East Lothian 'CFE Science' Framework

Organiser		Planet Earth		Biological Systems
Experiences and Outcomes		I can identify and classify examples of living things, past and present, to help me appreciate their diversity. I can relate physical and behavioural characteristics to their survival or extinction. **SCN2-01a** I can use my knowledge of the interactions and energy flow between plants and animals in ecosystems, food chains and webs. I have contributed to the design or conservation of a wildlife area. **SCN 2-02a** Through carrying out practical activities and investigations, I can show how plants have benefited society. **SCN 2-02b** I have collaborated in the design of an investigation into the effects of fertilisers on the growth of plants. I can express an informed view of the risks and benefits of their use. **SCN 2-03a** By considering examples where energy is conserved, I can identify the energy source, how it is transferred and ways of reducing wasted energy. **SCN 2-04a** Through exploring non-renewable energy sources, I can describe how they are used in Scotland today and express informed view on the implications for their future use .**SCN 2-04b** I can apply my knowledge of how water changes state to help me understand the processes involved in the water cycle in nature over time. **SCN 2-05a** By observing and researching features of our Solar System, I can use simple models to communicate my understanding of size, scale, time and relative motion within it. **SCN 2-06a**		By investigating some body systems and potential problems which they may develop, I can make informed decisions to help me to maintain my health and wellbeing. **SCN 2-12a** I have explored the structure and function of sensory organs to develop my understanding of body actions in response to outside conditions. **SCN 2-12b** I have contributed to investigations into the role of microorganisms in producing and breaking down some materials. **SCN 2-13a** By investigating the lifecycles of plants and animals, I can recognise the different stages of their development. **SCN 2-14a** By exploring the characteristics offspring inherit when living things reproduce, I can distinguish between inherited and non-inherited characteristics. **SCN 2-14b**
On track in P5	a	I can classify living things into plants and animals through knowledge of their characteristics. I can construct and uses a key which can be used to identify particular plants or animals. I can identify characteristics of living things that have contributed to the survival or extinction of a species. I can explain how some plants and animals have adapted to their environment I can suggest some reasons why some species are extinct /endangered.		
	b	I can identify herbivores, carnivores and omnivores correctly. I can explain the difference between a food chain and a food web. I can explain how energy flows between plants and animals in food chains and webs and ecosystems, using arrows correctly to show energy flow. I can use vocabulary such as 'producers' and 'consumers' correctly. I can contribute to the design or conservation of a wildlife area.		
	g	I can explain why the water cycle is a very important process in nature. I can demonstrate my understanding of the processes of the water cycle. I can discuss the necessity of water for life.		
	h	I can report collaboratively on the key features of the planets in the solar system. I can use simple models to communicate my understanding of the size and scale of the solar system and time and relative motion.		
On track in P6	e	I can demonstrate an understanding of the law of conservation of energy. I can identify the energy transfers and transformations that occur in everyday appliances. I can explain that when energy transfers and transformations take place, energy is converted into "useful" and "wasted" energy.	a	I can explain and describe the main systems of the body – respiratory, circulatory, digestive, reproductive, skeletal. I can confidently name all major organs. I can name at least 2 body systems and identify associated organs and structure from:-Respiratory, Circulatory, Digestive, Reproductive or Skeletal. I can show my understanding of how to keep my body healthy. Respiratory System: I can explain the main function of respiratory system as gas exchange through inhalation and exhalation. I can explain the main preventable causes of bronchitis, lung cancer and asthma. Circulatory System: I can explain the main function of circulatory system as transportation of oxygen, nutrients, waste. I can explain the main preventable causes of heart disease, stroke etc. Digestive System: I can explain the main function of the digestive system as the breakdown of food & absorption of nutrients/minerals/water. I can describe the main preventable causes of liver disease. Reproductive System: I can explain the main function of the reproductive system in the development of a baby. I can discuss some preventable sources of fertility problems. Skeletal System I can explain the main function of the skeletal system as protection & supporting movement.
			b	I can describe the sensory organs and their function. I can explain the basic working, location and response to outside conditions of parts of the following:- eye, ear, nose, tongue and skin.
	f	I can identify non-renewable sources of energy and discuss how these are used in Scotland. I can suggest ways in which they can reduce their own energy use and live more sustainably.	c	I can explain that bacteria, viruses & fungi are examples of microscopic organisms. I can explain that microscopic living things can multiply rapidly. I can give examples of how micro-organisms can be useful or harmful. I can explain how micro-organisms can be used in food production. I can explain how food is broken down in the gut as part of a healthy digestive system. I can explain why the process of decomposition is necessary and caused by micro-organisms – to break down dead

				material (decay).
			d	I can explain how pollination occurs and correctly use terms such as pollen and stigma. I can describe how fertilisation occurs. I can describe the development of seeds and fruits. I can use my observations to explain seed germination. I can identify and compare the two distinct groups, vertebrates and invertebrates. I can investigate the lifecycles of the five main types of vertebrates and report on my findings using a range of media. I can compare the lifecycles of some invertebrates.
			e	I can explain that genetics is the study of inherited characteristics. I can explain that inherited characteristics are carried on genes and can sometimes skip a generation. I can explore and categorise characteristics into inherited and non-inherited. I can describe how every living thing has its own DNA fingerprint.
On track in P7	c	I can carry out practical activities and investigations to show how plants benefit our society. I can provide examples of how plants have benefited society.		
	d	I can use findings from investigations to explain the effects of fertilisers on plant growth. I can evaluate the benefits and risks associated with fertilisers.		
National Benchmarks	a	Classifies living things into plants (flowering and non-flowering), animals (vertebrates and invertebrates) and other groups through knowledge of their characteristics. Begins to construct and use simple branched keys which can be used to identify particular plants or animals. Identifies characteristics of living things and their environment which have contributed to the survival or extinction of a species. Describes how some plants and animals have adapted to their environment, for example, for drought or by using flight.	a	The expectation is that at least two of the following body systems will be studied at Second Level. Respiratory system Describes the function of the respiratory system (lungs, windpipe and bronchi), for example, in gas exchange. Discusses the main preventable causes of bronchitis, lung cancer and asthma, for example, smoking. Circulatory system Describes the function of the circulatory system (heart and blood vessels), for example, transport of food, oxygen and waste materials. Discusses the main preventable causes of heart disease or stroke, for example, obesity, lack of exercise, smoking and high (saturated) fat diet. Digestive system Describes the function of the digestive system (mouth, oesophagus, stomach, liver, small intestine, large intestine, rectum and anus), for example, breakdown of food and absorption of nutrients, minerals and water. Discusses the main preventable causes of liver disease, for example, alcohol and drug misuse. Reproductive system Describes the function of the reproductive system (penis, testes, sperm tube/duct, ovaries, egg tube/duct, uterus and vagina), for example, to make a baby. Discusses some preventable causes of fertility problems, for example, alcohol misuse, anorexia and obesity. Skeletal system Describes the function of the skeleton (skull, spine, ribcage some bones of the arm and leg), for example, to provide support, protection and enable movement. Discusses some common problems of bones (for example, arthritis, osteoporosis and breaks) and how their incidence can be reduced (for example, through calcium in the diet and weight-bearing exercise).
	b	Describes how energy flows between plants and animals in more complex food chains and webs and ecosystems, using vocabulary such as 'producers', 'consumers' and 'herbivore'.	b	Describes how senses work individually or together to keep people safe from harm. Demonstrates understanding of how, if one sense is impaired, it can have an effect on the other senses, either positively or negatively. Describes how light enters the eye through the pupil and how the pupil changes size in dark/light conditions.
	c	Relates findings from practical investigations to describe how plants have benefited society, for example, in medicine, dyes, fuels, construction, and prevention of soil erosion and by influencing the balance of gases in the air.	c	Demonstrates understanding of how microorganisms, including bacteria, viruses and fungi, can multiply rapidly. Investigates and explains the action of some microorganisms used in food production, for example, yeast in bread and bacteria in yoghurt. Describes how some micro-organisms break down food causing it to be inedible or harmful if digested, and how others exist in the gut to break down food to aid digestion. Investigates, observes and records how microscopic organisms are necessary for the process of decomposition (the breaking down of dead material – decay).
	d	Collaborates with others to present a reasoned argument, based on evidence, of the risks and benefits of using fertilisers, demonstrating understanding of the underlying scientific concepts.	d	Plants Describes how pollination occurs when the male cell (pollen) lands on the stigma. Describes how fertilisation (sexual reproduction) occurs when the genetic information in the male cell fuses (joins) with the genetic information in the female cell. Describes how the fertilised ovule develops into a seed and how the ovary ripens to form a fruit.

				Investigates and explains how a seed germinates into a plant using water, oxygen, a food store and warmth. Animals Identifies and compares the two distinct groups of animals – vertebrates and invertebrates. Researches the lifecycles of the five main types of vertebrates including fish (spawn), birds (eggs which are rigid but fragile), amphibians (spawn and metamorphosis), reptiles (leathery shelled eggs) and mammal (live young), and communicates findings using a range of media. Compares the lifecycles of some invertebrates, for example, ladybird and spider.
	e	Demonstrates understanding of the law of conservation of energy (energy can be converted from one form to another but cannot be created or destroyed). Identifies the common types of energy (kinetic, potential, electrical, chemical, light, sound and heat) used in energy transfers and transformations that occur in everyday appliances. Explains that when energy transfers and transformations take place, energy is converted into 'useful' and 'wasted' energy, for example a mechanical braking system transforms kinetic energy into heat energy which is dissipated to the atmosphere as 'waste' heat.	e	Knows that genetics is the study of inherited characteristics and that inherited characteristics are carried on genes and can sometime skip a generation. Explores and categorises characteristics into inherited (eye and hair colour, height and right/left handedness) and non-inherited (native language spoken and favourite colour). Describes how every living thing has its own DNA fingerprint.
	f	Researches non-renewable sources of energy, such as fossil fuels and nuclear, and discusses how these are used in Scotland. Draws on increasing knowledge and understanding to suggest ways in which they can reduce their own energy use and live more sustainably.		
	g	Discusses the necessity of water for life, for example, for the growth of crops, for drinking and in river formation/flow. Demonstrates understanding of the processes involved in the water cycle.		
	h	Reports collaboratively on the key features of the planets including size, distance from the sun, length of day, length of year, temperature, materials from which they are predominantly made and the number of moons. Uses simple models to communicate understanding of size, scale, time and relative motion within our Solar System, including how solar & lunar eclipses occur. I can demonstrate an understanding of the law of conservation of energy		

Organiser	**Forces, Waves and Electricity**		**Materials**
Experiences and Outcomes	By investigating how friction, including air resistance, affects motion, I can suggest ways to improve efficiency in moving objects. **SCN 2-07a** I have collaborated in investigations to compare magnetic, electrostatic and gravitational forces and have explored their practical applications **SCN 2-08a** By investigating floating and sinking of objects in water, I can apply my understanding of buoyancy to solve a practical challenge **SCN 2-08b** I have used a range of electrical components to help to make a variety of circuits for differing purposes. I can represent my circuit using symbols and describe the transfer of energy around the circuit. **SCN 2-09a** To begin to understand how batteries work, I can help to build simple chemical cells using readily-available materials which can be used to make an appliance work. **SCN 2-10a** Through research on how animals communicate, I can explain how sound vibrations are carried by waves through air, water and other media. **SCN 2-11a** By exploring reflections, the formation of shadows and the mixing of coloured lights, I can use my knowledge of the properties of light to show how it can be used in a creative way. **SCN 2-11b**		By contributing to investigations into familiar changes in substances to produce other substances, I can describe how their characteristics have changed. **SCN 2-15a** I have participated in practical activities to separate simple mixtures of substances and can relate my findings to my everyday experience. **SCN 2-16a** By investigating common conditions that increase the amount of substance that will dissolve or the speed of dissolving, I can relate my findings to the world around me**. SCN 2-16b** Having explored the substances that make up Earth's surface, I can compare some of their characteristics and uses. **SCN 2-17a** I have investigated different water samples from the environment and explored methods that can be used to clean and conserve water and I am aware of the properties and uses of water. **SCN 2-18a** I have collaborated in activities which safely demonstrate simple chemical reactions using everyday chemicals. I can show an appreciation of a chemical reaction as being a change in which different materials are made. **SCN 2-19a**
On track in P5	a I can explain that friction is a force that opposes motion when one surface rubs against another. I can explain the link between air resistance (drag), the speed of a moving object and its surface area and go on to make informed predictions. I can explain that friction can be useful or problematic. I can demonstrate that efficient movement uses the least possible amount of energy. I can suggest ways to improve efficiency in moving objects.	d	I can analyse and compare samples of rocks, soils and minerals and report on their characteristics and uses.
	b I can measure gravitational force using a force meter or newton meter and record my results appropriately. I can explain electrostatic force in terms of the charge produced when two objects are rubbed together. I can explain that magnetic and electrostatic forces can both repel and attract. I can describe and explain some electrostatic, gravitational and magnetic forces in the world around me.	e	I can use my knowledge of the water cycle to explain how the quantity of water on earth has remained the same. I can investigate and discuss methods used to purify water. I can present the findings of my research into local and global water conservation. I can discuss the many uses of water.
	c I can explore the factors which affect floating and collate, organise and summarise my findings with assistance.		
On track in P6	f I can explain and demonstrate through experiments how sounds travel differently through air, water and solids. I can explain how hearing is limited by a range of factors.		

	g	I can demonstrate and record through practical investigations that light travels in straight lines, can be reflected by highly polished surfaces and that curved surfaces can distort the image. I can use my knowledge to predict how the position, shape and size of a shadow will change as an object moves in relation to a light source. I can demonstrate that white light can be split into the visible colours of the spectrum. I can identify the colours, in order, in a rainbow. I can explain that we see objects because they emit or reflect light that enters our eyes. I can use filters to create different coloured light from a white light source. I can explain how we recognise the colour of an object due to the reflection and absorption of particular parts of the visible spectrum.		
On track in P7	d	I can design and build a variety of electrical circuits using an increasing range of components. I can draw a circuit diagram using appropriate symbols to denote a bulb, switch, motor, bell, buzzer, wires, cell and a battery. I can describe how components in a circuit transfer energy into different forms.	a	I can explain that there are three states of matter and that all matter is made up of particles. I can explain the specific properties of solids, liquids and gases. I can use the correct terms to describe changes of state including those I observe in the world around me. I can identify and investigate reversible and irreversible changes in materials. I can identify and investigate irreversible chemical changes to materials. I can observe and identify some of the signs of a chemical reaction.
	e	I can apply my knowledge and understanding to build simple batteries (chemical cells). I can demonstrate understanding that a battery (cell) is a portable energy source which has a store of chemical energy. I can exchange the process of energy transformation from battery (cell) to electrical components.	b	I can demonstrate through practical activity that a mixture of solids of different sizes can be separated using a sieve or magnet. I can use the terms soluble, insoluble, dissolve, solution and solvent correctly. I can explain that insoluble solids of different sizes can be separated by filtering or sieving and can select the appropriate technique. I can explain that dissolved materials cannot be separated by filtering but can be separated by evaporation and can use the associated scientific vocabulary. I can relate findings of practical investigations about dissolving to everyday experiences
			c	I can find an association between the quantity of substance that dissolves and a range of conditions and relate this to the world around me. I can investigate how a range of factors can affect the rate of dissolving and relate this to the world around me.
			f	I can collaborate with others to safely demonstrate simple chemical reactions. I can investigate some everyday chemical reactions and name some of the new substances created. I can use my prior knowledge to identify when a chemical reaction has occurred.
National Benchmarks	a	Describes friction as a force which opposes the motion of moving objects, for example, two solid surfaces rubbing against one another or a solid surface moving through air or water. Finds an association between air resistance (drag), the speed of the object being investigated and the surface area exposed to the air, making links to original predictions. Demonstrates understanding of how friction and air resistance can both be useful, for example, in braking systems, and also a problem, for example, causing moving parts to wear. Describes efficient movement as that which requires the least possible energy and suggests ways to improve efficiency in moving objects, for example, by streamlining.	a	Investigates and explains physical changes to the properties of materials which are fully and partially reversible, for example salt dissolving in water, chocolate melting and water freezing. Uses scientific vocabulary such as "melting", "freezing", "evaporating" and "condensing" to describe changes of state. Investigates and records chemical changes to the properties of materials that are irreversible, for example cooking, rusting and striking a match. Observes and identifies some of the signs of a chemical reaction, for example production of bubbles, colour/texture change and heat given out/taken in. Explores and describes the characteristics of solids, liquids and gases, for example, solids retain the same volume and shape, liquids keep the same volume but the shape changes to fill the container and that gases change shape and volume to fill the container.
	b	Measures gravitational force with a force meter or newton meter and records results using appropriate units (Newtons). Explains how some objects may become electrically charged by rubbing two surfaces together and how the charges produce an electrostatic force. Investigates and demonstrates understanding that magnetic and electrostatic forces can both repel and attract. Describes practical applications of magnetic, electrostatic and gravitational forces, for example, magnetised needle in a compass.	b	Draws on findings from practical investigations to explain how a mixture of solids of different sizes can be separated using a sieve or magnet, for example sand and peas or salt and iron filings. Selects the most appropriate practical technique for separating insoluble solids, for example, filtering or sieving. Explains why a dissolved solid cannot be separated from the solvent by filtering but can be separated by evaporation. Uses scientific vocabulary such as "soluble", "insoluble", "dissolve" and "solution" in context. Relates findings of practical investigations about dissolving to everyday experiences, for example, recycling, salt production and water purification.
	c	Explores the factors which affect floating, for example, the object's shape and the density of the material that the object is made of, and collates, organises and summarises findings with assistance.	c	Finds an association between the quantity of substance that dissolves and a range of conditions – temperature, time, particle size, stirring and quantity of solvent. Investigates how a range of factors such as particle size and heat can affect the rate of dissolving. Relates learning about the quantity and rate of dissolving to everyday examples such as dissolving sugar in tea or salt in water (granules or big crystals, hot or cold liquid, stirred or not stirred).
	d	Designs and builds a variety of electrical circuits for differing purposes, using an increasing range of components. Draws circuit diagrams using appropriate symbols to denote a bulb, switch, motor, bell, buzzer, wires, cell and a battery. Describes how components in a circuit transfer energy into different forms.	d	Analyses and compares samples of rocks, soil and minerals and reports their characteristics and uses, using a range of media.
	e	Applies knowledge and understanding to build simple batteries (chemical cells) and demonstrates understanding that a battery (cell) is a portable energy source which has a store of chemical energy. Explains the process of energy transformation from battery (cell) to electrical components.	e	Uses knowledge of the water cycle to explain how the quantity of water on the Earth has remained approximately the same. Investigates and discusses the methods used to purify water, for example, sedimentation, filtration, evaporation, desalination and the addition of chemicals such as chlorine. Researches methods used to conserve water within the home, school and globally and communicates findings to others. Discusses the many uses of water, for example, to support all living things, in preservation (ice) and to generate electricity.

	f	Discusses and demonstrates through experiments how sound travels differently through air, water and solids. Explains how hearing is limited by a range of factors, for example, age, position, and flexibility (direction) of ears.	f	Collaborates with others to safely demonstrate simple chemical reactions, for example, effervescence. Investigates examples of everyday chemical reactions, such as burning and corrosion, and names some of the new substances which are produced. Uses prior knowledge to identify when a chemical reaction has occurred to produce a new substance.
	g	Demonstrates and records, through practical investigations, that light travels in straight lines, can be reflected by highly-polished surfaces and that curved faces can distort the image. Predicts and investigates how the position, shape and size of a shadow depend on the position of the object in relation to the light source. Demonstrates that white light/sunlight can be dispersed to show the colours of the visible spectrum and identifies the colours and order of the rainbow as red, orange, yellow, green, blue, indigo and violet. Explains that we see objects because they give out or reflect light rays that enter our eyes. Draws on findings from practical investigations to describe the effect that coloured filters have on white light and how they can be used to make other colours. Explains how we can recognise the colour of an object due the reflection and absorption of particular parts of the visible spectrum.		

Skills (Cross Cutting across all Experiences and Outcomes)				
	Inquiry and investigative skills	**Scientific analytical thinking skills**	**Skills and attributes of scientifically literate citizens**	**Topical Sciences**
National Benchmarks	Plans and designs scientific investigations and enquiries Formulates questions and predictions (hypotheses), with assistance, based on observations and information. Identifies the independent, dependent and controlled variables, with assistance. Anticipates some risks and hazards. Carries out practical activities in a variety of learning environments Applies appropriate safety measures. Contributes to carrying out all the procedures. Makes observations and collects information and measurements using appropriate devices and units. Manages identified controlled variables to ensure validity of results. Analyses, interprets and evaluates scientific findings Selects appropriate methods to record data/information. Identifies relationships between the independent and dependent variables. Makes links to original questions or predictions. Relates findings to the wider world. Draws basic conclusions consistent with findings. Identifies and discusses additional knowledge and understanding gained. Recognises anomalous results and suggests possible sources of error. Evaluates the investigation and suggests one way of improving it if it was to be repeated. Presents scientific findings Presents data/information by choosing from an extended range of tables, charts, diagrams, graphs, including bar graphs and line graphs. Reports collaboratively and individually using a range of methods. Collates, organises and summarises findings, with assistance, using headings or questions to provide structure for presentations. Uses appropriate scientific vocabulary and acknowledges sources, with assistance.	Applies scientific analytical thinking skills, with assistance, working with less familiar (or familiar but more complex) contexts. Applies understanding, and a combination of more than one science concept, to solve problems and provide solutions. Demonstrates further development of creative thinking including through the engineering processes of design, construction, testing and modification.	Presents a reasoned argument based on evidence, demonstrating understanding of underlying scientific concepts, and engages with the views of others. Demonstrates understanding of the relevance of science to their future lives and the role of science in an increasing range of careers and occupations. Demonstrates increased awareness of creativity and inventiveness in science, the use of technologies in the development of sciences and the impact of science on society. Expresses informed views about scientific and environmental issues based on evidence.	I can research historic and contemporary scientists (ensuring gender balance) and their scientific discoveries and reports collaboratively to others using a range of methods. I can describe the impact of scientific discovery, creativity and invention on society past and present, for example, in design, medicine and agriculture. I can demonstrate understanding of how science impacts on every aspect of our lives. I can relate the development of scientific skills in the classroom to an increasingly wide variety of science, technology, engineering and mathematics (STEM) careers. I can explore items of current scientific interest within the school, local community, nationally or in the global media and collates, organises and summarises findings, with assistance. I can hare opinions about a variety of topical scientific issues considering, for example, moral, ethical, societal, cultural, economic and environmental aspects.