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	Notice differences between people.	To observe and compare the plants and animals that I see in the natural world around me.			Plant seeds and care for growing plants.	Talk about the differences between materials and changes they notice.
Key Misconceptions	A baby and a toddler are the same part in the human lifecycle.	Baking can be reversible. Ice is not frozen water.	Magnets are like glue, so they stick together. Electricity is free and it is made at home.	Animals are all the in the same classification group.	Food is made in the supermarket or the shops.	Animals are all the in the same classification group. Objects sink because they are heavy.
Core Key Words	• map • baby • toddler • child • teenager • adult	• reversible • irreversible • autumnal • climate	• electricity • power grid • North Pole • South Pole	• invertebrates • vertebrates • extinct	• factory • fruit • vegetables • grains • protein • dairy	• mammals • fish • reptiles • amphibians • insects • birds • density

Science KS1 (Cycle A)

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topic	**Humans**	**Seasonal Changes (Autumn/Winter)**	**Animals**	**Materials**	**Living things and their Habitats**	**Plants**
Enquiry Question	Which sense is the most useful?	How might we know what season it is?	What is most important for animals to survive?	What is the best material to create a floating mode of transport?	Why don't polar bears live in the desert?	Why is it useful to know which plants are in our local area?
Big Ideas/ Key concepts	Genetic information is passed from each generation to the next; this information and the environment affect the features, growth, and development of organisms.	Substances can move within and between the atmosphere, hydrosphere, geosphere, and biosphere as part of large-scale Earth systems.	All organisms, including humans, depend on, interact with, and affect the environments in which they live and other organisms that live there.	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties.	All organisms, including humans, depend on, interact with, and affect the environments in which they live and other organisms that live there.	All organisms, including humans, depend on, interact with, and affect the environments in which they live and other organisms that live there.
Key Knowledge and skills	• To identify, name, **draw** and label the basic parts of the human body. • To explore the five senses and explain which part of the human body is associated with each sense, **using observational skills to ask and answer questions about these.** • To explore the different stages of a human lifecycle, **researching and** explaining the specific changes that occur as humans move through these stages.	• To understand that the UK has four seasons and name these. • To understand when the UK has autumn and winter, **naming the months associated with these seasons**, and use observational skills to observe autumnal changes. • To explore, **research and explain** changes that occur during winter. • To consider, **research and explain** how humans and animals adapt to respond to the changes that occur during autumn and winter. • To research **and explain** how day length varies as seasons change, focusing on autumn and winter. **Year 2 Pupils will make comparisons between day length in different seasons.**	• To understand and explain that animals need water, food and air (oxygen) to survive, **making comparisons to the needs of humans**. • To understand and explain the differing needs of some animals **and research how their needs are met within specific habitats.** • To identify and sort a variety of animals that are carnivores, herbivores and omnivores.	• To identify and name a variety of everyday materials, describing their physical properties, **such as being transparent, rigid, flexible, and opaque,** and compare materials based on these. • To distinguish between an object and the material from which it is made, **considering which materials are natural and which are man-made**. • To identify and compare the suitability of a variety of everyday materials for uses, **justifying their choices.**	• To identify and name a variety of plants and animals in their habitats, including microhabitats. • To develop knowledge of the different habitats which various animals need to survive and ask questions relating to living things and their habitats. • To explore **and explain** why different animals suit their habitats, considering prior knowledge of what animals need to survive **and prior knowledge of food chains.** • To describe how different habitats provide for the basic needs of different kinds of animals and plants and **how they depend upon each other.**	• To identify, name and **describe the roles of** different parts of plants, including trees, focusing on the roles of the roots, stem, leaves, and petals **and compare the key similarities between trees and small flowering plants**. • To name and identify some common wild and garden plants such as daisies, roses, daffodils, and sunflowers and identify some of these in the school environment. • To identify **and explain** differences between deciduous and evergreen trees and begin to identify examples of these, linking with knowledge of seasons.
End Point	To name body parts, understanding and explaining what they help us to do. To understand and explain some of the changes which occur as humans pass between stages in the human lifecycle.	To understand and explain the changes which occur in the world around us during autumn and winter and how these changes affect humans, animals, and plants.	To understand and explain the basic needs of animals for survival, describing how these needs differ and how they are met.	To understand and explain the properties of different materials, considering which materials are best suited for specific purposes based on these.	To understand and explain the different habitats of various plants and animals and explain ways in which organisms are adapted to suit their specific habitats.	To understand and explain which plants, including trees, may be found in our local area and how these can be identified. To name and begin to describe the roles of the basic parts of plants.
Prior Knowledge	In Early Years, pupils will have used their senses in a variety of ways to explore the world around them. Pupils will have begun to identify and name key body parts. Pupils will have prior knowledge of the stages in the human lifecycle.	In Early Years, pupils will have explored some seasonal changes throughout the year. Pupils will have prior understanding of what the four seasons are. Year 2 pupils will have an understanding of spring and summer and an awareness of the variation in day length in different seasons.	Pupils will have a basic understanding that animals need food and water to survive. Pupils will be aware of some of the differences in what animals eat. Year 2 pupils will have knowledge of the basic needs of humans.	Pupils will have some knowledge of objects made from everyday materials. Pupils will have explored some simple properties of everyday materials. Year 2 pupils will have begun to consider how properties of materials affect their uses.	In Early Years, pupils will have gained some knowledge of habitats being the place where living things live. Pupils will know the basic needs of animals and understand that these may differ slightly e.g., diet. Year 2 pupils will have prior knowledge of food chains.	In Early Years, pupils will have observed the growth of plants and begun to consider what they need to grow. Pupils have prior knowledge of how some trees lose their leaves in winter, whereas others do not. Pupils will have an awareness of the names of some common plants. Year 2 pupils will have knowledge of what plants need to grow.
Key Misconceptions	Everyone has the same body parts. Everyone has all five senses. The five senses do not work together to help us to understand the world around us. Adults were never babies or Pupils.	If it is sunny, it is warm/summer. If it is rainy, it is cold/autumn or winter. It only snows in winter. The change in daylight hours between seasons is not gradual.	All animals need the same things. Animals do not have wants. Wants and needs are the same.	Objects and materials are the same thing. Some properties mean the same thing e.g. soft/smooth. All heavy things sink. 'Material' refers to fabric.	All animals and plants can survive in all environments. All animals and plants have the same needs. Large creatures can live in microhabitats.	Trees are not plants. Flowers are not plants. Plants are not living things. Plants have the same basic needs as animals.

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		There are less than 24 hours in a day during winter. All animals hibernate.	Misconceptions around the definitions of carnivores, herbivores and omnivores e.g. if something eats any meat it is a carnivore.			The trees that we can see at the moment must be evergreen, because they have leaves.
Core Key Words	five senses lifecycle offspring stages baby toddler child teenager adult elderly	seasons winter autumn weather change adapt	carnivore herbivore omnivore need survive diet air oxygen	material properties float sink waterproof hard / soft	habitat microhabitat organism adaptation survive need	roots stem leaves petals deciduous evergreen

Science KS1 (Cycle B)

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topic	**Humans**	**Animals**	**Living Things and their Habitats**	**Materials**	**Plants**	**Seasonal Changes (Spring/Summer)**
Enquiry Question	Who's the healthiest person in the world?	Are all animals the same?	What do animals eat?	Can a box be made from any material?	How do plants grow from a seed or bulb?	How might we know what season it is?
Big Ideas/ Key concepts	Organisms must stay in good health to survive and thrive; the health of an individual results from interactions between its body, behaviour, environment, and other organisms.	Organisms can be classified according to their features.	All organisms, including humans, depend on, interact with, and affect the environments in which they live and other organisms that live there.	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties.	Organisms must stay in good health to survive and thrive; the health of an individual results from interactions between its body, behaviour, environment, and other organisms.	Substances can move within and between the atmosphere, hydrosphere, geosphere, and biosphere as part of large-scale Earth systems.
Key Knowledge and skills	• To understand and explain that humans need water, food, and air (oxygen) to survive, **making comparisons to the needs of animals**. • To understand and describe the importance of exercise for humans. • To observe **and research** the changes in their bodies after **different types of** exercise. • To identify and classify different foods and discuss the importance of eating the right amounts of different types of food. • To discuss **and explain** the importance of hygiene **and consider what we can do to be hygienic.**	• To identify and name a variety of common animals including fish, amphibians, reptiles, birds, and mammals. • To explore **and research** characteristics of different groups of animals and classify animals based on their characteristics. • To explore the offspring of different animals, identifying some similarities and differences in lifecycles, **describing how animals change as they grow**.	• To describe what different animals eat, **using prior knowledge of basic needs of animals and carnivores, herbivores, and omnivores to explain how this varies.** • To identify and name different sources of food for various animals. • To explore **and explain** the feeding relationships between living things using the idea of a simple food chain, **considering where animals get their food from in different habitats.** • To explore, compare **and explain the differences** between things that are living, dead and have never been alive. .	• To identify and name a variety of everyday materials, describing their physical properties, **such as being transparent, rigid, flexible, and opaque,** and compare materials based on these. • To distinguish between an object and the material from which it is made, **considering which materials are natural and which are man-made**. • To identify and compare the suitability of a variety of everyday materials for uses, **justifying their choices**. • To explore how some materials can change their shape by being squashed, bent, twisted or stretched **and explain when this may be useful.**	• To observe the growth of seeds and bulbs into mature plants, describing this process, **using knowledge of parts of plants to describe in detail.** • To consider and explore what plants need to grow well and remain healthy. • To explore the impact of variables such as water, light, and a suitable temperature on the growth of plants. • To consider **and begin to research** ways in which different plants require different conditions to grow healthily.	• To understand that the UK has four seasons and name these. • To understand when the UK has spring and summer, **naming the months associated with these seasons**, and use observational skills to observe signs of spring/summer. • To explore, **research and explain** changes that occur during spring and summer. • To consider, **research and explain** how humans and animals adapt to respond to the changes that occur during spring and summer. • To research **and explain** how day length varies as seasons change, focusing on spring and summer. **Year 2 Pupils will make comparisons between day length in different seasons.**
End Point	To understand and explain the basic needs of humans for survival and what humans can do to keep their bodies healthy.	To understand and explain the different ways in which animals can be classified, based on their characteristics. To understand and explain how different animals change as they grow.	To understand and explain what different animals eat and how living things are linked through feeding relationships. To understand and explain which things are living, which are dead, and which were never alive.	To understand and explain the properties of different materials, considering which materials are best suited for specific purposes based on these.	To understand and explain how plants grow from seeds and bulbs into healthy, mature plants.	To understand and explain the changes which occur in the world around us during spring and summer and how these changes affect humans, animals, and plants.
Prior Knowledge	Pupils will have knowledge of what humans need to survive. Pupils will have begun to explore how different body parts can be used for different purposes. Year 2 pupils will have knowledge of the basic needs of animals and how these needs are met.	In Early Years, pupils will have begun to explore different animals and how these can be sorted into different groups, including knowledge of vertebrates and invertebrates. Pupils will have knowledge of some animal lifecycles. Year 2 pupils will have knowledge of the human lifecycle.	Pupils will have a basic understanding that animals need food and water to survive. Pupils will know the basic needs of animals and understand that these may differ slightly e.g., diet. Year 2 pupils will have knowledge of carnivores, herbivores, and omnivores.	Pupils will have some knowledge of objects made from everyday materials. Pupils will have explored some simple properties of everyday materials. Year 2 pupils will have begun to consider how properties of materials affect their uses.	In Early Years, pupils will have observed the growth of plants and begun to consider what they need to grow. Pupils will have an awareness of the names of some common plants, Year 2 pupils will be able to name these, and the parts of plants.	In Early Years, pupils will have explored some seasonal changes throughout the year. Pupils will have prior understanding of what the four seasons are. Year 2 pupils will have an understanding of autumn and winter and an awareness of the variation in day length in different seasons.
Key Misconceptions	Humans have different basic needs to animals. Humans need more than food, water, and air to survive. Eating only fruits and vegetables is healthy.	Only mammals are animals. Humans are not animals. All pets are mammals. Whales and dolphins are fish.	All animals have the same diets. Animals have the same dietary requirements as humans. Animals do not eat other animals.	Objects and materials are the same thing. Some properties mean the same thing e.g., soft/smooth. All heavy things sink.	Plants are not living things. Plants have the same basic needs as humans. Plants do not require specific conditions to be able to grow healthily.	If it is sunny, it is warm/summer. If it is rainy, or cold, it's autumn or winter. It only snows in winter.

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Science Year 9
***Sequencing will vary for split classes**

	Autumn 1	Autumn 1	Autumn 2	Autumn 2	Spring 1	Spring 1
Topic	**Inheritance**	**Natural World**	**Waves – Light**	**Cells**	**Systems**	**Atoms and Elements**
Enquiry Question	Should extinct species be brought back to life?	How do organisms interact and survive?	Does wavelength of light affect photosynthesis?	How do we find out how big a cell is?	How do our bodies move?	Why is there a gap between magnesium and aluminium in the Periodic Table?
Big Ideas/ Key concepts	Genetic information is passed from each generation to the next; this information and the environment affect the features, growth and development of organisms.	All organisms, including humans, depend on, interact with and affect the environments in which they live and other organisms that live there.	Waves radiate information. Understanding waves helps us to communicate.	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes.	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes.	All matter is made up of atoms. The behaviour and structural arrangement of atoms explains the properties of different materials.
Key Knowledge and skills	• To describe a simple model of chromosomes, gene, and DNA in heredity. • To describe the structure of DNA. • To describe how genes are passed on. • To describe the difference between inherited and environmental variation. • To describe the discovery of the structure of DNA. • To describe evolution through the process of natural selection. • To define the term extinction and state the causes of it. • To explain the importance of maintaining biodiversity. • To describe the use of gene banks to preserve hereditary material.	• To describe how all life on Earth depends on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store. • To investigate factors affecting the rate of photosynthesis. • To describe how biotic factors affect the population of organisms. • To describe how abiotic factors affect the abundance of organisms. • To describe how organisms are affected by the accumulation of toxic materials. • To describe how decomposers are involved in the transfer of energy.	• To describe how energy can be transferred by waves. • To describe how light travels. • To explain how the eye produces an image. • To describe how a pin hole camera works. • To explain how we see different colours. • To investigate how the rate of photosynthesis is affected by the wavelength of light. • To describe the law of reflection and the difference between diffuse scattering and specular reflection. • To describe refraction.	• To describe how palisade cells are adapted to their function. • To describe how water enters the roots of a plant by osmosis. • To explain how xylem cells are adapted to transport water to the leave of the plant. • To describe the process of transpiration. • To describe the role of xylem and phloem. • To define the terms resolution and magnification. • To calculate the size of a cell.	• To describe the functions of the skeleton. • To describe how muscles work together in pairs. • To compare the differences between aerobic and anaerobic respiration. • To describe the process of anaerobic respiration in yeast as fermentation. • To compare the difference between anaerobic respiration in humans and anaerobic respiration in a unicellular organism (yeast)	• To explain how the modern Periodic Table is arranged and state what a group and period are. • To describe what the Periodic Table tells us about the structure of the atom. • To describe the principles underlying Mendeleev's Periodic table. • To compare the modern Periodic Table to previous versions. • To describe patterns in reactions that can be predicted by the Periodic Table. • To explain the trend in reactivity of alkali metals.
End Point	To be able to describe how genes are passed on through generations and that the genes passed on can result in evolution.	To be able to describe and explain how different factors affect the rate of photosynthesis. To be able to describe and explain the impact of bioaccumulation.	To investigate and explain why the rate of photosynthesis is affected by the wavelength of light. To be able to explain why we can see our reflection in mirrors.	To be able to describe how plants are adapted to get the reactants they need for photosynthesis. To be able to calculate the size of a cell from the size of the image and the magnification.	To be able to explain how our skeleton and muscles help us to move. To be able to compare the methods by which our bodies transfer the energy required to move.	To be able to describe how elements in the Periodic Table are arranged and how this has developed over time. To describe and explain trends in reactivity of the alkali metals.
Prior Knowledge	Students will know that the nucleus contains the genetic information as DNA. At KS2 students study Darwin's theory of evolution.	Students will have studied how energy is transferred in an ecosystem and the impact of adding a new predator on a food web. Students have looked at the process of photosynthesis and how a plant obtains the reactants needed for this reaction.	In year 7 students study energy stores and transfers. They will have come across light as a method for transferring energy. At KS2 students study how light travels. They look at how light travels in straight lines, can be reflected and refracted and how shadows are formed.	Students will have covered the structure of animal and plant cells as well as diffusion.	In year 7 and 8 students study respiration and how organisms get the reactants required for this reaction.	Students have studied the structure of the atom in years 7 and 8. They can know that as you go down a group the atoms have more shells.
Key Misconceptions	Organisms choose to evolve.	Arrows show what is being eaten.	Rays of light point out of the eyes. Light needs a medium to travel through.	Pure water is a concentrated solution. $actual\ size = \frac{image\ size}{magnification}$	Respiration is the same as breathing and only happens in the lungs.	That Mendeleev arranged the periodic table by atomic mass. Gaps were left for only for undiscovered elements.
Core Key Words	DNA gene chromosome variation natural selection evolution Darwin extinction biodiversity gene bank	predator prey algae abiotic biotic bioaccumulation abundance	transverse reflection refraction normal incidence translucent transparent opaque pupil retina optic nerve lens	osmosis xylem phloem palisade diffusion stomata magnification resolution	cranium clavicle humerus vertebrae femur bicep tricep antagonistic aerobic anaerobic fermentation lactic acid	Mendeleev atomic number atomic weight reactivity group period shielding

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Science Year 9
***Sequencing will vary for split classes**

	Spring 2	Spring 2	Summer 1	Summer 1	Summer 2	Summer 2
Topic	**Properties and Bonding**	**Reactions and Energy**	**Energy**	**Electricity**	**Forces**	**Waves – Sound**
Enquiry Question	What is the difference between 9 carat and 18 carat gold and why is this needed?	Gold can be found in the Earth's crust as a metal – can all metals be found this way?	How is energy transferred in our home and how are we charged for it?	How does resistance make sure that energy is transferred to components?	How can a force transfer energy?	How do we hear an echo?
Big Ideas/ Key concepts	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties.	During chemical reactions, atoms are rearranged, and new substances are formed.	The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives. Forces make things change. Understanding forces helps us to predict and control physical changes.	The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives.	Forces make things change. Understanding forces helps us to predict and control physical changes.	Waves radiate information. Understanding waves helps us to communicate.
Key Knowledge and skills	• To describe the bonding in metals. • To explain why metals are malleable and good conductors of electricity in terms of their structure and bonding. • To explain why pure metals are soft but alloys are harder. • To describe the difference between a giant structure and a small molecule. • To describe and explain the different in melting/boiling points for small molecules and giant structures.	• To use chemical reactions to determine the order of metals and carbon in the reactivity series. • To investigate how reactivity of a metal affects its reaction with an acid and use this to determine the reactivity series. • To explain the use of carbon in obtaining metals from metal oxides. • To predict displacement reactions using the reactivity series. • To describe the reaction between a metal and an acid and name the salt produced.	• To compare power ratings of appliances in Watts. • To compare amounts of energy transferred by appliances. • To interpret domestic fuel bills, fuel use and costs. • To calculate the gravitational potential energy transferred in a given situation. • To calculate the kinetic energy transferred in a given situation.	• To define resistance and identify some factors that affect resistance. • To describe how to find resistance in a circuit. • To calculate resistance. • To explain why increasing temperature increases resistance. • To state and apply the rules for series and parallel circuits relating to current, potential difference and resistance. • To explain what causes resistance. • To calculate the resistance of a component in a circuit.	• To describe the relationship between force and extension on an elastic object. • To investigate Hooke's law. • To describe how energy can be transferred by a force. • To describe how simple machines can be used to reduce the force needed. • To describe the turning effect of a force as a moment. • To calculate moments. • To calculate pressure on surfaces. • To describe and explain how pressure in fluids changes.	• To describe how sound travels. • To explain how an echo is made. • To compare light and sound waves. • To describe how we hear sound. • To define amplitude, frequency, and wavelength. • To explain how a microphone works. • To investigate the range of frequencies that can be heard. • To describe what ultrasound is and what it is used for.
End Point	To be able to explain why alloys are made. To be able to explain why small molecules have low melting/boiling points whereas giant structures have high meting/boiling points.	To be able to predict and explain the products of displacement reactions. To be able to describe how to produce a pure, dry salt.	To be able to describe how the energy stores change during an energy transfer. To be able to calculate the quantity of an energy store for gravitational potential, kinetic and elastic energy stores.	To be able to apply the rules for series and parallel circuits relating to current, potential difference and resistance. To be able to explain how resistance transforms electrical work done into heat, or other types of energy.	To be able to describe how applying a force can transfer energy from one store to another.	To be able to explain how an echo is formed and how we hear these.
Prior Knowledge	Students have studied the properties of solids, liquids, and gases in year 7 and of metals and non-metals in year 8.	Students have studied exothermic and endothermic reactions, the reactions of metals with oxygen as well as the reaction between acids and alkalis. They have investigated conservation of mass in different reactions.	In year 7 energy students have studied energy store. They have covered heating as a method of energy transfer in year 8 and electrical work done in the electricity topic in year 7 and 8. Energy transfer through mechanical work done has been studied during the force's units and energy transfer through light and sound has been studied in year 9 waves.	In year 7 and 8 students have studies series and parallel circuits and the rules for current and potential difference in these circuits.	Students have studied types of forces and how a resultant force affects the motion of an object.	Students have studied how waves transfer energy in relation to light waves. In KS2 students study how sound is created and how humans hear this.
Key Misconceptions	Stronger and harder mean the same thing. Bonds are broken when a substance changes state.	The metal or metal oxide is added in excess so the reaction is complete.	Energy is made or created. Internal energy is the same as thermal energy. Internal energy is just kinetic energy of particles. Appliances use energy (rather than transfer it).	Current is flow of charge and is not used up.	Pressure is a force. Heavier objects exert more pressure.	Sound travels through space.
Core Key Words	Pure alloy hard/soft giant structure small molecule force	reactivity series displacement salt chloride sulfate ionic excess	kinetic energy potential energy internal energy thermal conductivity gravitational potential energy kinetic energy	resistance potential difference current power Watts	Elastic extension limit of proportionality Hooke's law moment pressure	echo frequency amplitude wavelength ultrasound longitudinal vibrate

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Science Year 10 (BIOLOGY)
***sequencing varies dependent on course- refer to individual teacher plans**

Topic	**Cells**	**Systems**	**Disease**	**Natural World 1**
Enquiry Question	Can we cure paralysis?	If it takes Usain Bolt less than 10 seconds to run 100m why does it take him over 120 seconds to run 800m?	How has Science helped us to reduce mortality rates for communicable and non-communicable diseases?	The human population is growing exponentially, what can we do to make sure that we can grow enough crops to cope with demand?
Big Ideas/ Key concepts	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes.	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes.	Organisms must stay in good health to survive and thrive; the health of an individual results from interactions between its body, behaviour, environment and other organisms.	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes. All organisms, including humans, depend on, interact with and affect the environments in which they live and other organisms that live there.
Key Knowledge and skills	• To explain how the main sub-cellular structures are related to their functions. • To observe, draw and label a selection of cells using a light microscope. • To explain how the structure of different types of cells relate to their function. • To explain the importance of cell differentiation. • To understand how microscopy techniques have developed over time. • To explain how electron microscopy has increased understanding of sub-cellular structures. • To carry out calculations involving magnification, real size and image size. • To describe the stages in mitosis and the cell cycle. • To describe the function of stem cells in embryos, in adult animals and in the meristems in plants. • To explain how different factors affect the rate of diffusion. • To describe how the small intestine, lungs in mammals, gills in fish, roots and leaves in plants are adapted for exchanging materials. • To investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue. • To explain the difference between diffusion, osmosis, and active transport. ***SEPARATE SCIENCE:*** • To describe and explain how to prepare an uncontaminated culture using aseptic techniques.	• To describe the organisation of organisms. • To describe the nature of enzyme molecules and relate their activity to temperature and pH changes. • To carry out rate calculations for chemical reactions. • To explain enzyme action. • To describe how to test food. • To investigate the effect of pH on the rate of reaction of amylase enzyme. • To describe the structure and function of the human heart and lungs. • To explain how the structure of blood vessels relates to their function. • To use simple compound measures such as rate and carry out rate calculations on blood flow. • To describe the functions of the components of blood. • To compare the processes of aerobic and anaerobic respiration. • To describe the body's response to exercise. • To explain the importance of sugars, amino acids, fatty acids and glycerol in the synthesis and breakdown of carbohydrates, proteins, and fats.	• To evaluate the advantages and disadvantages of treating cardiovascular diseases by drugs, mechanical devices, or transplant. • To describe the relationship between health and disease and the interactions between different types of disease. • To explain the effect of lifestyle factors including diet, alcohol, and smoking on the incidence of non-communicable diseases at local to global levels. • To describe cancer as the result of changes in cells that lead to uncontrolled growth and division. • To explain how diseases caused by viruses, bacteria, protists, and fungi are spread in animals and plants. • To explain how the spread of disease can be reduced or prevented. • To describe the non-specific defence systems of the human body against pathogens. • To explain the role of the immune system in the defence against disease. • To explain how vaccination will prevent illness in an individual, and how the spread of pathogens can be reduced by immunising a large proportion of the population. • To explain the use of antibiotics and other medicines in treating disease. • To describe the process of discovery and development of potential new medicines. ***SEPARATE SCIENCE:*** • To describe how monoclonal antibodies are produced. • To describe some of the ways monoclonal antibodies are produced. • To describe physical and chemical plant defence responses.	• To explain how the structures of plant tissues are related to their functions. • To explain how the structure of root hair cells, xylem and phloem are adapted to their function. • To explain the effect of changing temperature, humidity, air movement and light intensity on the rate of transpiration. • To describe the process of transpiration and translocation, including the structure and function of the stomata. • To describe photosynthesis as an endothermic reaction in which energy is transferred from the environment to the chloroplasts by light. • To explain the effects of temperature, light intensity, carbon dioxide concentration and amount of chlorophyll on the rate of photosynthesis. • To determine the limiting factor in the rate of photosynthesis (HT ONLY).
End Point	To be able to describe how cells are adapted to the function. To be able to explain the purpose of the cell cycle and describe the stages within it. To be able to describe the processes by which substances move in and out of cells. To be able to explain how exchange surfaces are adapted for exchanging materials. ***SEPARATE SCIENCE:*** To be able to investigate the effect of antiseptics or antibiotics on bacterial growth.	To be able to explain how the respiratory system and digestive system are adapted to transfer the reactants for respiration to the blood. To be able to explain how the circulatory system provides the reactants needed for respiration to the cells. To be able to explain the effects of exercise of the body.	To be able to describe how lifestyle factors affect our health and evaluate different methods of treatment. To be able to explain how our body protect us from disease. To be able to describe and explain the advances in medicine that allow us to prevent and treat disease. ***SEPARATE SCIENCE:*** To be able to evaluate the advantages and disadvantages of monoclonal antibodies. To be able to apply scientific knowledge to detect and identify plant diseases.	To be able to describe how plants get the water and carbon dioxide for photosynthesis. To be able to describe how the glucose made in photosynthesis is transported round the plant and for what it is used. To be able to explain the factors that affect the rate of photosynthesis.
Prior Knowledge	At KS3 students have studied plant and animal cells. They have been introduced to stem cells and specialised cells. Students have covered diffusion and osmosis as methods of transport in cells.	At KS3 students have learnt about the organs of digestive system and the gaseous exchange system. They have learnt about diffusion and some examples of how the lungs are adapted for gas exchange.	At KS3 students have learnt about how our lifestyle can affect our gas exchange system and digestive system. They have studied bacterial cells and their importance to the digestive system.	At KS3 students have studied the structure of the leaf and photosynthesis.
Key Misconceptions	Nucleus of a cell contains protons and neutrons. Water moves from a high concentrated to a low concentration.	Respiration creates energy. During exercise, blood vessels move to the surface of the skin. Substrates have an active site. The substrate is the same shape as the active site on the enzyme. Respiration is another word for breathing.	All diseases are caused by pathogens. Antibiotics can be used to treat any infection.	Translocation is the movement of glucose. Chloroplasts and chlorophyll are the same. Plants do not respire.
Core Key words	Nucleus cytoplasm	active site denatured	communicable coronary heart disease (CHD)	epidermal palisade mesophyll

	ribosome cell membrane cell wall mitochondria synthesis specialisation differentiation stem cell mitosis diffusion osmosis active transport concentration gradient	amylase lipase protease bile glucose amino acids fatty acids glycerol artery vein capillaries aorta vena cava pulmonary vein pulmonary artery aerobic anaerobic oxygen debt metabolism	diabetes benign malignant pathogen virus bacteria protist fungi antibody antitoxin phagocytosis vaccination antibiotic Fleming	spongy mesophyll xylem phloem meristem stomata guard cell transpiration translocation photosynthesis limiting factor inverse square law (HT ONLY)

Science Year 10 (CHEMISTRY)
***sequencing varies dependent on course- refer to individual teacher plans**

Topic	**Atoms and Elements**	**Properties and Bonding**	**Reactions and Energy 1**	**Reactions and Energy 2**
Enquiry Question	Why aren't water pipes made of sodium?	How is your pencil like a diamond?	How do indigestion tablets work?	Why are some batteries rechargeable?
Big Ideas/ Key concepts	All matter is made up of atomic nuclei and electrons. The behaviour and structural arrangement of atomic nuclei and electrons explains the properties of different materials.	All matter is made up of atomic nuclei and electrons. The behaviour and structural arrangement of atomic nuclei and electrons explains the properties of different materials. Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties. The amount of a substance is measured in moles.	During chemical reactions, atoms are rearranged, and new substances are formed. Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties. The amount of a substance is measured in moles.	During chemical reactions, atoms are rearranged, and new substances are formed.
Key Knowledge and skills	• To write formulae and balanced chemical equations • To write balanced half equations and ionic equations (HT ONLT). • To describe, explain and give examples of the specified processes of separation. • To describe why the new evidence from the scattering experiment led to a change in the atomic model. • To compare the plum pudding model and the nuclear model of the atom. • To use the nuclear model to describe atoms. • To calculate the relative atomic mass of an element given the percentage abundance of its isotopes. • To explain how the position of an element in the Periodic Table is related to the arrangement of electrons in its atom. • To predict possible reactions and probable reactivity of elements from their position in the Periodic Table. • To describe the steps in the development of the Periodic Table. • To explain the differences between metals and non-metals and how their atomic structure relates to their position in the Periodic table. • To explain how the properties of the Noble gases, alkali metals and the halogens depend on the outer shell of electrons of the atoms. • To predict properties from given trends down the group. ***SEPARATE SCIENCE:*** • To describe the differences between group 1 and transition metals.	• To explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons. • To describe ionic, covalent, and metallic bonds. • To describe the limitations of dot and cross, ball and stick, two and three-dimensional diagrams to represent chemical structures. • To predict the states of substances at different temperatures. • To explain the different temperatures at which changes of state occur. • To explain properties of substances. • To compare giant structures, small molecules, and polymers. • To compare the properties and structure of pure metals and alloys. • To compare the properties of diamond, graphite, and fullerenes. ***SEPARATE SCIENCE:*** • To compare 'nano' dimensions to typical dimensions of atoms and molecules.	• To describe the reactions of metals with water or dilute acids and place these metals in order of reactivity. • To explain how the reactivity of metals is related to the tendency of the metal to form its positive ion. • To deduce an order of reactivity of metals based on experimental results. • To evaluate specific metal extraction processes. • To identify the substances which are oxidised or reduced in terms of gain or loss of oxygen. • To write ionic equations for displacement reactions and identify which species oxidised and reduced (HT ONLY). • To predict the products of neutralisation reactions. • To describe how to make pure, dry soluble salts. • To use the pH scale to identify acidic or alkaline solutions. • To explain the terms, dilute and concentrated, and weak and strong in relation to acids (HT ONLY). • To describe neutrality and relative acidity in terms of the effect on hydrogen ion concentration and the numerical value of pH (HT ONLY). • To predict the products of the electrolysis of ionic compounds in the molten state and as aqueous solutions. • To explain how to extract metals using electrolysis. ***SEPARATE SCIENCE:*** • To describe how to carry out titrations using strong acids and strong alkalis. • To calculate the chemical quantities in titrations.	• To distinguish between exothermic and endothermic reactions based on temperature change. • To evaluate uses and applications of exothermic and endothermic reactions. • To use reaction profiles to identify reactions as exothermic or endothermic. • To calculate the energy transferred in chemical reactions using bond energies (HT ONLY). • To calculate the mean rate of a reaction. • To draw tangents to curves to measure the rate of reaction. • To calculate the gradient of a tangent to the curve as a measure of instantaneous rate (HT ONLY). • To explain, using collisions theory, the effects of changing concentration, pressure, surface area and temperature on the rate of reaction. • To explain catalytic action in terms of activation energy. • To describe what happens in a reversible reaction. • To make qualitative predictions about the effect of changes on systems at equilibrium (HT ONLY). ***SEPARATE SCIENCE:*** • To interpret data for relative reactivity of different metals and evaluate the use of cells. • To evaluate the use of hydrogen fuel cells in comparison with rechargeable cells and batteries. • To write half equations for the electrode reactions in the hydrogen fuel cell.
End Point	To be able to describe developments in the model of the atom and the periodic table. To be able to link these developments to the structure of the atom. To explain trends in reactivity and chemical properties from understanding of the Periodic Table.	To be able to explain why different substances have different properties. ***SEPARATE SCIENCE:*** To evaluate the use of nanoparticles for a specified purpose and explain the possible risks.	To be able to explain how acids and alkalis react. To be able to explain how metals are extracted depending on their reactivity. ***SEPARATE SCIENCE:*** To be able to determine the reacting volumes of solutions of a strong acid and a strong alkali by titration.	To be able to explain what happens during reactions in terms of energy. To be able to explain how the rate of reaction can be changed. ***SEPARATE SCIENCE:*** To be able to evaluate the use of cells and fuel cells.

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Prior Knowledge	At KS3 students have studied the structure of the atom and the development of the Periodic Table.	At KS3 students have studied the properties of solids, liquids, and gases; metals and non-metals as well as metals and alloys. They have also looked at ceramics, composites, and polymers.	At KS3 students have studies acids and alkalis, neutralisation reactions as well as the reactions between metals and acids. They will be able to name the salts produced when different metals react with different acids. In atoms and elements, they will have looked at the reactivity of alkali metals and the halogens.	At KS3 students have studied exothermic and endothermic reactions. They have looked at how temperature and concentration affect the time taken for magnesium to dissolve and linked this to rate of reaction.
Key Misconceptions	Neutrons are negative. Relative mass and relative charge are the same for all subatomic particles. Mendeleev left gaps for undiscovered elements.	Bonds are broken when changes of state occur.	Increasing acidity increases the pH.	In an exothermic reaction less energy is required to break the bonds than to form new ones. To increase the rate of reactions more collisions are needed. Temperature (or other factor) increases the rate of reaction.
Core Key words	Element compound plum pudding alpha particle Niels Bohr James Chadwick electron proton neutron nucleus shell ion isotope Dimitri Mendeleev Noble gases alkali metals halogens	ionic covalent metallic intermolecular delocalised electron electrostatic giant structure small molecule polymer state symbol alloy diamond graphite graphene fullerene carbon nanotubes	oxidation reduction REDOX (HT ONLY) neutralisation salt filtration evaporation crystallisation pH electrolysis aqueous molten cryolite half equation cathode anode	exothermic endothermic reaction profile bond energy tangent collision theory concentration pressure surface area temperature catalyst activation energy equilibrium Le Chatelier's Principle

Science Year 10 (PHYSICS)
***sequencing varies dependent on course- refer to individual teacher plans**

Topic	**Matter**	**Energy**	**Electricity**	**Atomic Physics**	**Forces 1**
Enquiry Question	How do engineers design vessels to withstand high pressures and temperatures, such as submarines and spacecraft?	Why is the oblivion rollercoaster faster than the runaway train?	Why do birds not get electrocuted when they sit on a wire?	Is it safe to go to Chernobyl?	How is a bungee jump made safe? ***SEPARATE SCIENCE:*** Why is it difficult to make a good cup of tea high up a mountain?
Big Ideas/ Key concepts	Objects are made of particles with mass. Understanding particles helps us to design our world.	Forces make things change. Understanding forces helps us to predict and control physical changes. Objects are made of particles with mass. Understanding particles helps us to design our world.	The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives.	Objects are made of particles with mass. Understanding particles helps us to design our world.	Forces make things change. Understanding forces helps us to predict and control physical changes.
Key Knowledge and skills	• To draw simple diagrams to model the differences between solids, liquids, and gases. • To explain the differences in density between the different states of matter in terms of the arrangement of atoms or molecules. • To determine the density of regular and irregular shaped objects. • To describe how, when substances change state, mass is conserved. • To interpret heating and cooling graphs that include changes of state. • To distinguish between specific heat capacity and specific latent heat. • To explain how the motion of the molecules in a gas is related to both its temperature and its pressure. • To explain qualitatively the relation between the temperature of a gas and its pressure at constant volume. ***SEPARATE SCIENCE:*** • To use the particle model to explain how increasing the volume in which a gas is contained, at constant temperature, can lead to a decrease in pressure. • To calculate the change in pressure of a gas or the volume of a gas when either the pressure or volume is increased or decreased.	• To describe all the changes involved in the way energy is stored when a system changes. • To calculate the changes in energy involved when a system is changed by heating, work done by forces, work done when a current flows. • To calculate the amount of energy associated with a moving object, a stretched spring and an object raised above ground level. • To investigate the specific neat capacity of one or more materials. • To give examples that illustrate the definition of power. • To describe with examples where there are energy transfers in a closed system that there is no net change to the total energy. • To describe, with examples, how in all system changes energy is dissipated, so that it is stored in less useful ways. • To explain ways of reducing unwanted energy transfers. • To describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls. • To describe ways to increase the efficiency of an intended energy transfer (HT ONLY). • To describe the main energy sources available.	• To draw and interpret circuit diagrams. • To investigate how length of wire affects resistance in the wire. • To investigate how combinations of resistors in series and parallel affect the resistance and explain qualitatively why adding resistors in series increases the total resistance whilst adding resistors in parallel decreases the total resistance. • To explain that, for some resistors, the value of R remains constant but that in others it can change as current changes. • To explain the design and use of a circuit to measure the resistance of a component by measuring current through, and potential difference across, the component. • To describe the difference between series and parallel circuits. • To calculate current, potential difference and resistance in dc series circuits. • To solve problems for circuits which include resistors in series using the concept of equivalent resistance. • To explain the difference between direct and alternating potential difference. • To explain that a live wire may be dangerous even when a switch in the mains circuit is open.	• To describe the structure of the atom. • To describe the impact of the absorption or emission of electromagnetic radiation on the atom. • To describe the difference between isotopes. • To describe why new evidence from the scattering experiment led to a change in the atomic model. • To describe the development of the model of the atom. • To apply knowledge of nuclear radiation to the uses of radiation and evaluate the best sources of radiation to use in a given situation. • To write balanced equation to show alpha decay and beta decay. • To explain the concept of half-life and how it is related to the random nature of radioactive decay. • To determine the half-life of a radioactive isotope. • To calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives (HT ONLY). • To compare the hazards associated with contamination and irradiation. ***SEPARATE SCIENCE:*** • To explain why the hazards associated with radioactive material differ according to the half-life involved.	• To identify quantities as scalar or vector. • To describe the interaction between pairs of objects which produce a force on each object. • To calculate the resultant of two forces that act in a straight line. • To use free body diagrams to describe qualitatively examples where several forces lead to a resultant force on an object (HT ONLY). • To use vector diagrams to illustrate resolution of forces (HT ONLY). • To describe the energy transfer involved when work is done. • To convert between newton-metres and joules. • To explain why, to change the shape of an object, more than one force must be applied. • To describe the difference between elastic deformation and inelastic deformation caused by stretching forces. • To describe the difference between a linear and non-linear relationship between force and extension and calculate a spring constant in linear cases. • To calculate work done in stretching. • To calculate relevant values of stored energy and energy transfers. ***SEPARATE SCIENCE:*** • To describe examples in which forces cause rotation.

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	• To explain how, in a given situation eg a bicycle pump, doing work on an enclosed gas leads to an increase in the temperature of the gas.	• To evaluate the use of energy resources.	• To explain the dangers of providing any connection between the live wire and earth. • To explain how the power transfer in any circuit device is related to the potential difference across it and the current through it, and to the energy changes over time. • To describe how domestic appliances transfer energy from batteries or ac mains to the kinetic energy of electric motors or the energy of heating devices. • To describe the relationship between the power ratings for domestic appliances and the changes in stored energy when they are in use. • To explain why the National Grid system is an efficient way to transfer energy. ***SEPARATE SCIENCE:*** • To describe the production of static electricity, and sparking, by rubbing surfaces. • To describe evidence that charged objects exert forces of attraction or repulsion on one another when not in contact. • To draw the electric field for an isolated charged sphere and explain the concept of an electric field.	• To describe and evaluate the uses of nuclear radiations for exploration of internal organs, and for control or destruction of unwanted tissue. • To evaluate the perceived risks of using nuclear radiations in relation to given data and consequences. • To draw/interpret diagrams representing nuclear fission and how a chain reaction may occur.	• To calculate the size of a force, or its distance from a pivot, acting on an object that is balanced. • To explain how levers and gears transmit the rotational effects of forces. • To explain why, in a liquid, pressure at a point increases with the height of the column of liquid above that point and with the density of the liquid. • To calculate the differences in pressure at different depths of liquid. • To describe the factors which influence floating and sinking. • To describe a simple model of the Earth's atmosphere and of atmospheric pressure. • To explain why atmospheric pressure caries with height above a surface.
End Point	To be able to explain the changes in energy for specific latent heat and specific heat capacity. To be able to explain how temperature affects the pressure of a gas. ***SEPARATE SCIENCE:*** To be able to explain the relationship between pressure, volume, and temperature.	To be able to describe how energy stores transfer from one store to another in a system. To be able to calculate Gravitational potential, kinetic and elastic potential energy stores. To be able to calculate the energy transferred using the specific heat capacity and specific latent heat of a substance.	To be able to explain how energy is transferred efficiently and safely from a power station to our homes. ***SEPARATE SCIENCE:*** To be able to explain how the transfer of electrons between objects can explain the phenomenon of static electricity. To be able to explain how the concept of an electric field helps to explain the non-contact force between charged objects as well as other electrostatic phenomenon.	To be able to explain why some elements become radioactive. To be able to describe the behaviour of radioactive elements. To be able to carry out calculations associated with radioactive element behaviour. ***SEPARATE SCIENCE:*** To evaluate the hazards and uses of radioactive emissions.	To be able to describe the interactions between forces. To be able to perform calculations associated with forces and their interactions. ***SEPARATE SCIENCE:*** To be able to explain moments, lever and gears. To be able to explain pressure differences in fluids.
Prior Knowledge	Students will have studied the particle model at KS3 to understand and explain how the structure of solids, liquids and gases affect their properties. They will also have studied internal energy and how it changes as a substance heats up or cools down, or changes state.	Students will have learnt the energy stores and the energy transfers at KS3. Students calculate Gravitational potential, kinetic and elastic potential energy stores in year 9. Students will be able to describe what internal energy is from year 9. Students will be able to describe food as having chemical potential energy store from year 7.	Students will be familiar with a series and a parallel circuit. Students will be familiar with simple circuit symbols such as lamp, cell, battery, ammeter, and voltmeter. Students have been introduced to Ohm's law and V=IR.	Students will have knowledge of structure of the atom along with masses and charges of subatomic particles. Students have knowledge of the development of the model atom in year 8.	Students will have done simple resultant forces calculations and labelled simple diagrams with force arrows. Some students will recall the name of some common forces such as friction and weight. Forces studied in years 7, 8 and 9.
Key Misconceptions	To change state, you need to break bonds. Particles in a liquid are not close together. When you heat an object, the temperature always increases.	Energy can be created. Insulation makes things warm.	Electricity flows round the circuit. Potential difference is the same as power. A voltmeter measures volts. An ammeter measures amps. mW is megawatts. Two resistors in parallel will have a larger resistance than each resistor alone. Charge and charged particle are the same thing.	Radioactive decay can be affected by temperature. Half-life means the time taken for the radioactive material to disappear.	Mass is the same as weight. Kilogram is written as KG and not kg. We use a weighing scale to measure mass. Kinetic is a type of force. If a resultant force is 0N then the object is always stationary.
Core Key words	Density mass volume regular irregular displacement sublimate internal energy specific heat capacity specific latent heat pressure kinetic energy potential energy	system joule, J kinetic gravitational elastic specific heat capacity power Watts, W work done dissipated efficiency renewable non-renewable reliable	diode variable resistor LED LDR thermistor charge coulombs, C current potential difference resistance ohms, Ω series parallel mains electricity power	emission absorption photon isotope ion plum pudding alpha particle scattering experiment Niels Bohr James Chadwick radioactive decay activity becquerel, Bq alpha beta gamma	scalar vector contact non-contact vector resultant balanced gravity weight gravitational field strength work done extension spring constant limit of proportionality

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			National Grid Transformers	half life contamination irradiation	

Science Year 11 (BIOLOGY)
***sequencing varies dependent on course- refer to individual teacher plans**

Topic	**Coordination and Control**	**Inheritance**	**Natural World 2**
Enquiry Question	How do goal keepers save a penalty?	Can we genetically modify humans?	Can we save the giant panda?
Big Ideas/ Key concepts	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes. Genetic information is passed from each generation to the next; this information and the environment affect the features, growth, and development of organisms.	Genetic information is passed from each generation to the next; this information and the environment affect the features, growth, and development of organisms. Differences between organisms cause species to evolve by natural selection of better adapted individuals. The great diversity of organisms is the result of evolution.	All organisms, including humans, depend on, interact with, and affect the environments in which they live and other organisms that live there. Substances can move within and between the atmosphere, hydrosphere, geosphere, and biosphere as part of large-scale Earth systems.
Key Knowledge and skills	• To explain what homeostasis is. • To explain how the structure of the nervous system is adapted to its functions. • To explain how the various structures in a reflex arc relate to its function. • To investigate the effect of a factor on human reaction time. • To describe the principles of hormonal coordination and control by the human endocrine system. • To explain how insulin controls blood glucose levels in the body. • To compare Type 1 and Type 2 diabetes and explain how they can be treated. • To explain how glucagon interacts with insulin in a negative feedback cycle (HT ONLY). • To describe the roles of hormones in human reproduction, including the menstrual cycle. • To explain the interactions of FSH, oestrogen, LH, and progesterone, in the control of the menstrual cycle (HT ONLY). • To evaluate different hormonal and non-hormonal methods of contraception. • To explain the use of hormones in modern reproductive technologies to treat fertility (HT ONLY). • To explain the role of thyroxine and adrenaline in the body (HT ONLY). ***SEPARATE SCIENCE:*** • To identify the cerebral cortex, cerebellum and medulla on a diagram of the brain, and describe their functions. • To explain some of the difficulties of investigating brain function and treating brain damage and disease. • To relate the structures of the eye to their functions. • To describe how the eye focuses on near and far objects. • To interpret ray diagrams, showing myopia and hyperopia, and demonstrate how spectacles correct them. • To explain how the body lowers or raises body temperature, • To explain the effect on cells of osmotic changes in body fluids. • To describe the function of the kidneys in maintaining water balance of the body. • To describe the effect of ADH on the permeability of kidney tubules. • To describe the effects of some plant hormones and the different ways people use them to control plant growth.	• To compare mitosis and meiosis • To explain how meiosis halves the number of chromosomes in gametes and fertilisation restores the full number. • To describe the structure of DNA and define genome. • To predict the results of a single gene cross. • To evaluate the economic, social, and ethical issues concerning embryo screening. • To carry out a genetic cross to show sex inheritance. • To describe how the genome and its interaction with the environment influence the development of the phenotype of an organism. • To explain how evolution occurs through natural selection of variants that give rise to phenotypes best suited to their environment. • To explain the impact of selective breeding of food plants and domesticated animals. • To describe the process of genetic engineering and explain the potential benefits and risks of genetic engineering in agriculture and in medicine and that some people have objections. • To describe the evidence for evolution. • To describe factors which may contribute to the extinction of a species. • To describe the impact of developments in biology on classification systems. ***SEPARATE SCIENCE:*** • To explain the advantages and disadvantages of asexual and sexual reproduction for any organism. • To describe the structure of DNA. • To recall a simple description of protein synthesis. • To explain how the structure of DNA affects the protein made. • To describe how genetic variants may influence phenotype. • To explain how a change in DNA structure may result in a change in the protein synthesised by a gene. • To explain the potential benefits and risks of cloning in agriculture and in medicine and that some people have ethical objections. • To describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection. • To explain the impact of these ideas on biology. • To describe the steps which give rise to a new species. • To describe the development of our understanding of genetics including the work of Mendel.	• To describe the different levels of organisation in an ecosystem. • To describe the importance of interdependence and competition in a community. • To explain how a change in an abiotic or biotic factor would affect a given community. • To explain how organisms are adapted to live in their natural environment. • To describe feeding relationships within communities. • To explain the importance of the carbon and water cycles to living organisms. • To explain the role of microorganisms in cycling materials through an ecosystem. • To describe human impact on land, water, and air pollution. • To describe some of the biological consequences of global warming. • To describe both positive and negative human interactions in an ecosystem and explain their impact on biodiversity. ***SEPARATE SCIENCE:*** • To explain how temperature, water and availability of oxygen affect the rate of decay of biological material. • To evaluate the impact of environmental changes on the distribution of species in an ecosystem given appropriate information. • To describe the differences between the trophic levels of organisms within an ecosystem. • To construct accurate pyramids of biomass from appropriate data. • To describe pyramids of biomass and explain how biomass is lost between the different trophic levels. • To calculate the efficiency of biomass transfers between trophic levels by percentages or fraction of mass. • To explain how this affects the number of organisms at each trophic level. • To describe some of the biological factors affecting levels of food security. • To describe and explain some possible biotechnical and agricultural solutions, including genetic modification, to the demands of a growing population.
End Point	To be able to explain how the nervous system responds to stimuli and why this is important. To be able to describe how the endocrine system controls blood glucose levels and the menstrual cycle. To be able to explain how hormones are used in modern reproductive technologies. ***SEPARATE SCIENCE:*** To be able to explain how the structures of the eye and the brain relate to their functions. To explain how the body maintains body temperature and water balance. To be able to investigate the effect of light or gravity on the growth of newly germinated seeds.	To be able to explain how organisms inherit features from their parents. To be able to describe processes which cause species to change over time and how this can be tracked using classification. ***SEPARATE SCIENCE:*** To be able to explain the importance of the structure of DNA. To be able to explain the potential benefits and risks of cloning in agriculture and in medicine and that some people have ethical objections. To be able to explain why the importance of Mendel's discovery was not recognised until after his death.	To be able to explain the changes in biodiversity through investigation and understanding of human impacts on the environment. ***SEPARATE SCIENCE:*** To be able to investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change. To be able to explain how efficiency of biomass transfers between trophic levels impacts on the number of organisms at each trophic level. To be able to describe and explain some possible biotechnical and agricultural solutions, including genetic modification, to the demands of a growing population.
Prior Knowledge	At KS3 students have studies the menstrual cycle and contraception. They will have an understanding of hormones as chemical messengers from their study of puberty.	In Year 9 students have studied DNA as the unit of inheritance and have studied evolution through the process of natural selection. They will have described how genes are passed on through generations and that the genes passed on can result in evolution. At KS2 students have classified living things into different groups based on their similarities and differences from the widest category of kingdom to the most specific, species.	At KS3 students describe what is found in an ecosystem and the impact of one organism on an ecosystem. They will explain predator prey relationships and describe how food chains transfer energy. Students will have looked at the impact of bioaccumulation on organisms in a food chain and the importance of insect pollination on human food security. Global warming and air pollution are also covered in the Year 11 topic Earth and Environment 1.

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Key Misconceptions	The brain is the only part of the nervous system that controls the body. Hormone only affect the body in one way. The endocrine system is separate from the nervous system.	Genetic traits are solely determined by a single gene. Dominant traits are always more common than recessive traits. Genetic traits can be controlled or altered by individuals. Evolution is "just a theory" and therefore not supported by evidence. Evolution explains how life began on Earth. Evolution is incompatible with religious beliefs.	Humans are not part of the ecosystem. The environment is static. Bigger animals are always at the top of the food chain.
Core Key words	Homeostasis stimuli receptor sensory neurone relay neurone motor neurone effector response reflex endocrine system hormone insulin glycogen glucagon (HT ONLY) negative feedback (HT ONLY) FSH LH oestrogen progesterone IVF thyroxine adrenaline	gamete chromosome gene allele dominant recessive homozygous heterozygous genotype phenotype meiosis polydactyly cystic fibrosis evolution variation mutation Darwin selective breeding genetic engineering fossil extinction MRSA classification domain kingdom phylum class order family genus species	population community habitat ecosystem abiotic biotic extremophile quadrat transect abundance distribution carbon cycle water cycle biodiversity peat bog deforestation global warming

Science Year 11 (CHEMISTRY)
***sequencing varies dependent on course- refer to individual teacher plans**

Topic	**Quantitative Chemistry**	**Organic Chemistry**	**Chemical Methods**	**Earth and The Environment 1**	**Earth and The Environment 2**
Enquiry Question	How many water molecules are in a teaspoon of water?	Why is crude oil so useful?	How do we detect drug cheats at the Olympics?	Why did google become carbon neutral?	How did google become carbon neutral?
Big Ideas/ Key concepts	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties. The amount of a substance is measured in moles.	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties. The amount of a substance is measured in moles.	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties. The amount of a substance is measured in moles.	Substances can move within and between the atmosphere, hydrosphere, geosphere and biosphere as part of large-scale Earth systems.	Substances can move within and between the atmosphere, hydrosphere, geosphere and biosphere as part of large-scale Earth systems.
Key Knowledge and skills	• To balance chemical equations. • To calculate relative formula mass. • To explain any observed mass changes in a non-enclosed system during a chemical reaction. • To make estimations of uncertainty around a measurement. • To use relative formula mass to calculate the number of moles in a given mass and vice versa (HT ONLY). • To calculate masses of substances shown in a balanced equation (HT ONLY). • To calculate the masses of reactants and products from the balanced equation and the mass of a given reactant or product (HT ONLY). • To balance an equation given the masses of reactants and products (HT ONLY). • To explain the effect of a limiting quantity of a reactant on the number of products it is possible to obtain (HT ONLY).	• To describe what crude oil is made up of. • To explain how fractional distillation works in terms of evaporation and condensation. • To recall how boiling point, viscosity, and flammability change with increasing molecular size. • To write balanced equations for complete combustion. • To describe the conditions used for catalytic cracking and steam cracking. • To describe the test for alkenes. • To balance chemical equations for cracking. • To explain how modern life depends on the uses of hydrocarbons. ***SEPARATE SCIENCE:*** • To describe the reactions and conditions for the addition of hydrogen, water, and halogens to alkenes. • To draw fully displayed structural formulae of the first four members of the alkenes and the products of	• To use melting point and boiling point data to distinguish pure from impure substances. • To identify formulations. • To explain how paper chromatography separates mixtures. • To suggest how chromatographic methods can be used to distinguish pure from impure substances. • To interpret chromatograms and determine R_f values from chromatograms. • To describe the test and result for hydrogen, oxygen, carbon dioxide and chlorine. ***SEPARATE SCIENCE:*** • To identify metal ions from flame tests or reactions with sodium hydroxide solution. • To write balanced equations for the reactions to produce the insoluble hydroxides. • To identify non-metal ions from their reactions.	• To describe the Earth's atmosphere today. • To interpret evidence and evaluate different theories about the Earth's early atmosphere. • To describe the main changes in the atmosphere over time and some of the likely causes of these changes. • To describe and explain the formation of deposits of limestone, coal, crude oil, and natural gas. • To describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter. • To recall two human activities that increase the amounts of each of the greenhouse gases carbon dioxide and methane. • To evaluate the quality of evidence in a report about global climate change. • To describe uncertainties in the evidence base.	• To give examples of natural products that are supplemented or replaced by agriculture and synthetic products. • To distinguish between finite and renewable resources. • To distinguish between potable water and pure water. • To describe the differences in treatment of ground water and salty water. • To give reasons for the steps used to produce potable water. • To comment on the relative ease of obtaining potable water from waste, ground, and salt water. • To evaluate alternative biological methods of metal extraction (HT ONLY). • Top carry out simple comparative LCAs for shopping bags made from plastic and paper. • To evaluate ways of reducing the use of limited resources.

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SCIENCE

	• To calculate the mass of solute in a given volume of solution of known concentration. • To explain how the mass of a solute and the volume of a solution is related to the concentration of the solution (HT ONLY). ***SEPARATE SCIENCE:*** • To calculate the percentage yield of a product from the actual yield of a reaction. • To calculate atom economy of a reaction to form a desired product from the balanced equation. • To explain how the concentration of a solution in mol/dm^3 is related to the mass of the solute and volume of the solution. • To calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass. • Calculate volumes of gaseous reactants and products from a balanced equation and a given volume of a gaseous reactant or product.	their addition reactions with hydrogen, water chlorine, bromine, and iodine. • To describe what happens when any of the first four alcohols react with sodium, burn in air, are added to water, react with an oxidising agent. • To recall the main uses of these alcohols. • To describe what happens when any of the first four carboxylic acids react with carbonates, dissolve in water, react with alcohols. • To explain why carboxylic acids are weak acids in terms of ionisation and pH. • To recognise addition polymers and monomers from diagrams. • To draw diagrams to represent the formation of a polymer from a given alkene monomer. • To explain the basic principles of condensation polymerisation by reference to the functional groups in the monomers and the repeating units in the polymers.		• To recognise the importance of peer review of results and of communicating results to a wide range of audiences. • To describe potential effects of global climate change. • To describe actions to reduce emissions of carbon dioxide and methane and give reasons why actions may be limited. • To describe how carbon monoxide, soot, sulphur dioxide and oxides of nitrogen are produced by burning fuels and their impact on the environment.	***SEPARATE SCIENCE:*** • To describe experiments and interpret results to show that both air and water are necessary for rusting. • To explain sacrificial protection in terms of relative uncertainty. • To recall uses of specific alloys. • To interpret and evaluate the composition and uses of alloys given appropriate information. • To explain how low density and high-density poly(ethene) both are produced from ethene. • To explain the difference between thermosoftening and thermosetting polymers in terms of their structures. • To recall some examples of composites. • To compare quantitatively the physical properties of glass and clay ceramics, polymers, composites, and metals. • To explain how the properties of materials are related to their uses and select appropriate materials. • To apply the principles of dynamic equilibrium to the Haber process. • To recall the names of the salts produced when phosphate rock is treated with nitric acid, sulfuric acid and phosphoric acid. • To compare the industrial production of fertilisers with laboratory preparations of the same compound.
End Point	To be able to calculate mases in reactions using molar ratios. ***SEPARATE SCIENCE:*** To be able to explain why a particular reaction pathway is chosen to produce a specified product given appropriate data such as atom economy, yield, rate, equilibrium position and usefulness of by-products.	To be able to explain how fuels and plastics are formed. ***SEPARATE SCIENCE:*** To be able to describe the reactions of different organic compounds. To be able to describe the difference between addition and condensation polymerisation.	To be able to explain how to analyse chemical substances using chemical tests and chromatography. ***SEPARATE SCIENCE:*** To be able to use chemical tests to identify the ions in unknown single ionic compounds.	To be able to explain how the levels of gases have changed from Earth's early atmosphere to the atmosphere today.	To be able to explain and evaluate how Earth's natural resources are used sustainably. ***SEPARATE SCIENCE:*** To be able to explain the trade-off between rate of production and position of equilibrium and explain how the commercially used conditions for the Haber process are related to the availability and cost of raw materials and energy supplies, control of equilibrium position and rate.
Prior Knowledge	Students will have an understanding of conservation of mass. Some students will have calculated relative formula mass of simple molecules.	At KS3 students have studied distillation as a method of separating liquids with different boiling points. They will have studied the formation of crude oil and understand what fossil fuels are. Students will have an understanding of combustion.	At KS3 students have studied pure and impure substances as well as separation techniques including chromatography.	Students will have studied the composition of the Earth's atmosphere and the impact of burning fossil fuels on the atmosphere. Students who study Geography GCSE will have studied global warming and the enhanced greenhouse effect. Global warming and its effects are also covered in the Year 11 Natural World unit.	Students will have studied renewable and non-renewable energy resources at KS3. They will have studied filtration and distillation at KS3, and osmosis is covered in Year 10 Cells.
Key Misconceptions	The mole is a unit of weight. The mass of a substance stays the same.	All hydrocarbons are fossil fuels. Cracking only breaks down large alkanes into smaller alkanes. Hydrocarbons are only used as fuels.	The solvent in chromatography is always water. Chromatography produces 100% pure substances.	Oxygen was always present in the Earth's atmosphere. The hole in the ozone layer causes global warming. Carbon dioxide is the only greenhouse gas.	Renewable resources are reused. All water can be made potable. Sustainable development is only about conserving resources.
Core Key words	conservation of mass relative atomic mass relative formula mass uncertainty mole Avogadro's constant limiting reactant concentration solute solution solvent volume	crude oil hydrocarbon alkane fractional distillation evaporation condensation viscosity flammability combustion cracking alkene bromine water	pure impure formulation chromatography mobile phase stationary phase solvent Rf value Hydrogen Oxygen Carbon dioxide Limewater Chlorine Litmus paper	atmosphere condensed dissolved photosynthesis greenhouse effect wavelength absorb emit carbon dioxide methane peer review global warming climate change acid rain carbon footprint	sustainable development potable sterilise desalination reverse osmosis distillation sewage aerobic anaerobic bioleaching phytomining life cycle assessment recycle

PONTEFRACT ACADEMIES TRUST

SCIENCE

Science Year 11 (Physics)
***sequencing varies dependent on course- refer to individual teacher plans**

Topic	**Forces 2**	**Waves**	**Magnetism**	**Space (Separate Science only)**
Enquiry Question	Why do aeroplanes have a top speed?	How do we communicate by mobile phone?	How can electromagnets be used to make a lift move up and down?	What is dark matter and what is causing the universe to expand even faster?
Big Ideas/ Key concepts	Forces make things change. Understanding forces helps us to predict and control physical changes.	Waves radiate information. Understanding waves helps us to communicate.	The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives.	Understanding the uniqueness of the Earth and the vastness of space gives us perspective and awe.
Key Knowledge and skills	• To express a displacement in terms of both magnitude and direction. • To calculate speed of objects. • To calculate average speed for non-uniform motion. • To explain qualitatively that motion in a circle involves constant speed but changing velocity (HT ONLY). • To draw, interpret and determine speed from a distance-time graph. • To estimate the magnitude of everyday accelerations. • To draw velocity-time graphs and determine acceleration. • To determine the distance travelled from a velocity-time graph (HT ONLY). • To apply Newton's First Law to explain the motion of objects moving with uniform velocity and objects where speed and/or direction changes. • To explain that inertial mass is a measure of how difficult it is to change the velocity of an object (HT ONLY). • To investigate the effect of force on acceleration and the effect of mass on acceleration. • To apply Newton's Third Law to examples of equilibrium situations. • To explain methods to measure human reaction times. • To evaluate the effect of various factors on thinking distance based on given data. • To explain the factors which affect the distance required for vehicles to come to rest in an emergency, and the implications for safety. • To explain the dangers caused by large decelerations. • To estimate the forces involved in the deceleration of vehicles in typical situations on a road (HT ONLY). • To use the concept of momentum to describe and explain examples of momentum in an event. ***SEPARATE SCIENCE:*** • To interpret changing motion in terms of the forces acting. • To estimate how the distances for a vehicle to make an emergency stop varies over a range of speeds typical for that vehicle. • To apply equations relating force, mass, velocity, and acceleration to explain how the changes involved are inter-related.	• To describe the difference between longitudinal and transverse waves. • To describe evidence that, for both ripples on a water surface and sound waves in air, it is the wave and not the water or air itself that travels. • To describe a method to measure: ○ the speed of sound waves in air. ○ the speed of ripples on water. ○ the speed on waves in a solid. • To give examples that illustrate the transfer of energy by electromagnetic waves. • To construct ray diagrams to illustrate the refraction of a wave at the boundary between two different media. • To use wave front diagrams to explain refraction in terms of the change of speed that happens when a wave travels from one medium to another. • To investigate how infrared radiation absorbed or radiated by a surface depends on the nature of that surface. • To draw conclusions about the risk and consequences of exposure to radiation. • To explain why each type of electromagnetic wave is suitable for the practical application (HT ONLY). ***SEPARATE SCIENCE:*** • To show how changes in velocity, frequency, and wavelength, in transmission of sound waves from one medium to another, are inter-related. • To construct ray diagrams to illustrate the reflection of a wave at a surface. • To describe the effects of reflection, transmission, and absorption of waves at material interfaces. • To describe, with examples, processes which convert wave disturbances between sound waves and vibrations in solids. • To explain why such processes only work over a limited frequency range and the relevance of this to human hearing. • To explain in qualitative terms, how the differences in velocity, absorption, and reflection between different types of waves in solids and liquids can be used both for detection and exploration of structures which are hidden from direct observation. • To describe how the study of seismic waves provided new evidence that led to discoveries about parts of the Earth which are not directly observable. • To construct ray diagrams to illustrate the similarities and differences between concave and convex lenses. • To explain how colour of an object is related to the differential absorption, transmission, and reflection of different wavelengths of light by the object. • To explain the effect of viewing objects through filters or the effect on light of passing through filters. • To explain why an opaque object has a particular colour. • To explain that all bodies emit radiation and that the intensity and wavelength distribution of any emission depends on the temperature of the body.	• To describe the attraction and repulsion between unlike and like poles for permanent magnets. • To describe the difference between permanent and induced magnets. • To describe how to plot the magnetic field pattern of a magnet using a compass. • To draw the magnetic field pattern of a bar magnet. • To explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic. • To describe how the magnetic effect of a current can be demonstrated. • To draw the magnetic field pattern for a straight wire carrying a current and for a solenoid. • To explain how a solenoid arrangement can increase the magnetic effect of the current. • To show that Fleming's left-hand rule represents the relative orientation of the force, the current in the conductor and the magnetic field. • To recall the factors that affect the size of the force on the conductor. • To explain how the force on a conductor in a magnetic field causes the rotation of the coil in an electric motor. ***SEPARATE SCIENCE:*** • To explain how electromagnetic devices work based on diagrams of the devices. • To explain how a moving-coil loudspeaker and headphones work. • To recall the factors that affect the size of the induced potential difference/induced current. • To recall the factors that affect the direction of the induced potential difference/induced current. • To apply the principles of the generator effect in a given context. • To explain how the generator effect is used in an alternator to generate ac and in a dynamo to generate dc. • To draw/interpret graphs of potential difference generated in the coil against time. • To explain how a moving-coil microphone works. • To explain how the effect of an alternating current in one coil in inducing a current in another is used on transformers. • To explain how the ratio of the potential differences across the two coils depends on the ratio of the number of turns on each. • To calculate the current drawn from the input supply to provide a particular power output. • To apply the equation linking the p.d.s and number of turns in the two coils of a transformer to the currents and the power transfer involved and relate these to the advantages of power transmission at high potential differences.	• To explain how, at the start of a star's life-cycle, the dust and gas drawn together by gravity causes fusion reactions. • To explain that fusion reactions lead to an equilibrium between the gravitational collapse of a star and the expansion of a star due to fusion energy. • To describe the lifecycle of a star the size of the Sun. • To describe the life cycle of a star much more massive than the Sun. • To explain how fusion processes lead to the formation of new elements. • To explain qualitatively how for circular orbits, the force of gravity can lead to changing velocity but unchanged speed. • To explain qualitatively how for a stable orbit, the radius must change if the speed changes. • To explain qualitatively the red-shift of light from galaxies that are receding. • To explain that the change of each galaxy's speed with distance is evidence of an expanding universe. • To explain how red-shift provide evidence for the Big Bang model. • To explain how scientists are able to use observations to arrive at theories such as the Big Bang theory. • To explain that there is still much about the universe that is not understood, for example dark mass and dark energy.
End Point	To be able to describe how forces affect the motion of an object. To be able to perform calculations associated with forces and their effect on the motion of an object. ***SEPARATE SCIENCE:*** To be able to explain safety features such as: air bags, seat belts, gymnasium crash mats, cycle helmets and cushioned surfaces for	To be able to describe the behaviour and interactions of different types of waves. To be able to carry out calculations associated with wave behaviour. ***SEPARATE SCIENCE:*** To be able to investigate the reflection of light by different types of surfaces and the refraction of light by different substances.	To be able to describe how to produce electromagnets and explain how they work. To be able to explain how magnetic fields interact to produce motion. ***SEPARATE SCIENCE:*** To be able to explain how loudspeakers, microphones, and transformers work.	***SEPARATE SCIENCE:*** To be able to describe our solar system and how the planets orbit. To be able to the life cycle of a star. To be able to explain the evidence for the big bang and the creation of the universe.

	playgrounds with reference to the concept of rate of change of momentum.	To be able to explain how the temperature of a body is related to the balance between incoming radiation absorbed and radiation emitted and show how radiation affects the temperature of the Earth.		
Prior Knowledge	At KS3 students study relative motion and will be able to describe how resultant forces affect the motion of an object. They will be able to describe Newton's first law and describe how applying a force can transfer energy from one energy store to another.	Students will have studied how waves transfer energy in relation to light and sound waves. They will have studied reflection and refraction of light as well as how echoes are formed. They will be able to compare light and sound waves.	At KS3 students study magnetism as a non-contact force and the interaction of two magnets as well as the formation of a magnetic field around a current carrying wire. They will be able to describe how to form and electromagnet and change its strength.	Students will be familiar with the order of the planets and day and night taught at KS2 and in year 7. Students will know that the planets orbit the Sun and that the Sun is a star.
Key Misconceptions	Distance and displacement are the same thing. That units for speed are always the same. A force is needed to key an object moving with constant velocity. That the shapes for the graphs for acceleration vs time and distance vs time mean the same thing. s means speed in equations. That Newton had one law. That thinking, breaking, and stopping distance is the time it takes. Reaction time only affects time. Not distance. That a factor that increases stopping distance is the condition of breaks rather than poor condition of breaks.	Amplitude is the distance between the peak and trough. Only objects like a mirror reflects. That a trace of a sound on an oscilloscope shows that it is a transverse wave. Microwaves are an oven and are only used for cooking food. The primary colours of light are red, blue and yellow.	Induced magnets have fixed poles. All metals are magnetic. The larger the magnet the stronger the magnet.	That a light year is a length of time. The vacuum of space is completely empty. The Earth is the centre of our Universe. The universe is expanding into something.
Core Key words	displacement speed velocity acceleration terminal velocity Newton's First law Newton's second law Newtons' third law inertia stopping distance momentum (HT ONLY)	transverse longitudinal time period frequency hertz, Hz amplitude wavelength electromagnetic spectrum refraction wave front (HT ONLY) oscillations	pole induced electromagnet attract repel magnetic field Fleming's left-hand rule motor effect electromagnetic induction solenoid Tesla magnetic flux density	fusion protostar red giant white dwarf black dwarf red giant supernova neutron star black hole orbit red-shift Big Bang theory