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Science Department – Curriculum Intent

KS3 Curriculum Intent - Science

Head of Department: Dr O Richards

	Year 7	Year 8
	C1 Particles, Atoms and Elements **The particulate nature of matter** - the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure - changes of state in terms of the particle model. **Atoms, elements and compounds** - a simple (Dalton) atomic model - differences between atoms, elements and compounds - chemical symbols and formulae for elements and compounds - conservation of mass changes of state and chemical reactions. **Physical changes** - conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving - similarities and differences, including density differences, between solids, liquids and gases - Brownian motion in gases - diffusion in liquids and gases driven by differences in concentration - the difference between chemical and physical changes **Particle model** - the differences in arrangements, in motion and in closeness of particles explaining changes of state, shape and density, the anomaly of ice-water transition - atoms and molecules as particles. **Energy in matter** - changes with temperature in motion and spacing of particles internal energy stored in materials.	**B4 Food, Digestion and Healthy Eating** **Nutrition and digestion** - 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 importance of bacteria in the human digestive system - plants making carbohydrates in their leaves by photosynthesis and gaining mineral nutrients and water from the soil via their roots. **Career Links:** Nutritionist, Dietician, Healthcare Industries, Product Developer **P5 Waves (Sound, Light & Energy)** **Observed waves** - waves on water as undulations which travel through water with transverse motion; these waves can be reflected, and add or cancel – superposition. **Sound waves** - frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound - sound needs a medium to travel, the speed of sound in air, in water, in solids - sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal - auditory range of humans and animals. -

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Autumn Term

B2 Cells, Tissues and Organ Systems

Cells and organisation

- cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope
- the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and 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 skeletal and muscular systems

- 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.

Gas exchange systems

- 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 role of leaf stomata in gas exchange in plants.

Career Links:

Medicine, Nursing, Physiotherapy, Healthcare Industries

Energy and waves

- pressure waves transferring energy; use for cleaning and physiotherapy by ultra-sound; waves transferring information for conversion to electrical signals by microphone.

Light waves

- the similarities and differences between light waves and waves in matter
- light waves travelling through a vacuum; speed of light
- the transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface
- use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye
- light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras
- colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection.

Career Links:

Photographer, Lighting engineer

P4 Space

Space physics

- gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only)
- our Sun as a star, other stars in our galaxy, other galaxies
- the seasons and the Earth's tilt, day length at different times of year, in different hemispheres
- the light year as a unit of astronomical distance.

Career Links:

Astrophysicist

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Spring Term

B1 Plant and Animal Reproduction

Reproduction

- 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.

Career Links:
Medicine, Midwifery, Veterinary Science, Botany, Farming

P1 Domestic Energy, Energy Transfer and Energy Resources

Calculation of fuel uses and costs in the domestic context

- comparing energy values of different foods (from labels) (kJ)
- comparing power ratings of appliances in watts (W, kW)
- comparing amounts of energy transferred (J, kJ, kW hour)
- domestic fuel bills, fuel use and costs.

Energy changes and transfers

- simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged
- heating and thermal equilibrium: temperature difference between two objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference: use of insulators
- other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels.

Career Links:
Heating engineer

P2 Electricity, Magnetism and Electromagnets

Current electricity

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

C4 The Periodic Table and Metal Extraction

The Periodic Table

- the varying physical and chemical properties of different elements
- the principles underpinning the Mendeleev Periodic Table
- the Periodic Table: periods and groups; metals and non-metals
- how patterns in reactions can be predicted with reference to Periodic Table
- the properties of metals and non-metals
- the chemical properties of metal and non-metal oxides with respect to acidity.

Materials

- the order of metals and carbon in the reactivity series
- the use of carbon in obtaining metals from metal oxides
  properties of ceramics, polymers and composites (qualitative).

B6 Photosynthesis and Respiration

Photosynthesis

- 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.

Cellular respiration

- aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life
- a word summary for aerobic respiration
- the process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respiration
- the differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism.

P3 Forces, Motion and Effects

Describing motion

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	- potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current - differences in resistance between conducting and insulating components (quantitative). **Static electricity** - separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects - the idea of electric field, forces acting across the space between objects not in contact. **Magnetism** - magnetic poles, attraction and repulsion - magnetic fields by plotting with compass, representation by field lines Earth's magnetism, compass and navigation the magnetic effect of a current, electromagnets, D.C. motors (principles only). **Career Links:** Electrician, Electrical Engineer	- speed and the quantitative relationship between average speed, distance and time (speed = distance ÷ time) - the representation of a journey on a distance-time graph - relative motion: trains and cars passing one another. **Forces** - forces as pushes or pulls, arising from the interaction between two objects - using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces - moment as the turning effect of a force - forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water - forces measured in newtons, measurements of stretch or compression as force is changed - force-extension linear relation; Hooke's Law as a special case - work done and energy changes on deformation - non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity. **Pressure in fluids** - atmospheric pressure, decreases with increase of height as weight of air above decreases with height - pressure in liquids, increasing with depth; upthrust effects, floating and sinking - pressure measured by ratio of force over area – acting normal to any surface. **Balanced forces** - opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface. **Forces and motion** - forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only) change depending on direction of force and its size. **Career Links:** Crane operator, sky diver, pilot, plumber, engineer, driver

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Summer Term

P2 Electricity, Magnetism and Electromagnets

Current electricity

- electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge
- potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current
- differences in resistance between conducting and insulating components (quantitative).

Static electricity

- separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects
- the idea of electric field, forces acting across the space between objects not in contact.

Magnetism

- magnetic poles, attraction and repulsion
- magnetic fields by plotting with compass, representation by field lines
- Earth's magnetism, compass and navigation the magnetic effect of a current, electromagnets, D.C. motors (principles only).

Career Links:

Electrician, Electrical Engineer

C2 Chemical Reactions with Compounds and Mixtures

Chemical reactions

- chemical reactions as the rearrangement of atoms
- representing chemical reactions using formulae and using equations
- combustion, thermal decomposition, oxidation and displacement reactions

Energetics

- energy changes on changes of state (qualitative)
- exothermic and endothermic chemical reactions (qualitative).

C3 Chemical Reactions with Acids and Alkalis

- defining acids and alkalis in terms of neutralisation reactions
- the pH scale for measuring acidity/alkalinity; and indicators
- reactions of acids with metals to produce a salt plus hydrogen
- reactions of acids with alkalis to produce a salt plus water
- what catalysts do.

Pure and impure substances

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

Career Links:

Quality controller

B5 Health, Microbes and Drugs

Health

- micro-organisms
- defense against disease
- vaccines and antibiotics
- drugs used to treat disease
- the effects of recreational drugs (including substance misuse) on behaviour, health and life processes.

C5 Earth and Atmosphere

Earth and atmosphere

- the composition of the Earth
- the structure of the Earth
- the rock cycle and the formation of igneous, sedimentary and metamorphic rocks
- Earth as a source of limited resources and the efficacy of recycling
- the carbon cycle
- the composition of the atmosphere
- the production of carbon dioxide by human activity and the impact on climate.

Career Links:

Environmental scientist, Climate scientist

In Science, Year 9 is used as a 'bridging' year where students begin to focus on knowledge and skills required for GCSE. Students do not commit at this stage to following the Combined (Trilogy) or Triple Science pathway. For information on the Year 9 Science curriculum please see the Curriculum Intent documents for Biology, Chemistry and Physics.