	NC POINTS	PRIOR KNOWLEDGE	SUBSTANTIVE (KNOW THAT …)	DISCIPLINARY (KNOW HOW TO …)	REQUIRED PRACTICAL(S)	LESSON BREAKDOWN	KEY VOCABULARY
MATTER Particle model	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. a simple (Dalton) atomic model differences between atoms, elements and compounds chemical symbols and formulae for elements and compounds diffusion in terms of the particle model similarities and differences, including density differences, between solids, liquids and gases 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 changes with temperature in motion and spacing of particles	**KS1** Identifying everyday materials (e.g. wood, plastic, glass) Compare the physical properties and uses of everyday materials **KS2** States of matter Observing changes of states Role of state changes in the water cycle	The arrangement of particles in solids, liquids and gases How the movement and arrangement of particles changes during state changes What diffusion is and why it is affected by temperature The difference between an element and a compound Chemical formulae tell you the type and number of atoms in a compound	**Domain 1** Write a hypothesis Carry out experiments with regard for health and safety Identify variables **Domain 2** Set up and use a Bunsen burner Use analogue thermometer to measure temperature Use measuring cylinder to measure volume Use SI units for temperature, volume and time Record data in a table **Domain 3** Plot a graph of temperature against time when axes are provided Draw a line of best fit **Domain 4** Use experimental data to support hypothesis Use experimental data to support explanation	Investigating the melting and boiling points of water Investigating how temperature affects the time taken for a cross to "disappear" using tea bags	1. Particle model 2. Properties of solids, liquids and gases 3. Changing state 4. Melting and boiling points 5. Melting and boiling points RP 6. Diffusion 7. Diffusion RP planning 8. Diffusion RP investigation 9. Diffusion RP graph drawing and conclusions 10. Brownian motion 11. Atoms, elements and compounds	arrangement particle atom solid boiling boiling point compound compressed condensing density element energy forces freezing gas liquid melting melting point
FORCES Contact and non-contact forces	forces as pushes or pulls, arising from the interaction between two objects using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces 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 non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity Upthrust effects, floating and sinking opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface 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 moment as the turning effect of a force	**KS1** Shape of solid objects can be changed by squashing, stretching, bending and twisting Some forces need contact between objects but magnetic forces work at a distance **KS2** Objects fall towards Earth due to gravity Identify the effects of air resistance, water resistance and friction Some mechanisms such as levers, pulleys and gears allow a smaller force to have a greater effect **KS3** Behaviour and arrangement of particles in solids and gases Carry out experimental procedures with regard for health and safety Identify variables Record data in a table Plot data on a graph when given the axes Use data to support conclusions	Forces can be represented using diagrams We measure force using a newton meter Forces work in interaction pairs Unbalanced forces result in a change in motion How to calculate resultant force The effect of friction and drag on motion How to reduce friction and drag Forces can cause deformation Hooke's law states that if you double the force, extension will double How to calculate moments	**Domain 1** Carry out experiments with regard for health and safety Identify variables Identify hazards **Domain 2** Set up and use a clamp and retort stand Use a ruler to measure length in mm Record data in a table **Domain 3** Calculate extension Plot a graph of extension against force when axes are provided Draw a line of best fit **Domain 4** Use experimental data to support explanation	Using a newton meter to measure forces Investigating extension of springs and elastic	1. Contact and non-contact forces 2. Measuring forces 3. Drawing force diagrams 4. Resultant force 5. Friction and drag 6. Squashing and stretching 7. Investigating extension RP investigation 8. Investigating extension RP graph drawing and conclusions 9. Moments 10. Revision 11. Assessment 12. DIRT	air resistance contact force deformation drag extension forces friction Hooke's law newton meter non-contact force pull push resultant force Upthrust
ORGANISMS Skeleton and gas exchange	the structure and functions of the human skeleton, to include support, protection, movement and making blood cells biomechanics – the interaction between skeleton and muscles, including the measurement of force exerted by different muscles the function of muscles and examples of antagonistic muscles. the structure and functions of the gas exchange system in humans, including adaptations to function 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 the role of diffusion in the movement of materials in and between cells	**KS1** Name, draw and label the basic parts of the human body Identify that humans and some animals have skeletons and muscles for support, protection and movement **KS2** None **KS3** Forces may result in the movement of an object Forces work in interaction pairs Forces about a pivot produce a turning force (moment) Behaviour and arrangement of particles in gases Diffusion as movement of gases Write a hypothesis Carry out experimental procedures with regard for health and safety Use a measuring cylinder Plot data on a graph when given the axes Use data to support hypothesis	Explain that living organisms are made up of small parts called cells The function of the skeleton How joints allow you to move How to measure the strength of muscles The different types of muscles in the body Muscles work in antagonistic pairs What happens when we breathe How the air we breathe out is different to the air we breathe in How our muscles work to allow us to breathe	**Domain 1** Write a hypothesis Carry out experiments with regard for health and safety Design a results table **Domain 2** Use measuring cylinder to measure volume Use a ruler to measure height Record data in a table **Domain 3** Plot a graph of lung volume against height when axes are provided Evaluate the precision of data **Domain 4** Use experimental data to support hypothesis	Investigating lung volume	1. Levels of organisation 2. The skeleton 3. Joints 4. Muscles 5. Gas exchange 6. Breathing 7. Investigating lung volume RP investigation 8. Investigating lung volume RP graph drawing and conclusions	antagonistic pair cartilage cell diaphragm joint lung muscle organ organ system pressure tendon tissue volume
REACTIONS Acids and alkalis	chemical reactions as the rearrangement of atoms representing chemical reactions using formulae and using equations defining acids and alkalis in terms of neutralisation reactions the pH scale for measuring acidity/alkalinity; and indicators	**KS1** Identifying everyday materials (e.g. wood, plastic, glass) Compare the physical properties and uses of everyday materials Identify and compare the suitability of materials for particular uses **KS2** Some changes result in the formation of new materials, e.g. acid and bicarbonate of soda **KS3** Behaviour and arrangement of particles in solids, liquids and gases Difference between an element and a compound Identify hazards Carry out experimental procedures with regard for health and safety Use a measuring cylinder Plot data on a graph when given the axes Evaluate precision of measurements Use data to support conclusions	The difference between physical and chemical changes The signs of a chemical change The difference between acids and alkalis The difference between concentrated and dilute solutions The dangers of acids and alkalis How indicators can be used to identify how acidic or alkaline a substance is The pH scale The difference between strong and weak acids What happens in a neutralisation reaction How to make salts Writing word equations for making salts	**Domain 1** Identify hazards Carry out experiments with regard for health and safety **Domain 2** Use measuring cylinder to measure volume Measure pH using universal indicator Record observations in a table **Domain 3** Plot a graph of pH against volume of acid when axes are provided Evaluate the precision of data **Domain 4** Use experimental data to support conclusion	Measuring pH changes	1. Physical and chemical changes 2. Acids and alkalis 3. pH scale 4. Indicators 5. Neutralisation and naming salts 6. Measuring pH changes RP 7. Measuring pH changes RP graph drawing and evaluation 8. Revision 9. Assessment 10. DIRT	acid alkali chemical change indicator neutralisation pH physical change salt
ENERGY Transfers and work	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 comparing amounts of energy transferred (J, kJ, kW hour) simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged	**None at KS1 or 2** **KS3** Behaviour and arrangement of particles in solids, liquids and gases. Changing state requires a change in energy Forces about a pivot produce a turning force (moment) Forces may result in the movement of an object	Name the different energy stores Describe energy transfers in terms of moving energy between stores Energy dissipation How to calculate efficiency How to calculate work How simple machines maximise force and reduce energy needed	**Domain 1** Carry out experiments with regard for health and safety **Domain 2** Record observations in a table **Domain 4** Use experimental observations to support explanation	Conservation of energy	1. Energy stores 2. Energy transfers 3. Conservation of energy RP 4. Efficiency 5. Work done 6. Simple machines	chemical electric-magnetic mechanical conservation gear nuclear dissipation gravitational potential radiation efficiency heating thermal elastic potential kinetic work done electrical lever
GENES Variation and human reproduction	continuous or discontinuous, to include measurement and graphical representation of variation 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, fertilisation, gestation and birth	**KS1** Notice that animals including humans have offspring that grow into adults **KS2** Describe the life process of reproduction in some plants and animals **KS3** Leaves and lungs have adaptations to help them carry out processes.	The difference between inherited and environmental variation What continuous and discontinuous variation is What happens during adolescence The structure of the male and female reproductive systems How fertilisation takes place Hoe fertilised eggs implant How a fetus develops in the uterus The stages of the menstrual cycle How different forms of contraception work to prevent pregnancy	**Domain 2** Select appropriate equipment to measure height and arm span Make measurements using selected equipment Record measurements in table Use SI units for height (m) **Domain 3** Plot a histogram to show continuous variation **Domain 4** Use experimental data to support conclusions	Investigating arm span	1. Variation 2. Continuous and discontinuous data 3. Investigating arm span RP investigation 4. Investigating arm span RP graph plotting 5. Adolescence 6. Human reproductive organs 7. Menstrual cycle 8. Fertilisation 9. Implantation and gestation 10. Contraception 11. Revision 12. Assessment 13. DIRT	adolescence ovulation cervix penis continuous puberty contraception pubic hair discontinuous scrotum environmental testes fallopian tubes urethra gestation uterus histogram vagina implantation variation inherited vulva menstrual ovaries
ts and electromagnets	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, D.C. motors (principles only)	**KS1** Some forces need contact between objects but magnetic forces work at a distance Observe how magnets attract and repel some materials but not others Describe magnets as having two poles	How magnets interact How to view a magnetic field What a permanent magnet is Magnetic fields form around a wire carrying electricity	**Domain 1** Identify variables Plan an investigation Design a results table	Changing the strength of an electromagnet	1. Magnets and magnetic fields 2. Electromagnets 3. Investigating electromagnets RP planning 4. Investigating electromagnets RP investigation	attract coil electromagnet magnet

ELECTROMAGNETISM Magne		Predict whether magnets will attract or repel depending on which poles are facing **KS2** Identify common appliances that run on electricity **KS3** Non-contact forces Movement as doing work Energy stores and transfers	How to make an electromagnet What electromagnets are used for	**Domain 2** Record data in a table **Domain 3** Plot a graph of number of paperclips against number of turns when given only one axis Draw a line of best fit **Domain 4** Use experimental data to support explanation		5. Investigating electromagnets RP graph plotting and conclusions 6. Uses of electromagnets	magnetic field pole repel	
ECOSYSTEMS Plant reproduction and interdependence	reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms. 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.	**KS1** Describe how animals obtain their food from plants Find out and describe how plants need water, light and a suitab **KS2** None **KS3** Diffusion as movement of gases Behaviour and arrangement of particles in gases Chemical reactions making compounds Chemical reactions involve energy transfers Muscles needing energy to move	Name the parts of a flower and give their functions Explain how plants are adapted to wind and insect pollination Describe the processes of fertilisation and germination in plants Describe the different ways seeds can be dispersed Describe the adaptations of plants for different methods of seed dispersal Explain food chains in terms of energy transfer Explain how food chains link together to form food webs Explain the term inter-dependence Explain bio-accumulation Explain how organisms can coexist in an ecosystem Describe what animals and plants compete for	**Domain 1** Carry out experiments with regard for health and safety **Domain 3** Draw diagrams of observations	Dissecting a flower	1. Structure of flowers 2. Dissecting a flower RP 3. Pollination 4. Fertilisation and germination 5. Seed dispersal 6. Food chains 7. Food webs 8. Bioaccumulation 9. Interdependence 10. Competition 11. Adaptation 12. Revision 13. Assessment 14. DIRT	adaptation anther bio-accumulation competition dispersal feeding relationship fertilisation filament food chain food web germination inter-dependence ovary ovule petal pollen pollination pollinator sepal stamen stigma style survive variation	
WAVES Sound	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 loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal auditory range of humans and animals	**KS2** 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 vibrations that produced it Recognise that sounds get fainter as the distance from the sound source increases. **KS3** Ear lobe attachment as an example of variation Waves transfer energy as well as matter During puberty the pitch of the voice changes in males	What a sound wave is How speed travels How amplitude affects a sound How frequency affects a sound How to calculate the frequency of a wave How the ear allows us to hear			1. Sound waves 2. Amplitude and volume 3. Frequency and pitch 4. Calculating frequency 5. The ear	amplitude auditory nerve cochlea ear drum frequency longitudinal pitch sound stapes wave wavelength	
THE EARTH Structure and universe	the composition of the Earth the structure of the Earth the rock cycle and the formation of igneous, sedimentary and metamorphic rocks 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	**KS1** None **KS2** 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 Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky. **KS3** Behaviour and arrangement of particles in solids, liquids and gases Changing state requires a change in energy Properties of metals and non-metals Light travels as a wave Weight and gravity as non-contact forces Earth has a magnetic field	The structure of the Earth How sedimentary rocks form How igneous rocks form How metamorphic rocks form How rocks move through the rock cycle The objects in our solar system How light travels from the Sun to Earth Why we have day and night Why we have seasons Why the moon looks different at different times of the month How scientific ideas change over time	**Domain 1** Identify variables Carry out experiments with regard for health and safety **Domain 2** Use a water bath Make observations **Domain 3** Record observations as a diagram **Domain 4** Use experimental data to support conclusions	Investigating the effect of temperature on crystal formation	1. Earth's structure 2. Sedimentary rock 3. Igneous rock 4. Investigating the effect of temperature on crystal formation RP 5. Metamorphic rock 6. The rock cycle 7. Our solar system 8. Day and night 9. Seasons 10. Phases of the moon 11. Revision 12. Assessment 13. DIRT	axis cementation crescent crust crystal deposition erosion extrusive igneous inner core intrusive luminous light year mantle metamorphic outer core pressure satellite sediment sedimentary tilt waning waxing	