

Progression Document

Subject: Science

Pre-school - Reception

Plants:

- Noticing plants
- observing roots and colours.
- Planting and growing vegetables.

Animals and humans:

- Explore stories on animals.
- Naming features of animals and sounds they make.
- Comparing bones of different animals
- How the body changes during exercise
- What do humans look like?
- Healthy eating

Everyday Materials:

- Waterproof clothes for the mud kitchen area
- Woodwork - Vocab - strong/straight

Seasons:

- Different weather - picking up parts of plants. Observing the texture, colour.

Rocks:

- Sorting rocks into shiny, smooth etc.

Light:

- To know about day and night
- To know about light and dark / sun and moon
- Observe rainbows
- Use torch
- Shadow drawings

Force:

- Use magnets
- Explore accidental force such as repelling of opposite poles. Push and pull

Electricity:

- Functions of a battery, light bulb and a switch
- Earth & Space: knowing there is an outer world. Exploring rockets and reading around the outerworld - (Aliens Love Underpants)

States of Matter:

- Things freeze when it is cold
- Things melt when it is hot.
- Changes in a snowman.

Year group	Progression of skills	Progression in knowledge	Key vocabulary and essential experiences
Pre-school	<ul style="list-style-type: none"> •Exploring small world models •Noticing features of objects in their environment. •Investigate the natural world 	<p>Children should learn to:</p> <ul style="list-style-type: none"> •Enjoys playing with small-world models such as a farm, a garage, or a train track. •Notices detailed features of objects in their environment. <p>Adults should support by: Tell stories about places and journeys.</p> <p>What adults could provide:</p> <ul style="list-style-type: none"> •Make use of outdoor areas to give opportunities for investigations of the natural world, for example, provide chimes, streamers, windmills and bubbles to investigate the effects of wind. •Provide story and information books about places, such as a zoo or the beach, to remind children of visits to real places. 	<p>Key vocabulary Farm, house, train, train station, journey, noise, sound, zoo, beach, wind, sun, rain, snow</p> <p>Essential experiences</p> <p>Hobble Down</p>
Nursery	<ul style="list-style-type: none"> •Comments and asks questions about their familiar world. • observe familiar worlds. •Discuss observations •Talks about why things happen and how things work. •Explore natural world 	<p>Children should learn to:</p> <ul style="list-style-type: none"> •Comments and asks questions about aspects of their familiar world such as the place where they live or the natural world. •Can talk about some of the things they have observed such as plants, animals, natural and found objects. •Developing an understanding of growth, decay and changes over time. •Shows care and concern for living things and the environment 	<p>Key vocabulary Grow, shrink, plant, animal, changes, time, natural features, vegetables, fruit, flower, tree, chick, baby</p>

	<p>•Create own environments with play maps and small world equipment.</p> <p>Observing Comparing Classifying Measuring Communicating Inferring Predicting Measuring</p>	<p>Adults should support by:</p> <ul style="list-style-type: none"> •Use parents' knowledge to extend children's experiences of the world. •Support children with sensory impairment by providing supplementary experience and information to enhance their learning about the world around them. •Arouse awareness of features of the environment in the setting and immediate local area, e.g. make visits to shops or a park. • Introduce vocabulary to enable children to talk about their observations and to ask questions. <p>What adults could provide:</p> <ul style="list-style-type: none"> •Use the local area for exploring both the built and the natural environment. •Provide opportunities to observe things closely through a variety of means, including magnifiers and photographs. •Provide play maps and small world equipment for children to create their own environments. •Teach skills and knowledge in the context of practical activities, e.g. learning about the characteristics of liquids and solids by involving children in melting chocolate or cooking eggs. 	<p>Essential experiences Farm to come in Chicks Growing vegetables</p>
Reception	<p>https://foundationyears.org.uk/files/2012/03/Development-Matters-FINAL-PRINT-AMENDED.pdf p39</p> <p>https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/596629/EYFS_STATUTORY_FRAMEWORK_2017.pdf</p> <p>•Observe similarities, differences, patterns and change.</p>	<p>Early Learning Goal:</p> <ul style="list-style-type: none"> •Children know about similarities and differences in relation to places, objects, materials and living things. •Talk about the features of their own immediate environment and how environments might vary from one another. •Make observations of animals and plants and explain why some things occur, and talk about changes. <p>Adults should support by:</p> <ul style="list-style-type: none"> •Help children to notice and discuss patterns around them, e.g. rubbings from grates, covers, or bricks. •Examine change over time, for example, growing plants, and change that may be reversed, e.g. melting ice. •Use appropriate words, e.g. 'town', 'village', 'road', 'path', 'house', 'flat', 	<p>Key vocabulary- sink,float , weather,sunny,rainy, windy,snowy,hot,war m,cold</p> <p>Essential experiences- Water play- finding objects that sink or float Weather-</p>

	<ul style="list-style-type: none"> •Observe animals and plants Examine change over time •Discuss features of their own immediate environment notice and discuss patterns around them, e.g. rubbings from grates, covers, or bricks. Recycling •examining photographs and simple maps •Conversing with people express opinions on natural and built environments •hear different points of view on the quality of the environment. •Answer questions such as: “How can we...?” or “What would happen if...?” •record findings by, e.g. drawing, writing, making a model or photographing. •create simple maps and plans, paintings, drawings and model 	<p>‘temple’ and ‘synagogue’, to help children make distinctions in their observations.</p> <ul style="list-style-type: none"> •Help children to find out about the environment by talking to people, examining photographs and simple maps and visiting local places. •Encourage children to express opinions on natural and built environments and give opportunities for them to hear different points of view on the quality of the environment. •Encourage the use of words that help children to express opinions, e.g. ‘busy’, ‘quiet’ and ‘pollution’. •Use correct terms so that, e.g. children will enjoy naming a chrysalis if the practitioner uses its correct name. •Pose carefully framed open-ended questions, such as “How can we...?” or “What would happen if...?”. <p>What adults could provide:</p> <ul style="list-style-type: none"> •Give opportunities to record findings by, e.g. drawing, writing, making a model or photographing. •Provide stories that help children to make sense of different environments. •Provide stimuli and resources for children to create simple maps and plans, paintings, drawings and models of observations of known and imaginary landscapes. •Give opportunities to design practical, attractive environments, for example, taking care of the flowerbeds or organising equipment outdoors. 	<p>Make wind chimes to work out the direction of the wind; Make a rainwater collector (eg out of a plastic bottle with the top cut off) to measure rainfall.</p> <p>Testing suitability of different materials for a purpose e.g. 3 little pig’s houses, bridge etc....</p>
Year 1	<p>In year 1 we develop working scientifically through;</p> <p>asking simple questions and recognising that they can be</p>	<p>Plants</p>	<p><u>Vocabulary</u></p> <p>Plants-Seed,Stem Roots Petals bud Leaves Fruit</p>

	<p>answered in different ways</p> <p>observing closely, using simple equipment</p> <p>performing simple tests</p> <p>identifying and classifying</p> <p>gathering and recording data to help in answering questions</p> <p>Plants working scientifically- explore and answer questions about plants growing in their habitat. Observe the growth of flowers and vegetables that they have planted.</p>	<p>identify and name a variety of common wild and garden plants, including deciduous and evergreen trees (daffodils,pansy, roses, bluebells, oak tree, yew tree, holly bush)</p> <p>identify and describe the basic structure of a variety of common flowering plants, including trees(daffodils, roses, oak tree)</p> <p>They should become familiar plant structures (including leaves, flowers (blossom), petals, fruit, roots, bulb, seed, trunk, branches, stem).</p> <p>Animals, including humans identify and name a variety of common animals including fish (shark, know that dolphins and whales are not fish), amphibians (frog, toad), reptiles (snake, lizard), birds (pigeon, eagle) and mammals (rabbit, bear)</p> <p>identify and name a variety of common animals that are carnivores (lion, tiger), herbivores (frogs,horse, rabbit) and omnivores (fox, dogs, bears,</p>	<p>Nutrients Soil Grow Sunlight Water Edible Food Compost Spade Watering can Trowel Fork Evergreen, deciduous, evergreen, trunk, branchesMaths link:Tall Tallest Taller</p> <p>Animals including humans- Carnivore OmnivoreHerbivoreHabitatPrey Predator SensesTaste - tongue Smell - noseHear - earsFeel - skinVision - eyesBalanced diet, carbohydrate, protein, dairy, fat, sugar, vitamins and minerals, Healthy, unhealthy exercise</p>
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	<p>Use magnifying glasses to observe and then compare and contrast familiar plants (e.g. daffodils and</p> <p>Drawing diagrams showing the parts of different plants including trees. Keep records of how plants have changed over time, for example, the leaves falling off trees and buds opening (blossom trees, oak trees)</p> <p>Animals including humans-compare and contrast animals at first hand or through videos and photographs, describing how they identify and group them (fish, reptiles, mammals,birds, insects); grouping animals according to what they eat; and using their</p>	<p>humans)</p> <p>describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals including pets)</p> <p>identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense (learn the names of the main body parts (including head, neck, arms, elbows, legs, knees, face, ears, eyes, hair, mouth, teeth) through games, actions, songs and rhymes)</p> <p>Everyday materials</p> <p>distinguish between an object and the material from which it is made</p> <p>identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock</p> <p>describe the simple physical properties of a variety of everyday materials</p>	<p>Skeleton, ribs, pelvis, spine, skull Body parts head, neck, elbow, eye lashes, shoulder, back, throat, arm pit, hips, thighs, calf, nails, Fish Amphibians Reptiles Birds Mammals</p> <p>Materials- Flexible, Transparent, Strong, Stretch, Soft, Hard, Rough, Smooth Opaque Absorbent, Waterpro of, Metal, Plastic, Stone, Glass, Fabric, Paper, Leather, Rubber</p> <p>Seasonal changes-</p>
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senses to compare different textures, sounds and smells.

Everyday materials- simple tests to explore questions about suitability of materials, for example: 'What is the best material for an umbrella?

Seasonal changes: making tables and charts about the weather; and making displays of what happens in the world around them, including day length, as the seasons change.

(wood, plastic, glass, metal, water, and rock)

compare and group together a variety of everyday materials on the basis of their simple physical properties. (wood, plastic, glass, metal, water, and rock)

Seasonal changes

observe changes across the 4 seasons

observe and describe weather associated with the seasons and how day length varies

Safety- pupils should be warned that it is not safe to look directly at the sun, even when wearing dark glasses.

Spring

Summer
Autumn
Winter
Changes
Cloud
Snow
Lightening
Storm
Fog
Rain
Rainbow
Wind
Blossom
Hatch
Flowering
Holiday
Harvest
Icicles
snowflakes

Examples of key scientists-
Marie Curie,
modern zoologists

Essential experiences

Planting vegetables

			<p>Visiting a forest (Alice Holt?)</p> <p>Zoo coming in</p>
Year 2	<p>In year 2 we develop working scientifically through;</p> <p>asking simple questions and recognising that they can be answered in different ways</p> <p>observing closely, using simple equipment</p>	<p>Living things and their habitats</p> <p>explore and compare the differences between things that are living, dead, and things that have never been alive(fire, trees, animals, plants, dinosaur)</p> <p>identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other (e.g.</p>	<p>Vocabulary</p> <p>Living things and their habitats- Living, alive, used to live, dead, never alive, habitat, food, food chain, predator, prey, food, shelter, consumer, producer, Carnivore,omnivore, herbivore,</p> <p>Plants- Air, light, water, nutrients, warmth, leaf, stem, root, flower, fruit, seeds, petals, grow, soil.</p> <p>Animals including</p>

	<p>performing simple tests</p> <p>identifying and classifying</p> <p>using their observations and ideas to suggest answers to questions</p> <p>gathering and recording data to help in answering questions</p> <p>Living things and their habitats sorting and classifying things according to whether they are living, dead or were never alive, and recording their findings using charts. Explore the questions 'Is a flame alive? Is a deciduous tree dead in winter?' Construct a simple food chain that includes humans (eg, grass, cow,</p>	<p>polar bears and the arctic, scorpions and the desert)</p> <p>identify and name a variety of plants and animals in their habitats, including microhabitats (spiders, squirrels, polar bears, lizards/snakes)</p> <p>describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food</p> <p>Plants</p> <p>observe and describe how seeds and bulbs grow into mature plants (cress, sunflowers)</p> <p>find out and describe how plants need water, light and a suitable temperature to grow and stay healthy</p> <p>Building on year 1 knowledge by being introduced to the requirements of plants for germination, growth and survival, as well as the processes of reproduction and growth in plants.</p>	<p>humans-Survival, water, air, food, shelter, balanced diet, carbohydrate, protein, dairy, fat, sugar, vitamins and minerals, healthy, unhealthy, exercise, fish, amphibian, reptiles, birds, mammals, offspring.</p> <p>Use of everyday materials- Twist, crush, tear, pull, scrunch, bend, stretch, absorbent, suitable, transparent, natural, man-made, metal, plastic, stone, glass, fabric, paper, leather, rubber.</p> <p>Examples of key scientists- John Dunlop Charles Macintosh John McAdam</p> <p>Kew gardens- female botanists https://www.kew.org/read-and-watch/2</p>
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human).

Describe the conditions in different habitats and microhabitats (under log, on stony path, under bushes); and find out how the conditions affect the number and type(s) of plants and animals that live there.

Plants - observe and record the growth of a variety of plants as they change over time from a seed or bulb

setting up a comparative test to show that plants need light and water to survive

Animals including humans - observe through video or first-hand observation and measurement, how different animals, including humans, grow; asking questions about what things animals need for survival and

Animals, including humans

notice that animals, including humans, have offspring which grow into adults

find out about and describe the basic needs of animals, including humans, for survival (water, food and air)

describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene

Building on year 1 knowledge by; basic needs of animals for survival, as well as the importance of exercise and nutrition for humans.

introduced to the processes of reproduction and growth in animals- should not be expected to understand how reproduction occurs.

Uses of everyday materials

identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for

[50-years-women-in-botany](#)

Essential experiences-
Local area insect hunt and study

what humans need to stay healthy;

Uses of everyday materials-

comparing the uses of everyday materials in and around the school with materials found in other places (at home, the journey to school, on visits, and in stories, rhymes and songs); **observing closely**, identifying and classifying the uses of different materials, and **recording their observations**

particular uses

find out how the shapes of solid objects made from some materials(sponges etc) can be changed by squashing, bending, twisting and stretching

Building upon year 1 knowledge by:

identify and discuss the uses of different everyday materials so that they become familiar with how some materials are used for more than one thing or different materials are used for the same thing

Properties of materials that make them suitable or unsuitable for particular purposes and they should be encouraged to think about unusual and creative uses for everyday materials.

Research people who have developed useful new materials, for example **John Dunlop, Charles Macintosh or John McAdam.**

At the end of KS1 pupils should be able to talk about the topics of plants, animals including humans, everyday materials, seasonal changes, living things

and their habitats and uses of everyday materials. They should have developed their working scientifically skills so that they are able to:

- Ask questions using scientific vocabulary
- Carry out a simple test
- Be able to observe and record these findings through diagrams

In biology, pupils should be able to discuss the basic needs of animals and be able to compare diets and exercise focusing on the health benefits. Pupils should be able to talk about a variety of different living things and be able to name things that are living, dead or have never been alive.

In physics pupils should be able to give some real life examples of practical uses of materials e.g. plastic to waterproof.

In chemistry pupils should be able to name solids which are made of materials that can be changed by squashing, bending, twisting and stretching.

Pupils will begin to be aware of the job opportunities in science e.g. zoologist.

Year 3

In year 3 we develop our scientific skills by:

asking relevant questions and using different types of scientific enquiries to answer them setting up simple practical enquiries, comparative and fair tests making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers gathering, recording, classifying and presenting data in a variety of ways to help in answering questions recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables reporting on findings from enquiries, including oral and written explanations, displays or

Plants

identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers

explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant (cactus vs cress/sunflower)

investigate the way in which water is transported within plants

explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal

Building upon year 2 knowledge by- relationship between structure and function: the idea that every part has a job to do.

Vocabulary

Plants-

Function, nutrients, lifecycle, pollination, seed formation, seed dispersal

Animals including

humans- nutrition, carbohydrates, fats and oils, sugars, fruit and vegetables, protein, dairy, muscles, joints, cranium, fibula, tibia, pelvis, scapula, ribcage, hinge joint, socket and ball

Rocks-

fossils, metamorphic, sedimentary, igneous, organic, sediment, erosion

Light- reflection, opaque, shadow, source

Forces and

magnets- attract, repel, friction, north

	<p>presentations of results and conclusions using straightforward scientific evidence to answer questions or to support their findings.</p> <p>Plants - fair testing- comparing the effect of different factors on plant growth e.g. light</p> <p>Discovering how seeds are formed by observing the different stages of plant life cycles over a period of time;</p> <p>Observe how water is transported in plants- putting cut, white carnations into coloured water and observing how water travels up the stem to the flowers.</p> <p>Animals including humans- identifying and grouping animals with and without skeletons (jellyfish,</p>	<p>introduced to the idea that plants can make their own food, but at this stage they do not need to understand how this happens.</p> <p>Animals, including humans</p> <p>identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat</p> <p>identify that humans and some other animals have skeletons and muscles for support, protection and movement</p> <p>Building on year 2 knowledge by: importance of nutrition and should be introduced to the main body parts associated with the skeleton and muscles, finding out how different parts of the body have special functions.</p> <p>Rocks</p> <p>compare and group together different kinds of rocks on the basis of their appearance and simple physical properties (limestone, marble, chalk,</p>	<p>pole, south pole</p> <p>Examples of key scientists- Rosalind Franklin- x ray scientist, Mary Anning</p> <p>Essential experiences-rocks and soils (forest school)</p> <p>Holly lodge</p>
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worms, dogs, cats)

Compare and contrast the diets of different animals

Research different food groups and how they keep us healthy, and design meals based on what they find out.

Rocks- observe rocks, including those used in buildings and gravestones, and exploring how and why they might have changed over time;

Use a hand lens or microscope to help them to identify and classify rocks according to whether they have grains or crystals,

Explore different soils and identify

granite, slate)

describe in simple terms how fossils are formed when things that have lived are trapped within rock

recognise that soils are made from rocks and organic matter

Light

recognise that they need light in order to see things and that dark is the absence of light

notice that light is reflected from surfaces

recognise that light from the sun can be dangerous and that there are ways to protect their eyes

similarities and differences between them

Investigate what happens when rocks are rubbed together or what changes occur when they are in water.

Light - pattern seeking- what happens to shadows when the light source moves or the distance between the light source and the object changes.

Measure shadows, and explore what might cause the shadows to change.

Magnets and forces - Fair testing- find out how far things move on different surfaces, and gathering and

recognise that shadows are formed when the light from a light source is blocked by an opaque object

find patterns in the way that the size of shadows change

Building on prior knowledge by; explore what happens when light reflects off a mirror or other reflective surfaces, including playing mirror games to help them to answer questions about how light behaves. Think about **why** it is important to protect their eyes from bright lights.

Forces and magnets

compare how things move on different surfaces

notice that some forces need contact between 2 objects, but magnetic forces can act at a distance

observe how magnets attract or repel each other and attract some

	<p>recording data</p> <p>Explore the strengths of different magnets, sort materials into those that are magnetic and those that are not</p>	<p>materials and not others</p> <p>compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials</p> <p>describe magnets as having 2 poles</p> <p>predict whether 2 magnets will attract or repel each other, depending on which poles are facing</p>	
Year 4	<p>In year 4 we develop our scientific skills by:</p> <p>asking relevant questions and using different types of scientific enquiries to answer them setting up simple</p>	<p>Living things and their habitats</p> <p>recognise that living things can be grouped in a variety of ways (diet of living thing, physical features, where they live)</p>	<p>Vocabulary</p> <p>Living things and their habitat- classification key, environment, climate change, population, o-zone, deforestation, ecology</p> <p>Animals including humans- digestive</p>

	<p>practical enquiries, comparative and fair tests making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers gathering, recording, classifying and presenting data in a variety of ways to help in answering questions recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions identifying differences, similarities or changes related to simple scientific ideas and processes using straightforward scientific evidence to answer questions or to</p>	<p>explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment (insects, small mammals, birds)</p> <p>recognise that environments can change and that this can sometimes pose dangers to living things (pollution, climate change)</p> <p>Building on year 2 knowledge by; Explore examples of human impact (both positive and negative) on environments, for example, the positive effects of nature reserves, ecologically planned parks, or garden ponds, and the negative effects of population and development, litter or deforestation.</p> <p>Animals, including humans</p> <p>describe the simple functions of the basic parts of the digestive system in humans</p> <p>identify the different types of teeth in humans and their simple functions</p>	<p>system, oesophagus, small and large intestine, canine, incisor, molar, wisdom tooth, producer, predator, prey</p> <p>States of matter- solid, liquid, gas, particles, evaporation, condensation</p> <p>Sound- vibration, pitch, volume, source,</p> <p>Electricity- circuit, appliance, cells, wires, bulbs, switches, buzzer, conductor, insulator</p> <p>Examples of key scientists- Modern scientists:</p> <p>https://www.greatscienceshare.org/living-things-and-their-habitats</p>
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support their findings.

Living things and their habitats -
use and make simple guides or keys to explore and identify local plants and animals; making a guide to local living things; raising and answering questions based on their observations of animals and what they have found out about other animals that they have researched.

Animals including humans-
comparing the teeth of carnivores and herbivores and suggesting reasons for differences; finding out what damages teeth and how to look after them. Draw and discuss their ideas about the digestive system and compare them with models or images.

States of matter- grouping and

construct and interpret a variety of food chains, identifying producers, predators and prey

Building on year 3 knowledge by; introduced to the main body parts associated with the digestive system, for example: mouth, tongue, teeth, oesophagus, stomach, and small and large intestine, and explore questions that help them to understand their special functions.

States of matter

compare and group materials together, according to whether they are solids, liquids or gases

observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C)

identify the part played by evaporation and condensation in the water

Miller Reese Hutchison- inventor of the hearing aid

Essential experiences-
science museum (natural disasters)

Visitor- dental nurse

classifying a variety of different materials; exploring the effect of temperature on substances such as chocolate, butter, cream (for example, to make food such as chocolate crispy cakes and ice-cream for a party). **Research the temperature at which materials change state, for example, when iron melts or when oxygen condenses into a liquid.** Observe and record evaporation over a period of time, for example, a puddle in the playground or washing on a line, and investigate the effect of temperature on washing drying.

Sound - find patterns in the sounds that are made by different objects such as saucepan lids of different sizes or elastic bands of different thicknesses. Make earmuffs from a variety of different materials to investigate which provides the best insulation against sound. Make and

cycle and associate the rate of evaporation with temperature

Building on year 2 knowledge by- develop simple descriptions of the states of matter (solids hold their shape; liquids form a pool not a pile; gases escape from an unsealed container). Pupils should observe water as a solid, a liquid and a gas and should note the changes to water when it is heated or cooled.

Sound

identify how sounds are made, associating some of them with something vibrating

recognise that vibrations from sounds travel through a medium to the ear

find patterns between the pitch of a sound and features of the object that produced it

find patterns between the volume of a sound and the strength of the

play their own instruments by using what they have found out about pitch and volume. Explore and identify the way sound is made through vibration in a range of different musical instruments from around the world.

Electricity - observing patterns- that bulbs get brighter if more cells are added, that metals tend to be conductors of electricity, and that some materials can and some cannot be used to connect across a gap in a circuit.

vibrations that produced it

recognise that sounds get fainter as the distance from the sound source increase

Electricity

identify common appliances that run on electricity (kitchen appliances, T.V., lights)

construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers

identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery

recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit

recognise some common conductors and insulators, and associate metals with being good conductors

construct simple series circuits, trying different components, for example, bulbs, buzzers and motors, and including switches, and use their circuits to create simple devices. Pupils should draw the circuit as a pictorial representation, **not necessarily using conventional circuit symbols at this stage; these will be introduced in year 6.**

At the end of LKS2 pupils have broadened their scientific view of the world around them. Pupils will be able to explore and discuss the following topics; Plants, animals including humans, rocks, light, sound, forces and magnets, living things and their habitats, states of matter and electricity. Pupils will have developed their scientific skills so that they are able to make decisions about which type of scientific enquiry is best suited to the question that they want to test. At this point in pupils' learning journeys, they should be able to begin to draw simple conclusions applying some scientific vocabulary. In biology, pupils should be able to describe how we as humans hear and explain the importance of a skeleton.

In physics pupils should be able to identify electrical conductors and insulators and be able to construct a simple electrical circuit including a switch.
 In chemistry pupils should be able to carry out a simple investigation into changing states of materials.
 Pupils will have been taught about key scientists and will have started to learn about modern day scientists and how they shape the world that we live in.

<p>Year 5</p>	<p>In year 5 we develop our working scientifically skills by: planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree</p>	<p>Living things and their habitats</p> <p>describe the differences in the life cycles of a mammal, an amphibian (frog) , an insect (butterfly) and a bird</p> <p>describe the life process of reproduction in some plants and animals</p> <p>Building on year 4 knowledge by- study and raise questions about their local environment throughout the year. Observe life-cycle changes in a variety of living things, for example, plants in the vegetable garden or flower border, and animals in the local environment. find out about the work of naturalists and animal behaviourists, for example, David Attenborough and Jane Goodall. Find out about different types of reproduction, including sexual and</p>	<p>Vocabulary</p> <p>Living things and their habitats-reproduction, sexual, asexual</p> <p>Animals including humans- puberty</p> <p>Properties and changes of materials- solubility, transparency, conductivity (electrical and thermal), dissolve, solution, filtering, evaporating</p> <p>Earth and space- solar system, planet, celestial body, dwarf planet, orbit, geocentric, heliocentric, gravity</p>
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of trust in results, in oral and written forms such as displays and other presentations

Living things and their habitats- observe and compare the life cycles of plants and animals in their local environment with other plants and animals around the world (in the rainforest, in the oceans, in desert areas and in prehistoric times), Grow new plants from different parts of the parent plant, for example, seeds, stem and root cuttings, tubers, bulbs. Observe changes in an animal over a period of time (for example, by hatching and rearing chicks), compare how different animals reproduce and grow.

Animals including humans- research the gestation periods of other animals and compare them with humans; find out and record the length and mass of a baby as it

asexual reproduction in plants, and sexual reproduction in animals.

Animals, including humans

describe the changes as humans develop to old age

Building on year 4 knowledge by- draw a timeline to indicate stages in the growth and development of humans. They should learn about the changes experienced in puberty.

Properties and changes of materials

compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets

know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution

use knowledge of solids, liquids and gases to decide how mixtures might

Forces- gravity, air resistance, water resistance, friction, mechanism

Examples of key scientists-
NASA cosmotologists, **Jane Goodall**, **Spencer Silver**, who invented the glue for sticky notes, **Ruth Benerito**, who invented wrinkle-free cotton.

Essential experiences- science museum or planetarium (space)

grows.

Properties and changes of materials - carry out tests to answer questions, for example, 'Which materials would be the most effective for making a warm jacket, for wrapping ice cream to stop it melting, or for making blackout curtains?'

Compare materials in order to make a switch in a circuit. Observe and compare the changes that take place, for example, when burning different materials or baking bread or cakes. Research and discuss how chemical changes have an impact on our lives, for example, cooking, and discuss the creative use of new materials such as polymers, super-sticky and super-thin materials.

Earth and space- compare the time of day at different places on the Earth through internet links and direct communication; create simple models

be separated, including through filtering, sieving and evaporating

give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic

demonstrate that dissolving, mixing and changes of state are reversible changes

explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda

Building on year 4 knowledge by- systematic understanding of materials by exploring and comparing the properties of a broad range of materials, including relating these to what they learnt about magnetism in year 3 and about electricity in year 4. Explore reversible changes, including evaporating, filtering, sieving, melting and dissolving, recognising that melting and dissolving are different processes. Explore changes that are difficult to reverse, for example, burning, rusting and other reactions, for example, vinegar with bicarbonate of soda. Find out about how chemists create new

of the solar system; construct simple shadow clocks and sundials, calibrated to show midday and the start and end of the school day; find out why some people think that structures such as Stonehenge might have been used as astronomical clocks.

Forces- explore falling paper cones or cupcake cases, and design and make a variety of parachutes and carry out fair tests to determine which designs are the most effective.

Explore resistance in water by making and testing boats of different shapes. Design and make products that use levers, pulleys, gears and/or springs and explore their effects.

materials, for example, **Spencer Silver**, who invented the glue for sticky notes or **Ruth Benerito**, who invented wrinkle-free cotton.

Earth and space

describe the movement of the Earth and other planets relative to the sun in the solar system

describe the movement of the moon relative to the Earth

describe the sun, Earth and moon as approximately spherical bodies

use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky

Essential knowledge-

Introduced to a model of the sun and Earth that enables them to explain day and night. Pupils should learn that the sun is a star at the centre of our solar system and that it has 8 planets: Mercury, Venus, Earth, Mars,

Jupiter, Saturn, Uranus and Neptune (Pluto was reclassified as a 'dwarf planet' in 2006). They should understand that a moon is a celestial body that orbits a planet (Earth has 1 moon; Jupiter has 4 large moons and numerous smaller ones). Find out about the way that ideas about the solar system have developed, understanding how the geocentric model of the solar system gave way to the heliocentric model by considering the work of scientists such as **Ptolemy, Alhazen and Copernicus.**

Forces explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object

identify the effects of air resistance, water resistance and friction, that act between moving surfaces

recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect

Building on year 3 knowledge by- explore falling objects and raise questions about the effects of air resistance. Explore the effects of air resistance by observing how different objects such as parachutes and sycamore seeds fall. Experience forces that make things begin to move, get faster or slow down. Explore the effects

		<p>of friction on movement and find out how it slows or stops moving objects, for example, by observing the effects of a brake on a bicycle wheel. Explore the effects of levers, pulleys and simple machines on movement. Find out how scientists, for example, Galileo Galilei and Isaac Newton helped to develop the theory of gravitation.</p>	
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Year 6

In year 6 we develop our working scientifically skills by: planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs using test results to make predictions to set up further comparative and fair tests reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and

Living things and their habitats

describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals

give reasons for classifying plants and animals based on specific characteristics

Building on year 4 knowledge by- looking at the classification system in more detail. Introduced to the idea that broad groupings, such as micro-organisms, plants and animals can be subdivided. Through direct observations where possible, they should classify animals into commonly found invertebrates (such as insects, spiders, snails, worms) and vertebrates (fish, amphibians, reptiles, birds and mammals). Discuss reasons why living things are placed in one group and not another. Find out about the significance of the

Vocabulary-

Living things and their habitats- microorganism,

Animals including humans- circulatory system, blood vessels

Evolution and inheritance- inherited, adaptation, genes, chromosomes, variation

Light- retina, cones and rods, cornea, optic nerve, iris, pupil dilation, refraction, absorption,

Electricity- circuits, buzzer, cell, wire, bulb, switch, motor, current, voltage, wattage, conductor, insulator

Examples of key scientists- Charles

other presentations identifying scientific evidence that has been used to support or refute ideas or arguments

Living things and their habitats - use classification systems and keys to identify some animals and plants in the immediate environment.

Research unfamiliar animals and plants from a broad range of other habitats and decide where they belong in the classification system.

Animals including humans - explore the work of scientists and scientific research about the relationship between diet, exercise, drugs, lifestyle and health.

Evolution and inheritance- observe and raise questions about local animals and how they are adapted to their environment; comparing how some living things are adapted to

work of scientists such as Carl Linnaeus, a pioneer of classification.

Animals including humans

identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood

recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function

describe the ways in which nutrients and water are transported within animals, including humans

Build on year 3 and 4 knowledge by- build on their learning about the main body parts and internal organs (skeletal, muscular and digestive system) to explore and answer questions that help them to understand how the circulatory system enables the body to function. Learn how to keep their bodies healthy and how their bodies might be damaged – including how some drugs and other substances can be harmful to the human body.

Darwin, Alfred Wallace, Patricia Bath, Galileo Galilei, Isaac Newton.

Essential experiences-

STEM workshop

survive in extreme conditions, for example, cactuses, penguins and camels. Analyse the advantages and disadvantages of specific adaptations, such as being on 2 feet rather than 4, having a long or a short beak, having gills or lungs, tendrils on climbing plants, brightly coloured and scented flowers.

Light - decide where to place rear-view mirrors on cars; design and make a periscope and use the idea that light appears to travel in straight lines to explain how it works.

Investigate the relationship between light sources, objects and shadows by using shadow puppets. Extend their experience of light by looking a range of phenomena including rainbows, colours on soap bubbles, objects looking bent in water, and coloured filters (they do not need to explain why these phenomena

Evolution and inheritance

recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago

recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents (selective breeding in dogs and cats)

identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution (monkeys, reptiles)

Building on knowledge of rocks(fossils) in year 3- find out more about how living things on earth have changed over time.

Introduced to the idea that characteristics are passed from parents to their offspring, for instance by considering different breeds of dogs, and what happens when, for example, labradors are crossed with poodles. Know that variation in offspring over time can make animals more or less able to survive in particular environments, for

occur).

Electricity: identify the effect of changing one component at a time in a circuit; design and make a ww2 themed circuit.

example, by exploring how giraffes' necks got longer, or the development of insulating fur on the arctic fox. Find out about how **Charles Darwin and Alfred Wallace** developed their ideas on evolution.

Light

recognise that light appears to travel in straight lines

use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye

explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes

use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them

Building on year 3 knowledge by- exploring the way that light

behaves, including light sources, reflection and shadows.

Electricity

associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit

compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches

use recognised symbols when representing a simple circuit in a diagram

Building on year 4 knowledge by- construct simple series circuits, to help them to answer questions about what happens when they try different components, for example, switches, bulbs, buzzers and motors. Learn how to represent a simple circuit in a diagram using recognised symbols

At the end of UKS2 pupils have a deeper understanding of scientific phenomena and understand that scientific ideas can change and develop over time,

with some scientists proving or disproving ideas. At this stage of pupils' learning journeys, they should be able to spell, read and pronounce a range of scientific vocabulary correctly. Developing their scientific skills further, pupils should be able to present findings in a range of ways as well as using test results to make predictions and plan further tests and investigations. Pupils will be able to explore and discuss the following topics;
 Space, animals including humans, properties and changes of materials, light, forces, living things and their habitats, evolution and inheritance and electricity.

In biology, pupils should be able to describe how we as humans hear and explain the importance of a skeleton.

In chemistry, pupils should be able to

In physics, pupils should be able to

Pupils should be aware of the many job opportunities available in the field of science, know about key scientists and know how modern scientists have shaped the world we live in.

Year 7

Scientific attitudes

pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility

understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas,

Biology

Structure and function of living organisms

Cells and organisation cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope

the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and

	<p>together with the importance of publishing results and peer review</p> <p>evaluate risks</p> <p>Experimental skills and investigations</p> <p>ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience</p> <p>make predictions using scientific knowledge and understanding</p> <p>select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent</p>	<p>chloroplasts</p> <p>the similarities and differences between plant and animal cells</p> <p>the role of diffusion in the movement of materials in and between cells</p> <p>the structural adaptations of some unicellular organisms</p> <p>the hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms</p> <p>The skeletal and muscular systems</p> <p>the structure and functions of the human skeleton, to include support, protection, movement and making blood cells</p> <p>biomechanics – the interaction between skeleton and muscles, including the measurement of</p>
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	<p>and control variables</p> <p>use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety</p> <p>make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements</p> <p>apply sampling techniques</p> <p>Analysis and evaluation</p> <p>apply mathematical concepts and</p>	<p>force exerted by different muscles</p> <p>the function of muscles and examples of antagonistic muscles</p> <p>Nutrition and digestion</p> <p>the content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed</p> <p>calculations of energy requirements in a healthy daily diet</p> <p>the consequences of imbalances in the diet, including obesity, starvation and deficiency diseases</p> <p>the tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food (enzymes simply as biological catalysts)</p> <p>the importance of bacteria in the human digestive system</p>
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	<p>calculate results</p> <p>present observations and data using appropriate methods, including tables and graphs</p> <p>interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions</p> <p>present reasoned explanations, including explaining data in relation to predictions and hypotheses</p> <p>evaluate data, showing awareness of potential sources of random and systematic error</p> <p>identify further questions arising from</p>	<p>plants making carbohydrates in their leaves by photosynthesis and gaining mineral nutrients and water from the soil via their roots</p> <p>Gas exchange systems</p> <p>the structure and functions of the gas exchange system in humans, including adaptations to function</p> <p>the mechanism of breathing to move air in and out of the lungs, using a pressure model to explain the movement of gases, including simple measurements of lung volume</p> <p>the impact of exercise, asthma and smoking on the human gas exchange system</p> <p>the role of leaf stomata in gas exchange in plants</p> <p>Reproduction</p> <p>reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes,</p>
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	<p>their results</p> <p>Measurement</p> <p>understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature</p> <p>use and derive simple equations and carry out appropriate calculations</p> <p>undertake basic data analysis including simple statistical techniques</p>	<p>fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta</p> <p>reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms</p> <p>Health</p> <p>the effects of recreational drugs (including substance misuse) on behaviour, health and life processes</p> <p>Material cycles and energy Photosynthesis</p> <p>the reactants in, and products of, photosynthesis, and a word summary for photosynthesis</p> <p>the dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an</p>
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essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere

the adaptations of leaves for photosynthesis

Cellular respiration

aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life

a word summary for aerobic respiration

the process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respiration

the differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism

Interactions and interdependencies Relationships in an ecosystem

the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops

the importance of plant reproduction through insect pollination in human food security

how organisms affect, and are affected by, their environment, including the accumulation of toxic materials

Genetics and evolution Inheritance, chromosomes, DNA and genes

heredity as the process by which genetic information is transmitted from one generation to the next

a simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model

differences between species

the variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation

the variation between species and between individuals of the same species meaning some organisms compete more successfully, which can drive natural selection

changes in the environment which may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction

the importance of maintaining biodiversity and the use of gene banks to preserve hereditary material

Chemistry The particulate nature of matter

the properties of the different states of matter (solid, liquid and gas) in terms of the particle

model, including gas pressure

changes of state in terms of the particle model

Atoms, elements and compounds

a simple (Dalton) atomic model

differences between atoms, elements and compounds

chemical symbols and formulae for elements and compounds

conservation of mass changes of state and chemical reactions

Pure and impure substances

the concept of a pure substance mixtures, including dissolving diffusion in terms of the particle model simple techniques for separating mixtures: filtration, evaporation, distillation and

chromatography

the identification of pure substances

Chemical reactions

chemical reactions as the rearrangement of atoms

representing chemical reactions using formulae and using equations

combustion, thermal decomposition, oxidation and displacement reactions

defining acids and alkalis in terms of neutralisation reactions

the pH scale for measuring acidity/alkalinity; and indicators

reactions of acids with metals to produce a salt plus hydrogen
reactions of acids with alkalis to

produce a salt plus water

what catalysts do

Energetics

energy changes on changes of state (qualitative)

exothermic and endothermic chemical reactions (qualitative)

The periodic table

the varying physical and chemical properties of different elements

the principles underpinning the Mendeleev periodic table

the periodic table: periods and groups; metals and non-metals

how patterns in reactions can be predicted with reference to the periodic table

the properties of metals and non-metals

the chemical properties of metal and non-metal oxides with respect to acidity

Materials

the order of metals and carbon in the reactivity series

the use of carbon in obtaining metals from metal oxides

properties of ceramics, polymers and composites (qualitative)

Earth and atmosphere

the composition of the Earth

the structure of the Earth

the rock cycle and the formation of igneous, sedimentary and metamorphic rocks

Earth as a source of limited resources and the efficacy of recycling

the composition of the atmosphere

the production of carbon dioxide by human activity and the impact on climate

Physics Energy

Calculation of fuel uses and costs in the domestic context

comparing energy values of different foods (from labels) (kJ)

comparing power ratings of appliances in watts (W, kW)

comparing amounts of energy transferred (J, kJ, kW hour)

domestic fuel bills, fuel use and costs

fuels and energy resources

Energy changes and transfers

simple machines give bigger force but at the expense of smaller movement (and vice versa):
product of force and displacement unchanged

heating and thermal equilibrium: temperature difference between 2 objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such

transfers tending to reduce the temperature difference; use of insulators

other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels

Changes in systems

energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change

comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions

using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes

Motion and forces Describing motion

speed and the quantitative relationship between average speed, distance and time (speed = distance \div time)

the representation of a journey on a distance-time graph

relative motion: trains and cars passing one another

Forces

forces as pushes or pulls, arising from the interaction between 2 objects

using force arrows in diagrams, adding forces in 1 dimension, balanced and unbalanced forces

moment as the turning effect of a force

forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and

water

forces measured in newtons, measurements of stretch or compression as force is changed

force-extension linear relation; Hooke's Law as a special case

work done and energy changes on deformation

non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets, and forces due to static electricity

Pressure in fluids

atmospheric pressure, decreases with increase of height as weight of air above decreases with height

pressure in liquids, increasing with depth; upthrust effects, floating and sinking

pressure measured by ratio of force over area – acting normal to any surface

Balanced forces opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface

Forces and motion

forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only)

change depending on direction of force and its size

Waves Observed waves

waves on water as undulations which travel through water with transverse motion; these waves can be reflected, and add or cancel – superposition

Sound waves

frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound

sound needs a medium to travel, the speed of sound in air, in water, in solids

sound produced by vibrations of objects, in loudspeakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal

the auditory range of humans and animals

Energy and waves

pressure waves transferring energy; use for cleaning and physiotherapy by ultrasound; waves transferring information for conversion to electrical signals by microphone

Light waves

the similarities and differences between light waves and waves in matter

light waves travelling through a vacuum; speed of light

the transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface

use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye

light transferring energy from source to absorber, leading to chemical and electrical effects; photosensitive material in the retina and in cameras

colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection

Electricity and electromagnetism

Current electricity

electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge

potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current

differences in resistance between conducting and insulating components (quantitative)

Static electricity

separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects

the idea of electric field, forces acting across the space between objects not in contact

Magnetism

magnetic poles, attraction and repulsion

magnetic fields by plotting with compass, representation by field lines

Earth's magnetism, compass and navigation

the magnetic effect of a current, electromagnets, DC motors (principles only)

Matter Physical changes

conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving

similarities and differences, including density differences, between solids, liquids and gases

Brownian motion in gases

diffusion in liquids and gases driven by differences in concentration

the difference between chemical and physical changes

Particle model

the differences in arrangements, in motion and in closeness of particles explaining changes of state, shape and density; the anomaly of ice-water transition

atoms and molecules as particles

Energy in matter

changes with temperature in motion and spacing of particles

internal energy stored in materials

Space physics

gravity force, weight = mass x gravitational field strength (g), on Earth $g=10 \text{ N/kg}$, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and sun (qualitative only)

our sun as a star, other stars in our galaxy, other galaxies

the seasons and the Earth's tilt, day length at different times of year, in different hemispheres

the light year as a unit of astronomical distance