Year 1 – Seasonal Changes

National Curriculum Objectives/Knowledge Statements (Substantive):

- Observe changes across the four seasons
- Observe and describe weather associated with the seasons and how day length varies.

Pupils should observe and talk about changes in the weather and the seasons.
Note: Pupils should be warned that it is not safe to look directly at the Sun, even when wearing dark glasses.
Pupils might work scientifically by: making tables and charts about the weather; and making displays of what happens in the world around them, including day length, as the seasons change.

Key Ideas
Children need to learn about how a number of things change with the seasons, including the weather, the temperature and the number of daylight hours. They do not need to know why these things change. It would be best to teach these phenomena through exploring the local environment rather than on topics to do with *Earth and space*.

Prior Learning	Breakdown of Lessons		Vocabulary
In Early Years: • Developing an understanding of change. • Observe and explain why certain things may occur (e.g leaves falling off trees, weather changes). • Look closely at similarities, differences, patterns and change. • Comments and questions about the place they live or the natural world.	**Lesson and Big Question**	Knowledge **(Progression of substantive knowledge – what?)**. Or Science Enquiry/Skill Based Lesson **(Disciplinary/National Curriculum Working Scientifically Statements – why/how?).** These inc: Fair Testing (Asking Scientific Questions, Planning and Enquiry, Observing closely, Drawing Conclusions, Making Predictions, Evaluating an Enquiry), Identifying & Classifying, Observation Over Time (Observing closely), Pattern Seeking/Research.	Seasons, spring, summer, autumn, winter, windy, sunny, overcast, snow, rain, temperature, hot cold.
	Autumn /Winter– Laura Tobin in the meteorologist, she studies the weather and presents it on GMB. We are looking at the season of autumn – how do you know it is autumn?? Prove it. Spring – Alex Beresford is a meteorologist; he studies the weather and presents it on GMB. We are looking at the season of spring – how do you know it is spring? Prove it. Summer - Remember that Alex Beresford is a meteorologist; he studies the weather and presents it on GMB. We are looking at the season of summer – how do you know it is summer? Prove it.	Science Enquiry - All seasons - Observation – seasonal walk and collecting evidence. Identifying and classifying evidence to prove the season.	
	Autumn/Winter – Gabriel Fahrenheit (invented thermometers) and Anders Celsius (Celsius temperature scale) were scientist who looked at temperature. Can you observe and describe the temperature during autumn and the weather associated with the seasons. Spring - Jane Goodall is A British Ethnologist who studies animal behaviour. She wants to know why some animals have their babies in spring. BIG QUESTION - What are the main animals born in spring and why do animals have their babies in spring? Summer - John Dalton was a British weather pioneer. What he did with his instruments helped to turn the forecasting of weather into actual science. He would like to know if the weather from spring is different to summer- prove it. BIG QUESTION – How is the weather different in summer from spring? Prove it!	Science Enquiry - Autumn/Winter – Observation of temperature/Pattern Seeking/Research to find evidence of the temperature change. Spring – Knowledge – Know the animals born in spring. Science Enquiry - Summer - Observation of temperature/Pattern Seeking/Research to find evidence of the temperature change.	
	Autumn/Winter – Patrick Moore is a famous astrologer and studies the planets and the stars but he only observes them at night so it would be easier for him to look at the stars in autumn and winter. BIG QUESTION – Bonfire Night happens in autumn, on the 5th November. Why do you think it is a good idea to watch fireworks in the autumn? Prove it. Spring – John Dalton was a British weather pioneer. What he did with his instruments helped to turn the forecasting of weather into actual science. He would like to know if the weather from winter is different to spring- prove it. Summer - Dr Hilary Jones is a GP and advises people on GMB. He thinks you need to stay safe in the sun with WRAP, SPLAT, HAT to protect your skin. BIG QUESTION – How do you stay safe in the sun to protect your skin and stay safe? Prove it!	Autumn/Winter – Knowledge – Understand dark nights are better to see lights and that we are getting less light/darker earlier. Science Enquiry - Spring - Observation of temperature/Pattern Seeking/Research to find evidence of the temperature change. Summer – Knowledge – understand different ways to stay safe in the summer.	
	Autumn /Winter– Dr Steve Lyons is a meteorologist expert at the weather channel who knows all about the weather in the different seasons. Autumn has ended and turned into winter – prove it. Spring – Carl Linnaeus was a Swedish botanist who journeyed the world to name classify plants and animals. He would like to know what happens to plants in spring – does the life cycle of a plant begin in spring and what begins to happen? Prove it. Summer – Re-cap all seasons.	Science Enquiry - Autumn/Winter - Observation of weather/Pattern Seeking/Research to find evidence of the seasonal change. Spring – Knowledge – Plant life cycle. Summer – Knowledge – re-cap main points of all seasons.	
	Autumn/Winter – Chris Peckham is a famous naturist scientist who studies animals in their habit. Animals seem to disappear in the winter, do they all die or adapt to the winter? Prove it? Spring/Summer – Assessment	Autumn/Winter - Observation of weather/ Research to find evidence of hibernation.	

	Autumn/Winter– John Dalton was a British weather pioneer. What he did with his instruments helped to turn the forecasting of weather into actual science. Big Question: He would like to know if the weather is always snowing to be winter - prove it. Spring/Summer – N/A	Autumn/Winter - Observation of weather/Pattern Seeking/Research to find evidence of winter weather.	
	In Year 3: ● Recognise that they need light in order to see things and that dark is the absence of light. ● Notice that light is reflected fromsurfaces. ● Recognise that light from the sun can be dangerous and that there are ways to protect their eyes. ● Recognise that shadows are formed when the light from a light source is blocked by a solid object. ● Find patterns in the way that the sizes of shadows change.		

Year 3 – Light

National Curriculum Objectives/Knowledge Statements (Substantive):

- Recognise that they need light in order to see things and that dark is the absence of light.
- Notice that light is reflected fromsurfaces.
- Recognise that light from the sun can be dangerous and that there are ways to protect their eyes.
- Recognise that shadows are formed when the light from a light source is blocked by a solid object.
- Find patterns in the way that the sizes of shadows change.

Pupils should explore what happens when light reflects off a mirror or other reflective surfaces, including playing mirror games to help them to answer questions about how light behaves. They should think about why it is important to protect their eyes from bright lights. They should look for, and measure, shadows, and find out how they are formed and what might cause the shadows to change.
Note: Pupils should be warned that it is not safe to look directly at the Sun, even when wearing dark glasses.
Pupils might work scientifically by: looking for patterns in what happens to shadows when the light source moves or the distance between the light source and the object changes.

Key Ideas:

a) There must be light for us to see. Without light it is dark.
b) We need light to see things even shiny things.
c) Transparent materials let light through them and opaque materials don't let light through.
d) Beams of light bounce off some materials (reflection).
e) Shiny materials reflect light beams better than non-shiny materials.
Light comes from a source.

Prior Learning	Breakdown of Lessons:		Vocabulary
	Lesson and Big Question	Knowledge **(Progression of substantive knowledge – what?)**. Or Science Enquiry/Skill Based Lesson **(Disciplinary/National Curriculum Working Scientifically Statements – why/how?).** These inc: Fair Testing (Asking Scientific Questions, Planning and Enquiry, Observing closely, Drawing Conclusions, Making Predictions, Evaluating an Enquiry), Identifying & Classifying, Observation Over Time (Observing closely), Pattern Seeking/Research.	
In Year 1: • Name the seasons and know about the type of weather in each season • May have some knowledge of were light comes from. • Will most likely have seen their shadows and may know they appear when it is sunny. • Some understanding of a reflection. May understand they need light to be able to see things.	Lesson 1- Joseph Swan was an English scientist and inventor. He developed one of the early incandescent lightbulbs and was responsible for supplying lightbulbs to light up people's houses and public buildings, including The Savoy Hotel in London in 1881. Big Question: Light can come from either natural or man-made sources. Do you agree?	Knowledge – Identifying sources of light and sorting into those that are natural and those that are man-made. Know that darkness is the absence of light.	Light source, dark, reflect, ray, mirror, bounce, visible, beam, sun, glare, travel, straight, opaque, shadow, block, transparent, translucent.
	Lesson 2- Percy Shaw invented the 'Cat's Eye' after driving down a dark road and noticing the way the light had reflected from the eye of a cat at the side of the road. Percy realised the great potential of improving road safety if he could create a reflecting device that could be fitted to road surfaces. Big Question: How are reflections made?	Scientific Enquiry – Observations of reflections, different materials, which materials make the best reflections, can we make light bend around a corner? Knowledge- To know and understand that a reflection is made when the light source bounces off a reflective surface. Know the properties of a reflective surface.	
	Lesson 3- Lottie Reigner was a pioneering German filmmaker who experimented with using shadows to create films. She created the first full-length feature film using shadows in 1926. Big Question: How are Shadows formed?	Scientific Enquiry- Observations of shadows, different materials, which materials make the best shadows? Predicting and Drawing Conclusions. Knowledge – To know and understand how shadows are formed. To understand that a shadow is formed when a light source is blocked.	
	Lesson 4- A sundial uses shadows to tell the time. No one knows who invented the first sundial, evidence of them has been found by Archaeologists from Ancient Egypt, Other historians believe that people in Greece, Rome or Babylonia could have been the first inventors of sundials as well. **Theodosius of Bithynia:** Thought to be the inventor of a universal sundial. Big Question: How can shadows change?	Scientific Enquiry- Observations of shadows, how can shadows be made bigger or smaller, lighter or darker? Pattern Seeking.	
	Lesson 5- Sun safety quiz to establish what prior knowledge the children have about being safe in the sun. Introduce Franz Greiter and explain he was the first person to invent sun cream after getting burnt climbing mountains. Introduce the story of Sammy the Seagull and sing the sun safety song. Big Question: How can we stay safe in the sun?	Knowledge - They should think about why it is important to protect their eyes from bright lights. Pupils should be warned that it is not safe to look directly at the Sun, even when wearing dark glasses.	

In Year 4:

- Recognise that light appears to travel in straight lines.
- 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.
- 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.
- Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.
- Know how simple optical instruments work, e.g. periscope, telescope, binoculars, mirror, magnifying glass etc.

Year 4 – Sound

National Curriculum Objectives/Knowledge Statements (Substantive):

- Know how sound is made associating some of them with vibrating.
- Know what happens to a sound as it travels from its source to our ears.
- Know the correlation between the volume of a sound and the strength of the vibrations that produced it.
- Know how sound travels from a source to our ears.
- Know the correlation between pitch and the object producing a sound.

Pupils should explore and identify the way sound is made through vibration in a range of different musical instruments from around the world; and find out how the pitch and volume of sounds can be changed in a variety of ways. Pupils might work scientifically by: finding patterns in the sounds that are made by different objects such as saucepan lids of different sizes or elastic bands of different thicknesses. They might make earmuffs from a variety of different materials to investigate which provides the best insulation against sound. They could make and play their own instruments by using what they have found out about pitch and volume.

Key Ideas:

a) Sound travels from its source in all directions and we hear it when it travels to our ears.
b) Sound travel can be blocked.
c) Sound spreads out as it travels.
d) Changing the shape, size and material of an object will change the sound it produces.
e) Sound is produced when an object vibrates.
f) Sound moves through all materials by making them vibrate.
g) Changing the way an object vibrates changes it's sound.
h) Bigger vibrations produce louder sounds and smaller vibrations produce quieter sounds.

Faster vibrations (higher frequencies) produce higher pitched sounds

Prior Learning	Breakdown of Lessons		Vocabulary
	Lesson and Big Question	Knowledge **(Progression of substantive knowledge – what?)**. Or Science Enquiry/Skill Based Lesson **(Disciplinary/National Curriculum Working Scientifically Statements – why/how?)**. These inc: Fair Testing (Asking Scientific Questions, Planning and Enquiry, Observing closely, Drawing Conclusions, Making Predictions, Evaluating an Enquiry), Identifying & Classifying, Observation Over Time (Observing closely), Pattern Seeking/Research.	
In Year 3: • Have understanding that objects make different sounds. • Have understanding that they use their ears to hear sounds. • Know about their different senses.	Lesson 1 – What is sound? Explore the different ways sounds can be made. Look at a speaker with rice on- watch the rice moving as the sound is made- associate with vibrations being made. Big Question: Leonardo Da Vinci is a famous scientist and artist who discovered lots of interesting things about sound. He wants to ask you: How are sounds made?	Scientific Knowledge – identify how sounds are made associating some of them with something vibrating. Pattern Seeking – Know what happens when the volume has been turned up or down.	Amplitude, volume, quiet, loud, ear, pitch, high, low, particles, instruments, wave.
	Lesson 2 – Sound travelling Learn about the way that sound travels and that it can move faster through different materials and the reasons why. Big Question: Leonardo Da Vinci is a famous scientist and artist who discovered lots of interesting things about sound. He wants to ask you: How does sound travel?	Scientific Knowledge – identify how sounds are made associating some of them with something vibrating. Scientific enquiry – (asking scientific questions, making predictions observation)- Experiment with muffling a sound from a microphone with different materials. What do the children notice about the sound? Measure the sound in decibels. Children will explain why the sound is quieter when the microphone is covered.	
	Lesson 3 – The ear Label the different parts of the ear and the functions they have. Marion Downs developed newborn hearing screening. Big Question: What are the functions of the ear?	Scientific Knowledge – Recognise that vibrations travel through a medium to the ear.	
	Lesson 4 and 5 – Pitch Explore a variety of musical instruments and how the sound (pitch) can be changed. Explore what is meant by pitch. Make a set of pan pipes and explore how you make the pitch change.	Scientific Enquiry/ Pattern seeking- Find patterns between pitch changing and features of an object.	

In Year 6:

- 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.
- 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

Year 6 – Light

National Curriculum Objectives/Knowledge Statements (Substantive):

- Recognise that light appears to travel in straight lines.
- 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.
- 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.
- Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.
- Know how simple optical instruments work, e.g. periscope, telescope, binoculars, mirror, magnifying glass etc.

Pupils should build on the work on light in year 3, exploring the way that light behaves, including light sources, reflection and shadows. They should talk about what happens and make predictions.
Pupils might work scientifically by: deciding where to place rear-view mirrors on cars; designing and making a periscope and using the idea that light appears to travel in straight lines to explain how it works. They might investigate the relationship between light sources, objects and shadows by using shadow puppets. They could extend their experience of light by looking a range of phenomena including rainbows, colours on soap bubbles, objects looking bent in water and coloured filters (they do not need to explain why these phenomena occur).

Key Ideas:

a) Animals see light sources when light travels from the source into their eyes.
b) Animals see objects when light is reflected off that object and enters their eyes.
c) Light reflects off all objects (unless they are black). Non shiny surfaces scatter the light so we don't see the beam.
Light travels in straight lines

Prior Learning	Breakdown of Lessons		Vocabulary
	Lesson and Big Question	Knowledge **(Progression of substantive knowledge – what?)**. Or Science Enquiry/Skill Based Lesson **(Disciplinary/National Curriculum Working Scientifically Statements – why/how?)**. These inc: Fair Testing (Asking Scientific Questions, Planning and Enquiry, Observing closely, Drawing Conclusions, Making Predictions, Evaluating an Enquiry), Identifying & Classifying, Observation Over Time (Observing closely), Pattern Seeking/Research.	
In Year 4: • Recognise that they need light in order to see things and that dark is the absence of light. • Notice that light is reflected from surfaces. • Recognise that light from the sun can be dangerous and that there are ways to protect their eyes. • Recognise that shadows are formed when the light from a light source is blocked by a solid object. • Find patterns in the way that the sizes of shadows change.	BQ: Does light travel in a straight line?	Knowledge: Identify light sources (natural and manmade) Science enquiry using equipment/Fair testing/Planning and Enquiry: (x3 CDs, torch, dark coloured card, x3 pegs). Using these items, how can we prove/disprove light travels in a straight line? Use precise and accurate measurements and repeat readings, understanding why these give results that are more accurate.	Light source, dark, reflect, ray, mirror, bounce, visible, beam, sun, glare, travel, straight, opaque, shadow, block, transparent, translucent. Reflect Absorb Emitted Scattered Refraction
	BQ: Miss Hassan and Mr MacKenzie believe that shiny, flat, smooth surfaces reflect light the best. Prove it.	Knowledge: What does the word reflection mean? Angle of incidence/reflection, how light bounces off a surface. Scientific Enquiry: Think about properties of an object, what helps reflect light best? Investigate using variety of materials given. Discuss findings. Mirror and demo how to find/see angle of incidence. Choose 3 objects and looked at properties and tested to compare.	
	Miss Hassan and Mr MacKenzie believe refraction changes the way in which light travels. Prove it.	Knowledge: What is refraction? What causes the light to bend? Why? Scientific Enquiry: Using an empty glass/full glass, what happens to the pencil when in water? What happens to the arrow when placed behind the glass of water? When we place the arrow at the bottom of an empty glass, then start to fill it with water, what happens? How? Look at refraction and how light moves through different mediums.	
	BQ: Issac Newton says white light is made up of a range of colours – prove it.	Asking scientific questions/Observation: Colour Spectrum - Using prisms, show what happens when light refracts and bends. Investigate angle of light source to where the colours appear.	

	BQ: Stephen Louis Mcknik is an American neuroscientist who studies illusions. He thinks the eyes can play tricks on the mind and that perceptions can be different to reality – Prove it.	Knowledge: Label internal and external parts of the eye. Discover how we actually see things. Observation: Optical illusions – what actually happens and why.	
	Let's Investigate: Putting Eratosthenes' discovery to the test, create an object which will stand unsupported and investigate its shadow and the position of the light source.	Knowledge: how shadows are formed, when the sun rises/set and looking at length of shadows compared to position of sun in the sky. Scientific Enquiry: Creating a shadow puppet. Make predictions. Close observation to what happens to the size of the shadow when position of the light source changes.	

In KS3:

- 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 science.
- 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.

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Science Progression from EYFS to Year 6

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