# Science progression of knowledge-Physics (substantive knowledge)

| Year Group / Area of Study | Nursery | Reception | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
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| **Physics**<br><br>**<u>Seasonal changes</u>** | To talk about what they see, using a wide vocabulary. | To understand some important processes and changes in the natural world around them, including the seasons.<br><br>To understand the effect of changing seasons on the natural world around them. | To observe changes across the four seasons<br><br>To observe and describe weather associated with the seasons and how day length varies | | | | | |
| **Famous Scientists** | | | George James Symons (1833-1900) | | | | | |
| **Investigations** | What happens to water when it is cold?<br>What happens to ice when it is warm? | | **Modelled investigation**<br>**Observation over time**<br>What is the most common weather in Autumn? | | | | | |
| **Vocabulary** | liquid, solid, ice, water, winter, frozen, snow, ice, cold, hard. | | Spring, Summer, Autumn, Winter, seasons, months, weather, daylight | | | | | |
| **Misconceptions** | That ice is not water. | | The weather is always warm and dry during the summer.<br>It's only warm in the summer.<br>In autumn, all trees lose their leaves.<br>Plants only flower in summer.<br>It always snows during the winter.<br>It's only cold during the winter months. | | | | | |
| **Texts, rhymes and songs** | • Tree – Seasons Come, Seasons Go by Patricia Hegarty and Britta Tecketrup<br>• Lila and the Secret of Rain by David Conway and Jude Daly<br>• Maisy's Wonderful Weather by Lucy Cousins<br>• Snow/Sun/Rain/Storm (Poetry) by Sam Usher<br>• The Wind Blew by Pat Hutchins<br>• Little Bear's Spring By Elli Woolard<br>**<u>Non-Fiction</u>** | | • The Rabbit Problem by Emily Gravett<br>• Alfie Weather by Shirley Hughes<br>• Little Bear's Spring by Elli Woollard & Bryony May Smith<br>• One year with Kipper by Mike Inkpen<br>**<u>Non-Fiction</u>** | | | | | |
| **<u>Forces and Magnets</u>** | To explore and talk about different forces they can feel.<br><br>To explore how things work. | To understand some important processes and changes in the natural world around them, | | | To compare how things move on different surfaces<br><br>To notice that some forces need contact between 2 | | To explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object | |

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| | To talk about what they see, using a wide vocabulary. | | | | objects, but magnetic forces can act at a distance<br><br>To observe how magnets attract or repel each other and attract some materials and not others<br><br>To 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<br><br>To describe magnets as having 2 poles<br><br>To predict whether 2 magnets will attract or repel each other, depending on which poles are facing | | To identify the effects of air resistance, water resistance and friction, that act between moving surfaces<br><br>To recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect | |
| **Famous Scientists** | Archimedes<br>(287BC – 212 BC) | | | | Isaac Newton<br>(1643 - 1727) | | Galileo Galilei<br>(1564 - 1642)<br>Isaac Newton<br>(1643 - 1727) | |
| **Investigations** | Explore forces with buckets and pulleys.<br><br>Investigate cogs and how they work.<br>Investigate what happens when it is windy.<br><br>Investigate floating and sinking.<br><br>Stretching elastic bands.<br><br>Explore magnets – what is attracted and what is not attracted. | | | | **Intermediate investigation**<br>**Classifying**<br>Which materials are magnetic?<br><br>**Independent investigation**<br>**Fair test**<br>If we change the distance from the object what happens to the attraction of the magnet?<br><br>**Independent investigation**<br>**Fair test**<br>If we change the surface what will happen to the distance travelled?<br><br>**GD**<br>**Independent investigation**<br>**Fair test**<br>Are all magnets the same strength? | | **Intermediate investigation**<br>**fair test**<br>What effect does air resistance have on a falling object?<br><br>**Intermediate investigation**<br>**fair test**<br>What effect does water resistance have on an object falling through liquid?<br><br>**Intermediate investigation**<br>**fair test**<br>If I change the pivot point, will it affect how much force is needed?<br><br>**Intermediate investigation**<br>**fair test**<br>What is the effect of friction on an object that is being dragged?<br><br>**Independent investigation** | |

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| | | | | | | **Fair test**<br>Explain how a chemical reaction which produces gas can generate propulsion | |
| **Vocabulary** | float, sink, water, magnet, attract, repel, metal | | | forces, friction, surfaces, magnet, magnet, magnetic, magnetic field, poles, repel, attract | | Friction, air resistance, water resistance, buoyancy, streamlined, mechanism, forces, gravity, Earth's gravitational pull, weight, mass | |
| **Misconceptions** | All materials are attracted to a magnet | | | •All metals are attracted to a magnet<br>•All silver-coloured items are attracted to a magnet.<br>• Big magnets are stronger than smaller ones<br>• All naturally found metals are magnetic<br>• The shape of a magnet changes how strong it is. | | •Objects float in water because they are lighter than water.<br>•Objects sink in water because they are heavier than water.<br>•When objects are dropped from the same height, the object that weighs the most will hit the ground first<br>•Weight is the same as mass. | |
| **Texts, rhymes and songs** | Wind the Bobbin up (rhyme)<br>Who Sank the Boat? By Pamela Allen<br>**Non-Fiction** | | | • The Iron Man by Ted Hughes<br>• Mrs Armitage: Queen of the Road by Quentin Blake<br>**Non-Fiction**<br>Forces and movement- (Carol Ballard)<br>Science experiments with forces- (Sally Nankivell-Aston and Dorothy Jackson) | | •The Enormous Turnip by Katie Daynes<br><br>**Non-Fiction** | |
| **Light** | To talk about what they see, using a wide vocabulary. | | | To recognise that they need light in order to see things that dark is the absence of light<br><br>To notice that light is reflected from surfaces<br><br>To recognise that light from the sun can be dangerous and that there are ways to protect their eyes<br><br>To recognise that shadows are formed when the light from a light source is blocked by an opaque object<br><br>To find patterns in the way that the size of shadows change | | | To recognise that light appears to travel in straight lines<br><br>To use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye<br><br>To 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<br><br>To use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them |
| **Famous Scientists** | | | | Abu Ali al-Hasan (Alhazen) (965-1040) | | | Abu Ali al-Hasan (Alhazen) (965-1040) |

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| | | | | Thomas Edison<br>(1847-1931) | | | |
| **Investigations** | Use torches with different materials and investigate which the light shines through and which don't. | | | **Intermediate investigation**<br>**Classifying**<br>Which materials are reflective, and which are not?<br><br>**Intermediate investigation**<br>**Observation over time**<br>How do shadows change during the day?' | | | **Independent investigation**<br>**Observation over time/fair test**<br>Investigate a question of their choosing in relation to shadows and their size. |
| **Vocabulary** | light, dark, shadows, shine, torch | | | pupil, retina, shadow, opaque, translucent, transparent, light, light source, dark, reflection, reflect, reflective, ray | | | refraction, visual spectrum, prism, shadow, transparent, translucent, opaque, light, light source, reflection, incident ray, reflected, the law of reflection |
| **Misconceptions** | | | | • That light is only reflected on hard, shiny surfaces<br>• That light can only be reflected on smooth surfaces<br>• That only certain materials will reflect light. | | | That light doesn't travel in straight lines when it bounces off a mirror.<br><br>The moon is a source of light. |
| **Texts, rhymes and songs** | | | | • Fox in the Night: A Science Storybook About Light and Dark by Martin Jenkin<br>• The firework maker's daughter(www.stem.org.uk/teaching-science-through-stories)<br>• The Dark by Lemony Snicket<br>**Non-Fiction** | | | • Blackout by John Rocco<br><br>**Non-Fiction** |
| **Sound** | | | | | To identify how sounds are made, associating some of them with something vibrating<br><br>To recognise that vibrations from sounds travel through a medium to the ear<br><br>To find patterns between the pitch of a sound and features of the object that produced it<br><br>To find patterns between the volume of a sound and the strength of the vibrations that produced it<br><br>To recognise that sounds get fainter as the distance from the sound source increases | | |

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| **Famous Scientists** | | | | | Alexander Graham Bell (1847 -1922) | | |
| **Investigations** | | | | | **Intermediate Investigation Classifying**<br>Are the sounds around school natural or man-made?<br><br>**Intermediate Investigation Fair Test**<br>What effect does distance have on loudness of a sound?<br><br>**Intermediate / Independent investigation Fair Test**<br>What effect does the length/tightness of the material have on the pitch of the note? | | |
| **Vocabulary** | | | | | Vibration, sound wave, volume, amplitude, pitch, ear, particles, distance, soundproof, absorb sound, vacuum, eardrum | | |
| **Misconceptions** | | | | | An event in the distance can be seen and heard at the same time;<br>In order to change the pitch, an object should be hit harder. | | |
| **Texts, rhymes and songs** | | | | | • Horrid Henry Rocks (see www.stem.org.uk/teaching-science-through-stories )<br>• Moonbird by Joyce Dunbar<br><br>**Non-Fiction** | | |
| **Electricity** | | | | | To identify common appliances that run on electricity<br><br>To construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers<br><br>To 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<br><br>To recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit<br><br>To recognise some common conductors and insulators and associate metals with being good conductors | | To associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit<br><br>To 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<br><br>To use recognised symbols when representing a simple circuit in a diagram |

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| **Famous Scientists** | | | | | Thomas Edison<br>(1847-1931) | | Thomas Edison<br>(1847 – 1931) |
| **Investigations** | | | | | **Intermediate Investigation**<br>**Fair Test**<br>Are all metals are conductors of electricity?<br><br>**Independent investigation**<br>**Fair Test**<br>How does adding another battery affect the brightness of a lamp?<br><br>**Independent investigation**<br>**Fair Test**<br>Does the ..... affect the brightness of the lamp? | | **Modelled investigation**<br>**Fair test**<br>Investigate the brightness of a bulb<br><br>**Intermediate investigation**<br>**Fair test**<br>How can the number of cells in a circuit affect the volume of a buzzer, or the brightness of a bulb? |
| **Vocabulary** | | | | | electricity, generate, renewable, non-renewable, appliances, battery, circuit, insulator, conductor | | Circuit, symbol, cell/battery, current, amps, voltage, resistance, electrons |
| **Misconceptions** | | | | | Electricity is pushed out of both ends of a cell at the same time | | Current, voltage and electricity are all the same thing |
| **Texts, rhymes and songs** | | | | | • Oscar and the Bird: A Book About Electricity by Geoff Waring<br>• Until I Met Dudley by Roger McGough<br>• Electrical Wizard: How Nikola Tesla Lit Up The World by Elizabeth Rusch<br><br>**Non-Fiction** | | Goodnight Mr Tom (see www.stem.org.uk/teaching-science-through-stories )<br>• The boy who harnessed the wind by William Kamkwamba<br><br>**Non-Fiction** |
| **Earth and space** | | | | | | To describe the movement of the Earth, and other planets, relative to the Sun in the solar system<br><br>To describe the movement of the Moon relative to the Earth<br><br>To describe the Sun, Earth and Moon as approximately spherical bodies<br><br>To use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky | |
| **Famous Scientists** | | | | | | Nicolaus Copernicus<br>(1473-1543)<br>Margaret Hamilton<br>(1936 – present) | |

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| **Investigations** | | | | | | **Modelled Investigation Observation over time**<br>How does the position of the sun appear to change during the day?'<br><br>**Intermediate Investigation Observation over time**<br>How do shadows change throughout the day?<br><br>**Intermediate Investigation Observation over time**<br>What effect does the movement of the Earth around the Sun have on the length of shadows?' | |
| **Vocabulary** | | | | | | Orbit, rotate, axis, geocentric model, heliocentric model, astronomer, sun, star, moon, planet, sphere, spherical bodies, satellite | |
| **Misconceptions** | | | | | | • The Sun goes behind hills.<br>• The clouds cover the Sun.<br>• The Moon covers the Sun.<br>• The Sun goes behind the Earth once a day.<br>• The Earth goes around the Sun once a day.<br>• The Sun moves across the sky.<br>• The Earth rotates in a clockwise manner. | |
| **Texts, rhymes and songs** | | | | | | • The Jamie Drake Equation by Christopher Edge<br><br>**<u>Non-Fiction</u>** | |