Toynbee Curriculum
KS3 Topic Summaries

SCIENCE

Toynbee School

Scheme of Learning: Lab Skills

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Lab Skills	Particles and Separation Techniques	Forces	Cells and Organisation	Elements and the Periodic Table	Energy	Health and Human Body	Chemical Reactions	Electricity and Magnetism	Reproduction

Topic Overview:

This is the introductory topic all year 7 pupils will complete to enable them to carry out future practical activities in science safely.

Lesson Sequence:

We teach the basic lab safety rules and hazard symbols on chemicals and how to correctly use a Bunsen burner and other key pieces of lab equipment.

We then give an overview of the scientific method with a focus on accuracy and precision and how to collect and display data.

Sequence of Lessons:	
1	Lab Safety
2	Bunsen burners
3	Equipment
4	Accuracy & Precision
5	Observing
6	Displaying Data 1
7	Displaying Data 2
8	Summary lesson

Resources:	
1	A variety of chemicals with hazard symbols on.
2	n/a
3	Salt.
4	Blue liquid and red liquid. Measured out precisely (doesn't matter the volume so long as you tell the teacher) e.g. 17ml red, 57ml blue. (so they will need a different sized measuring cylinder for each colour.
5	Magnesium, hydrochloric acid, vinegar, calcium carbonate, copper sulphate
6	n/a
7	n/a
8	n/a

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	Multiple choice questions.
Application of Knowledge:	n/a for introductory topic

Scheme of Learning: Particles & Separation Techniques

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Lab Skills	Particles and Separation Techniques	Forces	Cells and Organisation	Elements and the Periodic Table	Energy	Health and Human Body	Chemical Reactions	Electricity and Magnetism	Reproduction

Topic Overview:

The national curriculum requires that we teach the following:

- the properties of the different states of matter (solid, liquid and gas) in terms of the particle model.
- changes of state in terms of the particle model
- mixtures, including dissolving
- diffusion in terms of the particle model
- simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography

Lesson Sequence:

We start with an introduction to particles and states of matter. We build on that to look at changes of state, then the movement of particles and finally separation techniques.

Sequence of Lessons:

1	States of Matter
2	The Particle Model
3	Changes of State
4	Boiling Vs Evaporation
5	Melting & Freezing
6	Diffusion
7	Solubility
8	Saturation
9	Filtering
10	Distillation
11	Chromatography
12	Revision
13	Assessment

Resources:

1	Selection of solids, liquids and gases (include sand, hair gel/jelly)
2	Lego blocks
3	Stearic acid warmed in water bath
4	Sulphuric acid, Copper oxide, Post-its for labelling dishes
5	Petri dishes, cubes of lard, butter, chocolate
6	**Demo:** Potassium permanganate crystals **Class set**: Equal sized cubes of agar jelly containing phenolphthalein, various concentrations of HCl
7	Liquids: Ethanol, copper sulphate solution Solids: Coffee, sugar, salt
8	Sugar
9	Rock salt mixture
10	Inky water, delivery tubes & conical flasks
11	Chromatography paper strips, pens for testing.
12	n/a
13	Worksheets in shared folder.

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	Multiple choice questions.
Application of Knowledge:	Describe the structure and properties of the three states of matter.

Scheme of Learning: Forces

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Lab Skills	Particles and Separation Techniques	Forces	Cells and Organisation	Elements and the Periodic Table	Energy	Health and Human Body	Chemical Reactions	Electricity and Magnetism	Reproduction

Topic Overview:

The Forces topic aims for pupils to develop their understanding of why objects behave in the world around them; from why they stay on the surface of the Earth, to why their car will speed up and slow down. This topic aims to link the importance of understanding forces with its impact on sport. We use the context of Olympic track cycling to gain an understanding of how forces underpin the design of a bike, as well as how changing body position and clothing can affect speed and increase the chance of winning an Olympic medal.

This topic builds on the KS2 idea that forces are pushes and pulls and begins to identify some basic forces. We build the foundations which will later be developed in the 'motion and pressure' topic in year 8 and 'Forces and interactions' and 'Forces and motion' in KS4 (GCSE).

Lesson Sequence:

Pupils will start by being able to list the different types of forces, and the direction that they act. They will need to understand if the forces are contact or non contact and how they interact with an object. Students will then develop this knowledge by describing if forces in opposite directions are balanced or unbalanced and to calculate a resultant force. Once they can identify resultant forces they will then be able to apply this knowledge to explain how resultant forces affect the object. We start by looking at how it affects the motion of an object (speed and direction). We then focus on two specific resistive forces, drag and friction, and the ways we can reduce them. We then move on to looking how resultant forces cause a change of shape. Finally the pupils look at the relationship between weight and mass. Pupils will be assessed by being asked to explain why changing the body position, tyre thickness or shape of a helmet can change a cyclist's speed.

Sequence of Lessons:

1	Intro to forces (contact and non-contact)
2	Representing forces
3	Resultant forces
4	Drag
5	Friction
6	Changing shape
7	Weight and Gravity
8	Forces assessment

Resources:

1	Newton meters (Range high and low resolution) Objects of different weights. Work sheet 1: Forces definition match Work Sheet 2: Table of results
2	Large Squared (graph) Paper. Worksheet 1: Free body diagram practice.
3	Worksheet 1: Resultant force practice 1 Worksheet 2: Resultant force practice 2
4	Equipment. Hair dryer x 4 Meter ruler x 8 Small dynamics trolly x 8 Plasticine. 100g x 8
5	Equipment: Friction Block and Newton Meter X 8 Table of results
6	Equipment:1 x spring 1x strawberry lace, 1 x clamp stand, a meter ruler, 2 x clamps and 2 x bosses. Table of results and graph to annotate.
7	Graph paper or print slide 10 to allow them to plot the graph.
8	Print off assessment sheet.

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	20 question multiple choice quiz
Application of Knowledge:	Explain why changing the body position, tyre thickness or shape of the helmet can change a cyclist's speed.

Scheme of Learning: Cells & Organisation

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Lab Skills	Particles and Separation Techniques	Forces	Cells and Organisation	Elements and the Periodic Table	Energy	Health and Human Body	Chemical Reactions	Electricity and Magnetism	Reproduction

Topic Overview:

The national curriculum requirements for this topic are to cover the following:

- 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 chloroplasts
- the similarities and differences between plant and animal cells
- the role of diffusion in the movement of materials in and between cells ? the structural adaptations of some unicellular organisms
- the hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms
- 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.

Lesson Sequence:

Starting with learning the new skill of using a microscope, we move onto learning the parts and functions of animal and plant cells and how they differ from microbes and specialised cells. We then build up from cells to tissues to organs then organ systems. We focus on the muscle and skeletal systems as an example of an organ system.

Sequence of Lessons:	
1	Using a microscope
2	Animal cells
3	Plant cells
4	Specialised cells
5	Microbes
6	Cells to Organisms
7	Skeletal system
8	Muscles & chicken dissection
9	Antagonistic muscles
10	Assessment

Resources:	
1	Microscopes, Pre-prepared microscope slides
2	Microscopes, Slides, Cover slips, Cotton buds, Disinfectant pot for used slides Methylene blue dye
3	Microscopes, Slides, Cover slips, Iodine Onions, Knives, White tiles
4	Specialised cells info sheets and table for pupils to complete (laminated in cabinet)
5	Microbe fact sheets and question sheet (laminated in cabinet)
6	n/a
7	Skeleton model, Joints fact sheet, (laminated in cabinet),
8	Chicken wings, Dissection tools, Bin bag for remains Disinfectant and extra paper towels to clean up after.
9	Arm muscle template printed onto card. Split pins, String, Enough scissors if not enough in classroom
10	In folder

Supportive Reading:

Comprehension activity	Unicellular organism comprehension sheets

Assessment:

Knowledge:	20 question multiple choice knowledge test
Application of Knowledge:	Extended writing answer comparing plant and animal cells.

Scheme of Learning: Elements and The Periodic Table

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Lab Skills	Particles and Separation Techniques	Forces	Cells and Organisation	Elements and the Periodic Table	Energy	Health and Human Body	Chemical Reactions	Electricity and Magnetism	Reproduction

Topic Overview:

The national curriculum requires that we teach the following:

- Differences between atoms, elements and compounds
- Chemical symbols and formulae for elements and compounds.
- The concept of a pure substance.
- 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.

Lesson Sequence:

We start with an introduction to the Periodic Table, including uses, properties and trends. We then use this knowledge to identify differences in elements, compounds and mixtures. Once pupils have understood this we then explore the uses and patterns found in groups 1,7 and 0 in more depth.

Sequence of Lessons:

1	The Periodic Table
2	Uses of Elements
3	Trends in The Periodic Table
4	Development of The Periodic Table
5	Compounds and Mixtures
6	Pure an Impure Substances
7	Group 1 Elements
8	Group 7 Elements
9	Group 0 Elements
10	Revision
11	Assessment

Resources:

1	Print table for pupils to complete
2	Info slides for elements in prep room drawers, squares of plain paper
3	Print table for pupils to complete. Selection of metals (Mg, Al, Zn, cobalt, nickel etc…), 1 basic electrical circuit set up (bulb, ammeter, wires, battery), tray of water, set of bar magnets
4	Print timeline slide and pictures to cut and stick slide. Both on A3.
5	Print worksheet for pupils to complete. Possible demo sandy water, sieve, filter paper, funnel.
6	Print graph worksheet. Salt water and pure water (for use with Bunsen burners and thermometers).
7	Demo: Li, Na, K in water trough, UI.
8	None
9	None
10	Revision
11	Assessment sheets in shared folder.

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	Multiple choice questions.
Application of Knowledge:	Compare the trends and uses of group 7 and group 1 elements.

Scheme of Learning: Energy

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Lab Skills	Particles and Separation Techniques	Forces	Cells and Organisation	Elements and the Periodic Table	Energy	Health and Human Body	Chemical Reactions	Electricity and Magnetism	Reproduction

Topic Overview:

Energy is a new topic at KS3 as no content has been covered at KS2. This topic looks at energy as a mathematical concept, the idea that energy allows us to work out if something could happen.
The topic includes:
Calculation of fuel uses and costs in the domestic context
Energy changes and transfers - simple machines; heating and thermal equilibrium; changing motion, dropping an object, 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

Lesson Sequence:

We begin with a summary of the different stores and pathways. Then move into the detail of how the stores can be calculated and the processes involved in the transfer of energy (pathways).
We cover the calculations of work done, power and the cost of electricity. We also look at the means of representing energy transfers in Sankey diagrams.
Finally, we look at the resources used to generate the electricity we use in our homes, including the advantages and disadvantages for each resource.
Please note: some of the lessons will take more than the 1 hour lesson slot. Please account for this in your advanced planning.

Sequence of Lessons:	
1	Energy stores
2	Chemical stores
3	Pathways
4	Conduction and convection
5	Heat and temperature
6	Sankey diagrams
7	Non- renewable resources
8	Renewable resources
9	Power and cost
10	Assessment

Resources:	
1	Energy stores table
2	Combustion of food experiment – different foods, tin lids, mounting pins + basic lab equipment
3	Work done calculations sheet
4	Conduction experiment – metal rods, drawing pins, Vaseline + basic lab equipment Convection experiment – potassium permanganate 'tea bags' + basic lab equipment Chimney demo
5	Image sheet for defining vocabulary
6	Sankey diagrams sheet
7	Power station worksheet
8	Renewables table sheet Resources posters (laminated)
9	Power calculations
10	Quiz sheet Assessment sheet

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	20 question multiple choice quiz
Application of Knowledge:	Extended writing task evaluating the use of an energy resource

Scheme of Learning: Health & the Human Body

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
SKILLS	Particles and separation	Forces	Cells and organisation	Atomic structure and the Periodic Table	Energy	**Health and human body**	Chemical reactions	Electricity and magnetism	Reproduction

Topic Overview:

The national curriculum requirements for this topic are to cover the following:

- Content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed
- Calculations of energy requirements in a healthy daily diet
- The consequences of imbalances in the diet, including obesity, starvation and deficiency diseases
- 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)
- 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 impact of exercise, asthma and smoking on the human gas exchange system
- The effects of recreational drugs (including substance misuse) on behaviour, health and life processes.

Lesson Sequence:

Starting with the respiratory system, we learn the parts and functions of different organs. We then move on to a healthy & unhealthy diet before learning about the digestive system. We focus on the structure and function of these two system.

Sequence of Lessons:

1	Hierarchy recap & Function of breathing/respiration
2	Respiratory system structure & function
3	Ventilation / Breathing
4	Alveoli & diffusion
5	Lung health
6	Healthy diet
7	Unhealthy diet. Dietary disease. Food tests 1: Fats
8	Food tests 2: Starch, glucose, protein.
9	Energy in food (linked to L7)
10	Digestive system structure & function
11	Enzyme function
12	What is a drug: Effects & dangers
13	Effects of alcohol
14	Assessment

Resources:

1	Torso including respiratory & digestive systems. CO2 test: limewater, straw, chilled mirrors (ice), stop-clocks. Handouts.
2	Handouts. Torso model (lungs), pluck demo. Rubber tubing, disinfectant, dissecting equipment, gloves for class.
3	Bell jar (diaphragm), Demo: 2 litre drinks bottles, large basins, clean tubing & disinfectant, cotton wool, marker pens.
4	Pink phenolphthalein; 0.5M Hydrochloric acid; Beakers / boiling tubes; Timers
5	Stop-clock, measuring tape, smokers lung vs non-smokers lung laminated sheets. Smoking machine video clip.
6	Laminated nutrient cards; Colouring pencils; true/false sheets for highlighting.
7	Laminated sheets diet info. Greaseproof paper, pre-weighed crisps or balances (depending on class): low fat, high fat, crackers, rice, etc. 1x1cm squared paper. Instruction sheets. Ethanol & water, pestle & mortar, test tubes, filter paper, funnels.
8	Test stations with food samples. Starch, spotting tiles, iodine, potato, rice, crisps, cake, etc, Benedicts, kettles/water-bath at 90oC, beakers, boiling tubes, biuret solution, bungs.
9	Corks with pins, balances, puffy crisps, etc, timers, boiling tubes, thermometers, measuring cylinders, food packets with energy info.
10	Human torso with digestive system. Diagrams to label/sequence. Tape measure.
11	Demo mesh/orange netting & molymods. Amylase, starch, iodine, visking tubing, benedicts reagent, glucose solution, water-bath at 90oC or kettle, Hydrogen peroxide 30% vol, Mn IV oxide (catalyst) potato cubes. Optional tights & fake faeces demo.
12	Card-sort or whiteboards. Photos of legal/illegal drugs. 4 white powders (see lesson) labelled: A = Table salt; B = citric acid crystals; C = Sugar; D = Talcum powder. UI indicator solution. Benedicts solution.
13	Reaction times drop-sticks. Data sheets.
14	Assessment sheets.

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	20 question multiple choice knowledge test
Application of Knowledge:	Extended writing answer describing the journey of oxygen & carbon dioxide through the respiratory system

Scheme of Learning: Chemical Reactions

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Lab Skills	Particles and Separation Techniques	Forces	Cells and Organisation	Elements and the Periodic Table	Energy	Health and Human Body	Chemical Reactions	Electricity and Magnetism	Reproduction

Topic Overview:

The national curriculum requires that we teach the following:

- Chemical reactions as the rearrangement of atoms
- Representing chemical reactions using formulae and using equations
- Combustion, thermal decomposition,
- Oxidation and endo and exothermic reactions

Lesson Sequence:

We start with an introduction to physical and chemical changes. We build on this knowledge to look at word and chemical equations, which is then linked with the conservation of mass. Finally we learn a range of chemical reactions (endo and exothermic, combustion, oxidation, thermal decomposition).

Sequence of Lessons:	
1	Physical and Chemical change
2	Word equations
3	Conservation of mass
4	Exo and Endothermic reactions
5	Combustion
6	Thermal decomposition
7	Revision
8	Assessment

Resources:	
1	Zinc, Copper sulphate, Magnesium, Iron sulphate, Iron filings, Hydrochloric acid, Sodium bicarbonate, Vinegar, Sodium hydroxide
2	Iron, Copper sulphate, Zinc, Silver nitrate, Hydrochloric acid, **Demo**: Sulphur, Oxygen, Lithium with water
3	Magnesium, Pan-balance
4	Magnesium, Hydrochloric acid, Potassium nitrate, Sodium carbonate, Sodium hydroxide, Calcium chloride, Ammonium nitrate
5	Candles, plasticine and different size beakers and **Demo**: combustion apparatus
6	**Demo:** Copper carbonate, Zinc carbonate, Calcium carbonate, Limewater

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	Multiple choice questions.
Application of Knowledge:	Compare the combustion reaction with the thermal decomposition reaction

Scheme of Learning: Electricity & Magnetism

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Lab Skills	Particles and Separation Techniques	Forces	Cells and Organisation	Elements and the Periodic Table	Energy	Health and Human Body	Chemical Reactions	Electricity and Magnetism	Reproduction

Topic Overview:

Electricity and magnetism has been covered in three of the four years at KS2. Students should have an understanding of simple circuits, including some circuits symbols and understand that magnets can exert a force at a distance on certain materials.
In this topic we cover:
Current electricity – students should gain knowledge of current, potential difference and resistance in simple series and parallel circuits.
Static electricity – the is caused by the transfer of electrons between two insulating materials and creates electric fields which can exert a force at a distance.
Magnetism – including magnetic field patterns, the Earth as a magnet, electromagnets and simple d.c. motors.

Lesson Sequence:

We begin with a recap of the information taught at KS2, looking at basic circuits and symbols. This then develops into a more detailed understanding of the concepts of current, potential difference and resistance in electric circuits.
We then look at static electricity caused by the transfer of electrons and demonstrate the effect of electrostatic forces.
Next we look at permanent magnets and identify the magnetic field pattern around a bar magnet. This is then compared to the magnetic field of the Earth.
Finally, we look at how the ideas of the topic can be linked together in electromagnetism and how electromagnets can be useful.
Please note: some of the lessons will take more than the 1 hour lesson slot. Please account for this in your advanced planning.

Sequence of Lessons:		Resources:	
1	Current	1	Yellow kit bulbs, cells and ammeters, leads
2	Potential difference	2	Yellow kit bulbs, cells and voltmeters, leads
3	Series and parallel	3	Worksheet, yellow kit bulbs, cells, ammeters and voltmeters, leads
4	Resistance	4	Worksheet
5	Static electricity	5	Van der Graaff worksheet, Demo – balloon, plastic rod and cloth, hole punchings/ground black pepper, Van der Graaff demo
6	Magnetic materials	6	Ppt slide 7 as a sheet, class set – bar magnets, selection of materials (iron, paper, rubber, nickel, wood, glass, copper, zinc, aluminium), paper clips, thread
7	Magnetic fields	7	Class set – bar magnets, plotting compasses, iron filings. Demo – navigational compass
8	Electromagnets	8	Class set – electromagnet wires, iron cores, assorted other cores (e.g. wood, plastic), box of paperclips, variable power supplies, leads, crocodile clips
9	Electromagnet uses	9	Electric bell diagram Motor kits, variable power supplies (small grey ones are good for this)
10	Assessment	10	Quiz sheet Assessment sheet

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	20 question multiple choice quiz
Application of Knowledge:	Extended writing task evaluating the use of an energy resource

Scheme of Learning: Reproduction

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Lab Skills	Particles and Separation Techniques	Forces	Cells and Organisation	Elements and the Periodic Table	Energy	Health and Human Body	Chemical Reactions	Electricity and Magnetism	Reproduction

Topic Overview:

The national curriculum requirements for this topic are to cover the following:

- 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, to include the effect of maternal lifestyle on the foetus through the placenta
- reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms.

Lesson Sequence:

Starting with the human system, we look at the functions and names of the reproductive organs in males and females. In a logical sequence we then learn about fertilisation, pregnancy, birth and finally puberty. We then move onto reproduction in flowering plants, again learning the functions and names of the relevant organs and then pollination and seed dispersal.

Sequence of Lessons:

1	Reproduction systems
2	Fertilisation in humans
3	Pregnancy & birth
4	Puberty
5	The menstrual cycle
6	Plant reproduction
7	Pollination
8	Seed dispersal
9	Assessment

Resources:

1	Question box and post-it notes. (keep this for duration of topic)
2	Resources in shared folder
3	Resources in shared folder
4	Resources in shared folder
5	Resources in shared folder
6	Cress seed, Petri Dishes, Cotton Wool, Marker Pens, Flowers, Dissection tools
7	Resources in shared folder
8	Maple seed templates, Paper clips
9	In shared folder

Supportive Reading:

Comprehension activity	Puberty problem pages L4

Assessment:

Knowledge:	20 question multiple choice knowledge test
Application of Knowledge:	Extended writing answer describing fertilisation in humans.

Scheme of Learning: Acids and Alkalis

Topic Sequence:

1	2	3	4	5	6	7	8	9
Acids & Alkalis	Motion & Pressure	Photosynthesis & Respiration	Metals & Materials	Waves	Inheritance & Evolution	Earth & Atmosphere	Space	Ecosystems & Interdependence

Topic Overview:

In year 5, students should study that some materials will dissolve in liquid to form a solution; and 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 the action of acid on bicarbonate of soda.
This topic then includes:
defining acids and alkalis in terms of neutralisation reactions
the pH scale for measuring acidity/alkalinity; and indicators
reactions of acids with alkalis to produce a salt plus water

Lesson Sequence:

This topic begins by recapping the necessity of completing risk assessments when working with chemicals (covered in the particles topic in year 7). We then move onto looking at the definition of concentration and how this will affect the speed of a reaction (qualitatively). Students will then use a range of indicators to investigate strength and pH. Finally, looking at neutralisation reactions, naming slats and balancing symbol equations.

Please note: some of the lessons will take more than the 1 hour lesson slot. Please account for this in your advanced planning.

Sequence of Lessons:		Resources:	
1	Hazards and risks	1	A selection of household acids and alkalis in original containers Keyword wordsearch
2	Concentration	2	0.1M HCl with irritant label, 0.1M NaOH with irritant label, 2M HCl with corrosive label, 2M NaOH with corrosive label Flasks with 3 obviously different concentrations of squash Magnesium ribbon
3	Indicators	3	The same selection of household chemicals to test from lesson 1 with pipettes, spotting tiles, pre-chopped red cabbage
4	Strength	4	The same selection of household chemicals to test from lesson 1 with pipettes, spotting tiles, UI solution, UI paper, pH probe (if working), small bottle fizzy water, blue litmus paper
5	pH	5	1M HCl, 1M NaOH, UI solution
6	Neutralisation	6	UI solution, 0.5M hydrochloric acid (for demo) and bicarbonate solution, 0.1M hydrochloric acid (for class expt), selection of indigestion tablets
7	Salts	7	Mg ribbon and 0.5M HCl, molymods or sweetie balancing For sweetie balancing – 1st reaction - each group needs 2 pots of sweets, one colour per pot and 10 of each sweet. 2nd reaction each group needs 3 pots of sweets, one colour per pot and 5 of each plus cocktail sticks to join them together. Worksheet for sweetie balancing
8	Assessment	8	Quiz sheet Assessment sheet

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	20 question multiple choice quiz
Application of Knowledge:	Extended writing task evaluating the use of an energy resource

Scheme of Learning: Motion and Pressure

Topic Sequence:

1	2	3	4	5	6	7	8	9
Acids & Alkalis	Motion & Pressure	Photosynthesis & Respiration	Metals & Materials	Waves	Inheritance & Evolution	Earth & Atmosphere	Space	Ecosystems & Interdependence

Topic Overview:

In KS2 (primary) pupils are taught to identify the effects of air resistance, water resistance and friction. We build on this with how these forces act between moving surfaces and recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect and compare how things move on different surfaces. In year 7 we have covered the contact and non contact forces as well as the affect of resultant forces on motion. This topic is designed to build upon the knowledge of forces and look at how they affect many different areas of science and how we can use forces to calculate pressure in solids, liquids and gasses as well as moments (the turning force sometimes called torque). The whole topic is set to the context of transport and more specifically global parcel delivery services. Students will have to develop their skill to be able to calculate and analyse data in both numeric and graphical forms.

Lesson Sequence:

This topic leans heavily on calculations and analysis of data. Pupils will start by being asked to remember what they learned during the forces topic in year 7 and state the three effects of a resultant forces on an object. We will move on in that lesson to applying the speed equation to calculate speeds, distances and times. This is then developed by looking at how speed can pe represented on a distance/time graph where pupils will need to be able to identify and explain how the gradient of the line represents the speed of the object. We will then look at how forces are also linked to pressure and use the pressure = force/area equation to identify the factor that affects pressure and what happens to objects under high and low pressures. We will develop this further by looking at pressures in fluids and developing our understanding of why some objects will float and other objects will sink. Pupils will then look at pressures in gasses and explain how altitude affects pressure on aircrafts. Pupils will then move on to calculating moments and using the principle of moments to explain why a crane can stay balanced when picking up heavy objects. Finally they will look at how when forces are applied to a spring, work is done and energy is stored in that stretched or compressed object until the force is removed. Pupils will be assessed by 20 multiple choice questions and then required to work out some calculations in a longer answer question.

Sequence of Lessons:

1	Speed
2	Distance/Time graphs
3	Pressure in Solids
4	Pressure in liquids
5	Pressure in gases
6	Moments (a) Calculation and Principle of moments
7	Moments (b) application of knowledge.
8	Work done
9	Assessment

Resources:

1	-
2	Graph work sheet
3	Ice road truckers print out
4	-
5	-
6	Class set: Moments rulers and 0.1N Weights and mass hangers
7	Class Set: Meter rulers, string, plastic cups, 1 x pan balances 0.1N Weights and mass hangers.
8	Class set Springs
9	Assessment Sheets

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	20 question multiple choice quiz
Application of Knowledge:	Extended Calculation task..

Scheme of Learning: Photosynthesis and Respiration

Topic Sequence:

1	2	3	4	5	6	7	8	9
Acids & Alkalis	Motion & Pressure	Photosynthesis & Respiration	Metals & Materials	Waves	Inheritance & Evolution	Earth & Atmosphere	Space	Ecosystems & Interdependence

Topic Overview:

The national curriculum requirements for this topic are to cover the following:

- The reactants in, and products of, photosynthesis, and a word summary for photosynthesis
- 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 essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere
- The adaptations of leaves for photosynthesis.
- 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.

Lesson Sequence:

First pupils are introduced to the ideas of how plants absorb light and photosynthesise. This is then linked to how leaves are adapted to allow this process to take place efficiently, involving leaf cell types, organelles and stomata. Pupils then move on to respiration and the different types and situations this takes place in, aerobically, anaerobically and in yeast.

Sequence of Lessons:

1	Photosynthesis
2	Structure of leaves
3	Stomata
4	Plants for Food
5	Aerobic Respiration
6	Anaerobic Respiration in Humans
7	Fermentation in Yeast
8	Assessment

Resources:

1	Ethanol, leaves, kettles, white tiles, iodine.
2	Need to print leaf structure worksheet. Leaf structure card sort in drawers.
3	Leaves with nail varnish on underside, microscopes, microscope slides, cover slips.
4	Graph paper, could print pyramids of biomass worksheet
5	Limewater, straws, small mirrors
6	n/a
7	Yeast solution, sugar solutions (high, medium and low concentrations), marker pens to write on test tubes, kettles. Could print results table. Graph paper.
8	Print MCQ and 6-mark question on yellow paper

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	20 question multiple choice knowledge test
Application of Knowledge:	Extended written answer comparing photosynthesis and respiration.

Scheme of Learning: Metals & Materials

Topic Sequence:

1	2	3	4	5	6	7	8	9
Acids & Alkalis	Motion & Pressure	Photosynthesis & Respiration	Metals & Materials	Waves	Inheritance & Evolution	Earth & Atmosphere	Space	Ecosystems & Interdependence

Topic Overview:

At KS2 students should have begun to classifying materials and link material properties to their uses for some everyday substances.
In this topic we cover:
representing chemical reactions using formulae and using equations
combustion, thermal decomposition, oxidation and displacement reactions
reactions of acids with metals to produce a salt plus hydrogen
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).

Lesson Sequence:

The topic begins with three lessons looking at how different metals behave in three common reactions (with water, acid and oxygen). The results of these experiments are then used to investigate the reactivity series and displacement reactions, including the use of carbon to extract metals from their ores.
The last two lessons look at more complicated materials, covering the properties and uses of ceramics, composites and polymers.

Please note: some of the lessons may take more than the 1 hour lesson slot. Please account for this in your advanced planning.

Sequence of Lessons:		Resources:	
1	Metals and acids	1	Mg, Zn, Cu, Al, Fe pieces and 0.5M HCl, white boards
2	Metals and oxygen	2	Rusty nail, new nails, oil, anhydrous calcium chloride, salt. Mg, Fe, Cu, Zn, Al pieces Balancing equations – version of ppt slide to stick in and balance
3	Metals and water	3	demo - lithium, sodium, calcium, UI, trough; Class set - Mg, Fe, Cu, Zn, Al,
4	Reactivity and displacement	4	Demo - copper wire, silver nitrate; Class set - Mg, Zn, Al, Cu and corresponding sulphates, laminated tables for experiment. Reactivity series to stick in; copy of laminated sheet for results
5	Reactivity and metal extraction	5	Iron oxide and carbon powder, tin lid, magnet
6	Ceramics and composites	6	Ceramic examples - roof tiles, bricks, pottery, porcelain, bone china Making test bars: cement, sand, aggregate, giant paperclips unbent into rods, card template for former, plasticine
7	Testing composites and polymers	7	Demo - making nylon concrete bars – reinforced and unreinforced. Use a mix of 1:3:6 cement:sand:aggregate and unbent giant paperclips for the reinforced bars (or student's prepared bars from last lesson), 100g masses Class set – at least 2 types of plastic bags, hole punch/bulldog clips, Sellotape, 100g masses and hanger
8	Assessment	8	Quiz sheet Assessment sheet

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	20 question multiple choice quiz
Application of Knowledge:	Extended writing task evaluating the use of an energy resource

Scheme of Learning: Waves

Topic Sequence:

1	2	3	4	5	6	7	8	9
Acids & Alkalis	Motion & Pressure	Photosynthesis & Respiration	Metals & Materials	**Waves**	Inheritance & Evolution	Earth & Atmosphere	Space	Ecosystems & Interdependence

Topic Overview:

Light and sound have been introduced at KS2 with student covering the concepts of sound being produced by vibrations and that light travels in straight lines.
In this topic we cover:
Water waves
Sound waves – properties, production and detection
Light waves – transmission (including the ray model), properties, detection and colour

Lesson Sequence:

The topic starts with a general look at waves including the key vocabulary needed for later in the topic. It moves on to focus on the properties of sound waves, the human ear and applications such as microphones and loudspeakers.
The second part of the topic looks at light in more detail, including ray diagrams for reflection and refraction, the human eye, a pinhole camera, lenses and colour.

Please note: some of the lessons will take more than the 1 hour lesson slot. Please account for this in your advanced planning.

Sequence of Lessons:	
1	Properties of waves
2	Sound waves
3	Hearing
4	Controlling sounds
5	Using sound
6	Light
7	Ray diagrams – reflection
8	Ray diagrams – refraction
9	Detecting light
10	Colour
11	Assessment

Resources:	
1	Slinky, wave diagram worksheet
2	String telephones, loudspeaker, CRO and sig. gen., pitch and volume worksheet
3	Ear model, loudspeaker, CRO and sig.gen., ear diagram worksheet and how we hear worksheet
4	Wooden blocks, trundle wheel (or tape measures), microphone worksheet
5	Card template, scissors, tape, half toilet roll tubes, 2m lengths of insulated copper wire, homemade speaker demo
6	LDR, desk lamp, multi-meter, leads, selection of materials e.g. paper, card, plastic, tracing paper, wood etc
7	Ray box, slit, power supply, mirror
8	Ray box, slit, power supply, glass block, convex lenses, demo of mug and coin trick
9	Pin hole camera, convex lenses, light source, eye diagram sheet, parts to functions sheet, possible eye dissection
10	Prisms, filter glasses
11	Quiz sheet Assessment sheet

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	20 question multiple choice quiz
Application of Knowledge:	Extended writing task evaluating the use of an energy resource

Scheme of Learning: Inheritance & Evolution

Topic Sequence:

1	2	3	4	5	6	7	8	9
Acids & Alkalis	Motion & Pressure	Photosynthesis & Respiration	Metals & Materials	Waves	**Inheritance & Evolution**	Earth & Atmosphere	Space	Ecosystems & Interdependence

Topic Overview:

The national curriculum requirements for this topic are to cover the following:

- 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

Lesson Sequence:

In the Cells and Organisation and the Reproduction topics in Year 7, pupils learned that DNA is stored in the nucleus of cells and is passed on from parents to offspring at fertilisation. This topic builds upon this knowledge by first looking more closely at the structure and discovery of DNA before introducing the broader idea of evolution through the process of natural selection. We then finish the topic by exploring the causes of extinction. In this way, we move from the microscopic world through to large-scale, macroscopic concepts that affect whole species.

Sequence of Lessons:

1	DNA Structure
2	DNA Discovery
3	Extracting DNA
4	Genetic Vs Environmental Variation
5	Continuous Vs Categoric Variation
6	Species & Classification
7	Natural Selection
8	Extinction
9	Assessment

Resources:

1	DNA origami template , (make sure you have enough scissors)
2	Worksheets in shared area
3	Salt, Washing up liquid, Ethanol – ice cold, Kiwis, Knives, Pestle & mortars, White tiles, Pineapple juice, Water bath at 37°C.
4	Chromosome cards
5	Worksheets in shared area
6	Shark key and pictures.
7	Worksheets in shared area
8	Worksheets in shared area
9	Endangered species factsheets
10	Worksheets in shared area

Supportive Reading:

Comprehension activity	Endangered species fact sheets

Assessment:

Knowledge:	20 question multiple choice knowledge test
Application of Knowledge:	Extended written answer explaining elephant evolution.

Scheme of Learning: Earth & Atmosphere

Topic Sequence:

1	2	3	4	5	6	7	8	9
Acids & Alkalis	Motion & Pressure	Photosynthesis & Respiration	Metals & Materials	Waves	Inheritance & Evolution	Earth & Atmosphere	Space	Ecosystems & Interdependence

Topic Overview:

The key stage three national curriculum requires the following content to be taught:

- 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 carbon cycle
- the composition of the atmosphere
- the production of carbon dioxide by human activity and the impact on climate

Lesson Sequence:

We begin by studying the structure and composition of the Earth by describing the crust, mantle and inner and outer core. We include the composition of the atmosphere at this point. We the move onto the rock cycle by describing the properties and formation of sedimentary, igneous and metamorphic rocks and the processes that transform one rock type to another. We then study how carbon is cycled around the environment by natural and artificial processes before looking at the impact humans have on the environment with respect to the importance of recycling and the causes and consequences of climate change.

Sequence of Lessons:

1	Structure of the Earth
2	Sedimentary Rocks
3	Igneous & Metamorphic Rocks
4	The Rock Cycle
5	The Carbon Cycle
6	Recycling
7	Climate Change
8	Assessment

Resources:

1	Laminated Earth Structure Fact Sheets
2	Examples of sedimentary rocks
3	Molten salol, 30x cold slides from freezer, 30x hot slides. Examples of igneous and metamorphic rocks
4	White, dark, milk chocolate, cheese garter, kitchen foil.
5	n/a
6	n/a
7	n/a
8	Test in shared folder

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	20 question multiple choice quiz
Application of Knowledge:	Extended writing task

Scheme of Learning: Space

Topic Sequence:

1	2	3	4	5	6	7	8	9
Acids & Alkalis	Motion & Pressure	Photosynthesis & Respiration	Metals & Materials	Waves	Inheritance & Evolution	Earth & Atmosphere	Space	Ecosystems & Interdependence

Topic Overview:

In KS2 (primary) pupils are taught to observe changes across the 4 seasons, describe weather associated with the seasons and how day length varies. They have also described the movement of the Earth and other planets relative to the Sun in the solar system and described the movement of the Moon relative to the Earth. This topic in KS3 builds on these principles as well and embedding some of the forces topic that pupils learned in year 7. Space is only covered by Separate science in GCSE so this is potentially the only experience of space some pupils will gain in secondary school. Therefore the depth and detail that is covered is quite extensive even looking at the UKs role in developing satellite communication. We will look at theories about the solar system, how they have changed over time and the evidence that has caused us to adapt our models and developed our understanding.

Lesson Sequence:

This topic leans heavily on literacy and pupils' ability to identify key information within a text and apply it to a context. It starts with an extract by Stephen Hawking on why humans will eventually have to leave the Earth. This is built upon by looking at important aspects for life on Earth, seasonal changes, the phases of the moon and eclipses. Our journey them moves into space looking at natural and artificial satellites. We then look further into space and identify the planets in the solar system, their order and specific features. Astronomical distances are explained at this point to allow pupils to understand the vast distances between planets, stars and galaxies. We eventually look at a satellite that could have life and evaluate the evidence to support the theory that life could be present. Pupils will be required to apply all the knowledge they have learned across many topics during the year to be able to complete the evaluation. We finish the topic with an assessment where the pupils will be asked to explain why the Earth has different seasonal variations in the northern hemisphere, southern hemisphere and at the equator. We include how satellites have allowed us to see the difference in the seasons in the different hemispheres.

Sequence of Lessons:

1	The Earth
2	Natural Satellites
3	Artificial Satellites
4	The history of the solar system
5	The Universe and Enceladus
6	Assessment

Resources:

1	Lamp, Globe, Thermographic film Model of Earth and Sun Worksheet 1: Leaving Earth Worksheet 2: Day length and temperature analysis
2	Lamp and Tennis ball Worksheet 1: Required reading. Worksheet 2: keyword match up print slide 4.
3	Worksheet 1: British Satellites Worksheet 2: Types of orbits
4	Toilet roll or 3m long strips of paper, Colouring pens Orrery (VI) Worksheet 1: Planet information Worksheet 2: Scale model distances.
5	Evidence cards and evaluation table for evaluation.
6	Assessment sheet to print.

Supportive Reading:

Comprehension activity	TBC

Assessment:

Knowledge:	20 question multiple choice quiz
Application of Knowledge:	Extended writing taskExplain why the Earth has different seasonal variation in the northern hemisphere, southern hemisphere and at the equator. You should include how satellites have allowed us to see the difference in the seasons in the different hemispheres.

Scheme of Learning: Ecosystems & Interdependence

Topic Sequence:

1	2	3	4	5	6	7	8	9
Acids & Alkalis	Motion & Pressure	Photosynthesis & Respiration	Metals & Materials	Waves	Inheritance & Evolution	Earth & Atmosphere	Space	Ecosystems & Interdependence

Topic Overview:

The national curriculum requirements for this topic are to cover the following:

- 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.

Lesson Sequence:

Starting with how animal and plants are adapted to their environments to help them compete, we move onto food webs and predator prey cycles. Then look at how organisms affect, and are affected by, their environment, including the accumulation of toxic materials and our dependence on them for our food security. We include a lesson on sampling techniques as a foundation for later KS4 work.

Sequence of Lessons:	
1	Competition in Animals
2	Competition & Adaptation in Plants
3	Adaptation in Animals
4	Food Webs
5	Predator Prey Cycles
6	Bioaccumulation
7	Sampling Techniques
8	Food Security
9	Assessment Lesson

Resources:	
1	n/a
2	n/a
3	Polar adaptation comprehension activity
4	Ocean food webs cut & stick
5	Predator Prey Graphs
6	Sorting sheet and video questions
7	Quadrats and trundle wheel
8	Food security comprehension activity
9	In folder

Supportive Reading:

Comprehension activity	Polar adaptations L3 and Food Security L8

Assessment:

Knowledge:	20 question multiple choice knowledge test
Application of Knowledge:	Extended written answer describing sampling techniques.

Scheme of Learning: Cell Biology

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Cell Biology	Particle Model of Matter	Infection & Response	Atomic Structure & the Periodic Table	Atomic Structure (Physics)	Bonding & Structure	Energy	Bioenergetics	Rates of Reaction	Chemistry of the Atmosphere

Topic Overview:

Cells are the basic unit of all forms of life. In this section we explore how structural differences between types of cells enables them to perform specific functions within the organism. These differences in cells are controlled by genes in the nucleus. For an organism to grow, cells must divide by mitosis producing two new identical cells. If cells are isolated at an early stage of growth before they have become too specialised, they can retain their ability to grow into a range of different types of cells. This phenomenon has led to the development of stem cell technology. This is a new branch of medicine that allows doctors to repair damaged organs by growing new tissue from stem cells.

Lesson Sequence:

We start by describing the structure and function of generic plant and animal cells and then specialised cells. We then look at the differences between prokaryotic and eukaryotic cells before moving on to the genetic information cells have. There are two required practicals in this topic (magnification and aseptic Technique). We then describe the process of mitosis and finish with a comparison of the different methods of cell transport. Our focus skill for this topic is 'planning a method'.

Sequence of Lessons:	
1	Animal and Plant Cell Differences
2	Microscopes *Required Practical.* - **mid topic assessment** (likely 2 lessons)
3	Prokaryotes and Eukaryotes. **Literacy opportunity**
4	Specialised Cells
5	Aseptic Technique Required Practical.
6	Genetic Information
7	Mitosis
8	Stem cells (2 lessons)
9	Evaluation of therapeutic cloning
10	Diffusion- Concentration and temperature
11	Diffusion – Surface area
12	How does the concentration of sugar solution affect osmosis *Required Practical* - **mid topic assessment –** (likely 2 lessons)
13	Active Transport
14	Revision
15	Test

Resources:	
1	Microscope diagram, Cells labelling worksheet – both found in shared area. Microscopes, pre-prepared slides of basic animal and plant cells.
2	Microscopes, onion (cut into pieces), tweezers, iodine, slides, cover slips. Required Practical method sheet to print – in shared area. Mid topic assessment in shared area. Practice questions in shared area.
3	Diagrams of example eukaryote and prokaryote printed and in drawers. Could print table of differences for pupils to complete. Collect literacy sheet to read from drawers.
4	Table for pupils to complete on PowerPoint. Information sheets in drawers. Post it notes for plenary. Print exam question if needed.
5	Print RP sheets, print example plates for pupils to measure. Nutrient agar plates spread with bacteria, 3 types of filter paper discs soaked in mouthwash or TCP or antiseptic, disinfectant for desks, tape, forceps, pens. DEMO – agar plate, 'bacteria' culture, glass spreader, inoculating loop.
6	Print diagram and handout for pupils of chromosomes and paragraph. Can print and use DNA model origami if desired.
7	Could print table for pupils to fill out details of cell cycle. Print exam question.
8	Resources in shared area
9	People cards for ethics task to be printed and given to pupils in groups. Could use IT room.
10	Blocks of agar coloured with phenylalanine, 0.5M HCl, 1.0M HCl, water bath at 50 degrees. Print results table slide.
11	Demo – icing sugar, sugar cube in Bunsen flame. Print table for pupils to complete. Info sheets in drawer.
12	0.2, 0.4, 0.6, 0.8, 1.0M sugar solutions, cylinders of potato, high resolution balances. Print results table if needed.
13	Print root hair cell diagram to annotate and exam questions.
14	Question mat to print
15	Test paper in shared area

Supportive Reading:

Comprehension activity	From Prokaryotes to Eukaryotes information to read

Assessment:

Knowledge:	Multiple choice and short answer questions.
Application of Knowledge:	Exam questions based on the skill of 'plan a method'

Scheme of Learning: Particle Model of Matter

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Cell Biology	Particle Model of Matter	Infection & Response	Atomic Structure & the Periodic Table	Atomic Structure (Physics)	Bonding & Structure	Energy	Bioenergetics	Rates of Reaction	Chemistry of the Atmosphere

Topic Overview:

The particle model is widely used to predict the behaviour of solids, liquids and gases and this has many applications in everyday life. It helps us to explain a wide range of observations and engineers use these principles when designing vessels to withstand high pressures and temperatures, such as submarines and spacecraft. It also explains why it is difficult to make a good cup of tea high up a mountain

Lesson Sequence:

We begin with a recap of the states of matter and changes of state from key stage three. We then build on this foundation to look deeper at what internal energy of a substance is and how potential and kinetic energy of particles changes during temperature rises and state changes. We include the required practical on specific heat capacity.

The middle part of the topic concerns density. We complete another required practical to calculate the densities of regular shapes, irregular shapes and liquids. We finish by looking at gas pressure.

In this topic, we will focus on the skill of 'describe'.

Sequence of Lessons:	
1	States of Matter
2	Change of State
3	Internal Energy
4	Specific Heat Capacity *(2 lessons worth)* *(required practical)*
5	Specific Latent Heat
6	Density of Regular Shapes *(required practical)*
7	Density of Irregular Shapes *(required practical)*
8	Density of Liquids *(required practical)* *Mid topic assessment*
9	Gas Pressure & Temperature
10	Revision
11	Test

Resources:	
1	n/a
2	Melted stearic acid in test tubes in a water bath
3	n/a
4	Demo: Specific heat capacity required practical – use a joule meter, not an ammeter and voltmeter.
5	n/a
6	Various metal cubes, callipers.
7	Variety of irregular shaped objects, eureka cans, washing up bowls.
8	Variety of liquids (golden syrup, wallpaper paste, sugar water, salt water, glycerol, sunflower oil) balances.
9	Empty drink cans, washing up bowls.
10	n/a
11	n/a

Supportive Reading:	
Extended answer practice	8 marker written answer in lesson 3

Assessment:	
Knowledge:	Multiple choice and short answer questions.
Application of Knowledge:	Exam questions based on the skill of describe

Scheme of Learning: Infection & Response

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Cell Biology	Particle Model of Matter	Infection & Response	Atomic Structure & the Periodic Table	Atomic Structure (Physics)	Bonding & Structure	Energy	Bioenergetics	Rates of Reaction	Chemistry of the Atmosphere

Topic Overview:

Pathogens are microorganisms such as viruses and bacteria that cause infectious diseases in animals and plants. They depend on their host to provide the conditions and nutrients that they need to grow and reproduce. They frequently produce toxins that damage tissues and make us feel ill. This section will explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Once inside the body our immune system is triggered which is usually strong enough to destroy the pathogen and prevent disease. When at risk from unusual or dangerous diseases our body's natural system can be enhanced by the use of vaccination. Since the 1940s a range of antibiotics have been developed which have proved successful against a number of lethal diseases caused by bacteria. Unfortunately many groups of bacteria have now become resistant to these antibiotics. The race is now on to develop a new set of antibiotics

Lesson Sequence:

Starting with an overview of communicable disease and their transmission, including a description of microbes, we learn about the specific disease required by the specification. We then describe the immune response of the human body and how this can be supported with antibiotics and vaccinations. We explore how new medicines are developed and the use of monoclonal antibodies. We finish with a look at how plants protect themselves from pathogens. Our focus skill for this topic is 'describe'.

Sequence of Lessons:	
1	Communicable disease
2	Spread of Disease.
3	Viral & bacterial disease
4	Fungi & protist disease
5	Defence mechanisms of human body.
6	Vaccination. **Literacy task**
7	Antibiotics & painkillers
8	Developing medicines
9	Double blind trials & placebos - **Mid topic assessment**
10	Monoclonal antibodies
11	Plant diseases
12	Revision
13	Test

Resources:	
1	Virus, fungi, bacteria & protist fact sheets – laminated in filing cabinet
2	Petri dishes with sterile agar, cotton buds, tape, marker pens.
3	Viral and bacterial disease laminated fact sheets in filing cabinet
4	Worksheets in shared area folder
5	Worksheets in shared area folder
6	Vaccination and covid literacy task sheets.
7	Patient card and action cards in filing cabinet.
8	Worksheets in shared area folder
9	Two number grids x 15. Two colours of pre-wrapped (for hygiene) sweets. Exam question in shared area folder.
10	Monoclonal antibody laminated fact sheets
11	Symptom checker question key. Laminated pictures of diseased plants.
12	Resources in shared area folder
13	Test paper in shared area

Supportive Reading:

Comprehension activity	Vaccinations & Covid comprehension L6

Assessment:

Knowledge:	Multiple choice and short answer questions.
Application of Knowledge:	Exam questions based on the skill of 'describe'

Scheme of Learning: Atomic Structure and the Periodic Table

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Cell Biology	Particle Model of Matter	Infection & Response	Atomic Structure & the Periodic Table	Atomic Structure (Physics)	Bonding & Structure	Energy	Bioenergetics	Rates of Reaction	Chemistry of the Atmosphere

Topic Overview:

The periodic table provides chemists with a structured organisation of the known chemical elements from which they can make sense of their physical and chemical properties. The historical development of the periodic table and models of atomic structure provide good examples of how scientific ideas and explanations develop over time as new evidence emerges. The arrangement of elements in the modern periodic table can be explained in terms of atomic structure which provides evidence for the model of a nuclear atom with electrons in energy levels.

Lesson Sequence:

We begin by building upon key stage three knowledge of elements, compounds and mixtures and experience a variety of separation techniques including filtration, chromatography, distillation and crystallisation.

We then look more closely at the atom, learning about sub-atomic particles and the scientific discoveries that lead to our current understanding of the atom's structure. We introduce the concept of atomic mass and isotopes before discovering how the periodic table came into existence through the work of Mendeleev and other scientists.

Once we have introduced ions and how the metals and non-metals vary in the ions they form, we spend the next few lessons focusing on groups in the periodic table. We look at the properties and trends of groups 1, 7, 0 and the transition metals.

The focus skill for this topic is 'compare'. We do this by comparing the groups in the periodic table, and the different models of the atom through history.

Sequence of Lessons:	
1	Elements & Compounds
2	Chemical Equations & Mixtures
3	Filtration & Crystallisation
4	Distillation & Chromatography
5	History of the Atom
6	Atomic Structure
7	Relative Atomic Mass & Isotopes
8	Development of the Periodic Table mid-topic assessment
9	Ions, Metals & Non-Metals
10	Group 1 mid-topic assessment
11	Group 7
12	Group 0 & Transition Metals
13	Revision
14	Test

Supportive Reading:	
Literacy tasks	Writing longer answer opportunities in various lessons and peer marking

Assessment:	
Knowledge:	Multiple choice and short answer questions.
Application of Knowledge:	Exam questions based on the skill of 'compare'.

Resources:	
1	Worksheets in shared area folder
2	3 Demos: top pan balance, NaOH + $CuSO_4$, vinegar & baking powder, zip lock bag, approx. 4g iron wool, 4g plasticine, metre stick and fulcrum, tin tray (e.g. takeaway carton)
3	Class practical: rock salt
4	Demo: Simple distillation of ink and water. Class practical: Chromatography – variety of pens, paperclips, chromatography paper slips.
5	Worksheets in shared area folder
6	Worksheets in shared area folder
7	Worksheets in shared area folder
8	n/a
9	n/a
10	Group 1 metals, water trough & lid, universal indicator, scalpel, white tile
11	Dimple tiles, pipettes, Chlorine, bromine & iodine water, potassium chloride, bromine & iodide solutions
12	sodium hydroxide solution, solutions of Cu^{2+}, Fe^{2+}, Fe^{3+} and transition metal sheets in filing cabinet
13	Resources in shared area folder
14	Test in shared area folder

Scheme of Learning: Atomic Structure (Physics)

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Cell Biology	Particle Model of Matter	Infection & Response	Atomic Structure & the Periodic Table	**Atomic Structure (Physics)**	Bonding & Structure	Energy	Bioenergetics	Rates of Reaction	Chemistry of the Atmosphere

Topic Overview:

Ionising radiation is hazardous but can be very useful. Although radioactivity was discovered over a century ago, it took many nuclear physicists several decades to understand the structure of atoms, nuclear forces and stability. Early researchers suffered from their exposure to ionising radiation. Rules for radiological protection were first introduced in the 1930s and subsequently improved. Today radioactive materials are widely used in medicine, industry, agriculture and electrical power generation.

Lesson Sequence:

We begin with a recap of the history of the atomic structure model and the diagram we use today. This was covered in topic on Atomic Structure and the Periodic Table as it is a fundamental idea behind most of the Chemistry topics and but also many of the Physics topics too. However, at this point we move away from the focus on electron shells and bonding and towards the nucleus with its protons and neutrons.

The topic then moves onto the idea that large, heavy atoms are unstable and will randomly decay to become a different element. This decay causes particles and energy to be emitted either as an alpha particle, a beta particle or a gamma wave (energy), possibly more than one of these at a time. The lessons then go on to look at the effect the emission of these particle has on the original nucleus.

Next in the topic we look at the different ways to measure radioactivity, including background radiation and consider the statistical constant that is the half-life of a radioactive element.

The uses of radioactivity and its associated risks are then considered; from tracers and medical applications to radio-carbon dating.

Finally, the processes of nuclear fission and fusion are looked at in more detail.

Sequence of Lessons:	
1	Structure of the Atom
2	Radioactive Decay
3	Nuclear Equations
4	Activity & Half-Life
5	Dangers of Radiation – *mid-topic assessed question*
6	Uses of Radiation
7	Nuclear Fission & Fusion
8	Revision
9	Test

Resources:	
1	n/a
2	Summary Qs and comparison table
3	PT with mass numbers, decay worksheet
4	Skittles, big measuring cylinders x4, half-life questions
5	Background pie chart, exam Q, Geiger-Müller tube, counter
6	Uses of Radiation Qs
7	Fission & Fusion Qs (use the level 3 Qs for top set)
8	Resources in shared folder
9	Test in shared folder

Supportive Reading:

TBC	

Assessment:

Knowledge:	Multiple choice and short answer questions.
Application of Knowledge:	Exam questions based on the skill of 'explain'.

Scheme of Learning: Bonding & Structure

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Cell Biology	Particle Model of Matter	Infection & Response	Atomic Structure & the Periodic Table	Atomic Structure (Physics)	**Bonding & Structure**	Energy	Bioenergetics	Rates of Reaction	Chemistry of the Atmosphere

Topic Overview:

Chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures. Scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. The properties of these materials may offer new applications in a range of different technologies.

Lesson Sequence:

We begin with a recap of previous chemistry knowledge by looking at the structure of the atom. It is essential for this topic, and indeed all of Chemistry, that pupils have a firm understanding of what electrons are. We look at how an atom can lose or gain an electron to form an ion. This leads onto how these electrons are transferred in ionic compounds. Pupils need to be able to explain the properties of small and giant ionic compounds.

We then move onto bonding between non-metals where electrons are not transferred, but shared. Again, pupils need to be able to describe the structure and properties of simple and giant covalent structures including diamond, graphite, fullerenes and graphene.

The final type of bonding we study is metallic bonding, Pupils needs to be able to explain why metals conduct heat and electricity with reference to their electrons.

Pupils need to be able to explain how the forces of attraction in solids, liquids and gases affect their properties. Finally, Separate Chemists learn about nanoparticles and their applications.

Sequence of Lessons:	
1	Atoms into Ions
2	Ionic Bonding
3	Giant Ionic Structures – *mid topic assessment*
4	Covalent Bonding
5	Structure of Simple Molecules
6	Giant Covalent Structures
7	Fullerenes & Graphene
8	Bonding in Metals
9	States of Matter
10	Nanoparticles – *Separate Chemistry Only*
11	Revision
12	Test

Resources:	
1	n/a
2	n/a
3	Salt (NaCl), Carbon electrodes, Crocodile clips, Power packs, Wires, Bulbs
4	n/a
5	n/a
6	n/a
7	n/a
8	n/a
9	n/a
10	Nanoparticle Info Sheets
11	n/a
12	Test in shared area

Supportive Reading:

Literacy tasks	Writing longer answer opportunities in various lessons and peer marking

Assessment:

Knowledge:	Multiple choice and short answer questions.
Application of Knowledge:	Exam questions based on the skill of 'explain'.

Scheme of Learning: Energy

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Cell Biology	Particle Model of Matter	Infection & Response	Atomic Structure & the Periodic Table	Atomic Structure (Physics)	Bonding & Structure	**Energy**	Bioenergetics	Rates of Reaction	Chemistry of the Atmosphere

Topic Overview:

The concept of energy emerged in the 19th century. The idea was used to explain the work output of steam engines and then generalised to understand other heat engines. It also became a key tool for understanding chemical reactions and biological systems. Limits to the use of fossil fuels and global warming are critical problems for this century. Physicists and engineers are working hard to identify ways to reduce our energy usage.

Lesson Sequence:

The topic begins with a look at the idea of energy as a means to calculate if it possible for something to happen. This involves looking at the stores of energy and the 'pathways' or energy transfers that occur.
The next part of the topic looks in more detail at how we calculate the amount of energy in the kinetic, gravitational, elastic and thermal energy stores, including the required practical on specific heat capacity.
Next it covers work done and relates this to the transfer of energy/pathways linking with the concepts of power and efficiency. The required practical on insulation fits into this section of the topic by looking at how unwanted energy transfers can be reduced.
Finally, the topic moves onto the energy resources used to generate electricity. Finishing with a lesson looking at how exam questions might be related to current environmental issues relating to climate change.

Sequence of Lessons:		Resources:	
1	Energy stores and pathways	1	Energy analogy demo (coloured water, 2 containers, 2 tubes), worksheet
2	Kinetic energy	2	Kinetic energy calculation sheet
3	Gravitational energy	3	Gravitational potential energy sheet
4	Elastic energy mid-topic assessment	4	Spring toys, Hooke's Law practical – springs, 100g masses and hanger, metre rulers, elastic energy sheet, mid-topic assessment sheet,
5	Specific Heat Capacity	5	Resource sin shared area
6	Power	6	1kg of 100g masses, metre ruler, timer, power worksheet
7	Efficiency mid-topic assessment	7	Sankey diagram sheet, efficiency sheet, Mid-topic assessment sheet
8	Conduction	8	Conduction box demo and kettle (different rods into metal trough)
9	Convection (optional)	9	Tea bag demo, potassium permanganate 'tea bag' demo, chimney demo
10	Insulation *(required practical)*	10	Class set: insulation practical (kettles, thermometers, beaker lids, different insulating materials, paper towels, elastic bands) +instruction sheet
11	Energy resources	11	Laminated energy resources sheets, blank summary sheet, poster making resources
12	Evaluating energy resources	12	'we do' and 'you do' GCSE questions
13	Revision	13	n/a
14	Test	14	test

Supportive Reading:

TBC	

Assessment:

Knowledge:	Multiple choice and short answer questions.
Application of Knowledge:	Exam questions based on the skill of calculate

Scheme of Learning: Bioenergetics

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Cell Biology	Particle Model of Matter	Infection & Response	Atomic Structure & the Periodic Table	Atomic Structure (Physics)	Bonding & Structure	Energy	**Bioenergetics**	Rates of Reaction	Chemistry of the Atmosphere

Topic Overview:

In this section we will explore how plants harness the Sun's energy in photosynthesis in order to make food. This process liberates oxygen which has built up over millions of years in the Earth's atmosphere. Both animals and plants use this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. Conversely, anaerobic respiration does not require oxygen to transfer energy. During vigorous exercise the human body is unable to supply the cells with sufficient oxygen and it switches to anaerobic respiration. This process will supply energy but also causes the build-up of lactic acid in muscles which causes fatigue.

Lesson Sequence:

We begin with a recap of the Cells topic from the start of year 9 and then focus on chloroplasts and the process of photosynthesis. The required practical for this topic investigates how the rate of photosynthesis is affected by the intensity of light. After the practical, we look at other limiting factors (other than light) and how they can be controlled in greenhouses to increase the rate of photosynthesis in plants grown there. We conclude the plants lessons by describing how plants use the glucose they produce during photosynthesis.

The second half of the topic looks at respiration. Beginning with aerobic respiration, we then explain the changes that occur in the body during exercise and compare aerobic to anaerobic respiration. We conclude the topic by learning about metabolism and the role of the liver.

Sequence of Lessons:

1	Photosynthesis
2	The Rate of Photosynthesis – ***Required Practical***
3	Limiting Factors
4	The Uses of Glucose
5	Aerobic Respiration – ***mid topic assessment***
6	The Response to Exercise
7	Anaerobic Respiration
8	Metabolism and the Liver
9	Revision
10	Test

Resources:

1	Exam question in shared folder
2	Pondweed, lamps, metre sticks, glass funnels, large beakers, sodium hydrogen carbonate solution, plasticine.
3	Worksheets in shared area
4	Worksheets in shared area
5	Limewater, straws
6	n/a
7	n/a
8	n/a
9	Resources in shared area
10	Test in shared area

Supportive Reading:

Literacy tasks	Response to exercise lesson has a longer written answer to complete

Assessment:

Knowledge:	Multiple choice and short answer questions.
Application of Knowledge:	Exam questions based on the skill of 'explain'

Scheme of Learning: Rates of Reaction

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Cell Biology	Particle Model of Matter	Infection & Response	Atomic Structure & the Periodic Table	Atomic Structure (Physics)	Bonding & Structure	Energy	Bioenergetics	Rates of Reaction	Chemistry of the Atmosphere

Topic Overview:

Chemical reactions can occur at vastly different rates. Whilst the reactivity of chemicals is a significant factor in how fast chemical reactions proceed, there are many variables that can be manipulated in order to speed them up or slow them down. Chemical reactions may also be reversible and therefore the effect of different variables needs to be established in order to identify how to maximise the yield of desired product. Understanding energy changes that accompany chemical reactions is important for this process. In industry, chemists and chemical engineers determine the effect of different variables on reaction rate and yield of product. Whilst there may be compromises to be made, they carry out optimisation processes to ensure that enough product is produced within a sufficient time, and in an energy-efficient way.

Lesson Sequence:

We begin this topic by defining rate of reaction and how it can be quantified. We then carry out a series of practical investigations to demonstrate how surface area, temperature, concentration and catalysts effect the rate of chemical reactions. We spend a lesson on the maths skill of drawing tangents on a curved line graph to determine rate and then finish the topic focussing on reversible reactions and how changing conditions affects their equilibrium. The focus skill for this topic is graph skills.

Sequence of Lessons:	
1	Rate of Reaction
2	Collision Theory & Surface Area
3	Temperature & Rate of Reaction
4	Concentration & Rate – *Required Practical & mid topic assessment*
5	Required Practical Write Up
6	The Effect of Catalysts
7	Using Tangents
8	Reversible Reactions
9	Altering Conditions
10	Revision
11	Test

Resources:	
1	1.0mol/dm^3 hydrochloric acid, Calcium carbonate, Balances, Cotton wool
2	Gas syringes, 1M Hydrochloric acid, Balances, Marble chips, Powdered $CaCO_3$ Conical flasks (correct size for gas syringe bungs)
3	Indigestion tablets, Pestle & mortars, Delivery tubes, Ice cream tubs, Kettles
4	Sodium thiosulphate, X's on card, 0.25M, 0.5M, 1M, 2M hydrochloric acid
5	Uncertainty worksheet
6	Hydrogen peroxide, Cooked liver, Raw liver Manganese oxide, Copper oxide, Iron oxide
7	Measuring rates worksheet
8	Class set: Anhydrous copper sulphate Demo: Traffic light reversible reaction bottle
9	n/a
10	Worksheets in shared folder
11	Test in shared folder

Supportive Reading:	
TBC	

Assessment:	
Knowledge:	Multiple choice and short answer questions.
Application of Knowledge:	Exam questions based on the skill of 'graph skills'.

Scheme of Learning: Chemistry of the Atmosphere

Topic Sequence:

1	2	3	4	5	6	7	8	9	10
Cell Biology	Particle Model of Matter	Infection & Response	Atomic Structure & the Periodic Table	Atomic Structure (Physics)	Bonding & Structure	Energy	Bioenergetics	Rates of Reaction	Chemistry of the Atmosphere

Topic Overview:

The Earth's atmosphere is dynamic and forever changing. The causes of these changes are sometimes man-made and sometimes part of many natural cycles. Scientists use very complex software to predict weather and climate change as there are many variables that can influence this. The problems caused by increased levels of air pollutants require scientists and engineers to develop solutions that help to reduce the impact of human activity.

Lesson Sequence:

In this short topic, we start by exploring the historical changes that have occurred in Earth's atmosphere – from the planet's origin up to the present era. We then look at the effect human activity has had on the atmosphere in terms of climate change and pollution.

Sequence of Lessons:	
1	History of our Atmosphere
2	Our Evolving Atmosphere
3	Greenhouse Gases – *mid topic assessment*
4	Global Climate Change
5	Atmospheric Pollutants
6	Revision
7	Test

Resources:	
1	Card sort
2	Reading comprehension
3	n/a
4	Climate change fact sheets x 9, Answer table.
5	n/a
6	n/a
7	Test in shared folder

Supportive Reading:	
Literacy tasks	Comprehension activity in L2 and longer written answer will be assessed in L3

Assessment:	
Knowledge:	Multiple choice and short answer questions.
Application of Knowledge:	Exam questions based on the skill of 'explain'.