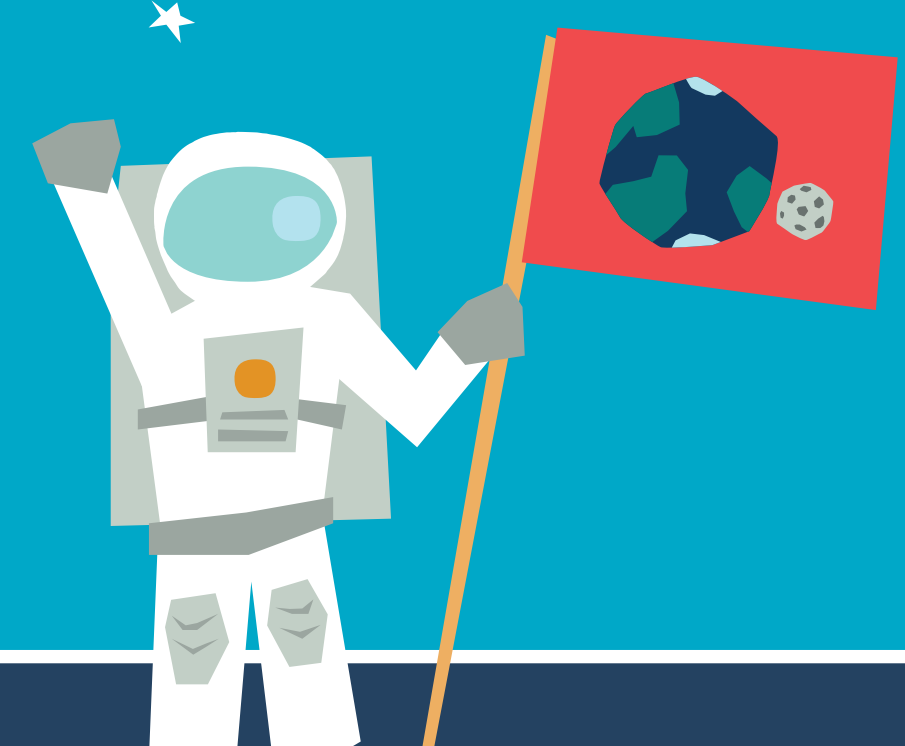
Winchester Science Centre
By Wonderseekers

Star Seekers

Pre-visit resources for KS3



KS3 - Star Seekers

These activities are designed to be completed before you visit for your Star Seekers workshop. We recommend working through the activities from 1 to 3 but you are welcome to pick and choose depending on your group's prior knowledge and any ideas they may spark along the way.

To explore the stars we need to learn how we can study them, through the light they send from millions of miles away. Through these activities, you will be exploring how light travels through the world. This will include how it creates shadows and how it moves around our world. We will also be exploring how we've used the light from stars to create images in our night sky.

Teacher Guide

Learning Objective

- To understand how light travels.
- To explore how shadows work.
- To explore how humans have used the light from stars to form constellations.

Key Science

Light is a type of energy that can move through the world as a wave and is produced by a light source. This light source could be natural or artificial. These light waves travel through the world in straight lines, only changing direction if they are reflected off a surface. We use light to see, as light reflects off objects and into our eyes. Not all light is reflected, some of it is absorbed into objects. This is how we get colour in our world as white light from the Sun is made up of all the different colours we find in the rainbow. As this light hits things in our world, some of the light is absorbed while some of it is reflected. The coloured waves of light that are reflected enter our eyes, and our brain recognises them as a different colour. Darkness in our world is created by an absence of light, this is the same for shadows as it is the night sky.

Light is one of the most useful tools for scientists to study our universe. It travels across the vast distances at 300 million metres per second. We capture the light from distant stars and planets in our telescopes to get a clear picture of these objects and learn all about them. From studying the light of different planets and stars, we have learned how large they are, what they are made of and even what gases they have in their atmosphere.

Curriculum Links

- Our Sun as a star, other stars in our galaxy, other galaxies
- Light waves travelling through a vacuum; the speed of light

Key terms

- **Satellite** – An object that orbits (goes around) another object. They can be man-made or natural.
- **Telescope** - A piece of equipment that can make faraway objects appear bigger, so scientists can study them. We use them to look at things in space.
- **Energy** – The ability to do work. It comes in many forms, such as heat, sound, movement, and light.
- **Light** - A type of energy that allows us to see things. Light comes from sources such as the Sun, a lightbulb, or fire. Darkness is the absence of light.
- **Reflect** – When light bounces off something. When light bounces off a mirror, you can see a reflection.
- **Atmosphere** – A blanket of gases around a planet.
- **Oxygen** - A type of gas that nearly all life on Earth needs to survive.
- **Visible light** – Light that human eyes can see.
- **Infrared** – A type of light that human eyes can't see, that waves a little slower than the colour red. We can feel infrared, as heat.
- **Ultraviolet** – A type of light that human eyes can't see, with waves a little faster than the colour violet. The sun emits ultraviolet light, and it can be dangerous to humans. It has so much energy that it can burn our skin, which is how we get sunburn.
- **Absorb** – To take in energy. Dark coloured materials absorb more heat than light coloured materials.
- **Electromagnetic spectrum** - All the types of light waves lined up in order of lowest energy (longest wavelength) to highest energy (shortest wavelength), starting at radio waves and ending at gamma rays. Visible light is in the middle.
- **Frequency & Wavelength** - Frequency is how fast something "waves" (how fast the wave goes up and down per second). Wavelength is the distance between the peaks of the waves. Waves with high frequency have a short wavelength (e.g. ultraviolet light), waves with low frequency have a long wavelength (e.g. infrared light).
- **Diffraction** – When a beam of light is spread out
- **Disperse** – light being spread out according to its colour as it shines through an object
- **Radio** – The type of electromagnetic wave with the longest wavelength.
- **Microwave** - An electromagnetic wave with a wavelength shorter than radio and longer than infrared.
- **X-ray** - An electromagnetic wave with a wavelength shorter than ultraviolet and longer than a gamma ray.
- **Gamma ray** – The type of electromagnetic wave with the shortest wavelength.

Activity 1 – Sources of light (5 minutes)

Overview

Explore different sources of light, and see if you can group them into the primary sources and secondary sources of light. Primary sources create their own light, whereas secondary sources reflect light from another source. For example the Sun is a primary source as it makes its own light, while the Moon is a secondary source as it reflects sunlight.

You will need (per group)

- Light sources cards.

Instructions

1. Discuss the definitions of primary and secondary light sources with the children using some examples. Ask if there are any sources of light that they already know.
2. Using the cards on page 8–10, have the children sort them into primary and secondary sources in groups.
3. Bring the class back together and share your answers. Come up with a correct grouping together.

Take it further

See if you can group them further into natural vs. artificial:

- **Natural** - Sun, other stars, bioluminescence (animals that glow) and lightning.
- **Artificial** - Light bulbs, lasers, car headlights etc.

Activity 2: Beams of Light (10-15 minutes)

Overview

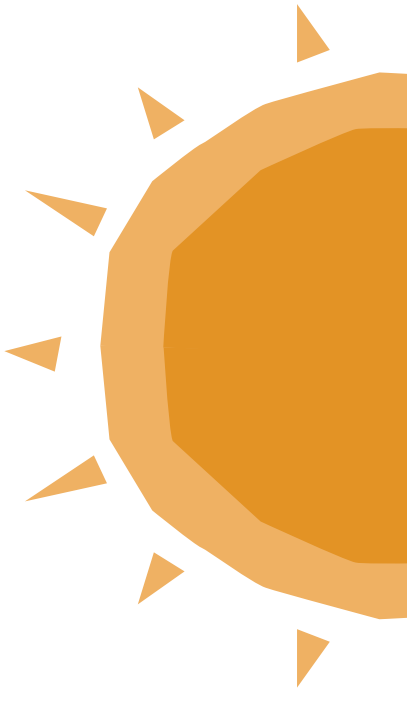
All animals need light to see but light waves only travel in straight lines. This means that for us to see light has to hit an object and reflect back into our eyes. This activity will get the students to play a game where they have to navigate as a light wave.

You will need

- Optional: A mirror.
- Stickers/Labels.

Instructions:

1. Mark different objects in the classroom as reflective or absorptive.
2. Explain that light travels in straight lines, it can't go around corners. To explain this further we are going to play a game, pretending to be beams of light! In this game the students will be waves of light. When they touch a reflective object they bounce off but if they touch an absorptive object they lose their energy and are out of the game.
3. Ask students to spread out and find a space in the room.
4. The teacher will call out instructions:
    - Walk in a straight line like a beam of light.
    - When you reach a wall, reflect, turn and 'bounce off' like light hitting a mirror. The students can pick a new angle to bounce off at.
    - Challenge the students to try to bend around a corner. Can you? You can't, unless you've reflected off something!
5. Bring everyone back in for a discussion around what happens when light meets something shiny, like a mirror for example. If you do happen to have a small mirror, you can use this to reflect light around the room. In this case because the mirror is so reflective the light reflects the image right back.



Activity 3: Build the Solar System game (15-20 minutes)

Overview

Light travels through space from our Sun to reach us here on Earth. That light doesn't just reach out to us it reaches out to every planet in our solar system and beyond. To explore where the light reaches, work together with your class to create a moving model of our Solar System. Each of the children represents an object in the solar system -

You will need

- Stickers/Labels.
- Cones.
- An open space.

Instructions:

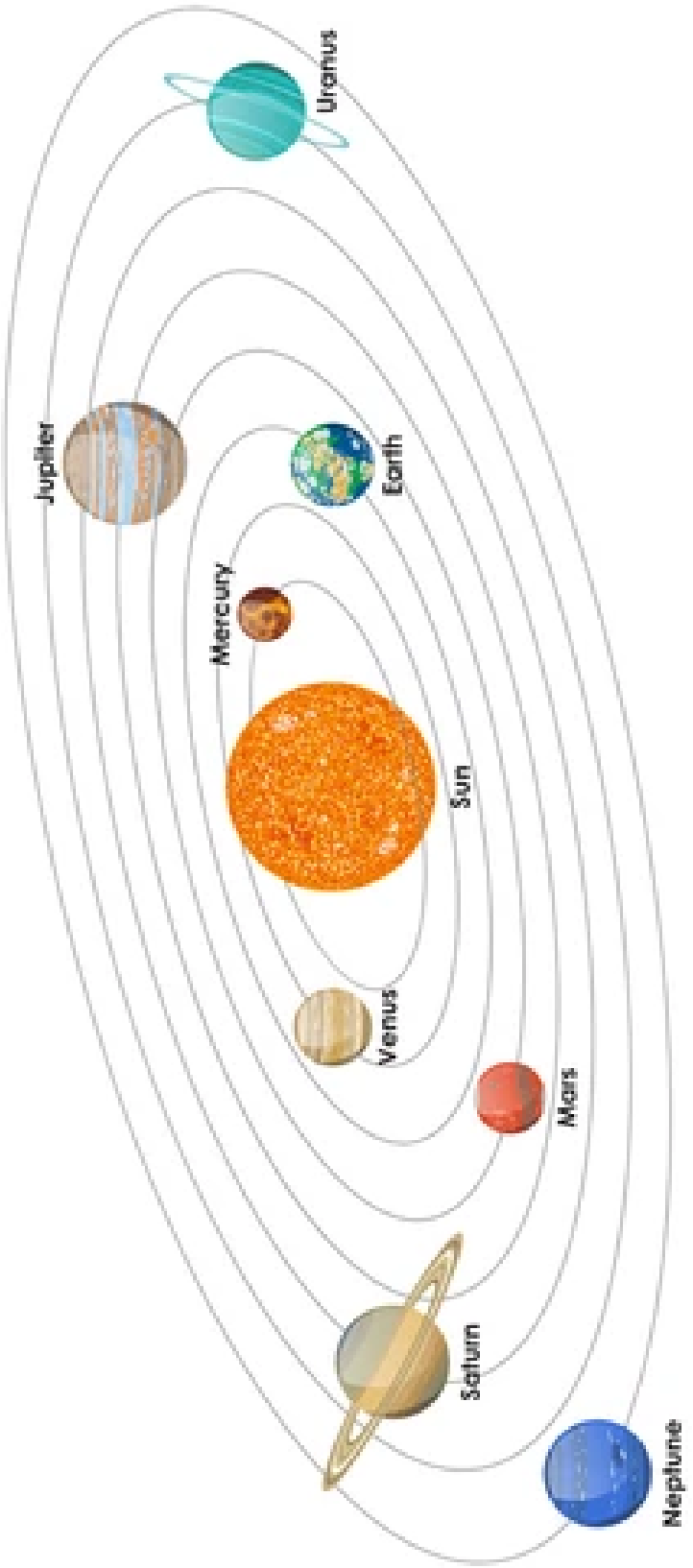
1. Set up nine cones in a straight line with space between them. See the diagram below.
2. At one end of the cones have a student volunteer to be the Sun. They will be the centre of our Solar System.
3. Then at each cone bring up students to be the planets. They need to be in planetary order away from the Sun - Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.
4. Then add it some Moons to stand with the planets – have 1 person be the moon for Earth, 2 people be the moons Phobos and Deimos for Mars, have 4 moons (Europa, Io, Ganymede and Callisto) join Jupiter, then have 3 moons join Saturn (Pan, Enceladus and Titan), 2 moons join Uranus (Titania and Oberon) and finally have 1 moon join Neptune (Triton).
5. Once the students are in place have them walk in a circle around the sun while keeping in order. Give them two minutes to see how many orbits they can complete. As the planets closer to the Sun have less distance to travel they should complete more orbits. This is what happens in our solar system, the planets take longer to orbit the Sun the further out they are.

Take it further

If you want to add to your model of the solar system, there are lots more you can add.

- Have 5 of your students be the dwarf planets: Pluto, Makemake, Haumea, Eris and Ceres. All are further out than Neptune, apart from Ceres which travels between Mars and Jupiter.
- You could add asteroids and comets moving through the circles, not being caught in the gravity but having their direction changed slightly.

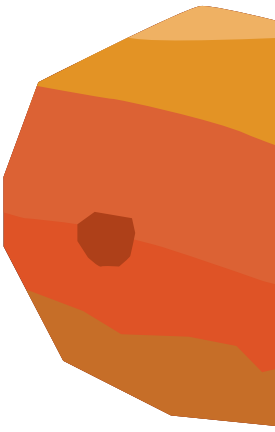
Activity 3: Build the Solar System game (15-20 minutes)



Activity 4 – Constellation Making

Overview

Natural sources of light have fascinated humans for centuries, especially the stars we find in our night sky. We have looked up at the stars and formed pictures of different stories and characters called the constellations. In this activity the students will create their own constellations.



You will need

- Black card.
- Torches.
- Scissors.
- Pencils.

Optional – Constellation pictures.

Instructions

Optional: Show the class some pictures of constellations, ask them if they can spot any creatures or objects in the stars.

1. Have the students pick a story to base their constellation around
2. Give each student their own square of black card. On this card they will be drawing their own constellation.
3. When drawing, the students should mark where the stars are with a cross and draw out the lines of their picture.
4. Once their constellation is drawn, use scissors to poke holes in the card where the stars are.
5. Once everyone's constellation is ready, place the black card on top of the torches and turn off the lights.
6. Turn on the torches and you should see the constellation illuminated on the ceiling of the classroom.

Sun

Moon

Fire

Lightbulb

Lasers

Stars

Lightning

Saturn's ring

Snow

Bioluminescence

Aviators

Water

Windows

Metals

Sun

Moon

Mercury

Venus

Earth

Mars

Jupiter

Saturn

Uranus

Neptune

Phobos

Demios

Oberon

Titania

Triton

Ganymede

Europa

Callisto

Io

Pan

Titan

Enceldaus

Ceres

Makemake

Eris

Haumea

Pluto

Satellite

Asteroid

Comet