not have an overall electric charge. **Use** the idea that intermolecular forces are weak compared with covalent bonds to **explain** the bulk properties of molecular substances	5.2.2.4, 5.2.2.5	Taking measurements	Numeracy
	11	Giant covalent inc diamond, graphite, graphene and fulerene	Polymers have very large molecules. The atoms in the polymer molecules are linked to other atoms by strong covalent bonds. The intermolecular forces between polymer molecules are relatively strong and so these substances are solids at room temperature. **Recognise** polymers from diagrams. Substances that consist of giant covalent structures are solids with very high melting points. All of the atoms in these structures are linked to other atoms by strong covalent bonds. These bonds must be overcome to melt or boil these substances. Diamond and graphite (forms of carbon) and silicon dioxide (silica) are examples of giant covalent structures. **Recognise** giant covalent structures from diagrams showing their bonding and structure. **Explain** the properties of diamond, graphite, graphene and fullernes. **Give** examples of graphene and fullernes	5.2.2.6, 5.2.3.1, 5.2.3.2, 5.2.3.3	Correct use of tier 3 vocabulary	Literacy
	12	Scientific literacy	Students to use the reading for learning stategy to help with comprehension of scientific literature		Reading comprehension. Social: How Science is portrayed in the media	Independence
	13	Peer STAR	Half an hour to complete the independent practise (closed book exercise). Half an hour to mark and complete STAR feedback sheet		Correct use of tier 3 vocabulary	Independence
	14	Revision - optional				
	15	Test - Teacher STAR				
	16	Test feedback				
Quantitive chemistry	17	Conservation of mass	The law of conservation of mass states that no atoms are lost or made during a chemical reaction so the mass of the products equals the mass of the reactants. Some reactions may appear to involve a change in mass but this can usually be explained because a reactant or product is a gas and its mass has not been taken into account. Explain any observed changes in mass in non-enclosed systems during a chemical reaction given the balanced symbol equation for the reaction and Explain these changes in terms of the particle model. Whenever a measurement is made there is always some uncertainty about the result obtained. Represent the distribution of results and make estimations of uncertainty. Use the range of a set of measurements about the mean as a measure of uncertainty.	5.3.1.1	Measurements	Numeracy

	18	Balanced equations	Balance equations This means that chemical reactions can be represented by symbol equations which are balanced in terms of the numbers of atoms of each element involved on both sides of the equation. Understand the use of the multipliers in equations in normal script before a formula and in subscript within a formula.	5.3.1.1	Balancing equations. Counting, multipling	Numeracy
	19	Peer STAR - balancing equations	Half an hour to complete the independent practise (closed book exercise). Half an hour to mark and complete STAR feedback sheet	5.3.1.1	Balancing equations. Counting, multipling	Numeracy
	20	Relative formula mass	The relative formula mass (Mr) of a compound is the sum of the relative atomic masses of the atoms in the numbers shown in the formula. In a balanced chemical equation, the sum of the relative formula masses of the reactants in the quantities shown equals the sum of the relative formula masses of the products in the quantities shown. **Calculate** the percentage by mass in a compound given the relative formula mass and the relative atomic masses.	5.3.1.2	Multiplication	Numeracy
	21	Concentration of solution	Many chemical reactions take place in solutions. The concentration of a solution can be measured in mass per given volume of solution, eg grams per dm3 (g/dm3). **Calculate** the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution. Higher only- **Explain** how the mass of a solute and the volume of a solution is related to the concentration of the solution.	5.3.2.5	Multiplication, division	Numeracy
	22	H- Moles	Chemical amounts are measured in moles. The symbol for the unit mole is mol. The mass of one mole of a substance in grams is numerically equal to its relative formula mass. One mole of a substance contains the same number of the stated particles, atoms, molecules or ions as one mole of any other substance. The number of atoms, molecules or ions in a mole of a given substance is the Avogadro constant. The value of the Avogadro constant is 6.02 x 10^23 per mole. Understand that the measurement of amounts in moles can apply to atoms, molecules, ions, electrons, formulae and equations, for example that in one mole of carbon (C) the number of atoms is the same as the number of molecules in one mole of carbon dioxide (CO2).	5.3.2.1	Using indicies	Numeracy
	23	H- amount of substance	The masses of reactants and products can be calculated from balanced symbol equations. Chemical equations can be interpreted in terms of moles. For example: Mg + 2HCl MgCl2 + H2 shows that one mole of magnesium reacts with two moles of hydrochloric acid to produce one mole of magnesium chloride and one mole of hydrogen gas. **Calculate** the masses of substances shown in a balanced symbol equation. **Calculate** the masses of reactants and products from the balanced symbol equation and the mass of a given reactant or product.	5.3.2.2	Multiplication, division, using equations	Numeracy
	24	H- using moles to balance equations	The balancing numbers in a symbol equation can be calculated from the masses of reactants and products by converting the masses in grams to amounts in moles and converting the numbers of moles to simple whole number ratios. **Balance** an equation given the masses of reactants and products. **Change** the subject of a mathematical equation.	5.3.2.3	Multiplication, division, changing the subject	
	25	H- limiting reactants	In a chemical reaction involving two reactants, it is common to use an excess of one of the reactants to ensure that all of the other reactant is used. The reactant that is completely used up is called the limiting reactant because it limits the amount of products. **Explain** the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain in terms of amounts in moles or masses in grams.	5.3.2.4	Correct use of tier 3 vocabulary	Literacy
	26	Revision - optional				
	27	Test - Teacher STAR				
	28	Test feedback				

Acids and alkalis	29	Acids, bases and carbonates	Acids are neutralised by alkalis (eg soluble metal hydroxides) and bases (eg insoluble metal hydroxides and metal oxides) to produce salts and water, and by metal carbonates to produce salts, water and carbon dioxide. The particular salt produced in any reaction between an acid and a base or alkali depends on: the acid used (hydrochloric acid produces chlorides, nitric acid produces nitrates, sulfuric acid produces sulfates), the positive ions in the base, alkali or carbonate. **Predict** products from given reactants	5.4.2.3	Constructing chemical names	Communication
	30	Acids and metals	Acids react with some metals to produce salts and hydrogen. (HT only) **Predict** products from given reactants	5.4.2.1	Constructing chemical names	Communication
	31	Formulas of salts	**Use** the formulae of common ions to deduce the formulae of salts.	5.4.2.2	Counting, multiplying	Numeracy
	32	pH scale and neutrlisation	Acids produce hydrogen ions (H+) in aqueous solutions. Aqueous solutions of alkalis contain hydroxide ions (OH–). The pH scale, from 0 to 14, is a measure of the acidity or alkalinity of a solution, and can be measured using universal indicator or a pH probe. A solution with pH 7 is neutral. Aqueous solutions of acids have pH values of less than 7 and aqueous solutions of alkalis have pH values greater than 7. In neutralisation reactions between an acid and an alkali, hydrogen ions react with hydroxide ions to produce water. This reaction can be represented by the equation: H+ + OH- --> H2O. **Describe** the use of universal indicator or a wide range indicator to measure the approximate pH of a solution . **Use** the pH scale to identify acidic or alkaline solutions.	5.4.2.4	Correct use of tier 3 vocabulary	Literacy
	33	Scientific literacy	Students to use the reading for learning stategy to help with comprehension of scientific literature		Reading comprehension. Social: How Science is portrayed in the media	Communication
	34	Peer STAR - salts	Half an hour to complete the independent practise (closed book exercise). Half an hour to mark and complete STAR feedback sheet			
	35	Soluble salts	Soluble salts can be made from acids by reacting them with solid insoluble substances, such as metals, metal oxides, hydroxides or carbonates. The solid is added to the acid until no more reacts and the excess solid is filtered off to produce a solution of the salt. Salt solutions can be crystallised to produce solid salts. Students should be able to describe how to make pure, dry samples of named soluble salts from information provided.	5.4.2.3	Writing a method Spiritual: Using imagination in learning	Literacy
	36	Required practical - making salts	Preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate, using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution.	Required practical 1	Social: developing social skills via practical work Mutual respect and tollerance	Teamwork
	37	H- Strong and weak acids	A strong acid is completely ionised in aqueous solution. Examples of strong acids are hydrochloric, nitric and sulfuric acids. A weak acid is only partially ionised in aqueous solution. Examples of weak acids are ethanoic, citric and carbonic acids. For a given concentration of aqueous solutions, the stronger an acid, the lower the pH. As the pH decreases by one unit, the hydrogen ion concentration of the solution increases by a factor of 10. **Use and explain** the terms dilute and concentrated (in terms of amount of substance), and weak and strong (in terms of the degree of ionisation) in relation to acids. **Describe** neutrality and relative acidity in terms of the effect on hydrogen ion concentration and the numerical value of pH (whole numbers only).	5.4.2.6	Correct use of tier 3 vocabulary	Literacy
	38	Revision - optional				
	39	Test - Teacher STAR				
	40	Test feedback				

Chemical changes	41	Metal oxides -REDOX	Metals react with oxygen to produce metal oxides. The reactions are oxidation reactions because the metals gain oxygen. **Explain** reduction and oxidation in terms of loss or gain of oxygen.	5.4.1.1	Correct use of tier 3 vocabulary	Literacy
	42	The reactivity series	When metals react with other substances the metal atoms form positive ions. The reactivity of a metal is related to its tendency to form positive ions. Metals can be arranged in order of their reactivity in a reactivity series. The metals potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper can be put in order of their reactivity from their reactions with water and dilute acids. The non-metals hydrogen and carbon are often included in the reactivity series. A more reactive metal can displace a less reactive metal from a compound. **Recall and describe** the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with water or dilute acids and where appropriate, to place these metals in order of reactivity. **Explain how** the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion . **Deduce** an order of reactivity of metals based on experimental results. The reactions of metals with water and acids are limited to room temperature and do not include reactions with steam.	5.4.1.2	Interpeting data to draw a conclusion	Numeracy
	43	H- Ionic equations	**Write** balanced ionic equations	5.4.1.4	Counting, multiplying, positive and negative numbers	Numeracy
	44	H- Oxidation and reduction	HT ONLY Explain in terms of gain or loss of electrons, that these are redox reactions. Identify which species are oxidised and which are reduced in given chemical equations. Knowledge of reactions limited to those of magnesium, zinc and iron with hydrochloric and sulfuric acids. **Write** simple half equations	5.4.1.4	Correct use of tier 3 vocabulary	Literacy
	45	Process of electrolysis	When an ionic compound is melted or dissolved in water, the ions are free to move about within the liquid or solution. These liquids and solutions are able to conduct electricity and are called electrolytes. Passing an electric current through electrolytes causes the ions to move to the electrodes. Positively charged ions move to the negative electrode (the cathode), and negatively charged ions move to the positive electrode (the anode). Ions are discharged at the electrodes producing elements. This process is called electrolysis.	5.4.3.1	Correct use of tier 3 vocabulary	Literacy
	46	Electrolysis of molten ionic compounds	When a simple ionic compound (eg lead bromide) is electrolysed in the molten state using inert electrodes, the metal (lead) is produced at the cathode and the non-metal (bromine) is produced at the anode. **Predict** the products of the electrolysis of binary ionic compounds in the molten state.	5.4.3.2	Correct use of tier 3 vocabulary	Literacy
	47	Electrolysis to extract metals	Metals can be extracted from molten compounds using electrolysis. Electrolysis is used if the metal is too reactive to be extracted by reduction with carbon or if the metal reacts with carbon. Large amounts of energy are used in the extraction process to melt the compounds and to produce the electrical current. Aluminium is manufactured by the electrolysis of a molten mixture of aluminium oxide and cryolite using carbon as the positive electrode (anode). **Explain** why a mixture is used as the electrolyte, **Explain** why the positive electrode must be continually replaced.	5.4.3.3	Cultural: understanding how electrolysis is used in everyday life	
	48	Scientific literacy	Students to use the reading for learning stategy to help with comprehension of scientific literature		Reading comprehension. Social: How Science is portrayed in the media	

	49	Electrolysis of aqueous solutions	The ions discharged when an aqueous solution is electrolysed using inert electrodes depend on the relative reactivity of the elements involved. At the negative electrode (cathode), hydrogen is produced if the metal is more reactive than hydrogen. At the positive electrode (anode), oxygen is produced unless the solution contains halide ions when the halogen is produced. This happens because in the aqueous solution water molecules break down producing hydrogen ions and hydroxide ions that are discharged. **Predict** the products of the electrolysis of aqueous solutions containing a single ionic compound.	5.4.3.4	Use of postive and negative numbers	Numeracy
	50	H- Half equations at electrodes	During electrolysis, at the cathode (negative electrode), positively charged ions gain electrons and so the reactions are reductions. At the anode (positive electrode), negatively charged ions lose electrons and so the reactions are oxidations. **Write** half equations for the reactions occurring at the electrodes during electrolysis, and **complete** and **balance** supplied half equations.	5.4.3.5	Counting, balancing equations	Numeracy
	51	Required practical	Investigate what happens when aqueous solutions are electrolysed using inert electrodes. This should be an investigation involving developing a hypothesis.	Required practical 3	Taking measurements, Mutural resepect and tollerance	Numeracy
	52	Peer STAR - salts	Half an hour to complete the independent practise (closed book exercise). Half an hour to mark and complete STAR feedback sheet			
	53	Revision - optional				
	54	Test - Teacher STAR				
	55	Test feedback				
Chemical analysis	56	Pure substances and Formulations	In chemistry, a pure substance is a single element or compound, not mixed with any other substance. Pure elements and compounds melt and boil at specific temperatures. Melting point and boiling point data can be used to distinguish pure substances from mixtures. In everyday language, a pure substance can mean a substance that has had nothing added to it, so it is unadulterated and in its natural state, eg pure milk. **Use** melting point and boiling point data to distinguish pure from impure substances. A formulation is a mixture that has been designed as a useful product. Many products are complex mixtures in which each chemical has a particular purpose. Formulations are made by mixing the components in carefully measured quantities to ensure that the product has the required properties. Formulations include fuels, cleaning agents, paints, medicines, alloys, fertilisers and foods. **Identify** formulations given appropriate information. Students do not need to know the names of components in proprietary products.	5.8.1.1 and 5.8.1.2	Interpeting data to draw a conclusion	Numeracy

	57	Chromatography	Chromatography can be used to separate mixtures and can give information to help identify substances. Chromatography involves a stationary phase and a mobile phase. Separation depends on the distribution of substances between the phases. The ratio of the distance moved by a compound (centre of spot from origin) to the distance moved by the solvent can be expressed as its Rf value: Rf = distance moved by substance distance moved by solvent Different compounds have different Rf values in different solvents, which can be used to help identify the compounds. The compounds in a mixture may separate into different spots depending on the solvent but a pure compound will produce a single spot in all solvents. **Explain** how paper chromatography separates mixtures. **Suggest** how chromatographic methods can be used for distinguishing pure substances from impure substances. **Interpret** chromatograms and determine Rf values from chromatograms. **Provide** answers to the appropriate number of Significant figues	5.8.1.3	Using equations. Social: uses of chomatography	Problem solving
	58	Required practical	Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Calculate Rf values.	Required practical 6	Using equations	Teamwork
	59	Peer STAR Rf values	Half an hour to complete the independent practise (closed book exercise). Half an hour to mark and complete STAR feedback sheet			
	60	Tests for gases	The test for oxygen (glowing splint relights) , hydrogen (lit splint, squeaky pop) , carbon dioxide (bubble through limewater, cloudy) and chlorine (Damp litmus paper, bleaches white).	5.8.2	Interpeting data to draw a conclusion	Numeracy
	61	Revision - optional				
	62	Test - Teacher STAR				
	63	Test feedback				