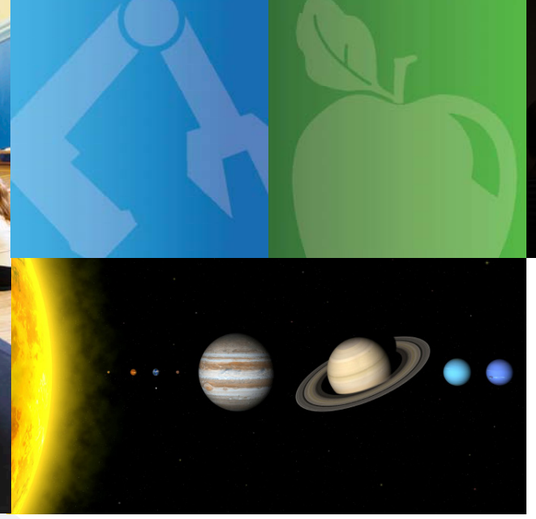


EDINBURGH INTERNATIONAL SCIENCE FESTIVAL

generation science

EDF ENERGY

SPACE BASE

Welcome to Generation Science!

Brought to you by the Edinburgh International Science Festival, our shows and workshops spark pupils' curiosity and bring science to life.

What we do

Each show or workshop is fully equipped and delivered by trained science communicators. We create fun, interactive environments where everyone gets out of their seats and gets involved. Our inspiring demonstrations and engaging activities are linked to the Curriculum for Excellence, explaining key concepts in a unique and memorable way.

Event Description

Secrets of Space is a planetarium show that explores the wonders of our solar system, the scope and scale of the universe and our place within it. Starting with the movements of the sun across the sky the class find out how scientists historically observed the movement of stars and planets to create theories about the formation of the solar system. After exploring the solar system in more detail, the class look at how scientists observe celestial bodies today and think about the size and scale of the universe.

Curriculum Links

Space Base is linked to the Curriculum for Excellence and complements the following experiences and outcomes in the Science and Technologies strands:

SCN 1-06a: By safely observing and recording the sun and moon at various times, I can describe their patterns of movement and changes over times. I can relate these to the length of day, a month and a year.

SCN 2-06a: By observing and researching features of our solar system, I can use simple models to communicate my understanding of size, scale, time and relative motion within it.

SOC 2-06a: I can discuss why people and events from a particular time in the past were important, placing them within a historical sequence.

Learning Outcomes

- Recall that the movements of the sun and stars across the sky led people to believe in a geocentric model of the universe.
- Understand the definition of a geocentric model as one in which celestial bodies orbit around the Earth.
- Recall that more detailed observations of the sky provided evidence to support a heliocentric model.
- Understand that a heliocentric model is a sun centred model where planets and other rock objects orbit around the sun.
- Describe our solar system as a heliocentric system with planets of different sizes and compositions orbiting at different distances from the sun.
- Recall that modern scientists detect light which we can't see to observe objects in the universe.
- Appreciate the relative size and location of the earth within the Universe.

The re-development of Generation Science teacher notes has been made possible by a grant from the **Texas Instruments Community Fund**

www.sciencefestival.co.uk/education

The Science behind the Show

Observations in the sky - Geocentric and Heliocentric models

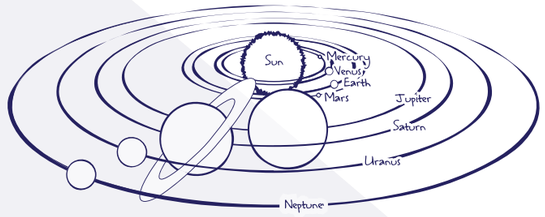
During the day the sun can be seen rising from the horizon in the east, progressing across the sky and setting at the horizon in the west. At night stars can also be seen moving across the sky. Before space exploration, the only way to understand what was happening beyond the Earth's atmosphere was to observe the movements of objects across the sky and suggest theories which would explain these movements.

One theory, which was popular for a long time, was the geocentric or Earth centred model. Scientists suggested that the sun, moon, planets and stars were in orbit around the Earth to explain the movements they observed in the sky.

Another theory suggested was the heliocentric model or sun-centred model. This theory proposed that the Earth moved around the sun, and actually dates from as early as the 3rd century but was not widely supported until the 1600s. This is now known to be the accurate description of how our solar system works.

The Solar System

Our solar system's structure has a star (our sun) at the centre with planets, dwarf planets, asteroids, comets and satellites all moving in approximately circular paths around it. This movement is known as orbiting. These objects stay in orbit due to the gravitational force between them and the sun. Gravity is an attractive force which occurs between two bodies but is particularly noticeable when the two bodies have very large masses.



All of the planets in our solar system orbit on paths which are approximately level with each other and travel in the same direction (anti-clockwise) around the sun. Every planet is individual, each being composed of different materials and orbiting at a different distance from the sun. The planets also spin on their own axes, and it is this spinning which gives us day and night, seasons as well as making the stars appear to move across the night sky. Many planets also have their own moons which orbit around them producing lunar cycles.

Observing the Universe

Due to the vast distances between Earth and our neighbouring planets, stars and galaxies, the main way that scientists explore our universe is by observing and detecting light with telescopes. Light is emitted and reflected off many objects in space. This light contains information about the object it has come from and other things it has passed through on the way. It can tell scientists how fast a star or planet is travelling, as well as the materials it is made of.

In addition to the light we can see, which we refer to as visible light, there is also an invisible spectrum of light humans can't see, for example infrared, ultraviolet, x-ray, microwaves and gamma waves. Although we can't see this light, we can detect it using special instruments. Scientists use these special instruments in telescopes to detect light in the invisible spectrum to get even more information about the universe and the objects within it.

Some Useful Links

www.csiro.au/en/Education/DIY-science

www.spaceplace.nasa.gov

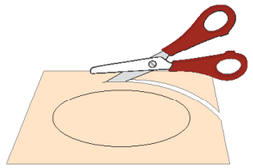
Scottish Charity Registration Number: SC003790
Generation Science, Harbourside House, 110 Commercial Street, Edinburgh, EH6 6NF

FOLLOW-UP CLASSROOM ACTIVITY 1

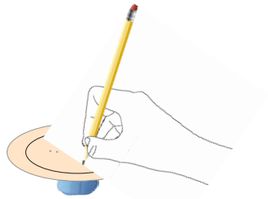
Crafty Constellations

You will need:

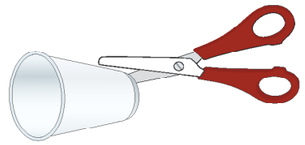
- A disposable cup (preferably a polystyrene cup)
- Sticky tape
- Scissors
- A torch
- A sharp pencil
- Card
- Paper
- Blue tack



1. Place the cup on a piece of paper and trace around its base. Leaving a 1cm border, cut around the edge of the circle.



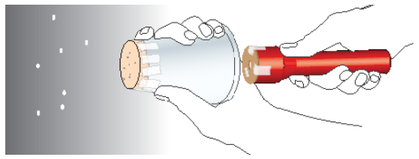
2. Draw the stars of a constellation as dots onto this paper circle. Then use the sharp pencil to pierce a hole in each of the stars you have drawn (put a piece of Blue-Tack behind before you do so to prevent hurting yourself).



3. Carefully cut out and remove the base of the cup.

4. Using sticky tape around the edges, attach your paper constellation to the base of the cup.
5. Place the torch, light facing down, on a piece of card and trace around the face.

6. Cut out the circle and then cut a small hole (no bigger than 1cm wide) in the centre of the circle. Attach the cardboard circle over the front of the torch with sticky tape.



7. Switch the torch on and hold inside the cup. Point the bottom of the cup at a plain surface, and view your constellation. You may need to adjust the cup's distance from the surface or the torch to get a clear image.

Templates of constellations can be found via a simple internet search of "star constellation template images".
Try creating your own constellation with its own story. Are you and your classmates able to recreate the night's sky for different times of year?

Explanation

A constellation is a collection of stars which appear grouped together to make a pattern in the sky. In reality, the stars may not be connected or near each other in any way however, from the viewpoint of Earth they form a memorable pattern. This can be very useful – it is much easier to find a particular star when you know the pattern it makes with other stars in the nights sky.

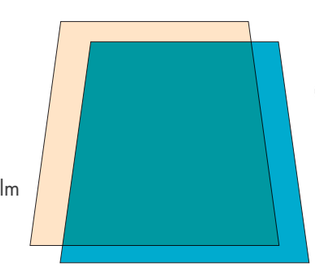
Many different cultures have been discovering and recording constellations for thousands of years, each giving their own shapes, names and stories to them. The most well known constellation names are from the ancients Greeks. They created and named over 40 constellations which are still recognised today.
In 1930 it was decided that more formal constellation boundaries were required to map the entire nights sky to make the study of stars easier. 88 constellations were created and defined which are currently recognised by the International Astronomical Union.

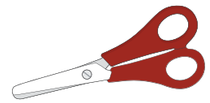
FOLLOW-UP CLASSROOM ACTIVITY 2

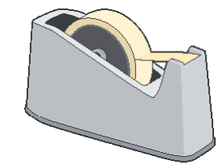
Starry, Starry Night

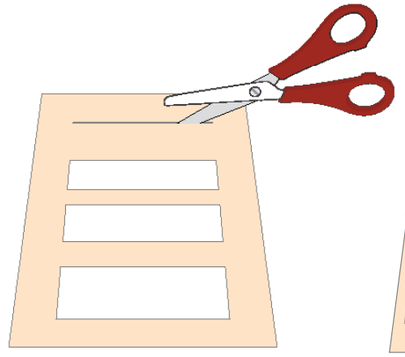
You will need:

- Clear night sky
- A4 card
- Coloured cellophane/Clingfilm
- Scissors
- Sticky tape

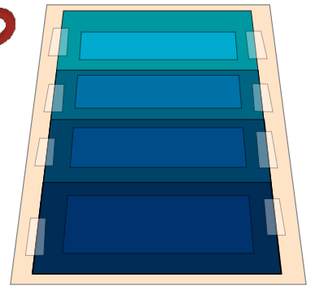




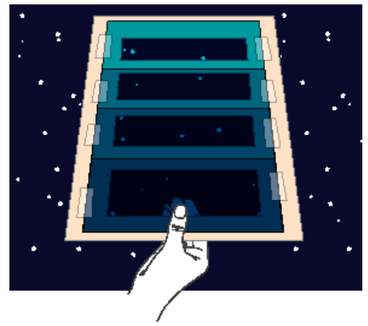




1. Hold the A4 card portrait, draw and cut out four windows, approximately 11cm wide, 3cm deep with at least 2cm between each.
2. Securely attach one piece of cellophane which covers all four windows.
3. Use another piece of cellophane to cover the bottom three windows and securely attach.



4. Repeat step 3 for the bottom two windows and then again for only the bottom window so that each window is covered by a different number of cellophane layers.



5. Hold your star detector up to the night sky and look through. Some stars you will be able to see through all four windows, others only in the first, others in the first and second and others in the first three.
6. When looking at different stars take a note of whether they could be seen only in window one (with only one layer of cellophane), in the first two windows, in the first three windows or whether they could be seen in all four windows

Which brightness of stars did you see the most and least of?
Why do you think some stars are so much brighter than others?
Are there conditions in which you may be able to see more faint stars?

Explanation

Stars are giant balls of gas in which nuclear fusion reactions are occurring. They give off lots of heat and light and we are able to see some stars here on Earth. How bright a star appears depends on how much light is reaching us. This is affected by how much light the star is producing, how far away it is and by how much light is absorbed by any material which sits between the star and the Earth.

In the star viewer, each window contains a different amount of cellophane. The cellophane absorbs light and the thicker the cellophane the more light it absorbs. Only the brightest stars will emit enough light to be viewed through the thickest cellophane window.

The brightness and colour of light given off by a star depends on the size and age of the star. The larger the star is, the more energy it has for burning and the brighter it will appear.

Stars also give off light in all directions. As a result, if we are further away from a star, less of its light will reach us on the Earth.