



01

Physics - UK

YEARS 7 - 9

 Experience Level: **KEY-STAGE 3**

 Number of Classes: **VARIABLE**

 Age Range: **11 - 14 YEARS**

Energy

01

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.
- Fuels and energy resources.

02

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 2 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.

03

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.
- Comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions.
- Using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes.

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03

Motion and forces

01

Describing motion

- 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.

02

Forces

- Forces as pushes or pulls, arising from the interaction between 2 objects.
- Using force arrows in diagrams, adding forces in 1 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.

03

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.

04

Balanced forces

- Opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface.

05

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.

Waves

01

Observed waves

- Waves on water as undulations which travel through water with transverse motion; these waves can be reflected, and add or cancel – superposition.

02

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 loudspeakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal.
- The auditory range of humans and animals.

03

Energy and waves


- Pressure waves transferring energy; use for cleaning and physiotherapy by ultrasound; waves transferring information for conversion to electrical signals by microphone.

04

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; photosensitive 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.

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Electricity and electromagnetism

01

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).

02

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.

03

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, DC motors (principles only).

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Matter

01

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.

02

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.

03

Energy in matter

- Changes with temperature in motion and spacing of particles.
- Internal energy stored in materials.

04

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).

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06

Space physics (Contd).

- 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.