**Key Stage 3 Physics**

**Department for Education**

**National Curriculum (September 2013)**

**Subject content**

Pupils should be taught about:

**Energy**

**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.

**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.

**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.

**Motion and forces**

**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.

**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.

**Waves**

**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.

**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.

**Electricity and electromagnetism**

**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).

**Matter**

**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.

**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.