

Where to Next in Science - Physics in Years 7, 8 and 9

Energy

Changes and transfers

- Processes that cause change, with forces, with matter and with electricity.

- Calculations comparing ratings of appliances in kilowatts (kW) and amounts of energy from different foods.

- Fuel, fuel sources and heating.

Auditing change

- Audit calculation using measures of change in energy.
- Rates of change measured in kW.

Motion and forces

Describing motion

- Speed and the relationship between average speed, distance and time (speed = distance $\div$ time).

- The representation of a journey on a distance-time graph.

- Relative motion.

Forces

- Forces arising from the interaction between two objects.

- Moments.

- Measurement of forces in Newtons.

- Hooke's Law.

- Gravity forces acting at a distance on Earth and in space.

Pressure forces

- Atmospheric pressure.

- Pressure in liquids, including upthrust effects, floating and sinking.

- Pressure measured by

Waves

Observed waves

- Waves on water.

Sounds waves

- Frequencies of sound waves.

- The speed of sound in air.

- Sound produced by vibrations of objects.

- Auditory range.

Energy and waves

- Sound waves carrying energy.

Light waves

- The similarities and differences between light and waves.

- Light waves travelling through a vacuum and the speed of light.

- The transmission of light through materials.

- The refraction of light and the human eye.

- Light transferring energy.

- Colour and the different frequencies of

Electricity and electromagnetism

Current electricity

- Electric current.

- Current as flow of charge.

- Potential difference and resistance.

- Differences in resistance between conducting and insulating components.

Static electricity

- Separation of positive or negative charges when objects are rubbed together.

- The idea of electric field forces acting across the space between objects not in contact.

Magnetism

- Magnetic poles, attraction and repulsion.

- Magnetic fields.

- The magnetic effect of a current, electromagnets, D.C.

Matter

Physical changes

- Conservation of material and of mass.

- Similarities and differences between solids, liquids and gases.

- Brownian motion in gases.

- Diffusion in liquids and gases.

- 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.

- Atoms and molecules as particles.

Energy in matter

- Changes of temperature in motion and spacing of particles.

- Internal energy stored

	<p>ratio of force over area - acting in all directions.</p> <p>Balanced forces</p> <ul style="list-style-type: none">• Opposing forces and equilibrium. <p>Forces and motion</p> <ul style="list-style-type: none">• The role of forces in causing motion or changes in motion.	light.	motors.	in material
--	---	--------	---------	-------------

Where to Next in Science - Biology in Years 7, 8 and 9

Structure and function of living organisms

Cells and organisation

- The purpose and structure of cells.
- The function of parts of a cell.
- Movement of materials in and between cells.
- The organisation of multicellular organisms.

The skeletal and muscular systems

- The structure and functions of the human skeleton.
- The interaction between skeleton and muscles.
- The function and actions of major muscle groups.

Human nutrition and digestion

- Content in a healthy human diet.
- Food tests for starch, simple sugars, protein and fat.
- Calculations of energy requirements in a healthy daily diet.
- The consequences of imbalances in the diet.

Energy flow and material cycles

Photosynthesis

- The dependence of almost all life on Earth on the transfer of solar energy.
- The relationship between the structures and functions of leaves.
- The word equation for photosynthesis.
- Mineral nutrition in plants.
- Chemosynthesis in bacteria and other organisms.

Cellular respiration

- Aerobic and anaerobic respiration in living organisms.
- The word equation for aerobic respiration.
- The process of anaerobic respiration in humans and micro-organisms, including the word equation for anaerobic respiration.
- The differences between aerobic and anaerobic respiration.

Interactions and interdependencies

Relationships in an ecosystem

- The interdependence of organisms.
- How organisms affect, and are affected by, their environment.
- The role of variation in enabling closely related living things to survive in the same ecosystem.

Genetics and evolution

Reproduction

- Reproduction organs and processes in humans.
- Reproduction in plants.
- Insect pollination in human food security.

Inheritance, chromosomes, DNA and genes

- Heredity.
- The development of the DNA model.
- Variation between individuals of different species.
- Variation between individuals within a species.
- Variation leading to competition which can drive adaptation.
- Changes in the environment that leave some species less well adapted to compete successfully and reproduce.
- The use of gene banks to preserve hereditary material.

• The tissues and organs of the digestive system.

• The importance of bacteria in the digestive system.

The breathing (gas exchange) system

• The structure and functions of the gas exchange system in humans.

• The mechanism of breathing.

• The impact of exercise, asthma and smoking on the breathing system.

Health

• The effects of drugs (including as medicines as well as substances misuse) on behaviours.

Where to Next in Science - Chemistry in Years 7, 8 and 9

Pure and impure substances

- Mixtures, including dissolving.
- Techniques for separating mixtures: chromatography, filtering, evaporation and distillation.
- The identification of pure substances.

The particulate nature of matter

- The properties of the different states of matter.
- Changes of state in terms of particle kinetics and energy changes.
- The nature of atoms, elements and compounds.
- Conservation of mass in chemical and physical change.

Chemical reactions

- Chemical reactions as the rearrangement of atoms.
- Representing chemical reactions using formulae and using equations.
- Combustion.

Energetics

- Chemical reactions.
- Acids, alkalis and neutralisation.
- Defining acids, bases and alkalis.
- The pH scale for measuring acidity/alkalinity.
- Reactions of acids with bases and metals.

The Periodic Table

- The Periodic Table: periods and groups; metals and non-metals.
- How patterns in reactions can be explained and predicted with reference to the Periodic Table.
- The varying physical and chemical properties of different elements.
- The chemical properties of metals and non-metals.

Materials

- The order of metals and carbon in the reactivity series.
- The use of carbon in obtaining metals from metal oxides.
- Ceramics, polymers and composites.

Earth science

- The composition of the Earth and the atmosphere.
- Changes to the Earth's atmosphere since its formation.
- The production of carbon dioxide by human activity and the impact on climate and the efficacy of recycling.

Where to Next in Science - Working Scientifically in Years 7, 8 and 9

Experimental skills and investigations

- Ask questions and develop lines of enquiry based on observations.
- Make predictions using scientific knowledge and understanding.
- Plan and design investigations and experiments to make observations and test predictions.
- Identify independent, dependent and control variables and other factors to be taken into account when collecting evidence and data.
- Select appropriate techniques, apparatus, and materials during fieldwork and laboratory work, working safely.
- Make and record observations and measurements using a range of methods for different investigations.
- Evaluate the reliability of methods and suggest possible improvements.

Handling information and problem solving

- Present observations and data using appropriate methods, including tables and graphs.
- Interpret observations and data.
- Present reasoned explanations.
- Evaluate data, showing awareness of potential errors.
- Identify questions arising from results of investigations.

Scientific attitudes

- Work objectively with concern for validity.
- Understand the need for collaborative research and peer review.
- Evaluate risks.

Measurement

- Understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature.
- Use and derive simple equations.
- Undertake data analysis.