Physics

Light and Seeing

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| EYFS | Key knowledge | New Vocabulary |
| 1. Comments and asks questions about aspects of their familiar world such as the place   where they live or the natural world.   1. Talks about why things happen and how things work. 2. Knows how to operate simple equipment, e.g.  turns on CD player and uses 3. remote control. 4. Shows an interest in technological toys with  knobs or pulleys, or real objects such as cameras and mobile phones. |  |  |
| Milestone 1 |  |  |
| 1. Observe and name a variety of sources of light, including electric lights, flames and the Sun, explaining that we see things because light travels from them to our eyes. | Know that light is a form of energy  Know that energy comes in different forms and can be neither created nor destroyed, only changed from one form to another  Know that the Sun is a light source | Sun, energy, light source |
| Milestone 2 | | |
| 1. Recognise that light is required in order to see things and that dark is the absence of light. 2. Notice that light is reflected from surfaces. 3. Recognise that light from the Sun can be dangerous and that there are ways to protect your eyes. 4. Recognise that shadows are formed when the light from a light source is blocked by a solid object. 5. Find patterns in the way that the size of a shadow changes. | Know that we need light to see things and that darkness is the absence of light  Know that light is reflected when it travels from a light source and then ‘bounces’ off an object  Know that everything that we can see is either a light source or something that is reflecting light from a light source into our eyes  Revise that the Sun is a light source, but that the Moon is not and is merely reflecting light from the Sun  Know that many light sources give off light and heat  Know that filaments in traditional bulbs heat up until they glow, giving off light and heat  Know that fluorescent bulbs glow when electricity adds energy to a gas within the bulb  Know that sunglasses can protect eyes from sunlight but looking at the Sun directly – even with sunglasses – can damage the eyes  Know that opaque objects block light creating shadows and that light passes through transparent objects  Know that opacity/transparency and reflectiveness are properties of a material  Know that as objects move towards a light source, the size of the shadow increases  Know how to show the changing of shadow size by drawing a diagram with straight lines representing light  Know that a data logger can keep track of light levels and that this can be plotted on a graph to show how this changes over the course of a day | wave, mirror, image, beam, solid, opaque, transparent, object, data logger |
| Milestone 3 | | |
| 1. Understand that light appears to travel in straight lines. 2. Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eyes. 3. Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them, and to predict the size of shadows when the position of the light source changes. 4. Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes. | Know that light travels in straight lines  Know that translucent objects allow some light to pass through, but some of the light changes direction as it passes through the object; this means that something seen through a translucent object is not clearly defined  Know that diffraction is when a beam of light is spread out as a result of passing through a narrow passage.  Know that when light passes from one medium to another (e.g. from air to water), it changes direction; this is called refraction; this happens because light travels at different speeds in different media.  Know that white light comprises all the colours of light  Know that white light refracted by two surfaces in a prism will spread out so that all of its constituent colours can be seen; this array of colours is called a spectrum; it happens because the different colours of that constitute white light travel at different speeds.  Know how to draw a diagram to show why the shape of a shadow will match the shape of an object  Know that a periscope takes advantage of the predictable angles of reflection to allow an image to be shown to a viewer | angle of reflection, refraction, spectrum, translucent, medium, periscope, diffraction |

Electrical Circuits

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| EYFS | Key knowledge | New Vocabulary |
| 1. Comments and asks questions about aspects of their familiar world such as the place where   they live or the natural world.   1. Talks about why things happen and how things work. 2. Knows how to operate simple equipment, e.g.  turns on CD  player and uses remote control. 3. Shows an interest in technological toys with  knobs or pulleys, or real objects such as cameras and mobile phones. 4. Shows skill in making toys  work by pressing  parts or lifting  flaps to achieve effects such  as 5. sound, movements or new  images. |  |  |
| Milestone 1 |  |  |
| 1. Identify common appliances that run on electricity. 2. Construct a simple series electrical circuit | Know that mains and batteries are sources of electricity.  Know that electrical energy is one of many forms of energy  Know that electrical current can flow if there is a complete circuit  Know how to construct a simple circuit using components | Electricity, component, circuit, appliance, battery, energy, current, circuit, series circuit |
| Milestone 2 | | |
| 1. Identify common appliances that run on electricity. 2. Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers. 3. Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery. 4. Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit. 5. Recognise some common conductors and insulators, and associate metals with being good conductors. | Know that current electricity is the flow of charged particles called electrons around a circuit  Know that electrical current flows well through some materials, called electrical conductors, and poorly through other materials, called electrical insulators  Know that conductors have free electrons and that when electrical current flows around a conductor the electrons move  Know that electrical conductivity (how well a material conducts electricity) is an example of a property  Know that metals are good electrical conductors  Know that a chemical reaction inside a cell produces the charged particles that can flow around a circuit  Know that more than one cell lined up to work together is called a battery  Know that wires – which contain a conductor inside them, usually made of metal – can allow electrical current to flow around a circuit  Know that when electrical current flows through a circuit components within that circuit – such as buzzers which make a noise and bulbs which emit light – begin to work  Know that a switch functions by completing or breaking a complete circuit  Know that exposure to high levels of electrical current can be dangerous | charge, electron, cell, bulb, buzzer, switch, wire, current electricity, static electricity, negative terminal, positive terminal, chemical reaction, emit, conductor, insulator, particle, property, |
| Milestone 3 | | |
| 1. Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. 2. Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. 3. Use recognised symbols when representing a simple circuit in a diagram. | Know that voltage is a measure of the power of a cell to produce electricity; it is a measure of the ‘push’ of electric current, not the size of the electric current  Know that as the number and voltage of cells in a circuit increases, the brightness of a bulb or the volume of a buzzer will increase (though too high a voltage may ‘blow’ the bulb or buzzer)  Know how to draw simple circuit diagrams  Know the recognized symbols for a battery, bulb, motor, buzzer and wire  Know how to predict whether components will function in a given circuit, depending on whether or not the circuit is complete; whether or not a switch is in an on or off position; and whether or not there is a cell to provide electrical current to the circuit  Know that two bulbs in a circuit can be wired up to create a series circuit or a parallel circuit; if one bulb blows in a series circuit the other will not shine as the circuit has been broken; in contrast, if one bulb blows in a parallel circuit, there will still be a complete circuit for the other bulb so it will continue to shine; use this knowledge to explain the advantages of using parallel circuits (e.g. in the lighting in homes) | series circuit, parallel circuit, resistance, voltage |

Sound and Hearing

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| Milestone 1 |  |  |
| 1. Observe and name a variety of sources of sound, noticing that we hear with our ears. |  |  |
| Milestone 2 | | |
| 1. Identify how sounds are made, associating some of them with something vibrating. 2. Recognise that vibrations from sounds travel through a medium to the ear. | Know that sound is generated when an object vibrates; some of the energy from the vibrating object is transferred to the air, making the air particles move  Know that energy comes in different forms and can be neither created nor destroyed, only changed from one form to another  Know that sound is a form of energy that transfers in a longitudinal wave - like that seen in a slinky - not a transverse wave - like that seen in water ripples  Know that sound travels through a medium (e.g. particles in the air) and thus sounds does not travel through a vacuum which has no particles in it at all  Know that longitudinal sound waves are detected in the ear by humans and that the brain interprets this as the sounds we hear  Know that sound travels at different speeds through different objects; it travels at around 340 metres per second in air, much slower than light travels; this is why we often hear thunder after we see lightning as the light reaches our eye before the sound reaches our ears | particle, vibration, percussion instrument, wind instrument, string instrument, volume, transverse wave, longitudinal wave, medium, vacuum |
| Milestone 3 | | |
| 1. Find patterns between the pitch of a sound and features of the object that produced it. 2. Find patterns between the volume of a sound and the strength of the vibrations that produced it. 3. Recognise that sounds get fainter as the distance from the sound source increases. | Know that pitch is how high or low a sound is and that this is determined by how many vibrations per second are being made by the vibrating object; the number of vibrations per second is called frequency  Know that volume is how loud or quiet a sound is and that this is determined by the amount of energy in the wave (e.g. from how hard or soft a percussion instrument is hit)  Know that the volume of a sound is quieter if the listener is further away from the object | Pitch, frequency |

Earths movement in space

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| Milestone 1 |  |  |
| 1. Observe the apparent movement of the Sun during the day. 2. Observe changes across the four seasons. 3. Observe and describe weather associated with the seasons and how day length varies. | Know that days are longer in the summer and shorter in winter  Know that weather changes through the year, getting hotter in the summer and colder in the winter  Know that the winter is likely to bring ice on the ground when water freezes due to the cold  Know that the Earth orbits the Sun with one orbit constituting a year of 365/366 days | energy, freezing, melting, orbit, reflection, Sun, clouds, wind, snow, ice, spring, summer, autumn, winter |
| Milestone 2 | | |
| 1. Describe the movement of the Earth relative to the Sun in the solar system. 2. Describe the movement of the Moon relative to the Earth. | Know that the universe comprises all matter and space in existence  Know that a celestial body is a large object in the universe  Know that a star is an exceptionally hot ball of gas, originally made from hydrogen and helium  Know that the Sun is a star  Know that a planet (e.g. Earth) is defined as a spherical celestial body that orbits a star and that has cleared the neighbourhood of its orbit of other objects, some of which crash into the planet and others that become moons of that planet  Know it was once thought that everything orbited the Earth, but that scientists like Copernicus and Galileo used telescopes and measurement to show that the Earth orbited the Sun  Describe how the movement of the Earth gives rise to seasonal change  Know that there are eight major planets in our solar system: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune  Know that the universe is utterly vast and that our solar system makes up a tiny fraction of the universe  Know that a satellite orbits a planet and that moons are natural satellites  Know that the Moon orbits the Earth roughly every 28 days  Know that as the Moon orbits the Sun, different parts of it are lit up by the Sun, which is why we see a different shape lit up on the Moon as the lunar cycle progresses  Know the phases of the moon (New Moon, Waxing Crescent, First Quarter, Waxing Gibbous, Full, Waning Gibbous, Third Quarter, Waning Crescent, Dark Moon  Know that humans have sent man-made satellites into orbit that assist with telecommunication  Know that all the planets in the solar system orbit the Sun and that the further away they are from the Sun, the longer their orbit | planet, satellite, sphere, solar system, eclipse, star, universe, constellation, axis, celestial body, Moon, rotating, lunar, solar, telescope, rotation  waxing, waning, gibbous, crescent |
| Milestone 3 | | |
| 1. Describe the movement of the Earth relative to the Sun in the solar system. 2. Describe the movement of the Moon relative to the Earth. 3. Describe the Sun, Earth and Moon as approximately spherical bodies.   Use the idea of the Earth’s rotation to explain day and night and the apparent movement of the Sun across the sky. | (Note – objectives 1 and 2 are repeated from milestone 2)  Know that the sun, earth and moon are approximately spherical bodies.  Know that the Earth spins around an imaginary line through its centre called an axis and that this axis is tilted relative to the Earth’s orbit  Know that equatorial bulge occurs due to the fast rotation of the Earth on its axis reducing the effect of gravity on the equator  Know that night and day are the result of the Earth rotating on its axis  Know that the tilt of the Earth towards and away from the Sun’s light as the Earth orbits the Sun leads to the seasons as during winter the light is spread over a wider area  Know that a solar eclipse occurs when the Moon is between the Sun and the Earth, casting a shadow on the Earth; a lunar eclipse occurs when the Earth is between the Sun and the Moon, casting a shadow on the Moon | Equatorial bulge, equator, gravity |

Movement, forces and magnets

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| 1. their familiar world such as the place where  they live or the natural world. 2. Talks about why things happen and how things work. 3. Knows how to operate simple equipment, e.g.  turns on CD  player and uses remote control. 4. Shows an interest in technological toys with  knobs or pulleys, or real objects such as   cameras and mobile phones.   1. Shows skill in making toys  work by pressing  parts or lifting  flaps to achieve effects such     as sound, movements or new  images. |  |  |
| Milestone 1 |  |  |
| 1. Notice and describe how things move, using simple comparisons such as faster and slower. 2. Compare how different things move | Know that a force can be thought of as a push or a pull  Know that objects move differently due to different forces, including magnetic force. | metal, material, surface, friction, force, stretch, squash, rough, smooth, magnetic force |
| Milestone 2 | | |
| 1. Compare how things move on different surfaces. 2. Notice that some forces need contact between two objects, but magnetic forces can act at a distance. 3. Observe how magnets attract or repel each other and attract some materials and not others. 4. Compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials. 5. Describe magnets as having two poles. 6. Predict whether two magnets will attract or repel each other, depending on which poles are facing. | Know that there are three types of contact force: impact forces (when two surfaces collide), frictional forces (when two surfaces are already in contact) and strain forces (when an elastic material is stretched or squashed).  Know that objects move differently on rough and smooth surfaces; objects resist movement more on rough surfaces because there is higher friction as the object moves  Know that there are also non-contact forces that can act between objects without them touching and that magnetism is an example of a non-contact force  Know that magnets have two poles called north and south  Know that like poles (south-south and north-north) of two magnets repel each other and that opposite poles of two magnets (north-south) attract each other  Know that there is a magnetic field around a magnet which is strongest at each pole  Know that some materials are magnetic, meaning that they are attracted to a magnet, while other materials are non-magnetic | pole, north, south, sliding friction, static friction, elastic, resist, attraction, repulsion, impact force, frictional force, strain force |
| Milestone 3 | | |
| 1. Describe magnets as having two poles. 2. Predict whether two magnets will attract or repel each other, depending on which poles are facing. 3. Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. 4. Identify the effect of drag forces such as air resistance, water resistance and friction that act between moving surfaces. 5. Describe, in terms of drag forces, why moving objects that are not driven tend to slow down. 6. Understand that force and motion can be transferred through mechanical devices such as gears, pulleys, levers and springs. 7. Understand that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. | (Note objectives 1 and 2 are repeated from Milestone 2)  Know that a force is measured in a unit called Newtons, named after a British scientist called Sir Isaac Newton who discovered lots about gravity and how planets move  Know that pull forces can be measured using a device called a force meter  Know that the amount of matter (stuff) in an object is its mass  Know that gravity is a force that acts between all objects in the universe, but that it acts much more strongly between objects that have more mass and that are close together  Know that unsupported objects are pulled towards the Earth by the force of gravity  Know that acceleration is a change in speed and that unbalanced forces acting on an object cause it to accelerate  Know that air resistance is a force felt by an object as it moves through the air; it is caused by the object bumping into the gas particles that make up air; the quicker an object moves, the more gas particles it bumps into and the more air resistance it experiences  Know that a falling object will accelerate until its air resistance matches the gravitational force pulling it down; at this point, the object will continue to move at this speed (called its terminal velocity) without getting any quicker or slowing down  Know that a parachute’s shape increases the air resistance that a falling object experiences, giving it a much lower terminal velocity  Know that water resistance is a force felt by an object as it moves through water; it is caused by the object bumping into the water particles  Know that the shape of an object determines how much air resistance or water resistance it experiences; shapes of object that experience little air resistance or water resistance are described as streamlined  Know how to draw a force diagram with arrows representing the different forces acting on an object  Know that a lever is a rigid length pivoting around a fulcrum  Know that a pulley is a wheel with a fulcrum that supports a moving cable or belt  Know that a gear is a rotating wheel with cut teeth that mesh with the teeth of another gear so that turning one gear turns an adjacent gear in the opposite direction  Know that gears, levers and pulleys are simple machines that used to allow a smaller force to have a greater effect; they do this by moving a smaller force over a longer distance at one end of the machine, which the machine turns into a larger forcer over a small distance at the other end | acceleration, air resistance, buoyancy, effort, force meter, fulcrum, gravity, load, mass, mesh, Newton, pivot, rigid, streamlined, terminal velocity, unsupported, water resistance, weight |