Dream Reach Achieve

# Whittington Green School - Science

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**CURRICULUM INTENT:** The Whittington Green Science department aims to provide a high quality science education which develops lifelong learners who demonstrate a curiosity about the natural world; possess the skills and scientific knowledge required to understand the role of science in our everyday lives and its scope for developments in the future. Young people are encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes.

The national curriculum for science aims to ensure that all pupils:

♣ develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics

♣ develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them

♣ are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future.

**Scientific knowledge and conceptual understanding**

The programmes of study describe a sequence of knowledge and concepts. While it is important that pupils make progress, it is also vitally important that they develop secure understanding of each key block of knowledge and concepts in order to progress to the next stage. Insecure, superficial understanding will not allow genuine progression: pupils may struggle at key points of transition (such as between primary and secondary school), build up serious misconceptions, and/or have significant difficulties in understanding higher-order content.

Pupils should be able to describe associated processes and key characteristics in common language, but they should also be familiar with, and use, technical terminology accurately and precisely. They should build up an extended specialist vocabulary. They should also apply their mathematical knowledge to their understanding of science, including collecting, presenting and analysing data. The social and economic implications of science are important but, generally, they are taught most appropriately within the wider school curriculum: teachers will wish to use different contexts to maximise their pupils' engagement with and motivation to study science.

The principal focus of science teaching in key stage 3 is to develop a deeper understanding of a range of scientific ideas in the subject disciplines of biology, chemistry and physics. Pupils should begin to see the connections between these subject areas and become aware of some of the big ideas underpinning scientific knowledge and understanding. Examples of these big ideas are the links between structure and function in living organisms, the particulate model as the key to understanding the properties and interactions of matter in all its forms, and the resources and means of transfer of energy as key determinants of all of these interactions.

They should be encouraged to relate scientific explanations to phenomena in the world around them and start to use modelling and abstract ideas to develop and evaluate explanations.

Pupils should understand that science is about working objectively, modifying explanations to take account of new evidence and ideas and subjecting results to peer review. Pupils should decide on the appropriate type of scientific enquiry to undertake to answer their own questions and develop a deeper understanding of factors to be taken into account when collecting, recording and processing data. They should evaluate their results and identify further questions arising from them.

'Working scientifically' is described separately at the beginning of the programme of study, but must always be taught through and clearly related to substantive science content in the programme of study. Teachers should feel free to choose examples that serve a variety of purposes, from showing how scientific ideas have developed historically to reflecting modern developments in science.

Pupils should develop their use of scientific vocabulary, including the use of scientific nomenclature and units and mathematical representations.

**Spoken language**

The national curriculum for science reflects the importance of spoken language in pupils' development across the whole curriculum – cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their scientific vocabulary and articulating scientific concepts clearly and precisely. They must be assisted in making their thinking clear, both to themselves and others, and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions.

**Attainment targets**

By the end of key stage 3, pupils are expected to know, apply and understand the matters, skills and processes specified in the relevant programme of study.

**Working scientifically**

Through the content across all three disciplines, pupils should be taught:

- Scientific attitudes
- Experimental skills and investigations
- Analysis and evaluation
- Measurement

## Subject content – Biology

Pupils should be taught about:

- Structure and function of living organisms
- Material cycles and energy
- Interactions and interdependencies
- Genetics and evolution

## Subject content – Chemistry

Pupils should be taught about:

- The particulate nature of matter
- Atoms, elements and compounds
- Pure and impure substances
- Chemical reactions
- Energetics
- The Periodic Table
- Materials
- Earth and atmosphere

## Subject content – Physics

Pupils should be taught about:

- Energy
- Motion and forces
- Waves
- Electricity and electromagnetism
- Matter
- Space physics

| Year 7 | |
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| By the end of key stage 3, pupils are expected to know, apply and understand the matters, skills and processes specified in the relevant programme of study.<br><br>**Working scientifically**<br>Through the content across all three disciplines, pupils should be taught:<br>• Scientific attitudes<br>• Experimental skills and investigations<br>• Analysis and evaluation<br>• Measurement<br><br>Subject content – Biology<br>Pupils should be taught about:<br>• Structure and function of living organisms<br>• Material cycles and energy<br>• Interactions and interdependencies<br>• Genetics and evolution | Subject content – Chemistry<br>Pupils should be taught about:<br>• The particulate nature of matter<br>• Atoms, elements and compounds<br>• Pure and impure substances<br>• Chemical reactions<br>• Energetics<br>• The Periodic Table<br>• Materials<br>• Earth and atmosphere<br><br>Subject content – Physics<br>Pupils should be taught about:<br>• Energy<br>• Motion and forces<br>• Waves<br>• Electricity and electromagnetism<br>• Matter<br>• Space physics |
| Cultural capital | Careers links will be covered to give context to all lessons that are delivered. Wider curriculum opportunities will be taken where appropriate to broaden student experiences i.e. trips etc. |
| Adaptations for SEND | A broad and relevant curriculum will be taught to all students in Science, this will be appropriately scaffolded by LSA's and teachers to ensure every student can access the curriculum. |

| Term/Unit | Topic Overview / Content | Learning Expectation / Concepts and Skills | Recall and review of past learning | National Curriculum target | Key Vocab / Concepts |
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| Science skills | Learning about science equipment, how to read scales, how to carry out a science experiment and analyse the data including drawing graph | • Ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience<br>• Use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety | Recap lab rules and how to light a Bunsen burner from transition. Recap bar chart drawing from KS2 and how to calculate a mean. | • Scientific attitudes<br>• Experimental skills and investigations<br>• Analysis and evaluation<br>• Measurement | Equipment<br>Accurate<br>Variables<br>Prediction<br>Observations<br>Reproducible<br>Observations<br>Correlation |

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| | | • Make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements<br>• Select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate<br>• Make predictions using scientific knowledge and understanding | | | Relationship<br>Analysis |
| Cells | Structure and function of the key parts of animal and plant cells. Explain how substances needed for cells to function move into and out of the cells. Using light microscopes to see cells | • Identify cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope.<br>• Explain the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts.<br>• Compare the similarities and differences between plant and animal cells<br>• Explain the role of diffusion, Osmosis and Active transport in the movement of materials in and between cells<br>• Describe the structural adaptations of some unicellular organisms (sex cells, ciliated cells, root hair cells, blood cells and STEM cells etc).<br>• Describe the hierarchical organisation of multicellular organisms (cells, tissues, organs, systems to organisms. | Recalling that cells are what is in our body and what our body is made from such as blood cells in circulatory system | • Structure and function of living organisms<br>• Scientific attitudes<br>• Experimental skills and investigations<br>• Analysis and evaluation | Microscope<br>Nucleus<br>Cell Membrane<br>Cell wall<br>Cytoplasm<br>Mitocondria<br>Chloroplast<br>Diffusion<br>Osmosis<br>Organelle |

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| States | Explain the 3 states of matter and they can change state. Investigating how we can separate out mixtures. | • Describe the different states of matter in terms of arrangements, motion and closeness of particles.<br>• Explain changes of state in terms of energy.<br>• Explain the concept of a pure substance<br>• Use the terms saturated and solubility to describe how different substances may dissolve in water.<br>• Use the key terms soluble, insoluble, solute, solvent and solution.<br>• Undertake simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography.<br>• Describe how to identify pure substances (from their particle models, boiling points, chromatography etc).<br>• Describe energy changes on changes of state (qualitative) | Recap solids, liquids and gases as well as how we change states (freezing, melting, evaporation and condensation)<br>Recap ideas about separation | • The particulate nature of matter<br>• Pure and impure substances<br>• Chemical reactions<br>• Energy<br>• Matter<br>• Scientific attitudes<br>• Experimental skills and investigations<br>• Analysis and evaluation<br>• Measurement | Matter<br>Property<br>State<br>Evaporation<br>Condensation<br>Solute<br>Solvent<br>Soluble<br>Insoluble<br>Boiling |
| Forces | Investigating how forces, such as friction and air resistance, interact together and how they can be balanced or unbalanced forces. | • Describe forces as pushes or pulls, arising from the interaction between two objects<br>• Use force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces<br>• To know that forces deform objects.<br>• Know that forces are measured in Newton's.<br>• To understand measurements of stretch or compression as force is changed<br>• Describe the effects of non-contact forces.<br>• Describe Hooke's law<br>• To understand the effects of balanced forces<br>• To understand forces are needed to cause objects to stop or start moving, | From KS2 pushes and pull, friction and resistance. Gravity, magnets and floating and sinking (buoyancy) | • Motion and forces<br>• Scientific attitudes<br>• Experimental skills and investigations<br>• Analysis and evaluation<br>• Measurement | Newtons<br>Contact<br>Friction<br>Balanced<br>Magnetic<br>Electrostatic<br>Gravity<br>Mass<br>Weight<br>Directly proportional |

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| | | or to change their speed or direction of motion (qualitative only)<br>• To understand how things change depending on direction of force and its size. | | | |
| Systems | Describing and explaining the respiratory system, how we breathe and gas exchange, and reproductive system including puberty, reproduction and menstrual cycle. | • Explain the structure and functions of the gas exchange system in humans, including adaptations to function.<br>• Describe 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<br>• Evaluate the impact of exercise, asthma and smoking on the human gas exchange system.<br>• Describe and explain how the skeletal system and muscles create movement.<br>• Describe reproduction in humans, including the structure and function of the male and female reproductive systems.<br>• Explain the stages of the menstrual cycle.<br>• Describe the process of fertilisation.<br>• Identify the main stages in gestation and birth.<br>• Consider the effect of maternal lifestyle on the foetus through the placenta. | Life cycles and reproduction at KS2. Very basic information given about needing males and females for babies to be made. Plant reproduction. | • Structure and function of living organisms<br>• Scientific attitudes<br>• Analysis and evaluation | Ventilation<br>Diffusion<br>Exchange<br>Puberty<br>Adolescence<br>Menstrual cycle<br>Fertilisation<br>Ovulation<br>Implantation<br>Pollination |
| Elements, compounds and mixtures | Explaining what elements, compound and mixtures are and how they are different. | • Consider atoms and molecules as particles.<br>• Define the key terms atom, element, pure, compound and molecule accurately with specific examples.<br>• Use chemical symbols and formulae for elements and compounds. | New ideas in the topic. Linking to idea that matter is made from particles.<br><br>Recalling from KS2 that some reactions | • Atoms, elements and compounds<br>• Chemical reactions<br>• Energetics<br>• The Periodic Table<br>• Scientific attitudes | Atom<br>Element<br>Compound<br>Reactant<br>Product<br>Combustion<br>Oxidation |

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| | Investigating how chemical reactions occur and representing reactions with word and symbol equations | • Identify the difference between chemical and physical changes.<br>• Represent chemical reactions using formulae and using equations.<br>• Investigate combustion, thermal decomposition, and conservation of mass reactions<br>• Investigate exothermic and endothermic chemical reactions (qualitative).<br>• Describe energy changes on changes of state (qualitative) | are reversible and some irreversible | • Experimental skills and investigations<br>• Analysis and evaluation<br>• Measurement | Thermal decomposition<br>Exothermic<br>Endothermic |
| Microbes | Looking at what causes us to get ill and how our body protects us from diseases. | • Name the 3 different types of microbes<br>• Describe the structure of bacteria and viruses<br>• Explain how microbes and be spread<br>• Explain how the white blood cells protect us from disease<br>• Explain how vaccinations work<br>• Define the term pathogen.<br>• Describe a group of bacteria as chemosynthetic bacteria and explain how they survive. | KS2 basic - What are microbes? They use the term 'germs'. This language needs to be changed as its not specific enough at KS3 or KS4 to describe or explain microbes. | • Structure and function of living organisms<br>• Material cycles and energy | Bacteria<br>Virus<br>Fungi<br>Microbe<br>Pathogen<br>Engulf<br>Antigen<br>Antibody<br>Antitoxin<br>Antibotic |
| Energy | Looking into different type of energy and transfers occur. Specific focus on to heat transfers. | • Describe energy in term of stores and pathways<br>• Draw Sankey diagrams to represent energy transfers<br>• Explain that energy isn't lost in transfers<br>• Explain changes with temperature in the motion and spacing of particles.<br>• Describe what power is and carry out calculations<br>• Describe work done in terms of energy | KS2 cover ideas about renewable and non-renewable energy sources | • Energy<br>• Motion and forces<br>• Electricity and electromagnetism<br>• Scientific attitudes<br>• Experimental skills and investigations<br>• Analysis and evaluation<br>• Measurement | Conservation<br>Efficiency<br>Wasted<br>Dissipate<br>Conduction<br>Convection<br>Radiation - Absorb, emit and reflect<br>Insulation<br>Power<br>Work done |

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| Acids and alkalis | Investigating acids and alkali reactions. | • Define acids and alkalis in terms of neutralisation reactions.<br>• Use the pH scale for measuring acidity/alkalinity; and indicators.<br>• Investigate the reactions of acids with metals to produce a salt plus hydrogen<br>• Investigate the reactions of acids with alkalis to produce a salt plus water. Consider the chemical properties of metal and non-metal oxides with respect to acidity. | Recalling that in the stomach there is acid at KS2. Recalling from the reactions topic the names of some of the acids used in science. | • Atoms, elements and compounds<br>• Chemical reactions<br>• The Periodic Table<br>• Scientific attitudes<br>• Experimental skills and investigations<br>• Analysis and evaluation<br>• Measurement | pH Scale<br>Indicator<br>Acid<br>Alkali<br>Neutralisation<br>Burette<br>Salt<br>Crystallisation<br>Evaporating<br>Antacid |
| Digestive system | Describing and explaining how our digestive system works and how are nutrients are broken down for them to be absorbed. | • Describe the content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and explain why each is needed<br>• Describe the tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food.<br>• Explain the role of enzymes as biological catalysts<br>• Consider the consequences of imbalances in the diet, including obesity, starvation and deficiency diseases. Explain the importance of bacteria in the human digestive system.<br>• Describe what is meant by a drug and the effect of drugs on the body including alcohol and thalidomide. | From KS2 What's the digestive system, what happens in the mouth and intestine. | • Structure and function of living organisms | Nutrients<br>Deficiency<br>Obesity<br>Drugs<br>Alcohol<br>Absorption<br>Enzyme<br>Denature<br>Diffusion |
| Space | Looking into our solar system. What's in it, how time passes, satellites, eclipses and spaces exploration. | • Describe the composition of the solar system<br>• To know that gravitational force is weight and is different on the moon.<br>• weight = mass x gravitational field strength (g), on Earth g=10 N/kg. | Space covered at KS2. The Earth's orbit, day and night, the solar system and the planets, space travel. | • Motion and forces<br>• Waves<br>• Matter<br>• Space physics<br>• Scientific attitudes | Satellite<br>Meteorite<br>Ellipse<br>Waxing<br>Waning<br>Gibbous |

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| | | • Describe our Sun as a star and there are other stars in our galaxy, other galaxies Explain the seasons in relation to the Earth's tilt, day length at different times of year, in different hemispheres | | • Analysis and evaluation<br>• Measurement | Crescent<br>Lunar<br>Solar<br>Geostationary |