Yearly overview

Subject: Year 9 Science

Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Prior knowledge: **Movement:** The parts of the human skeleton work as a system for support, protection, movement and the production of new blood cells. Antagonistic pairs of muscles create movement when one contracts and the other relaxes. **Cells:** Multicellular organisms are composed of cells which are organised into tissues, organs and systems to carry out life processes. There are many types of cell. Each has a different structure or feature so it can do a specific job. **Breathing:** In gas exchange, oxygen and carbon dioxide move between alveoli and the blood. Oxygen is transported to cells	**Prior knowledge:** **Separating Mixtures:** A pure substance consists of only one type of element or compound and has a fixed melting and boiling point. Mixtures may be separated due to differences in their physical properties. The method chosen to separate a mixture depends on which physical properties of the individual substances are different. **Periodic Table:** The elements in a group all react in a similar way and sometimes show a pattern in reactivity. As you go down a group and across a period the elements show patterns in physical properties. **Elements:** Most substances are not	**Prior knowledge:** **Energy Costs:** We pay for our domestic electricity usage based on the amount of energy transferred. Electricity is generated by a combination of resources which each have advantages and disadvantages. Calculate the cost of home energy usage, using the formula: cost = power (kW) x time (hours) x price (per kWh). **Energy Transfers:** We can describe how jobs get done using an energy model where energy is transferred from one store at the start to another at the end. When energy is transferred, the total is conserved, but some energy is	**Prior knowledge:** **Respiration:** Respiration is a series of chemical reactions, in cells, that breaks down glucose to provide energy and form new molecules. Most living things use aerobic respiration but switch to anaerobic respiration, which provides less energy, when oxygen is unavailable. **Photosynthesis:** Plants and algae do not eat, but use energy from light, together with carbon dioxide and water to make glucose (food) through photosynthesis. They either use the glucose as an energy source, to build new tissue, or store it for later use. Plants have specially-adapted organs that allow	**Prior knowledge:** **Metals and non metals:** Metals and non-metals react with oxygen to form oxides which are either bases or acids. Metals can be arranged as a reactivity series in order of how readily they react with other substances. Some metals react with acids to produce salts and hydrogen. **Acids and Alkalis:** The pH of a solution depends on the strength of the acid: strong acids have lower pH values than weak acids. Mixing an acid and alkali produces a chemical reaction, neutralisation, forming a chemical called a salt and water.	**Prior knowledge:** **Particle model:** Properties of solids, liquids and gases can be described in terms of particles in motion but with differences in the arrangement and movement of these same particles: closely spaced and vibrating (solid), in random motion but in contact (liquid), or in random motion and widely spaced (gas). Observations where substances change temperature or state can be described in terms of particles gaining or losing energy. **Pressure:** Pressure acts in a fluid in all directions. It increases with depth due to the increased weight of fluid, and results in an upthrust. Objects sink or float

for aerobic respiration and carbon dioxide, a waste product of respiration, is removed from the body. Breathing occurs through the action of muscles in the ribcage and diaphragm. The amount of oxygen required by body cells determines the rate of breathing. **Digestion:** The body needs a balanced diet with carbohydrates, lipids, proteins, vitamins, minerals, dietary fibre and water, for its cells' energy, growth and maintenance. Organs of the digestive system are adapted to break large food molecules into small ones which can travel in the blood to cells and are used for life processes.	pure elements, but compounds or mixtures containing atoms of different elements. They have different properties to the elements they contain.	dissipated, reducing the useful energy. **Voltage and Resistance:** We can model voltage as an electrical push from the battery, or the amount of energy per unit of charge transferred through the electrical pathway. In a series circuit, voltage is shared between each component. In a parallel circuit, voltage is the same across each loop. Components with resistance reduce the current flowing and shift energy to the surroundings. **Current:** Current is a movement of electrons and is the same everywhere in a series circuit. Current divides between loops in a parallel circuit, combines when loops meet, lights up bulbs and makes components work. Around a charged object, the electric	them to obtain resources needed for photosynthesis.	**Chemical Energy:** During a chemical reaction, bonds are broken (requiring energy) and new bonds formed (releasing energy). If the energy released is greater than the energy required, the reaction is exothermic. If the reverse, it is endothermic. **Types of reaction:** Combustion is a reaction with oxygen in which energy is transferred to the surroundings as heat and light. Thermal decomposition is a reaction where a single reactant is broken down into simpler products by heating. Chemical changes can be described by a model where atoms and molecules in reactants rearrange to make the products and the total number of atoms is conserved.	depending on whether the weight of the object is bigger or smaller than the upthrust. Different stresses on a solid object can be used to explain observations where objects scratch, sink into or break surfaces. **Heating and Cooling:** The thermal energy of an object depends upon its mass, temperature and what it's made of. When there is a temperature difference, energy transfers from the hotter to the cooler object. Thermal energy is transferred through different pathways, by particles in conduction and convection, and by radiation.

		field affects other charged objects, causing them to be attracted or repelled. The field strength decreases with distance.			
Term 1 knowledge	**Term 2 knowledge**	**Term 3 knowledge**	**Term 4 knowledge**	**Term 5 knowledge**	**Term 6 knowledge**
This term: **Cell biology:** Cells are the basic unit of all forms of life. In this section we explore how structural differences between types of cells enables them to perform specific functions within the organism. These differences in cells are controlled by genes in the nucleus. For an organism to grow, cells must divide by mitosis producing two new identical cells. If cells are isolated at an early stage of growth before they have become too specialised, they can retain their ability to grow into a range of different types of	This term: **Atomic structure and the periodic table.** The periodic table provides chemists with a structured organisation of the known chemical elements from which they can make sense of their physical and chemical properties. The historical development of the periodic table and models of atomic structure provide good examples of how scientific ideas and explanations develop over time as new evidence emerges. The arrangement of elements in the modern periodic table can be explained in terms of atomic	This term: **Energy** The concept of energy emerged in the 19th century. The idea was used to explain the work output of steam engines and then generalised to understand other heat engines. It also became a key tool for understanding chemical reactions and biological systems. Limits to the use of fossil fuels and global warming are critical problems for this century. Physicists and engineers are working hard to identify ways to reduce our energy usage. **Electricity**	This term: **Infection and response.** Pathogens are microorganisms such as viruses and bacteria that cause infectious diseases in animals and plants. They depend on their host to provide the conditions and nutrients that they need to grow and reproduce. They frequently produce toxins that damage tissues and make us feel ill. This section will explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Once inside the body our immune system is triggered which is	This term: **5.3 Quantitative chemistry** Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions. Given this information, analysts can then use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions. Chemical reactions can be classified in various ways. Identifying different types of chemical reaction allows chemists to make sense of how different chemicals react	This term: **6.3 Particle model of matter** The particle model is widely used to predict the behaviour of solids, liquids and gases and this has many applications in everyday life. It helps us to explain a wide range of observations and engineers use these principles when designing vessels to withstand high pressures and temperatures, such as submarines and spacecraft. It also explains why it is difficult to make a good cup of tea high up a mountain! **6.4 Atomic structure** Ionising radiation is hazardous but can be

cells. This phenomenon has led to the development of stem cell technology. This is a new branch of medicine that allows doctors to repair damaged organs by growing new tissue from stem cells. **Organisation** In this section we will learn about the human digestive system which provides the body with nutrients and the respiratory system that provides it with oxygen and removes carbon dioxide. In each case they provide dissolved materials that need to be moved quickly around the body in the blood by the circulatory system. Damage to any of these systems can be debilitating if not fatal. Although there has been huge progress in surgical techniques, especially with regard to	structure which provides evidence for the model of a nuclear atom with electrons in energy levels. **Bonding, structure, and the properties of matter.** Chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures. Scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. The properties of these materials may offer new applications in a range of different technologies.	Electric charge is a fundamental property of matter everywhere. Understanding the difference in the microstructure of conductors, semiconductors and insulators makes it possible to design components and build electric circuits. Many circuits are powered with mains electricity, but portable electrical devices must use batteries of some kind. Electrical power fills the modern world with artificial light and sound, information and entertainment, remote sensing and control. The fundamentals of electromagnetism were worked out by scientists of the 19th century. However, power stations, like all machines, have a limited lifetime. If we all continue to demand more electricity this means building new power	usually strong enough to destroy the pathogen and prevent disease. When at risk from unusual or dangerous diseases our body's natural system can be enhanced by the use of vaccination. Since the 1940s a range of antibiotics have been developed which have proved successful against a number of lethal diseases caused by bacteria. Unfortunately, many groups of bacteria have now become resistant to these antibiotics. The race is now on to develop a new set of antibiotics. **Bioenergetics.** In this section we will explore how plants harness the Sun’s energy in photosynthesis in order to make food. This process liberates oxygen which has built up over millions of years in the Earth’s atmosphere. Both animals and plants use	together, to establish patterns and to make predictions about the behaviour of other chemicals. Chemical equations provide a means of representing chemical reactions and are a key way for chemists to communicate chemical ideas. **5.4 Chemical changes** Understanding of chemical changes began when people began experimenting with chemical reactions in a systematic way and organizing their results logically. Knowing about these different chemical changes meant that scientists could begin to predict exactly what new substances would be formed and use this knowledge to develop a wide range of different materials and processes. It also helped biochemists to understand the complex reactions	very useful. Although radioactivity was discovered over a century ago, it took many nuclear physicists several decades to understand the structure of atoms, nuclear forces and stability. Early researchers suffered from their exposure to ionising radiation. Rules for radiological protection were first introduced in the 1930s and subsequently improved. Today radioactive materials are widely used in medicine, industry, agriculture and electrical power generation.

coronary heart disease, many interventions would not be necessary if individuals reduced their risks through improved diet and lifestyle. We will also learn how the plant's transport system is dependent on environmental conditions to ensure that leaf cells are provided with the water and carbon dioxide that they need for photosynthesis.		stations in every generation – but what mix of power stations can promise a sustainable future?	this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. Conversely, anaerobic respiration does not require oxygen to transfer energy. During vigorous exercise the human body is unable to supply the cells with sufficient oxygen and it switches to anaerobic respiration. This process will supply energy but also causes the build-up of lactic acid in muscles which causes fatigue.	that take place in living organisms. The extraction of important resources from the earth makes use of the way that some elements and compounds react with each other and how easily they can be 'pulled apart'.	
Future knowledge: Infection and response Pathogens are microorganisms such as viruses and bacteria that cause infectious diseases in animals and plants. They depend on their host to provide the conditions and nutrients that they	**Future knowledge: Quantitative chemistry.** Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions. Given this information, analysts can then use quantitative methods	**Future knowledge: 6.3 Particle model of matter.** The particle model is widely used to predict the behaviour of solids, liquids and gases and this has many applications in everyday life. It helps us to explain a wide range of observations	**Future knowledge: 4.5 Homeostasis and response** Cells in the body can only survive within narrow physical and chemical limits. They require a constant temperature and pH as well as a constant supply of dissolved food and water. In	**Future knowledge: 5.5 Energy changes** Energy changes are an important part of chemical reactions. The interaction of particles often involves transfers of energy due to the breaking and formation of bonds. Reactions in which	**Future knowledge: 6.5 Forces** Engineers analyse forces when designing a great variety of machines and instruments, from road bridges and fairground rides to atomic force microscopes. Anything mechanical can be

need to grow and reproduce. They frequently produce toxins that damage tissues and make us feel ill. This section will explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Once inside the body our immune system is triggered which is usually strong enough to destroy the pathogen and prevent disease. When at risk from unusual or dangerous diseases our body's natural system can be enhanced by the use of vaccination. Since the 1940s a range of antibiotics have been developed which have proved successful against a number of lethal diseases caused by bacteria. Unfortunately, many groups of bacteria have now become resistant to these	to determine the purity of chemical samples and to monitor the yield from chemical reactions. Chemical reactions can be classified in various ways. Identifying different types of chemical reaction allows chemists to make sense of how different chemicals react together, to establish patterns and to make predictions about the behaviour of other chemicals. Chemical equations provide a means of representing chemical reactions and are a key way for chemists to communicate chemical ideas.	and engineers use these principles when designing vessels to withstand high pressures and temperatures, such as submarines and spacecraft. It also explains why it is difficult to make a good cup of tea high up a mountain!	order to do this the body requires control systems that constantly monitor and adjust the composition of the blood and tissues. These control systems include receptors which sense changes and effectors that bring about changes. In this section we will explore the structure and function of the nervous system and how it can bring about fast responses. We will also explore the hormonal system which usually brings about much slower changes. Hormonal coordination is particularly important in reproduction since it controls the menstrual cycle. An understanding of the role of hormones in reproduction has allowed scientists to develop not only contraceptive drugs but also drugs which can increase fertility.	energy is released to the surroundings are exothermic reactions, while those that take in thermal energy are endothermic. These interactions between particles can produce heating or cooling effects that are used in a range of everyday applications. Some interactions between ions in an electrolyte result in the production of electricity. Cells and batteries use these chemical reactions to provide electricity. Electricity can also be used to decompose ionic substances and is a useful means of producing elements that are too expensive to extract any other way.	analysed in this way. Recent developments in artificial limbs use the analysis of forces to make movement possible.

antibiotics. The race is now on to develop a new set of antibiotics.					