Science Department Programme of Study: GCSE CHEMISTRY

	Year 7	Year 8	Year 9	Year 10	Year 11
Phase 1	**PRACTICAL SKILLS** This unit introduces students to the practical nature of Science. It provides the fundamental practical skills that students will require and build upon over at least the next 5 years. **7I – ENERGY & 8K FORCES** This unit looks at food, energy stores and transfers, and energy resources. Introduction to forces. **7F – Acids and alkalis** This unit looks at acids and alkalis and how they are described using a pH number. It looks at neutralisation reactions and some of their uses, and reinforces standard hazard symbols.	**7H – ATOMS, ELEMENTS AND COMPOUNDS** This unit expands on particle theory and explains the difference between atoms, and molecules, elements and compounds, whilst linking these with the more abstract ideas of particle models, naming compounds and word equations. **8E – COMBUSTION** What are combustion and oxidation reactions, including those of hydrocarbons, metals and non-metals? The idea of an exothermic reaction is introduced and there is also a look at the pollution of the air by the products of fossil fuel combustion. There are opportunities to discuss the impact of global warming and methods for controlling carbon dioxide.	**STATES OF MATTER** Using data to predict the state of a substance. How the arrangement, movement & energy of particles change during changes of state. How to use melting points to tell the difference between mixtures and pure substances. **SEPARATION TECHNIQUES** (cont. Phase 2) Investigating how different methods of separation work, theoretically and practically. How to choose a separation method based on the properties of the substances in the mixture. How water is purified for drinking.	**ORGANIC CHEMISTRY 1 & THE EARTH'S EARLY ATMOSPERE** Hydrocarbons are found in crude oil. How crude oil is separated into useful fractions. The alkanes as a homologous series Problems caused by some atmospheric pollutants. How and why cracking of oil fractions is carried out. The advantages and disadvantages of different fuels for cars. How the Earth's atmosphere has changed in the past & how it is changing now, including the causes & effects of climate change. **ORGANIC CHEMISTRY 2** (cont. Phase 2) The structure& properties of alkanes and alkenes. How ethanol is produced from carbohydrates. The structure & properties of alcohols and carboxylic acids. The composition of biological polymers. The manufacture, disposal and recycling of addition & condensation polymers.	**ACIDS, BASES, SALTS & CONCENTRATION** The ions in acids and alkalis, and how their concentrations are linked to pH. The reactions of acids and different types of bases. Calculating the concentration of solutions from theoretical and practical data. Carrying out acid-alkali titrations. How different soluble and insoluble salts can be prepared in the laboratory. **THE IDENTIFICATION OF IONS AND SOLUBILITY** (cont Phase 2) How the rules of solubility can be applied. How to identify metal ions. The chemical tests for various non-metal ions & ammonia gas. Instrumental methods of analysis and their advantages.
Phase 2	**7E – MIXTURES & SEPARATIONS** This unit revises and builds on work in KS2 on materials, specifically on mixtures, solutions and separation techniques using the context of providing clean drinking water. This consolidates the practical skills acquired in Phase 1. **7A – CELLS, TISSUES, ORGANS & SYSTEMS** This unit starts by reminding students about the features of organisms MRSGREN, and then looks at organ systems, organs, tissues and cells. This includes looking at how microscopes have changed and the discoveries it has led to.	**8K – ENERGY TRANSFERS** This unit looks at energy transfers by heating in the context of homes. **7L – SOUND** This unit looks at how sounds are made, transmitted and detected, some uses of sound and compares sound wave with waves on the surface of water. **8J – LIGHT** This unit revises work from KS2 on light, which is then extended to consider how light travels and what happens when it meets an object. The unit is set in the context of stage, film and illusions. **9A – GENETICS & EVOLUTIONS** This unit recaps ideas about the causes of variation and then looks at inherited variation in more detail. DNA is introduced before students consider how inherited genes can affect an organism's survival. The unit ends with coverage of natural selection.	**ATOMIC STRUCTURE** How our ideas about atoms have changed. How elements are arranged in the Periodic Table. Interpreting the data given in the Periodic Table. The arrangement and properties of sub-atomic particles. Isotopes and how the relative atomic mass is calculated. **IONIC COMPOUNDS, BONDING, STRUCTURE & PROPERTIES** (cont. Phase 3) How Dalton's ideas about atoms and molecules helped to explain the properties of matter. How ionic bonds are formed. The formation of ionic lattice, and the ratio and formula of atoms involved. The structure and properties of ionic compounds. Oxidation and reduction reactions.	**PERIODICITY, MATERIALS & NANOPARTICLES** (cont. Phase 3) How Mendeleev arranged the elements know at the time, predicting undiscovered elements. How the elements are arranged in the modern Periodic Table. The properties, patterns & reactions of Group 1, 7 & 0. Properties of ceramics, polymers, metals and composite materials. How to compare the physical properties of different materials. What composite materials are. How and why materials are chosen for uses. Nanoparticles, their uses and possible risks.	**ELECTROLYTIC PROCESSES & FUEL CELLS** More about reactivity and REDOX reactions. The use of electrolysis in the extraction and purification of metals. Writing half-equations. Predicting the products of electrolysis reactions. The advantages and disadvantages of fuel cells.
Phase 3	**7G – THE PARTICLE MODEL** This unit develops an understanding of the different properties of solids, liquids and gases. Scientific method and ideas on experiments, observations, hypotheses and theories are discussed, leading to an understanding of the particle theory of matter. **7K – FORCES** This unit revises the concepts of forces and their effects and extends students' knowledge of friction, gravity and springs. These ideas are presented using a theme of outdoor sports, such as climbing and mountain biking, to link to ideas about forces, friction and pressure. **8I - FLUIDS** This unit looks at changes of state, and then goes on to look at fluids and some of their effects, including pressure, floating and sinking, and drag.	**8D – UNICELLULAR ORGANISMS** Under the broad theme of their uses, this unit takes a detailed look at what unicellular organisms are, the differences between different types, their problems and their uses. **8C – BREATHING AND RESPIRATION** Under the broader theme of water sports, this unit covers gas exchange in humans and other organisms, together with details of aerobic and anaerobic respiration in humans. **9B – PLANT GROWTH** This unit looks at photosynthesis and aerobic respiration in plants in more detail, and then considers plant adaptations. The products we get from plants are then looked at, before studying farming methods and their problems.	**METALS: BONDING, STRUCTURE & PROPERTIES** (cont. Phase 4) How the physical properties of metals are related to their structure. How the oxidation of metals results in corrosion, and how this can be prevented. The formation of alloys can change the properties of the metals involved. How the reactivity series of metals can be used in extracting them from their ores. Most metals in everyday use are transition metals. The importance of recycling and how lifetime assessments for products can be carried out.	**MOLES AND EQUATIONS** (cont. Phase 4) Representing elements and compounds using symbols. Calculating relative formula masses. How to show chemical reactions using equations. Calculating the number of moles in a given mass. Calculating empirical and molecular formula. The conservation of mass, charge & species in a chemical equation. Calculating the number of particles in a substance & molar volumes. Reasons why the actual yield is less than the theoretical yield, and % yield calculations. What is meant by the term 'atom economy'.	**REVISION**
Phase 4	**8A – DIGESTION & BALANCED DIET** This unit looks at the main components in the human diet and why they are needed. The digestive system is also covered in some detail, and the idea of enzymes is introduced. **7B – ASEXUAL & SEXUAL REPRODUCTION** This unit explores sexual reproduction in animals, in the context of efforts being made by zoos to prevent endangered species becoming extinct. However, the central focus for learning is the human reproductive system and sexual reproductions in humans. **7J – CURRENT ELECTRICITY** This unit looks at the measurement of current and how it behaves in series and parallel circuits, and at voltage and resistance. Various models for thinking about what is happening in circuits are explored, and the unit concludes by looking at how we use electricity safely.	**8F – THE PERIODIC TABLE** This unit examines and strengthens the students' understanding of matter, atoms and chemical and physical change. Students then look at using the trends in the periodic table to make predictions about physical and chemical properties of elements and their compounds. **8G – MTEALS & THEIR USES** This unit builds upon the students' knowledge and understanding of common physical properties of metals, and to introduce their main chemical properties. The idea that reactions can occur at different speeds is also illustrated, leading to the introduction of the general reactivity series of metals. **9F – REACTIVITY** This unit reviews physical change and gas pressure, and then the reactivity series and a chemical method of preventing rusting are covered. Exothermic and endothermic reactions are introduced, followed by displacement reactions. Calculation of percentage change is related to oxidation and thermal decomposition reactions.	**COVALENT BONDING & ALLOTROPY** How covalent bonds are formed. How the typical properties of molecules can be explained via intermolecular forces. Describing covalent compounds diagrammatically. The bonding, structure & properties of the allotropes of carbon. How the properties of fullerenes and graphene can be explained due to their structure and bonding.	**REACTION RATES AND BOND ENERGIES** How changes in conditions can affect the rate of chemical reactions. How in some reactions there is a net loss of energy to their environment, whilst in others there is net gain. Representing energy transfers diagrammatically. Calculating the energy transfers that can occur during chemical reactions. **DYNAMIC EQUILIBRIUM** Some reactions are reversible. In a closed system an equilibrium can be achieved. Factors affecting equilibrium and predicting the effect of changing conditions. How Fritz Haber arrived at the compromise conditions used in the manufacture of ammonia.	**STUDY LEAVE**
	END OF YEAR EXAM	**END OF YEAR EXAM**	**END OF YEAR EXAM**		
	7D – ECOSYSTEMS With a general theme about adaptations, this unit looks at ecosystems and the factors that affect them. This includes the impact of human activity and the importance of biodiversity.	**8L – EARTH & SPACE & 9I FORCES** This unit builds on work from KS2 on the Solar System and looks at the Earth, including the seasons and the Earth's magnetic field and gravity. It also looks at the Solar System and what is beyond the Solar System, whilst revising some aspects of forces and their effects, energy stores and transfers. It then looks at calculations of speed and relative speed and representing journeys on distance-time graphs.			