

Year 7				
Topic	Links to other units	Why that, why then?	Key concepts:	Key Stage 2 expected knowledge:
Introduction to science (4 lessons)	Taught across all units	Strong foundation of disciplinary knowledge, building on KS2 working scientifically	Disciplinary Knowledge • Safety in the lab • Naming, drawing and correctly using key pieces of equipment (test tube, boiling tube, Bunsen burner, thermometer, timer, measuring cylinder, balances)	Ask and investigate simple questions, use simple equipment, use observations, understand “fair test”. Be able to make observations and record measurements. Record results using simple diagrams, bar charts and tables. Identify similarities and differences related to simple scientific changes.
Particles & Atoms (6 lessons)	Links to: separating mixtures, periodic table, heating and cooling	• Builds on Year 4/5 • Baseline test • Oak National Academy	• Describe movement and spacing of particles in solid, liquid and gas as well as drawing particle diagrams and using the particle model to explain properties • Define and describe diffusion as well as using the particle model to explain why diffusion is different in solids, liquids and gases • Describe the changes of state that occur Developing Deeper Understanding: Explain the challenges of classifying substances that demonstrate the properties of more than one state (e.g. sand or shaving foam) Explain the difference between evaporation and boiling Understand how diffusion is different to evaporation	Group materials together according to whether they are solids, liquids and gases. (Y4) Observe that some materials change state when they are heated or cooled. (Y4)
Cells (6 lessons)	Links to: reproduction, digestion,	• Introduces organisation • Develop disciplinary	• Label and describe how to use a microscope • Label and describe the function of organelles in plant cells (animal cell organelles + chloroplast and cell wall)	

	photosynthesis, variation, gas exchange	knowledge (1) (specifically classification and organisation)	- identify organs in plants, name some plant tissues describing their jobs (roots, stem, flower, leaves) - label and describe parts of an animal cell (nucleus, cell membrane, cytoplasm, mitochondria) - describe key features of specialised animal and plant cells and how they support its function (sperm cell, red blood cell, root hair cell) - Define unicellular and describe some of the functions of some of the structures of unicellular organisms as well as describing the uses and dangers of unicellular organisms Developing Deeper Understanding: - Given the role of a cell/tissue, suggest some ways in which it may be adapted (e.g. if the heart tissues contract and use energy, they must contain large numbers of mitochondria) - Identify a plant tissue that does not need chloroplast and explain why (i.e. roots- because they do not absorb light because they are below ground) - Explain why animals cells do not need to have a cell wall Evolving Further Scientific Curiosity: - Compare images produced by different types of microscope (similarities and differences)	
Forces (10 lessons)	Links to: movement, forces & motion	- Foundational physics topic - Builds on forces in KS2 (Year 4/5)	- Identification of contact and non-contact force - Recall the unit of Force as Newton's and it's measurement with a Newton metre - Describe the effects of force as changing shape or direction - Draw free body diagrams and use them to calculate resultant force - Understand the relationship between weight, mass and gravity - Understand friction and air resistance as resistive forces Developing Deeper Understanding:	Find out how the shape of solid objects can be changed by squashing, bending, twisting and stretching. (Y2) Compare how objects move on different surfaces. Notice that some forces need contact between 2 objects, but magnetic forces act at a distance. (Y3)

			- Understand how a parachute changes the size of the forces acting on a person during a skydive. Explain how this will be related to the surface area of the parachute. Evolving Further Scientific Curiosity: - Suggest how the effects of forces on objects will vary depending on their mass.	Explain that unsupported objects fall towards the Earth because of gravity (Y5) Identify the effects of air resistance, water resistance and friction. (Y5)
Movement (6 lessons)	Links to cells	- Builds on forces topic - (muscles as levers). - Interleave specialised cells (disciplinary knowledge 2).	- Identify some key bones in the skeleton - Understand the role of tendons, ligaments, muscles and antagonistic pairs of muscles - Understand how the body is organised in terms of cell, tissues, organs and organ systems Developing Deeper Understanding: - Compare the organisation of the body to the hierarchy of another organisation/system (e.g. workers in a factory) - Given a specific injuries, suggest problems patients might have with movement (e.g. if the achilles tendon is damaged how does that impact the movement in the leg/foot) Evolving Further Scientific Curiosity: - Compare the internal skeleton of a human to the exoskeleton of a crab/cockroaches)	Identify, name and label basic parts of the human body. (Y1) Identify that humans have skeletons and muscles for support, movement and protection. (Y3) Identify and name the main parts of the circulatory system and describe the function of the heart. (Y5)
Reproduction (10 lessons)	Links to: cells, ecosystems (pollination), photosynthesis (plant reproduction),	- Addressing puberty as students are experiencing it. - Interleave specialised cells and organelles and organ systems.	- Describe the structure of DNA and its role in inheritance - Understand the changes that occur during puberty for males and females - Describe the main stages of the menstrual cycle and how periods are managed - Describe the process in the development of a baby from conception to birth Developing Deeper Understanding:	Notice that humans (and other animals) have offspring that grow into adults. (Y2)

	variation & inheritance		Compare the number of offspring an animal has with the length of gestation and suggest why there may be a relationship between them Evolving Further Scientific Curiosity: Suggest how technology has helped to change ideas around what families look like (e.g. single parent IVF, 3 person IVF, surrogacy)	
Electricity	Links to energy and ecosystem (impact on climate)	- Introduces equipment they have not yet used. - Foundation for energy next year	- Construct simple circuits from a range of equipment and draw a diagrammatic representation using circuit symbols - Use ammeter and voltmeters to record current and voltage at different points in the circuit to explore the difference between series and parallel circuits - Describe how electricity is generated in a power station and how it is distributed via the National Grid - Explain some advantages/disadvantages of different types of renewable and non-renewable energy resources Developing Deeper Understanding: Evaluate the use of a variety of models for electricity - including the water model and the rope model. Evolving Further Scientific Curiosity: Although nuclear power is non-renewable, is it the UK's best option for low carbon fuel?	Identify common objects that use electricity (Y4) Construct a simple series circuit and name its basic parts (Y4) Identify whether or not a lamp will light in a series circuit based on the position of the lamp and an open/closed switch (Y4) Associate the brightness of a bulb with the voltage of cells in a circuit (Y4) Use recognised symbols to represent simple circuits in a diagram. (Y6)
Separating Mixtures (9 lessons)	Links to particles & atoms, periodic table	Acts as a bridge between particles and acids and alkalis	- Understand what a mixture is, including words to describe the components of a mixture (solute, solvent etc) - Describe solubility and explain it using the particle model - Describe techniques that allow for different components of a mixture to be separated - Name key pieces of equipment needed for separation Developing Deeper Understanding:	Know that some substances dissolve in liquid to form a solution and describe how to recover a substance from a solution (Y5) Use knowledge of solids, liquids and gases to describe how mixtures might be separated including filtering, sieving and evaporating (Y5)

			On a desert island, which would be more useful - distillation or crystallisation? (in distillation the water is recovered whereas water is lost during crystallisation) How did chromatography put an end to the best selling cookies in a Leeds bakery? (their sprinkles contained a food colouring not approved in the UK) Evolving Further Scientific Curiosity: The Droitwich salt company “grow” local salt from a natural brine spring- how does it work?	
Digestion (10 lessons)	Links to acids and alkalis, health	Interleave cells, build on organisation,	- Name the components of a balanced diet and their role in the body - Describe diseases associated with nutrient deficiency - Carry out simple tests for starch and protein - Label the organs of the digestive system and their function (including adaptations of the small intestine) - Describe the action of enzymes in the digestive system Developing Deeper Understanding: - Compare the dietary requirements of different groups of people (e.g. vegans/vegetarians) - Explain why bread tastes sweet if you chew it for a long time - Explain the link between the optimum temperature of enzymes and body temperature Evolving Further Scientific Curiosity: - Understand how Alexis St Martin advanced our understanding of digestion and discuss the ethical ideas surrounding conducting experiments on human subjects.	Describe the importance of eating the right amount of different types of food and exercise. (Y3) Describe the simple functions of the basic parts of the digestive system in humans. (Y4)
Acids and Alkalis (11 lessons)	Links to digestion	Interleave role of stomach acid.	Recognise common hazards symbols and appropriate safety precautions	Understand changes associated with the reaction of acid and bicarbonate. (Y5)

		Oak National Academy chemical reactions topic.	- Describe simple properties of acids and alkalis and how an indicator may be used to distinguish between them - Describe the steps and equipment involved in producing simple indicators from fruit/vegetables - Classify substances as strong/weak acids/alkalis based on their pH - Describe neutralisation and write a simple word equation to describe a neutralisation reaction - Carry out an investigation into antacid tablets and draw conclusions based on data Developing Deeper Understanding: - Explain the usefulness of universal indicator and the pH scale compared to simple indicators - Explain why toothpaste needs to be alkaline - Bee stings are acidic - suggest a substance that could be safely applied to skin to reduce the effects of the sting Evolving Further Scientific Curiosity: - Explain what is strange about colour changing hydrangeas compared to other coloured indicators (wrong way around - blue in acidic conditions)	Understand that some changes are reversible and some are irreversible (Y5)
Space	Links to forces	Builds on forces. Similar position to Oak National Academy.	- Describe the order of the planets in the solar system and describe their orbits as elliptical - Use data to describe trends in the solar system (including distance from the Sun and surface temperature) - Explain how the rotation of the Earth causes day/night and the seasons - Explain how the rotation of the Moon and Earth cause the phases of the Moon - Explain how solar and lunar eclipses are caused - Describe satellites as natural or artificial	Describe changes between seasons and how day length changes across seasons (Y1) Describe the movement of the Earth and other planets relative to the Sun (Y5) Describe the movement of the moon relative to the Earth (Y5) Use the idea of the Earth's rotation to explain day and night and the apparent

			- Describe the function of artificial satellites and describe their orbits as geostationary or polar - Explain some challenges of human survival in space Developing Deeper Understanding: - How does the movement of the Moon around the Earth relate to the tides? Evolving Further Scientific Curiosity: - Should people be allowed to pay to go into Space? - Should we be focussed on colonising Mars/the Moon as an alternative to addressing climate issues on Earth?	movement of the Sun across the sky. (Y5)
Year 8				
Periodic table (11 lessons)	Links to acids and alkalis, chemical reactions, earth & atmosphere	Interleaves particles, introduces equations needed for photosynthesis/chemical reactions	- Define an element and classify elements as metal and non-metal - Understand that each element of the periodic table has a symbol and that the periodic table is arranged in groups and periods with the metals on the left and middle and non-metals on the right - Describe simple properties and uses of metals and non-metals - Understand the groups in the periodic table have similar properties to each other and take part in similar chemical reactions (using groups 1, 7 and 0 as examples) - Understand what a compound is and how a compound can be represented by a chemical formula. - Name simple compounds based on their chemical formulae.	Describe physical properties of every day materials. (Y1) Group materials together on the basis of physical properties (Y1)
Energy	Links to electricity Links to digestion (food as energy)	Foundational knowledge needed for photosynthesis, waves, chemical reactions.	- Know the law of conservation of energy - Recognise energy stores and describe how energy can be transferred between stores - Calculate efficiency	

		Teacher voice stated too conceptual for year 7.	Challenge: Explain why a ball that is bounced does not return to the height it was dropped from Suggest ways in which devices could be made more efficient	
Photosynthesis	Links to cells, reproduction, periodic table	Builds on light energy, interleaves ideas from reproduction. Need this to understand ecosystems	- State the photosynthesis equation and describe where the reactants come from and what happens to the products - Describe the structure of plants (including roots, stems, leaves, flowers) and explain their role - Describe the adaptations of leaves - Understand the effect of temperature and light intensity on the rate of photosynthesis - Explain how water and glucose are transported around plants - Describe different methods of seed dispersal and their advantages/disadvantages	Describe how plants need water, light and a suitable temperature to grow. Observe and describe how seeds grow into mature plants. (Y2) Identify and describe the functions of roots, stems, leaves and flowers. Investigate how water travels through a plant. Explore ideas about pollination, seed formation and seed dispersal. (Y3) Describe the process of reproduction in some plants. (Y5)
Heating and Cooling (10 lessons)	Links to energy, particles	Builds on ideas about particles and energy. Supports chemical reactions in terms of understanding temperature change	- Describe what is meant by temperature and how it can be measured - Describe what is meant by conduction and use “conductor” and “insulator” to classify materials - Compare the conducting ability of solids, liquids and gases explaining it using the particle model - Describe the process of convection and identify some everyday examples of convection - Describe the process of radiation and carry out an experiment to determine surfaces that are good/poor absorbers of radiation - Describe how insulators work and the types of insulation found in homes	Recognise some common conductors and insulators (Y4) Associate metals with being good conductors (Y4)

Waves	Links to particles, energy	Must come after energy.	• Describe a wave as transferring energy without transferring mass • Label peak, trough, amplitude and wavelength on a transverse wave and give examples • Label compression, rarefaction and wavelength on a longitudinal wave and give examples • Compare the movement of waves through solids, liquids and gases • Describe how sound is produced and how features of sound (pitch & volume) can be shown by the wave • Describe how the ear converts waves into sound • Describe materials as transparent/translucent/opaque based on their ability to transmit/absorb light • Classify objects as luminous/non-luminous • Describe how shadows are formed • Describe how light is reflected and how the law of reflection can be investigated • Describe what happens when light is refracted, including in the human eye • Describe white light as being made up of all the colours • Explain how primary colours can be combined to produce secondary colours and how filters can be used	Recognise that light is needed in order to see things. Notice that light is reflected by surfaces. (Y3) Identify that light travels in straight lines (Y6) Understand that we see things because light travels from a source to our eyes (Y6) Recognise how shadows are formed and that light is blocked by opaque objects. (Y3) Find patterns in the way sizes of shadows change. (Y3) Identify how sounds are made, associated with vibration. Recognise that vibrations travel through a medium to the ear (Y4) Find patterns between the pitch of sound and the object that produced it. (Y4) Find patterns between the volume of a sound and the vibrations that produced it. (Y4) Recognise that sound gets fainter as distance from the source increases. (Y4)
Chemical reactions	Links to acids and alkalis,	Understand key reaction types which underpin other ideas	• Understand the difference between chemical/physical changes with examples	Demonstrate that some changes are reversible (dissolving and state change)

	periodic table, Earth's resources	such as extracting metals	• Understand the difference between an endothermic and an exothermic reaction • Understand what is meant by thermal decomposition and describe how it can be carried out • Understand what is meant by combustion including the difference in products of complete and incomplete combustion • Understand what happens in directions between metal and oxygen • Understand what happens when metals react with water • Describe the reaction of iron with oxygen as "rusting" and investigate the conditions needed for rusting • Understand what happens when metals react with acids, including naming the salts formed and describing the test for Hydrogen • Understand what happens when metal carbonates react with acids, including naming the salts formed and describing the test for carbon dioxide • Represent chemical reactions using words equations	Understand that some changes form new products and this is not reversible. (Y5) Understand changes associated with burning and the reaction of acid and bicarbonate. (Y5)
Ecosystems	Links to reproduction, photosynthesis, earth and atmosphere	Must build on photosynthesis, energy (energy transfer in ecosystems) and waves (climate change and radiation).	• Understand key ecological terms like ecosystem, community, habitat and population • Describe a simple feeding relationship using food chains/food webs • Explain the effect of a change in population of one organism on the whole food chain • Explain the role of pollinators in the ecosystem • The reasons for human population increase over the last few hundred years. • Describe some ways that humans impact ecosystems (including pollution) • Understand what is meant by food security and how changes in climate can affect food security	Understand what a habitat is and that living things are suited to their habitats. (Y2) Describe how animals obtain food from plants and other animals and understand simple food chains. (Y2) Identify producers, predators and prey. (Y2)

Variation and Inheritance	Links to cells, reproduction, ecosystems, earth & atmosphere	Interleaves cells/reproduction, introduces evolution which is built on in Earth's atmosphere	• Compare genetic and environmental variation. • Compare continuous and discontinuous data. • Explain how variation leads to changes in survival chances and over time evolution by natural selection. • Define an endangered species and state reasons for organisms to become endangered, as well as ways humans try to help endangered species. • Define extinction and give reasons for extinctions, including mass extinction. • Define biodiversity and explain its importance.	Recognise that living things have changed over time and that fossils provide information about living things that were on Earth millions of years ago (Y6) Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. (Y6)
Earth's structure	Links to Earth resources, Earth & atmosphere	Sets a foundation for Earth's resources Builds on ideas about conduction and climate Oak Academy	• Describe the structure of the Earth and how it was formed. • Define weathering and describe how it can occur. • Identify examples of igneous, sedimentary and metamorphic rock and describe how they are formed. • Describe the rock cycle and model it. • Evaluate models (scotch egg, chocolate rock types, starburst rock cycle).	Compare different types of rock based on their appearance (Y3)
Year 9				
Earth's resources	Links to periodic table, earth's structure, electricity, chemical reactions	Builds on Earth's structure and leads into evolution of the atmosphere and ecosystems (recycling and pollution).	• Use the reactivity series to describe displacement reactions. • Explain how catalysts affect the rate of chemical reactions. • Define an ore and a native metal and describe how metals can be extracted from their ores by smelting or by electrolysis. • Define a polymer, identify examples and describe their properties. • Describe the properties and uses of ceramics and composites. • Describe the process of recycling and explain why it's important.	identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock (Y1)

				describe the simple physical properties of a variety of everyday materials (Y1)
Respiration	Links to cells, chemical reactions, movement, gas exchange	This interleaves cell structure and leads into gas exchange. It has been separated from gas exchange to minimise incorrect conflation of ideas.	- Define aerobic and anaerobic respiration, including the word equations. - Describe the effects of anaerobic respiration on the body. - Describe fermentation in plants and yeast, including the word equation, and describe its uses.	Understand the basic needs of humans for survival.
Forces and Motion	Links to forces Y7, movement (turning force around a joint).	Interleaves initial ideas about forces.	- Define a force and compare contact and non-contact forces. - Describe the causes and effects of drag and how it can be reduced. - Describe how forces cause objects to deform including Hooke's law. - Define and calculate work done in deformations. - Define and calculate moments. - Calculate speed and draw and interpret distance time graphs. - Describe relative motion in terms of speed. - Use $F=ma$ equation to describe the effect of forces on motion.	Recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect (Y5)
Pressure	Links to particles, gas exchange	This builds on particle model and is required for gas exchange.	- Define pressure and calculate pressure using force and area. - Describe and explain pressure in liquids. - Explain how objects float. - Use the relationship $\text{density} = \frac{\text{mass}}{\text{volume}}$ - Describe how engineering and organisms have adapted to water pressure at depth.	

			Describe and explain gas pressure and the effects of temperature and volume on pressure.	
Gas Exchange	Links to cells, movement, pressure	Builds on cells, diffusion and requires an understanding of gas pressure.	- Identify the organs of the respiratory system and their function - Describe the adaptations of the lungs and capillaries for gas exchange - Describe how gas exchange takes place across the alveoli - Describe how the mechanical movement of the chest brings about gas exchange - Explain how pressure changes in the chest during breathing - Evaluate models of the respiratory system	
Earth & Atmosphere	Links to particles, earth's structure, earth's resources, ecosystems	This builds on respiration and photosynthesis (carbon cycle, evolution of Earth's atmosphere).	- Describe the composition of the early atmosphere - Describe the composition of the modern atmosphere - Explain how changes in the types of organisms on Earth brought about changes to the atmosphere - Explain how carbon is cycled - Recognise chemical formulae and the names of chemical compounds - Balance chemical equations - Describe the difference between complete and incomplete combustion - Understand the effects of climate change	Recognise that environments can change and that this can sometimes pose danger to living things. (Y4)
Electricity and Magnetism	Links to electricity, forces	This builds on year 7 electricity topic and introduces conceptually more difficult ideas as well as magnetism.	- Understand what is meant by static electricity - Define current, potential difference and resistance and investigate how these change in series and parallel circuits - Use circuit symbols to represent components - Describe the poles of a magnet as North and South and understand when poles will attract and repel	Classify materials as magnetic and non-magnetic. (Y3) Describe a magnet as having two poles. (Y3) Predict whether magnets will attract or repel each other

			Describe what is meant by an electromagnet and explain how the strength of it may be changed	depending on which way they are facing. (Y3)
Health	Links to cells, movement, digestion, respiration, gas exchange	This builds on ideas about the circulatory and respiratory systems as well as topics from earlier years such as reproduction.	- Understand that health is a combination of physical, mental and social wellbeing - Describe common signs of mental illness and places where people can access support - Categorise drugs as medical and recreational and understand that some drugs are legal and others are illegal - Describe the short term and long term effects of smoking and alcohol - Describe how drugs are developed - Define a pathogen - Describe ways to reduce the spread of disease - Label the structure of the heart - Compare the structure and function of arteries, veins and capillaries - Label the organs of the digestive system and describe their functions - Describe how to test for starch, sugars, protein and lipids	Recognise the effect of drugs and lifestyle on the way the body works (Y5) Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood (Y6) describe the simple functions of the basic parts of the digestive system in humans (Y4)
Atomic structure	Links to periodic table, Earth's atmosphere	This builds on Y7, Y8 and Y9 topics and is essential foundational chemistry knowledge which will help students to progress smoothly to GCSE.	- The structure of the periodic table. - Define elements and compounds and be able to name compounds based on their formula. - The properties of subatomic particles and how to calculate them from the periodic table. - Draw electronic configuration of elements. - Use state symbols and balance equations. - Describe how the model of the atom has changed, including detailed knowledge of the alpha particle scattering experiment. - Define what an isotope is. - Calculate relative formula mass and relative atomic mass.	Not studied at KS2

Particle model	Links to changes of state, diffusion, pressure	This will build on the idea of particles which students have gained through Y7 and Y9 and will allow students to start using more advanced language around this concept, ready for KS4.	• Describe how particles are arranged in solids, liquids and gases and describe the changes of state. • Explain what causes gas pressure and how factors affect gas pressure. • Describe what density is and use an equation to calculate it. • Carry out a practical to find the density of different objects.	compare and group materials together, according to whether they are solids, liquids or gases (Y4) demonstrate that dissolving, mixing and changes of state are reversible changes (Y5) Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature (Y4)
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Disciplinary Knowledge: <https://www.gov.uk/government/publications/research-review-series-science/research-review-series-science>