Physics

Why does my shadow change length?

SUBSTANTIVE KNOWLEDGE

When light hits a transparent object, it goes through it in a straight line so we can see a clear image through it.
When light hits a translucent material, it goes through it but is scattered, this means light can pass through, but we can't see an image through it.
When light hits a mirrored surface, it reflects off it in straight lines, so we can see an image in the reflective material.
Sometimes when light hits a material it reflects off it in many different directions (it is scattered). In this case light will be reflected but no image will be seen in the material.
Shiny surfaces are better reflectors and rough surfaces scatter light more. Opaque objects don't allow any light to pass through them.

When light is emitted from a light source, it travels in straight lines until it hits an object. This can be represented by an arrow.

Shadows form when light hits an opaque object, the area behind is in darkness because light can only travel in straight lines.

Shadows have the same shape as the objects that cast them.

Animals see objects when light is reflected off the object and enters the eye through the pupil.

The pupil changes its size to allow enough, but not too much light into the eye.

Too much light damages the eye and too little results in poor quality images.

VOCABULARY

Shadow - A dark area or shape produced by a body or object coming between rays of light and a surface.

Opaque - Not able to be seen through.
Transparent - A material that allows light to pass through so objects behind can be clearly seen.

Translucent - A substance that allows light but not detailed shaped to pass through.

Reflection - The throwing back of light or sound without absorbing it.

Pupil - The pupil is the black circle in the centre. It opens and closes to control the amount of light that enters the eye.

DISCIPLINARY KNOWLEDGE

Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
Recording data and results of increasing complexity using scientific diagrams
Identifying scientific evidence that has been used to support or refute ideas or arguments.
Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
Choose the most appropriate equipment to make measurements and explain how to use it accurately.

HONESTY
ENTHUSIASM
AMBITION
RESPECT
TOGETHERNESS

Physics

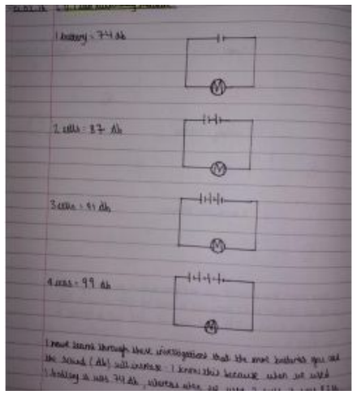
How can electric circuits be controlled?

SUBSTANTIVE KNOWLEDGE

Current is the flow of electricity around a circuit.
- The power supply in a circuit pushes the current round the circuit
- The voltage of the power supply is a measure of this push
- Voltage is measure in volts
- Batteries have a limited store of energy and when this is gone, they can no longer push the current

Current is the flow of electricity through a conductor
- When current passes through a device it makes it work
- Increasing the voltage (the number of cells in the battery) increases the current. The larger the flow of current, the harder the device works

All parts of a circuit offer resistance to electrical current including the wires.
- Resistance is the slowing down of electrical current
- The more devices added into a circuit the greater the resistance
- This means less current flows around the circuit



VOCABULARY

Current - The flow of electricity through a conductor.

Voltage - The push on the electrical current through a conductor.

Volts - The unit for voltage.

Conductor - A material that will allow electricity to flow through it.

Resistance - measurement of the opposition to electrical flow in a circuit.

Resistor - A component in a circuit that resists electrical flow.

DISCIPLINARY KNOWLEDGE

Recording and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations
Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate
Using test results to make predictions to set up further comparative and fair tests
Planning different types of scientific enquiries to answer questions, including variables

Scientists Study:

Michael Faraday
Contemporary - Henry Snaith

Physics

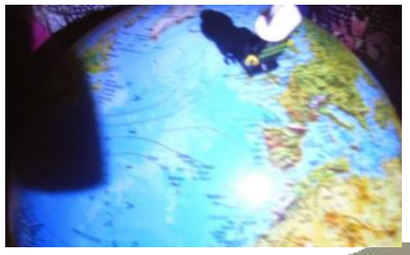
What is Earth's address in space?

SUBSTANTIVE KNOWLEDGE

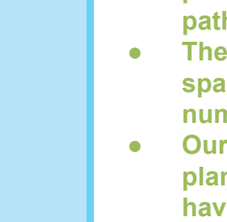
- A Solar system is a collection of planets, which orbit (a curved path) a star.
- There are huge number of stars in space and therefore a huge number of solar systems
- Our solar system consists of 8 planets, many of those planets have moons which orbit around them.
- Earth's moon is not a planet but is a satellite which orbits Earth. It is around a quarter of the size of Earth.
- As the Moon orbits the Earth, the Sun lights up different parts of it, making it seem as if the Moon is changing shape. We call these the phases of the moon.
- The Moon doesn't emit (give off) light itself, the 'moonlight' we see is actually the Sun's light reflected off the lunar surface.
- Our solar system can be represented with a model (see diagram), but it isn't possible to draw it to scale.

- The planets and moons are rotating (spinning)
- The time it takes one planet to rotate is called a day. On Earth this is 24 hours
- The time it takes a planet to complete one orbit around its star is called a year. On Earth this is 356.25 days
- The solar system is with a massive collection of stars called the galaxy (called the Milky way)
- The Milky way is one of billions of galaxies in the Universe.
- Stars are huge balls of gas that produce vast amounts of light and heat.
- Asteroids are lumps of rock that orbit a star (there are millions in between Mars and Jupiter)
- Comets are objects that are made of Ice, which melts when they get closer to the sun leaving a tail.

- Gravity is force of attraction between two objects with mass (a quantity of matter)
- The bigger the mass the bigger force it exerts
- Gravity works over distance but gets weaker as distance increases
- Stars, planets, moons have a very large amount of mass. They exert a gravitational attraction on each other
- Differences in gravity result in smaller mass objects orbiting around lager mass objects, e.g. planets around stars and moons around planets



Longitudinal Study - phases of the moon and rainfall.



DISCIPLINARY KNOWLEDGE

Recording data and results of increasing complexity

In

Physics

Earth and Space Page 2

VOCABULARY

Solar System - A collection of planets and moons in orbit around the sun, along with asteroids and comets

Planets - A body moving in an elliptical orbit around a star

Orbit - A curved path of a celestial object round a star or planet

Star - A giant ball of gas in the centre of a solar system that all planets orbit around.

Moon - A natural satellite that orbits a planet

Rotating - To move or cause to move around an axis or centre

Day - A complete rotation of a planet on its axis, on Earth equal to 24 hours

Year - A complete orbit by a planet around its star, on Earth equal to 365.25 days

Galaxy - A system of millions or billions of stars with gas and dust held together by gravity

Universe - All existing matter and space as a whole. Contains all galaxies and has been continually expanding since its formation 13.9 billion years ago

Asteroid - A small rocky body orbiting the sun. Many are found between Mars and Jupiter.

Comet -An object consisting of rock and ice orbiting the sun.

Gravity -The force that attracts a body towards the centre of the earth or any other body with mass.

Mass - A quantity of matter measured in kg

DISCIPLINARY KNOWLEDGE

identifying scientific evidence that has been used to support or refute ideas or arguments

Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate

Biology

What is evolution and how do we know that it happened?

Substantive Knowledge

The Earth is very old. Around 4.2 billion years. We know this from dating rocks

Life first appeared on Earth around 3.8 billion years ago.

Life was, at first, very simple but over millions and millions of years life became more complex through the process of evolution

There are many sources of evidence for evolution

Fossils are one of the main sources of evidence for evolution. They show when new organisms appear and when they go extinct.

Due to the nature of fossil formation and discovery, fossils only provide an incomplete record of evolution.

Scientists use fossils along with other pieces of evidence *(DNA, Embryology, comparative anatomy, artificial selection)* to work out how organisms have evolved

Fossils form when dead organisms are rapidly buried or leave an imprint and are turned to stone over a long period of time. If they survive in the Earth, they then have to be found by a palaeontologist who will study them.

All living (and extinct) organisms are classified into groups based upon their physical features.

This includes animals, plants, fungi, and microorganisms like bacteria.

Within each of these broad groups, organisms are classified into small subgroups. Animals- invertebrates, mammals, birds, amphibians, reptiles and fish, Plants- flowering plants, ferns, conifers, moss.

Bacteria are a group of organisms that are not visible to the naked eye but are very abundant and have distinct physical features we can only see under powerful microscopes.

VOCABULARY

Million - A number that is equivalent to the product of a thousand and a thousand e.g., 1,000,000 (106)

Billion - A number that is equivalent to the product of a thousand and a million e.g., 1000,000000 (109)

Evolution- The process by which different kinds of living organisms have developed from early forms over time

Extinct - A species, family or group having no living members in existence.

Fossil - The remains or impression of prehistoric animals or plants preserved in rock

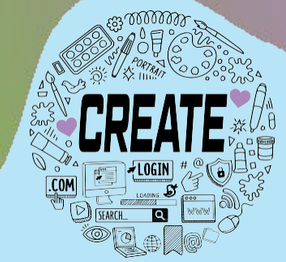
Palaeontologist - A scientist who specialised in life forms that existed in prehistoric times

Organism- A living thing, e.g., animal, plant, fungi or bacteria

Microorganism- A very small organism that cannot be seen with the naked eye

Bacteria - A specific type of microorganism present in huge numbers across most of the earth

Microscope - An instrument for looking at very small objects



Disciplinary Knowledge

Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations

Identifying scientific evidence that has been used to support or refute ideas or arguments.The method of scientific classification

Biology

How does evolution happen?

Substantive Knowledge

Evolution is the change of physical form in a population over a long-time span

Natural selection is the process which controls that change.

In any population there is variation and competition for resources (food, water, mates).

Within that variation, organisms that have features which make them better adapted at securing food, water, and mates, are more likely to survive and produce offspring which have inherited those same successful features. Those that are not well adapted will eventually go extinct.

Over a long enough timeline all organisms in a population will have those successful features.

This is known as the *Theory of Evolution by Natural Selection* and was developed by Charles Darwin in 1859

Before Darwin, Lamarck's Idea of acquired characteristics was proposed. (Giraffes stretch their necks in life, which made their children have longer necks).

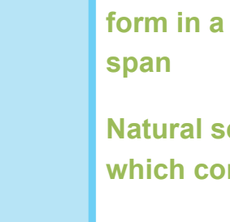
Darwin as a young man travelled around the world on the HMS Beagle. On this 5-year voyage he saw lots of things and recorded down lots of evidence which allowed him to work out how organisms change over time by a different mechanism of Natural selection

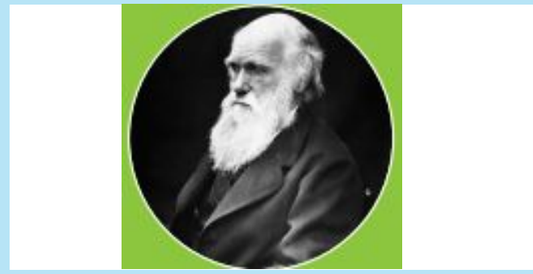
DISCIPLINARY KNOWLEDGE

Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations

Identifying scientific evidence that has been used to support or refute ideas or arguments

The disciplinary knowledge of models.





HONESTY ENTHUSIASM AMBITION RESPECT TOGETHERNESS

Biology

Evolution and Inheritance Page 2

VOCABULARY

Evolution - The process by which different kinds of living organisms have developed from early forms over time.

Natural selection - The key mechanism of evolution where the best adapted organisms in a population are selected by nature to survive and pass on those physical features.

Population - All the members of a species that live in a one area.

Variation - The differences between the individuals in a species.

Competition Species tend to produce more offspring than the environment can sustainably support leading to competition for survival.

Adapted - Modified features that make an organism more suitable for its purpose

Offspring - The young of living organisms, produced either by a single organism or, in the case of sexual reproduction, two organisms.

Inheritance - The passing on of characteristics to offspring.

Charles Darwin - Naturalist and scientist credited with the discovery of the mechanisms for how organisms adapt and change over time via the process of natural selection.

Lamarck Jean-Baptise- Lamarck was a naturalist who proposed an alternative mechanism for evolution centred around the inheritance of physical characteristics acquired during an organism's lifetime.

HMS Beagle - The Ship that Darwin sailed around the world on for 5 years and collected much of the evidence that led to his discovery of the process of Evolution by natural selection.

SCIENTIST STUDY
Standing on the Shoulders of Giants
CHARLES DARWIN