The Solar System Trail

Background

The Solar System is our home and the place where life as we know it has evolved. For children it is an exciting and inspiring concept that they are excited to explore. For schools, It provides an opportunity and a context to work across various areas of the primary school curriculum. Working with the Solar System Trail scaled model, children can not only familiarise themselves with the Solar System and our place in space, but it can become a focus and an aid to the study of science and other subjects by making them relatable to the bigger picture we are part of.

The current Irish science and geography curriculums look at the following strands: materials, forces, living things, and environments. These are all touched upon in this work as well as other subjects that may be incorporated, including maths, history of science and more.

The following activities are suggestions and a base for further development of this exciting work.

The Solar System Trail

The Solar System Trail is designed to give a sense of the dimensions of the Solar System and our place in it. As a scaled model of the Solar System, the dimensions of the Sun and planets and the distances between them on the trail are relative to what they are in space.

Our Solar System Trail is 2km long and stretching from the Sun to the orbit of Neptune, walking the trail impresses on us that the Solar System is a real environment that we are part of and not an abstract or a virtual concept viewed through digital means.

The Solar System consists of – the Sun, 8 Planets, more than 170 moons, millions of a steroids, billions of ice rocks and a lot of space…
Our trail represents an area at the heart of the Solar System, from the Sun to the orbit of the furthest known planet – Neptune. It's where the main action is… but this is far from depicting the whole Solar System.

To get an idea of the full extent of the Solar System look at the following:

The distance from the Earth from the Sun is 150 million km, or 1 AU (Astronomical Unit). Neptune, at the end of our trail, is 30 AU's from the Sun, or 30 times further away from the Sun than Earth. Scientist think that the Solar System extends to 50,000 AU's, to a region called the Oort Cloud, a region populated by trillions of ice comets spinning silently for billions of years at the edge of the Solar System. That is the region beyond which the Sun's influence gives way to interstellar space.

If we wanted to represent that boundary on our 2km trail, we would need to extend the trail by 3200 km. Keep in mind that the trail marks the orbits of the planets as they extend to one side of the Sun, whilst in space the planets are in constant movement as they orbit around the Sun. Our representation of the Solar System would therefore extend 3200km in all direction from the Sun. From Newfoundland, Canada is the West, to the approaches of the North Pole in the North, to Moscow, Russia in the East and Casablanca, Morocco in the South.

Yet even the area in focus, from the Sun to Neptune, is challenging to comprehend. Most representations of the Solar System show a distorted depiction made to fit onto a page of a book or a screen. Some show the relative sizes of the Sun and planets. Fewer show the relative distances. It is a challenge to visualise or represent both together. To do that we need to shrink the Solar System down to a size we can understand. On the one hand we need to be able to walk it within a reasonable time whilst maintaining a concept of the system, and on the other to be able to see the planets by not shrinking the system and placed our from view.

The scale of our trail is a compromise between the two.

Focus Areas

Junior and Senior Infants

The Earth

The surface features of the Earth – the land and its features, the seas, the atmosphere.

The water cycle.

1st & 2nd Class

The Sun, Earth and The Moon

Focus area – Sun, Earth and Moon.

Size - How big is the Moon compared to Earth and The Earth compared to the Sun? (make a model)

Distance – how far is the Moon from the Earth? (make an Earth – Moon model)

Shapes – spheres, why is it the shape of Stars and planets in space.

The fazes of the Moon

Forces – Light, radiation (Sun) and reflection (Moon). Heat. Gravity.

The movement of the planets: The Sun and planets are constantly on the move!
The main movement of the Planets:
Spin – day, night, dawn and dusk (is the Sun rising and setting or are we spinning?).
Orbit – the seasons, the equinox and solstice, your birthday.
Gravity – The tides as a sign of the Sun, Moon and Earth pulling each other.

Focus Areas

3rd & 4th Class

The Inner Rocky Planets. Mercury, Venus, Earth and Mars

Focus area – The Inner Rocky Planets - What kind of places are Mercury? Venus? Earth? Mars?

Gravity and Escaping Earth's gravity to explore the planets.

Matter - The states of matter – solid, liquid and gas. Land, sea and atmosphere.

Global Warming - A look at Venus, Earth and Mars's atmospheres and the lesson they tell us.

Goldilocks and the atmosphere (Earth is just right, Mars too little, Venus too much). Asteroids and their impact (craters on The Moon and Mercury, did any ever hit the Earth?)

Living Things – liquid water - The habitable zone (between the orbits of Venus and Mars)

5th & 6th Class

Gas Giants. Jupiter, Saturn, Uranus, Neptune. The Sun as a Star

Focus area – The Gas Giants - What kind of places are Jupiter? Saturn? Uranus? Neptune?

Matter - how mater changes state across the Solar System (methane as gas on Earth but liquid on Titan, the moon of Saturn), find other examples. Comets – ice in the sky that leaves a trail of gas (the tail of a comet is ice that evaporates as it gets closer to the Sun and heats up)

Forces - Pressure and temperature – what happens inside the atmospheres of the Gas Giants? How pressure changes the state of matter.

Focus area – The Sun.

How stars work – atoms and molecules. Nuclear fusion.

Light and the electromagnetic spectrum. (looking at pictures of the Sun through other wavelengths)

The Solar Wind and the Earth's magnetic field (what is the aurora)

Junior and Senior Infants

The Earth

Activity – The Features of the Earth

All About Earth

This Apollo 11 picture taken by an astronaut in 1969 shows the Earth rising over the moon. Doesn't it look small?

What is Earth like?

Our home planet Earth is a rocky, terrestrial planet. It has a solid and active surface with mountains, valleys, canyons, plains and so much more. Earth is special because it is an ocean planet. Water covers 70% of Earth's surface.

Our atmosphere is made mostly of nitrogen and has plenty of oxygen for us to breathe. The atmosphere also protects us from incoming meteoroids, most of which break up in our atmosphere before they can strike the surface as meteorites.

Since we live here, you might think we know all there is to know about Earth. Not at all, actually! We have a lot we can learn about our home planet. Right now, there are many satellites orbiting Earth taking pictures and measurements. This is how we can learn more about weather, oceans, soil, climate change, and many other important topics.

Activity – Drawing The Earth

Earth's surface is more than2/3 covered in water and 1/3 is land.

Find a ball that you can draw on - Paint 1/3 of its surface in green and brown and 2/3 in blue.

Add white patches of clouds that will cover about 1/3 of the surface but in small patches.

The Water Cycle

What is the Water Cycle?

The water cycle is a way that water moves all around the Earth. It never stops and doesn't really have a beginning or an end. It's like a big circle. We'll describe it by starting with water that's on land. For example, water that resides in the ocean or in a lake. Some water on the surface of the ocean will evaporate due to heat from the sun. When it evaporates it turns into vapour water and goes up into the atmosphere. This vapour water gets together with a lot of other vapour water and turns into clouds. Clouds move about the earth with the weather and once they are so full of water they drop the water to Earth in some form of precipitation. It could be rain, snow, sleet, or hail. When the water hits the earth it may fall right back into the ocean or feed a flower or be snow on the top of a mountain. Eventually this water will evaporate and start the whole cycle again.

How water goes from land to vapour in the atmosphere

There are three main ways that water on land turns into vapour:

Evaporation - This is the main process by which water goes from the ground to vapour in the atmosphere. Around 90 percent of the water vapour in the atmosphere got there through evaporation. Evaporation takes place only on the water's surface. It takes energy in the form of heat. Hot water will evaporate more easily than cold water. The sun provides a lot of the energy for evaporation in the water cycle, primarily causing evaporation from the surface of the ocean.

Sublimation - This is when water moves directly to vapour from ice or snow without ever melting into water. Good conditions for sublimation to occur is when ice or snow is in very cold conditions, but it is windy and the sun is shining.

Transpiration - Transpiration is when plants release water on to their leaves that then evaporates into vapour. Plants will release a lot of water as they grow. Around 10 percent of the water vapour in the atmosphere is estimated to come from transpiration.

Water in the atmosphere

We see water in the atmosphere in the form of clouds. There is a small amount of water even in clear skies, but clouds are where water has started to condense. Condensation is the process of water vapour becoming liquid water. Condensation is a major step in the water cycle. The atmosphere helps to move water around the world. It takes water that evaporated from the ocean and moves it over land where clouds and storms form to water plants with rain.

Precipitation

Precipitation is when water falls from the atmosphere back to land. Once enough water gathers in a cloud droplets of water will form and fall to the earth. Depending on the temperature and weather this could be rain, snow, sleet, or even hail.

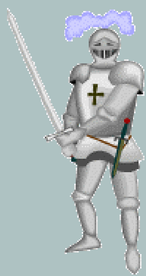
Water storage

A lot of the Earth's water does not take part in the water cycle very often., Much of it is stored. The Earth stores water in a number of places. The ocean is the largest storage of water. Around 96 percent of the Earth's water is stored in the ocean. We can't drink the salty ocean water, so fortunately for us, freshwater is also stored in lakes, glaciers, snow caps, rivers, and below the ground in groundwater storage.

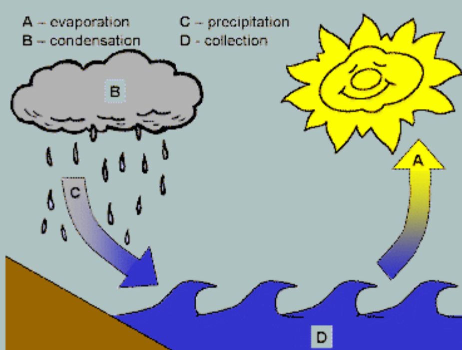
Activity – The Water Cycle

Run and get a glass of water and put it on the table next to you. Take a good long look at the water. Now -- can you guess how old it is?

The water in your glass may have fallen from the sky as rain just last week, but the water itself has been around pretty much as long as the earth has!



When the first fish crawled out of the ocean onto the land, your glass of water was part of that ocean. When the Brontosaurus walked through lakes feeding on plants, your glass of water was part of those lakes. When kings and princesses, knights and squires took a drink from their wells, your glass of water was part of those wells. **And you thought your parents were OLD**



The earth has a limited amount of water. That water keeps going around and around and around and around and (***well, you get the idea***) in what we call the "Water Cycle".

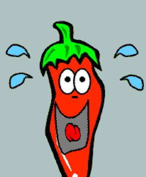
This cycle is made up of a few main parts:

- evaporation (and transpiration)
- condensation
- precipitation
- collection

Evaporation:

Evaporation is when the sun heats up water in rivers or lakes or the ocean and turns it into vapor or steam. The water vapor or steam leaves the river, lake or ocean and goes into the air.

Do plants sweat?



Well, sort of.... People perspire (sweat) and plants transpire. Transpiration is the process by which plants lose water out of their leaves. Transpiration gives evaporation a bit of a hand in getting the water vapor back up into the air.

Condensation:

Water vapor in the air gets cold and changes back into liquid, forming clouds. This is called condensation.

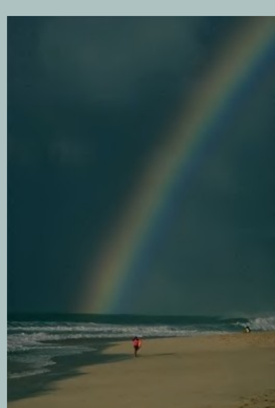
You can see the same sort of thing at home... Pour a glass of cold water on a hot day and watch what happens. Water forms on the outside of the glass. That water didn't somehow leak through the glass! It actually came from the air. Water vapor in the warm air, turns back into liquid when it touches the cold glass.

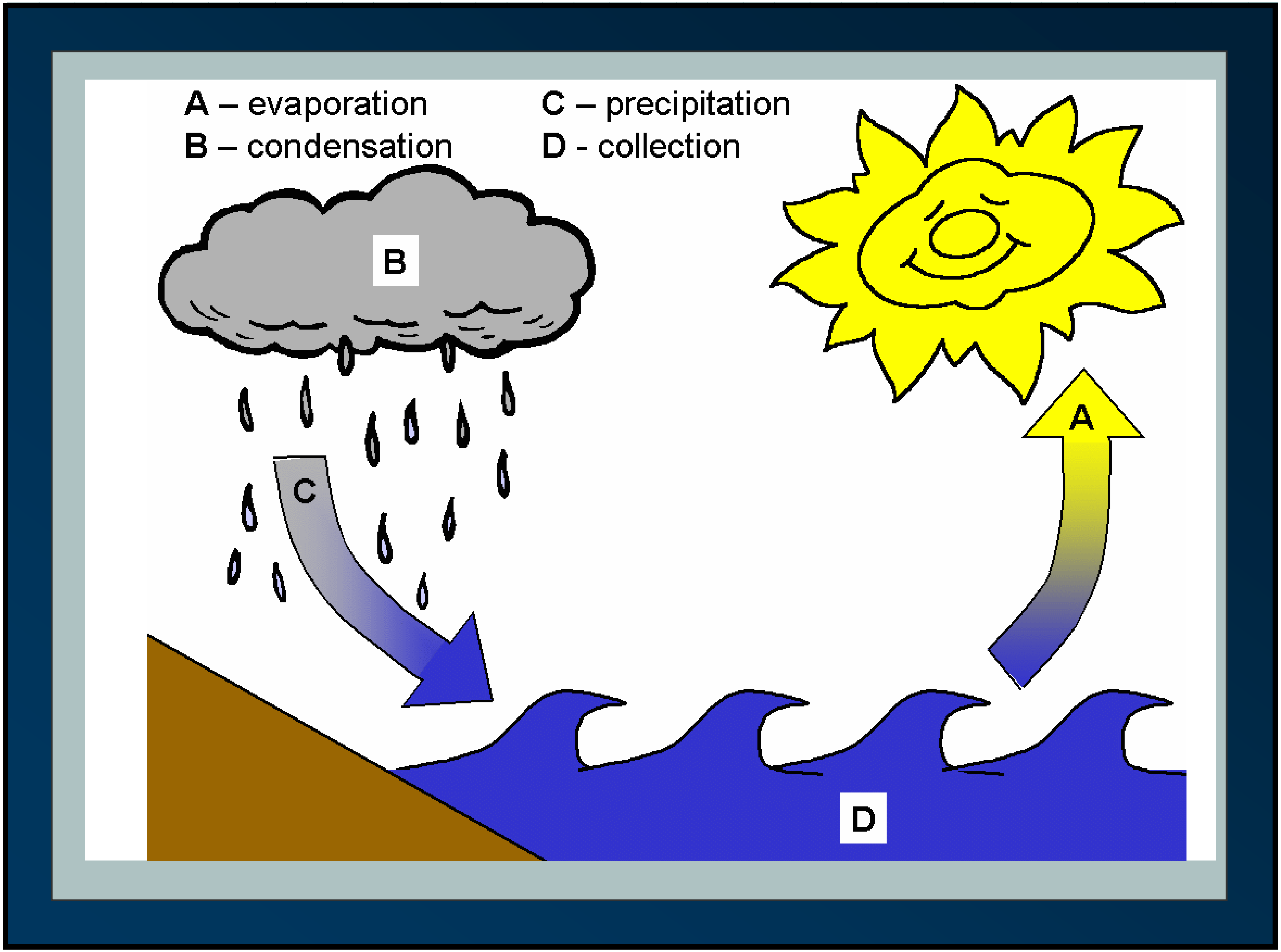
Precipitation:

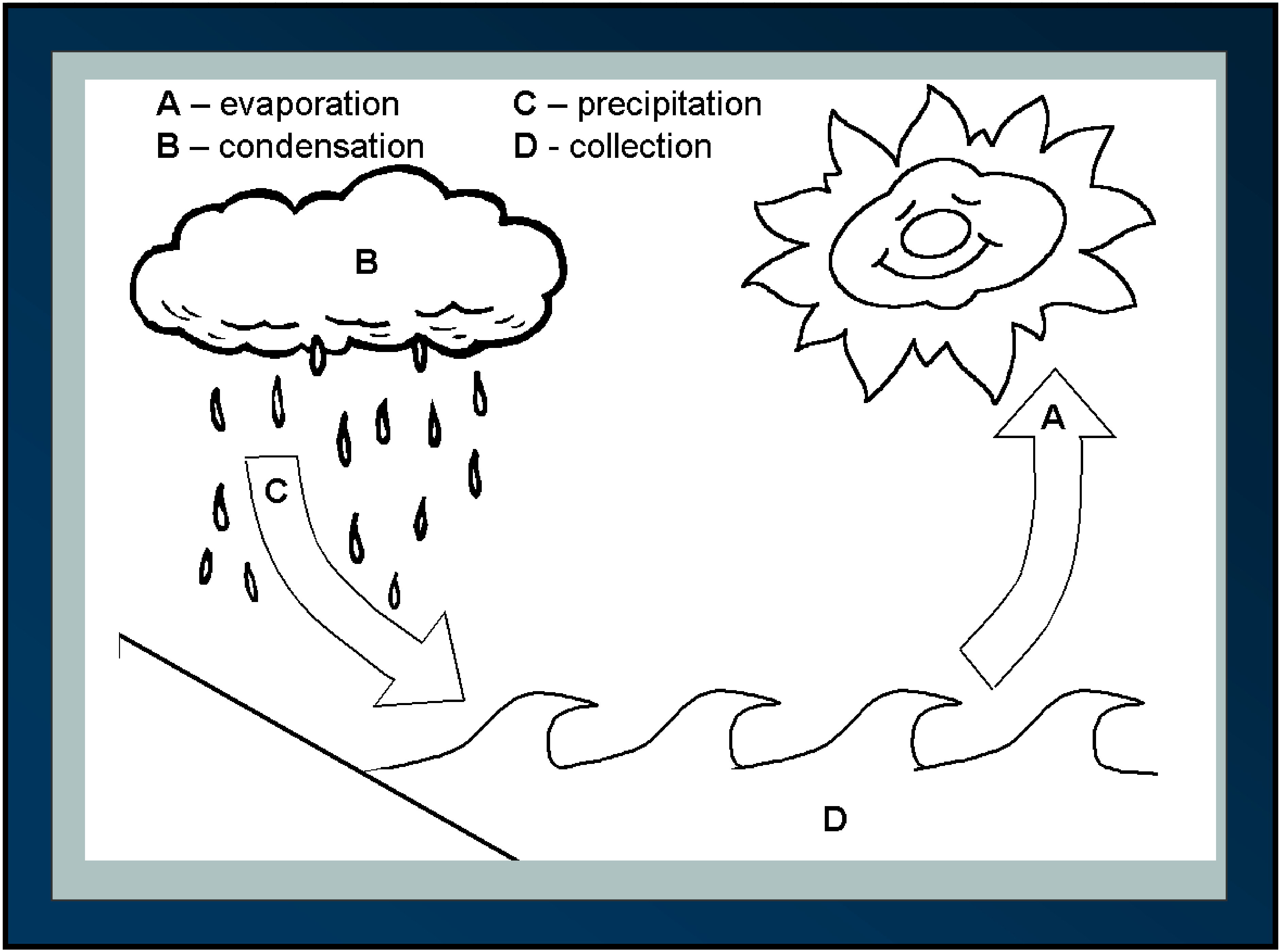
Precipitation occurs when so much water has condensed that the air cannot hold it anymore. The clouds get heavy and water falls back to the earth in the form of rain, hail, sleet or snow.

Collection:

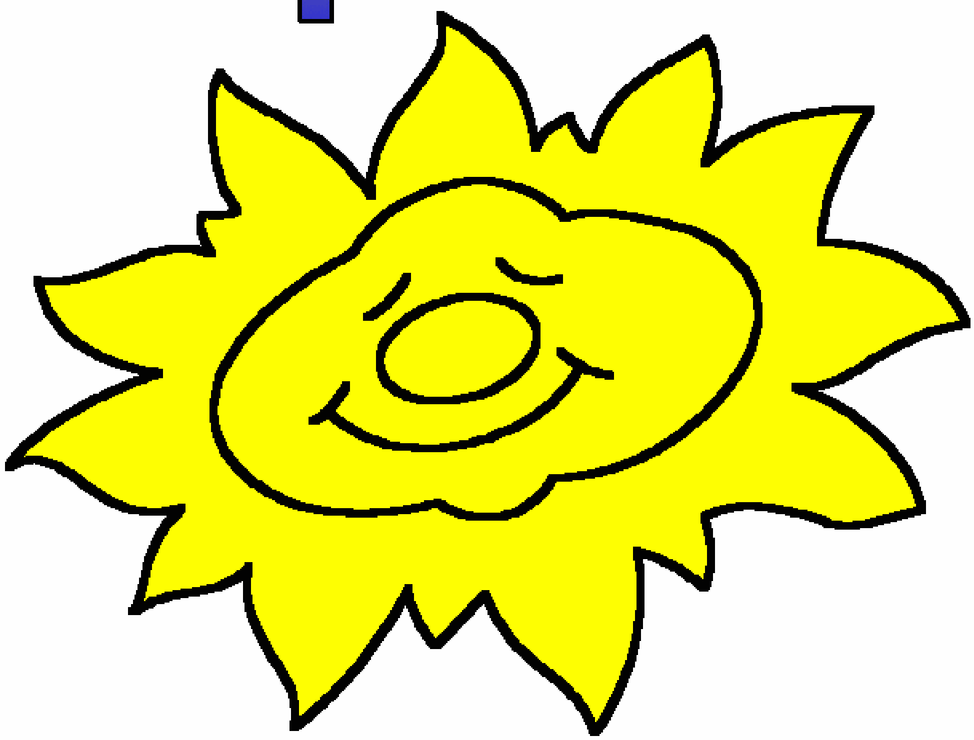
When water falls back to earth as precipitation, it may fall back in the oceans, lakes or rivers or it may end up on land. When it ends up on land, it will either soak into the earth and become part of the "ground water" that plants and animals use to drink or it may run over the soil and collect in the oceans, lakes or rivers where the cycle starts **all over again.**




A – evaporation
B – condensation
C – precipitation
D - collection
B
C
A
D

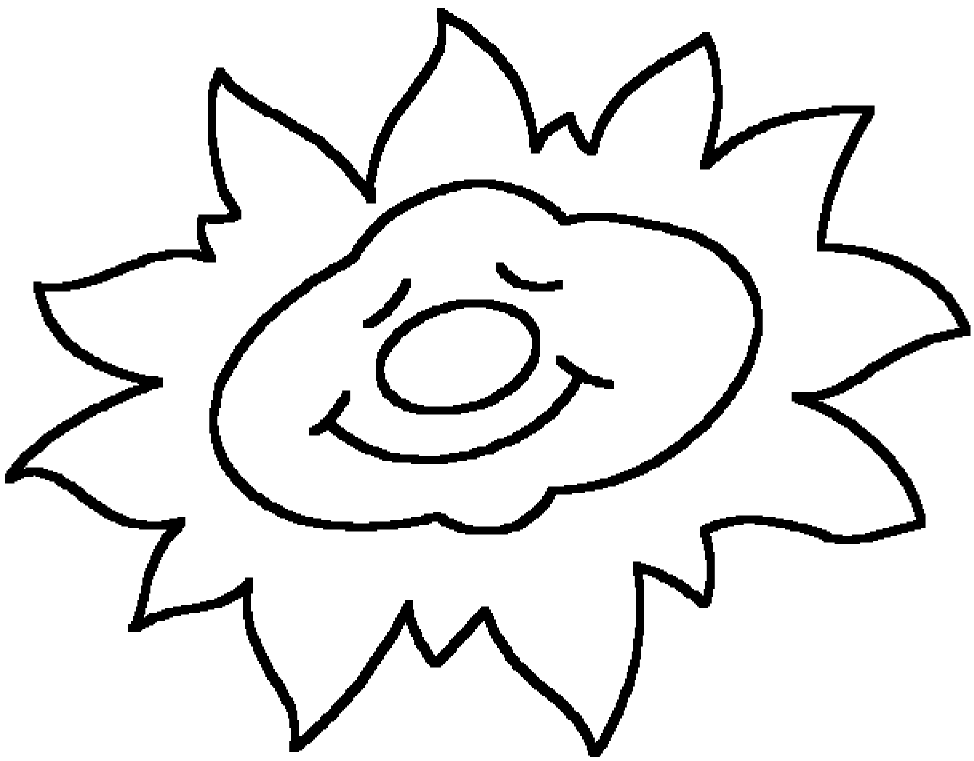

A – evaporation
B – condensation
C – precipitation
D - collection
B
C
A
D

Evaporation



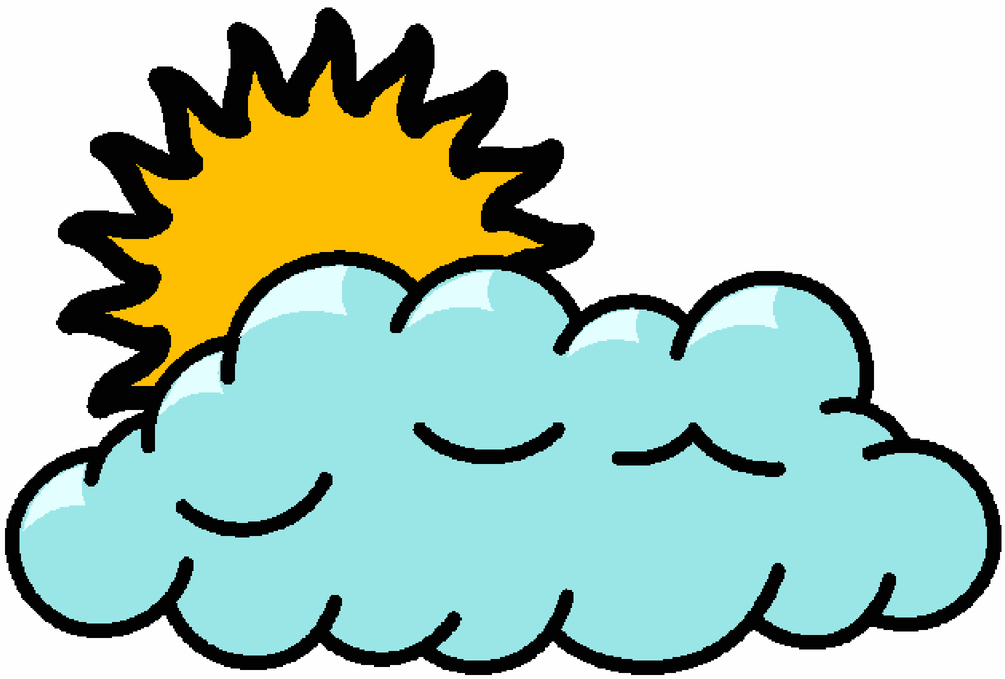
Evaporation is when the sun heats up water in rivers or lakes or the ocean and turns it into vapor or steam. The water vapor or steam leaves the river, lake or ocean and goes into the air. Make your own evaporation. With an adult's help, heat some water in a kettle. Watch closely! Do you see the steam rising? That's evaporation!

Evaporation



Evaporation is when the sun heats up water in rivers or lakes or the ocean and turns it into vapor or steam. The water vapor or steam leaves the river, lake or ocean and goes into the air. Make your own evaporation. With an adult's help, heat some water in a kettle. Watch closely! Do you see the steam rising? That's evaporation!

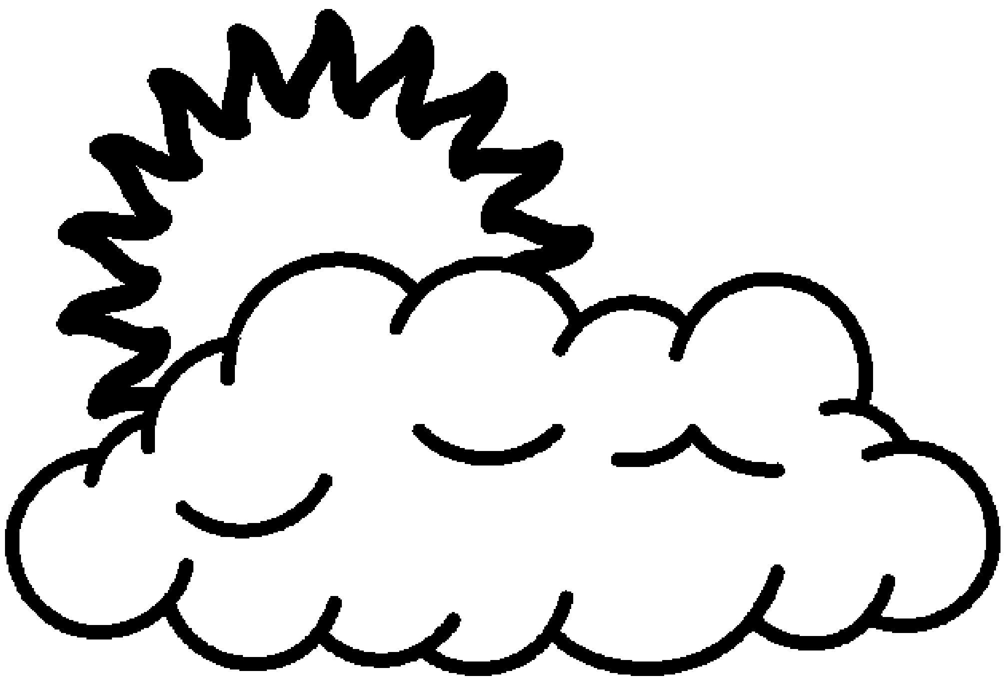
Condensation



Water vapor in the air gets cold and changes back into liquid, forming clouds. This is called condensation.

To see condensation in action, put a large (at least 8 ½ x 11) piece of cardboard (a book will work) in the freezer for about an hour. Now, take the boiling kettle of water and hold the cold book about 1 foot over the spout (right in the steam… wear oven mitts). Water droplets will form on the book. That's condensation!

Condensation



Water vapor in the air gets cold and changes back into liquid, forming clouds. This is called condensation.

To see condensation in action, put a large (at least 8 ½ x 11) piece of cardboard (a book will work) in the freezer for about an hour. Now, take the boiling kettle of water and hold the cold book about 1 foot over the spout (right in the steam… wear oven mitts). Water droplets will form on the book. That's condensation!

Precipitation

Precipitation occurs when so much water has condensed that the air cannot hold it anymore. The clouds get heavy and water falls back to the earth in the form of rain, hail or snow.

If you continue the condensation experiment long enough, so much water will condense on the book that it won't be able to hold it all. At that point, water will start dripping down from the book and you've created precipitation!

Precipitation

Precipitation occurs when so much water has condensed that the air cannot hold it anymore. The clouds get heavy and water falls back to the earth in the form of rain, hail or snow.

If you continue the condensation experiment long enough, so much water will condense on the book that it won't be able to hold it all. At that point, water will start dripping down from the book and you've created precipitation!

Collection

When water falls back to earth as precipitation, it may fall back in the oceans, lakes or rivers or it may end up on land. When it ends up on land, it will either soak into the earth and become part of the "ground water" that plants and animals use to drink or it may run over the soil and collect in the oceans, lakes or rivers where the cycle starts all over again.

Collection

When water falls back to earth as precipitation, it may fall back in the oceans, lakes or rivers or it may end up on land. When it ends up on land, it will either soak into the earth and become part of the "ground water" that plants and animals use to drink or it may run over the soil and collect in the oceans, lakes or rivers where the cycle starts all over again.

1st & 2nd Class

Sun

Earth

The Moon

Activity – Day and Night

The Earth rotates on its axis every 24 hours resulting in the day and night cycle

Show students the globe, and tell them it represents Earth. Help them identify the axis. Explain that a flashlight will represent the sun's rays.

Tape a piece of paper over your location so that students can see where they live.

Turn off the lights and shine the flashlight at the piece of paper on the globe.

Ask students: "Is there light shining on our location now? What do you think will happen as I turn the globe on its axis?" Have the students record on paper.

Slowly rotate the globe while holding the flashlight in the same spot.

Stop the globe when it has rotated halfway. Ask students: "Now is there light shining on our location? Is the other side of the globe in the dark or the light?" Have the students right down their observations.

Discuss with students that it takes 12 hours for Earth to rotate halfway and it takes 24 hours for a full rotation

Example of Observations. When its daytime where I live its still night time in different countries. Sometimes when its night time for a county they still can see part of the sun. There are different time zones because of the sun. How long is the day and night cycle? If I took a plane ride from where I live during daytime to the other side of the earth would I lose time or gain time?

Activity - Sundial

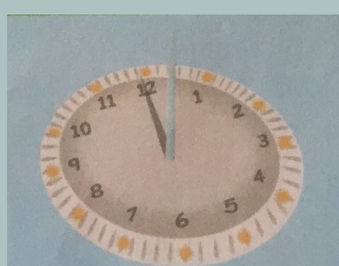
You can tell the time from the position of shadows made by the Sun. Make a sundial to see this for yourself! Build your sundial in the morning so that you can read it at 12 midday.

You will need:

⇒ **A drinking straw, A paper plate, Pens & A clock**

1. **Copy the numbers from a clock onto the paper plate, with 12 at the top.**

2. **Ask an adult to cut a hole in the middle of the plate and push the straw through so it stands up straight.**

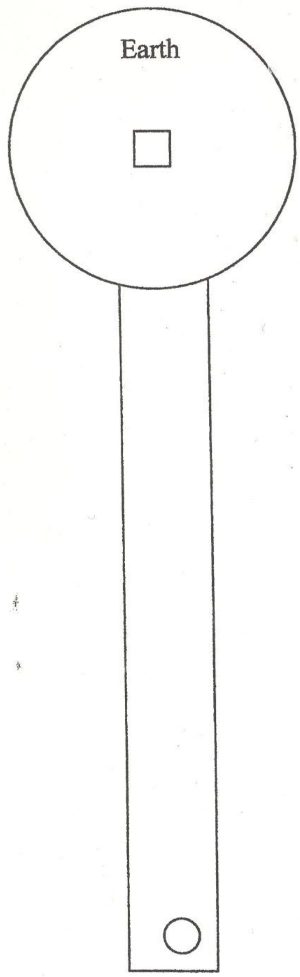


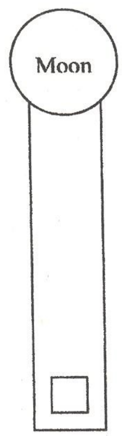
3. **At midday, take the sundial to a sunny place and turn it around until the shadow of the straw points at the 12. Now you're ready to tell time!**

4. **The shadow moves as the Sun's position in the sky changes. The shadow will point to the right time until sunset.**

To us, it looks like the Sun moves across the sky. But, it actually stays still and it's us that's moving as Earth spins around.

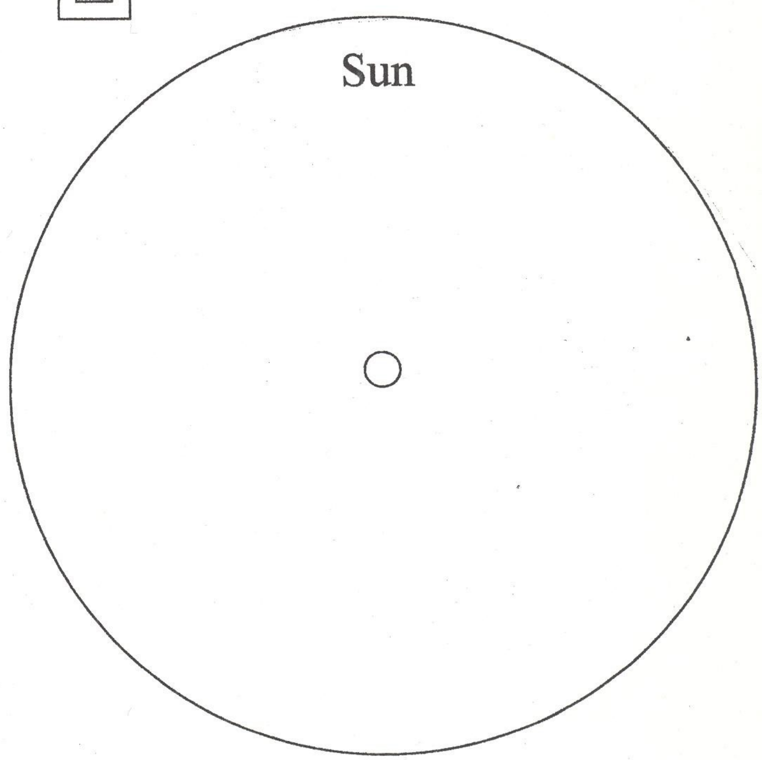
Activity: How the Earth and Moon orbit the Sun

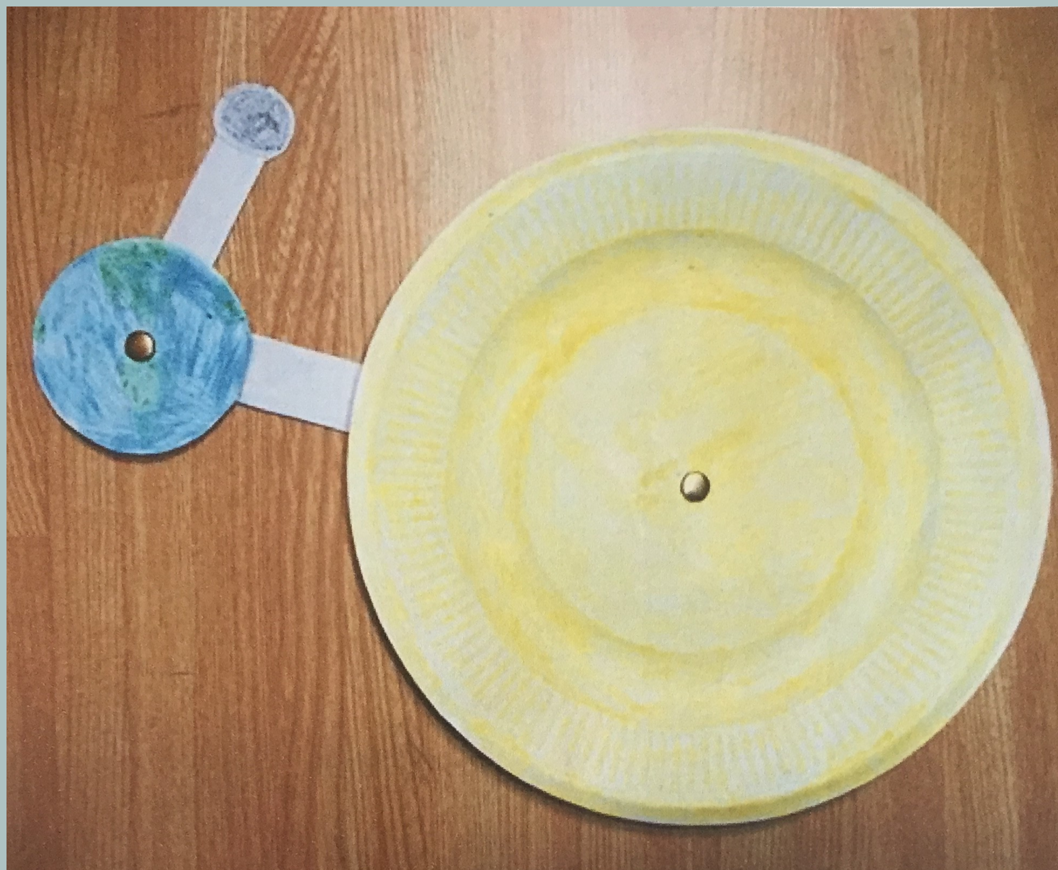


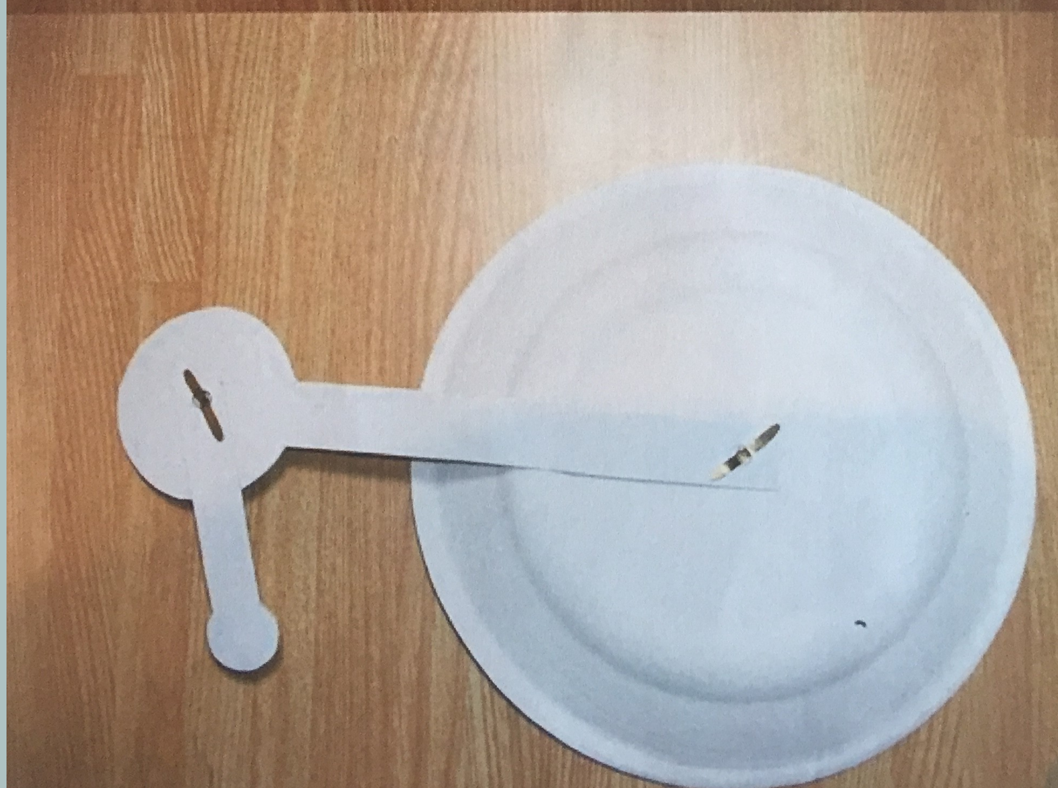


Directions:

1. **Color the earth, moon and the sun.**
2. **Cut out the patterns.**
3. **Connect the earth to the sun using a brad or paper fastener on the circle.**
4. **Connect the moon to the earth using a brad or paper fastener on the square shape.**
5. **Show the movement of the earth and moon by moving the earth around the sun and the moon around the earth.**







Activity – A Scale Model of The Earth and Moon

Background

The Moon is our closest neighbour in space and the only other world humans have set foot on. It has a huge effect on the Earth and life on it, yet not many people know the relative sizes of the Moon and the Earth or can visualise the distance between them.

In this activity we will work out the relative sizes and look for objects to represent both. Then we will work out the distance between them and adjust it to our model. It is possible to adjust this activity to different age groups according to their abilities.

Useful Facts: Earth Diameter 12,742km. Moon Diameter 3,474km
Average Distance from the Earth to the Moon: 385,000km

Getting the Size Right

Find the approximate size relationship between the Earth and the Moon comparing the length of their diameter. Describe the closest fraction that represents the Moon size compared to the Earth – 1/10, 1/6, **1/4**, 1/2 ?

Choose an object to represent each (such as a basketball and tennis ball, or two size inflated balloons.

You have found out the relative size of the Earth and the Moon!

Getting the Distance Right

The Moon is at a distance of 385,000km from Earth.

Hold on to your Earth and Moon and try and guess how far they are from each other?
Now let's work it out! How many times can the Earth's diameter fit between the Earth and the Moon?

Answer – we know that the distance is 385,000km and the diameter is 12,742km.
385,000km/12,742 km= 30.2km. We can round it to 30.
Measure with a string the diameter of your Earth object. Measure 30 times that distance and place the Moon.

You have found out the relative distance of the Earth and the Moon!
You can do it by finding the circumference as well:
The formula to find the circumference: 2 πr.
r=diameter/2, π=3.14.
Answer – Earth's diameter is 12,742km.
r (radius) is 12,742km / 2 = 6,371km.
2 π = 6.28.
The circumference = 6,371 x 6.28 = 40,010
How many circumferences of the Earth can fit between the Earth and the Moon?
Answer - 385,000/40,000 = approximately 9.5

Take a string and measure the circumference of your Earth object. Now measure 9.5 times that distance to place the Moon.

Activity – Lunar Eclipses and Solar Eclipses

An **eclipse** happens when a planet or a moon gets in the way of the sun's light. Here on Earth, we can experience two kinds of eclipses: **solar eclipses** and **lunar eclipses**.

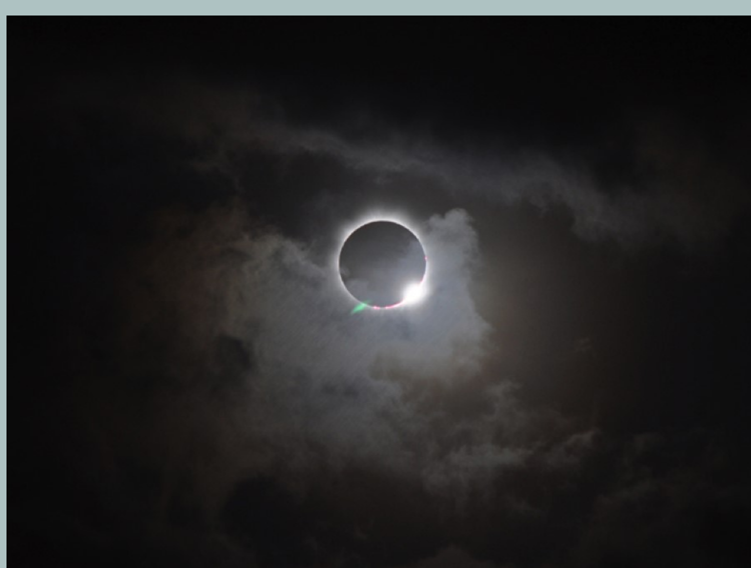
What's the difference?

Solar Eclipse

A *solar eclipse* happens when the moon gets in the way of the sun's light and casts its shadow on Earth. That means during the day, the moon moves over the sun and it gets dark. Isn't it strange that it gets dark in the middle of the day?

This **total eclipse** happens about every year and a half somewhere on Earth. A partial eclipse, when the moon doesn't completely cover the sun, happens at least twice a year somewhere on Earth.

Note: This diagram is not to scale.



In this picture, the moon is covering up the sun in the middle of the day. This total solar eclipse was visible from the northern tip of Australia on November 13, 2012. Image courtesy of Romeo Durscher.

But not everyone experiences every solar eclipse. Getting a chance to see a total solar eclipse is rare. The moon's shadow on Earth isn't very big, so only a small portion of places on Earth will see it. You have to be on the sunny side of the planet when it happens. You also have to be in the path of the moon's shadow.

On average, the same spot on Earth only gets to see a solar eclipse for a few minutes about every 375 years!

Caution!

Never look directly at the sun, even for a second! It will damage your eyesight forever!

To view a solar eclipse, use special solar viewing glasses.

SUNGLASSES DO NOT WORK, EVEN IF YOU STACK MANY OF THEM TOGETHER.

Lunar Eclipse

During a lunar eclipse, Earth gets in the way of the sun's light hitting the moon. That means that during the night, a full moon fades away as Earth's shadow covers it up.

The moon can also look reddish because Earth's atmosphere absorbs the other colours while it bends some sunlight toward the moon. Sunlight bending through the atmosphere and absorbing other colours is also why sunsets are orange and red.

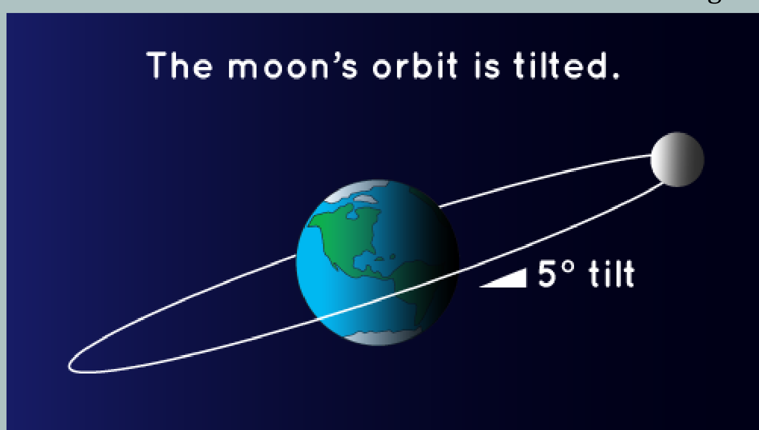
During a total lunar eclipse, the moon is shining from all the sunrises and sunsets occurring on Earth!

Note: This diagram is not to scale.

The moon appears orange-red in a total lunar eclipse on October 27, 2004.

Why don't we have a lunar eclipse every month?

You might be wondering why we don't have a lunar eclipse every month as the moon orbits Earth. It's true that the moon goes around Earth every month, but it doesn't always get in Earth's shadow. The moon's path around Earth is tilted compared to Earth's orbit around the sun. The moon can be behind Earth but still get hit by light from the sun.



In this diagram, you can see that the moon's orbit around Earth is at a tilt. This is why we don't get a lunar eclipse every month. This diagram is not to scale: the moon is much farther away from Earth than shown here..

Because they don't happen every month, a lunar eclipse is a special event. Unlike solar eclipses, lots of people get to see each lunar eclipse. If you live on the night-time half of Earth when the eclipse happens, you'll be able to see it.

Remembering the Difference

It's easy to get these two types of eclipses mixed up. An easy way to remember the difference is in the name. The name tells you what gets darker when the eclipse happens. In a solar eclipse, the sun gets darker. In a lunar eclipse, the moon gets darker.

Activity - See how an eclipse works for yourself!

You will need:

⇒ Fruit to represent the Moon, such as a round cherry

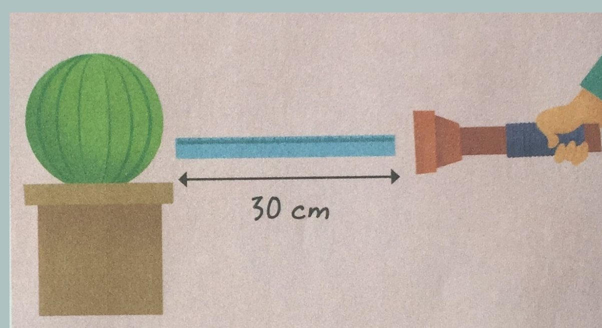
⇒ Fruit to represent the Earth, such as a round melon

⇒ A dark room

⇒ A torch or mobile phone torch app to represent the Sun

⇒ A wooden skewer

1. Place the cherry 'Moon' on the skewer



2. Place the melon 'Earth' on a flat surface and the torch 'Sun' 30cm away.

3. Using the skewer hold the 'Moon' between the 'Earth and 'Sun'.

Activity – The Seasons

What causes the seasons?

It's all about Earth's tilt!

Many people believe that Earth is closer to the sun in the summer and that is why it is hotter. And, likewise, they think Earth is farthest from the sun in the winter.

Although this idea makes sense, it is **incorrect.**

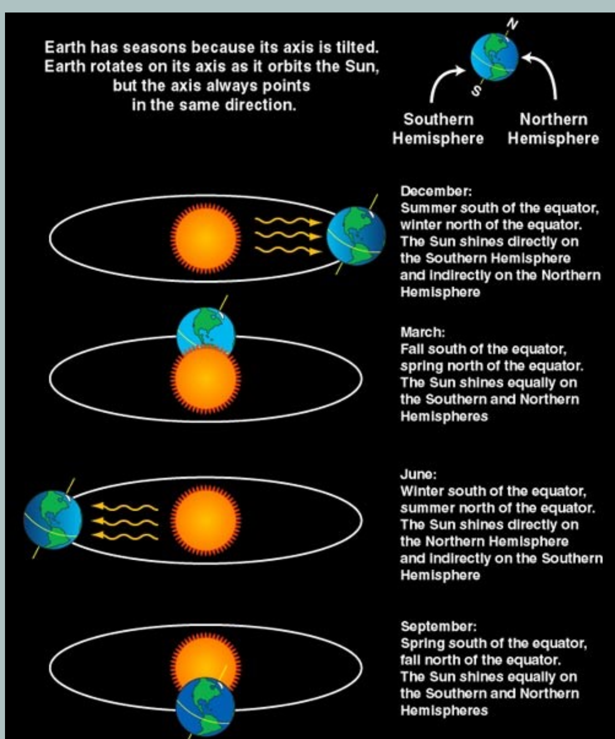
It is true that Earth's orbit is not a perfect circle. It is a bit lop-sided. During part of the year, Earth is closer to the sun than at other times. However, in the Northern Hemisphere, we are having winter when Earth is closest to the sun and summer when it is farthest away! Compared with how far away the sun is, this change in Earth's distance throughout the year does not make much difference to our weather.

There is a different reason for Earth's seasons.

Earth's axis is an imaginary pole going right through the centre of Earth from "top" to "bottom." Earth spins around this pole, making one complete turn each day. That is why we have day and night, and why every part of Earth's surface gets some of each.

Earth has seasons because its axis doesn't stand up straight.

Divide the class into groups and see if they can try and represent the following:



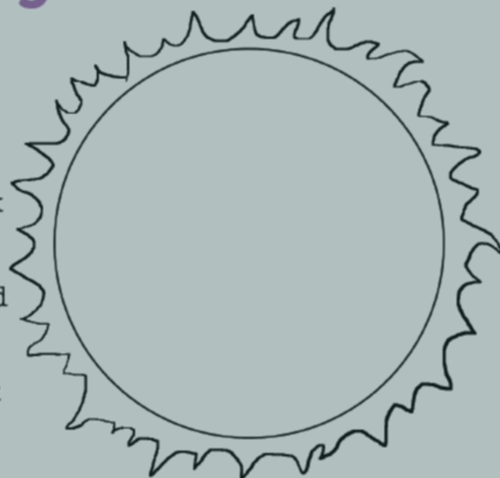
Sometimes it is the North Pole tilting toward the sun (around June) and sometimes it is the South Pole tilting toward the sun (around December). It is summer in June in the Northern Hemisphere because the sun's rays hit that part of Earth more directly than at any other time of the year. It is winter in December in the Northern Hemisphere, because that is when it is the South Pole's turn to be tilted toward the sun.

If you go to South America for the winter holidays, bring your swimsuit, not your skis!

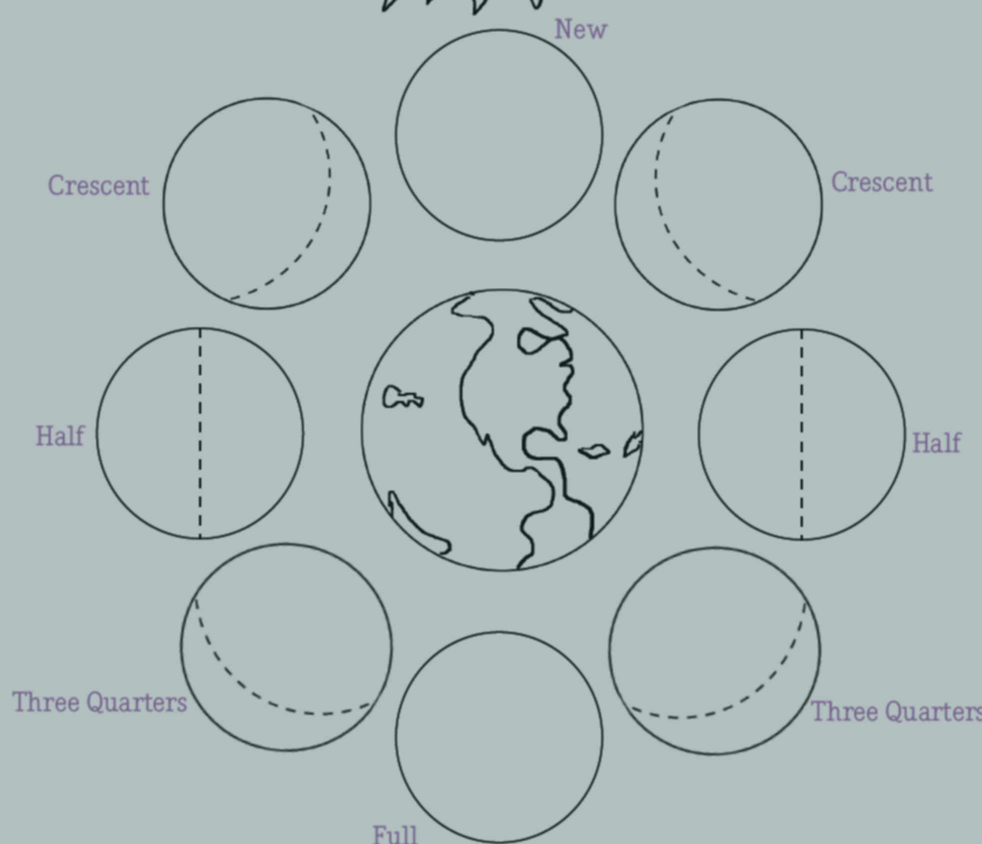
Activity – The Moon

Learning The Moon's Phases

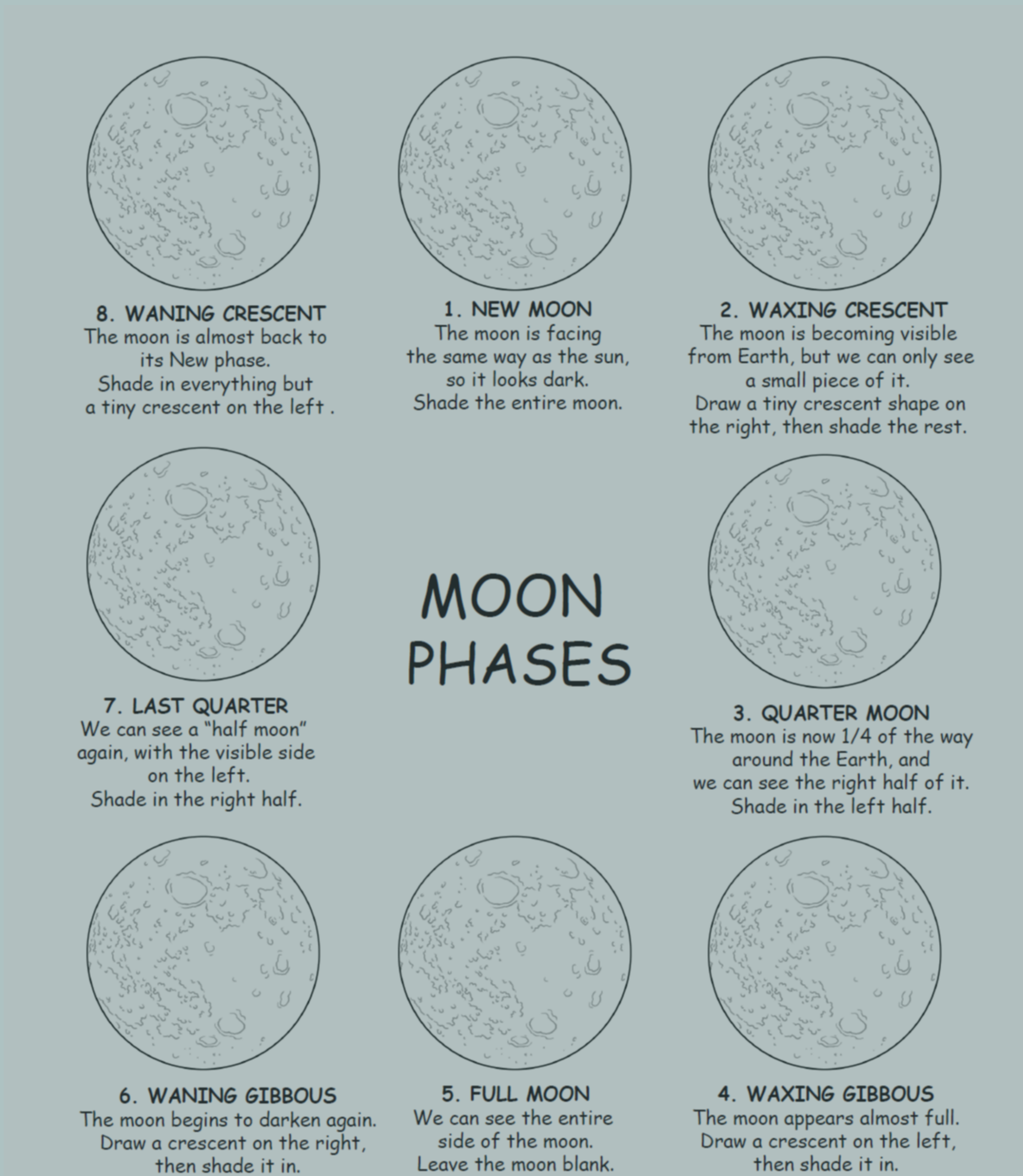
Did you know that the moon is different every night? It grows from a thin crescent to full moon then shrinks back to a crescent every month! That's because the moon rotates around the Earth, and the sun's light gets reflected off of the moon at different angles.

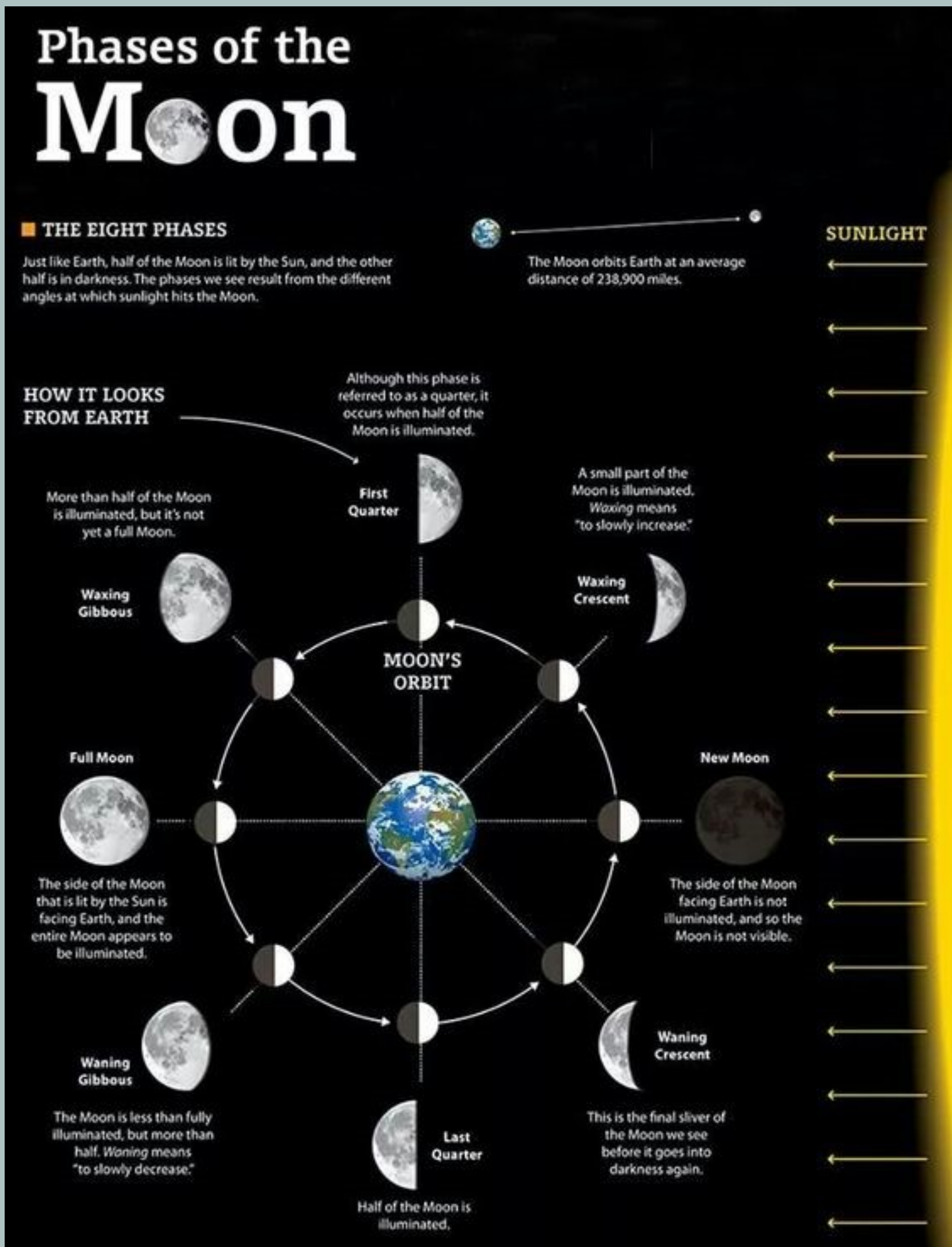


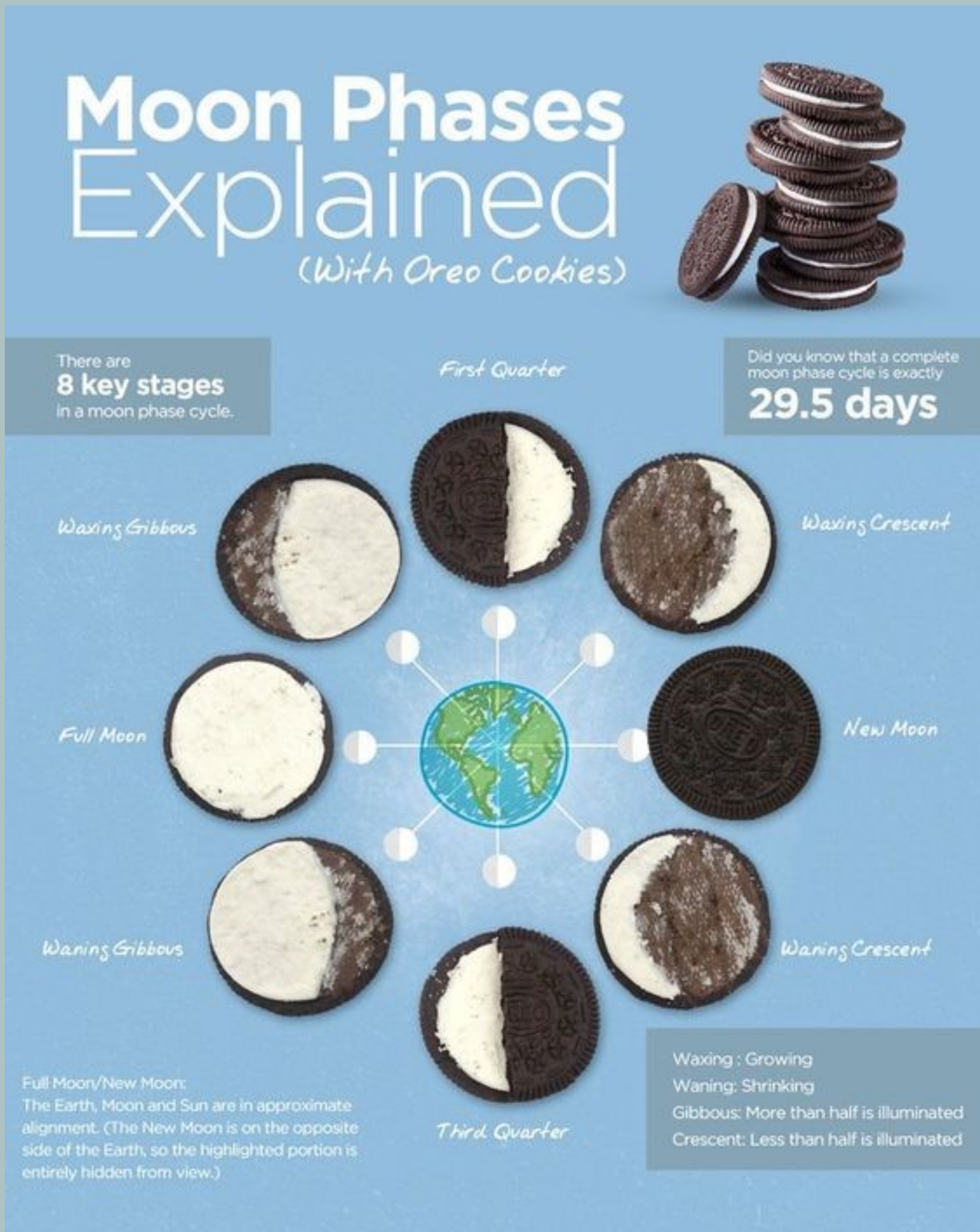
There are eight phases of the moon, labeled below. In the empty circles, draw how the moon looks in that phase. Then color in the sun and Earth!



Identifying the phases of the moon




Phases of the Moon
THE EIGHT PHASES
Just like Earth, half of the Moon is lit by the Sun, and the other half is in darkness. The phases we see result from the different angles at which sunlight hits the Moon.
The Moon orbits Earth at an average distance of 238,900 miles.
SUNLIGHT
HOW IT LOOKS FROM EARTH
Although this phase is referred to as a quarter, it occurs when half of the Moon is illuminated.
First Quarter
A small part of the Moon is illuminated. Waxing means "to slowly increase."
More than half of the Moon is illuminated, but it's not yet a full Moon.
Waxing Gibbous
Waxing Crescent
MOON'S ORBIT
Full Moon
New Moon
The side of the Moon that is lit by the Sun is facing Earth, and the entire Moon appears to be illuminated.
The side of the Moon facing Earth is not illuminated, and so the Moon is not visible.
Waning Gibbous
Waning Crescent
The Moon is less than fully illuminated, but more than half. Waning means "to slowly decrease."
This is the final sliver of the Moon we see before it goes into darkness again.
Last Quarter
Half of the Moon is illuminated.


Moon Phases Explained
(With Oreo Cookies)
There are
8 key stages
in a moon phase cycle.
First Quarter
Did you know that a complete moon phase cycle is exactly
29.5 days
Waxing Gibbous
Waxing Crescent
Full Moon
New Moon
Waning Gibbous
Waning Crescent
Third Quarter
Full Moon/New Moon:
The Earth, Moon and Sun are in approximate alignment. (The New Moon is on the opposite side of the Earth, so the highlighted portion is entirely hidden from view.)
Waxing : Growing
Waning: Shrinking
Gibbous: More than half is illuminated
Crescent: Less than half is illuminated

3rd & 4th Class

The Inner Rocky Planets

Mercury

Venus

Earth

Mars

Activity - Making Gravity

You will need:

⇒ small can, string and water

Steps

1. Attach a piece of string to a small can
2. Half fill the can with water
3. Do not put the lid back on
4. In an outside area swing the can around your head very quickly

Did you Know?

The surface gravity on the planets in our solar system varies. If Earth has a surface gravity of one, the surface gravity on the other planets would be as follows:

Mercury: 0.38

Mars: 0.38

Saturn: 0.92

Neptune: 1.12

Venus: 0.91

Jupiter: 2.36

Uranus: 0.89

Pluto*: 0.07

* Dwarf Planet

Activity - Down with Gravity

You will need:

⇒ Newspaper, 2 oranges, chair & Grape

Steps

1. Place newspaper on the floor
2. Place a chair on top on the newspaper
3. Carefully stand on the seat of the chair
4. Hold one orange in each hand, extend your arms. Each orange must be the same height
5. Let the oranges go at the same time and observe which one lands first
6. Repeat from step 3 but this time hold an orange in one hand and a grape in the other
7. Observe which one lands first

Did you Know?

The force on Earth that pulls everything down is called gravity. No matter how much an object weighs, gravity pulls it downwards at the same speed.

Activity - Centrifugal Force

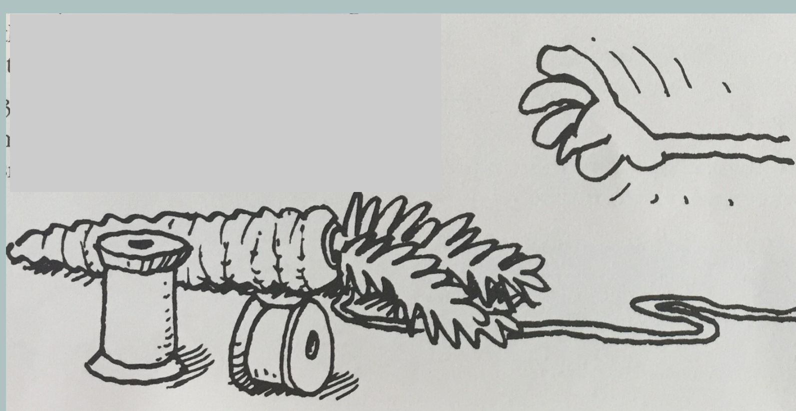
What is a centrifugal force?

You will need:

⇒ String, carrot with the leaves still attached, large spool, small spool

Steps

1. Tie the string to the top of the carrot with the leaves
2. Slip the other end of the string through the large spool and then attach it to the small spool by tying it up.
3. Hold the large spool and begin making circles with your hand. The small spool should lift in the air.
4. Watch the carrot to see what happens

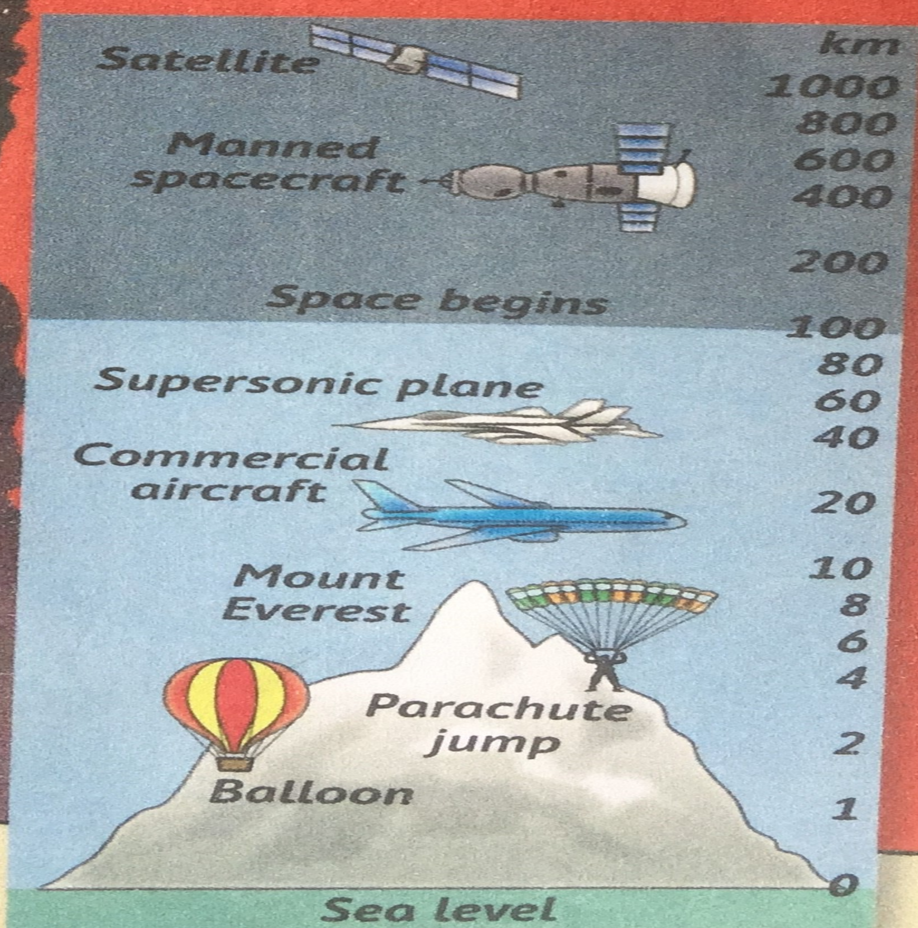


Did you Know?

The force of the rotation acts as a pulling force. This pulling force is what causes the carrot to move. Centrifugal force is the force that pulls away from the centre circle.

Where does space begin?

Space isn't very far away. It begins about **100** km above your head. At this height, there is almost no air at all.



Activity - Driving to the Moon

Approaching the dimensions of the Solar System.

The Solar System is huge. Using an activity such as this, can help bridge between the familiar and the larger scale of planet sizes and distances.

It can be in the form of a guessing game or true or false: 'WHO CAN GUESS HOW LONG IT WOULD TAKE…' or Maths questions - 'If the atmosphere extends to 100km, how long would it take to get to the edge of the atmosphere driving at 100km/h?

We all have been in a car driving on the motorway.

At a speed of 100km per hour, it takes 2.5hrs to get from Galway to Dublin. Let's imagine that our car can drive upwards into the sky.

When will we get there? How long would it take to get to (at a speed of 100km/h driving straight up):

The top of the tallest mountain? (**5.5 minutes**)

The height of an airplane at cruising altitude? (**6 mins**)

Space starts 100km over our heads. How long would it take us to get there? (**1hour**)

How long to the Space Statin? (**3.5 hours**)

How long the Hubble space telescope? (**6 hours**)

How long would it take to drive to the centre of the Earth? (**2.5 days**), and all the way through? (**5 days**)

How long to the GPS satellites that help us navigate with our phones ? (**8 days**)

So space doesn't start so far from here? Well we barely dipped our toes. From here it stretches beyond imagination:

How long to get to the Moon, our closet neighbour? (**5 months**)

How long to drive across the Sun? (**1.6 years**)

And how long to get to the sun, our local star at the centre of the Solar System? (**170 years**)

That is why they invented spaceships.

Activity – The Tides

Ocean Tides

Tides are the rise and fall of the levels of the ocean. They are caused by the gravitational pull of the Sun and Moon as well as the rotation of the Earth.

Cycles of a Tide

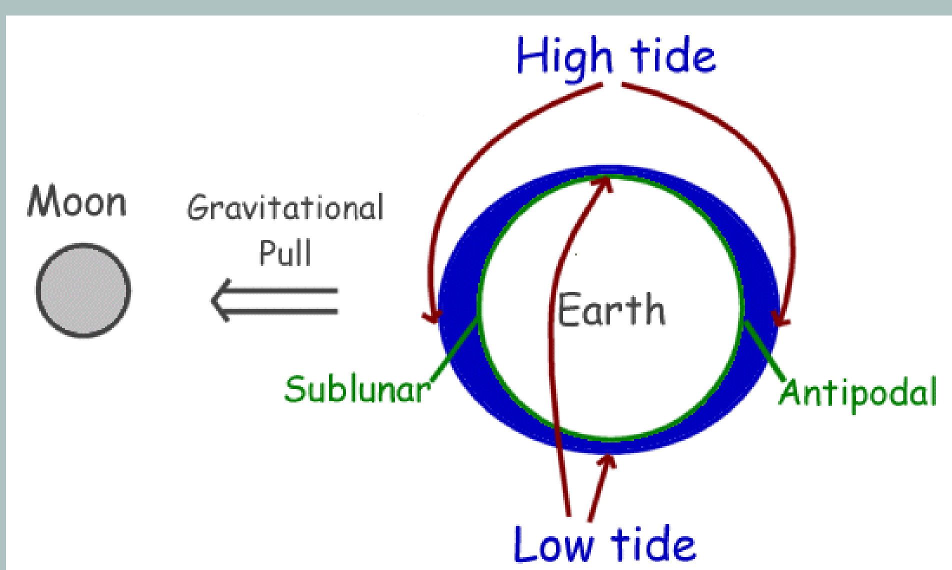
Tides cycle as the Moon rotates around the Earth and as the position of the Sun changes. Throughout the day the sea level is constantly rising or falling.

1. The sea level rises
2. High tide is reached
3. The sea level falls
4. Low tide is reached
5. Back to number 1

This cycle can happen once or twice a day depending on the location of the area to the Moon. Tides that happen once a day are called diurnal. Tides that happen twice a day are called semidiurnal. Because the Earth rotates in the same direction as the Moon, the cycle is actually slightly longer than a day at 24 hours and 50 minutes.

Tides and the Moon

While the Sun and the rotation of the Earth both have some tidal impact, the location of the Moon has the biggest affect on the tide. The gravity of the Moon causes a high tide both on the side of the Earth directly below the Moon (sublunar tide) and the opposite side of the Earth (antipodal). Low tides are on the sides of the Earth 90 degrees away from the Moon. See the picture below.



Tidal Currents

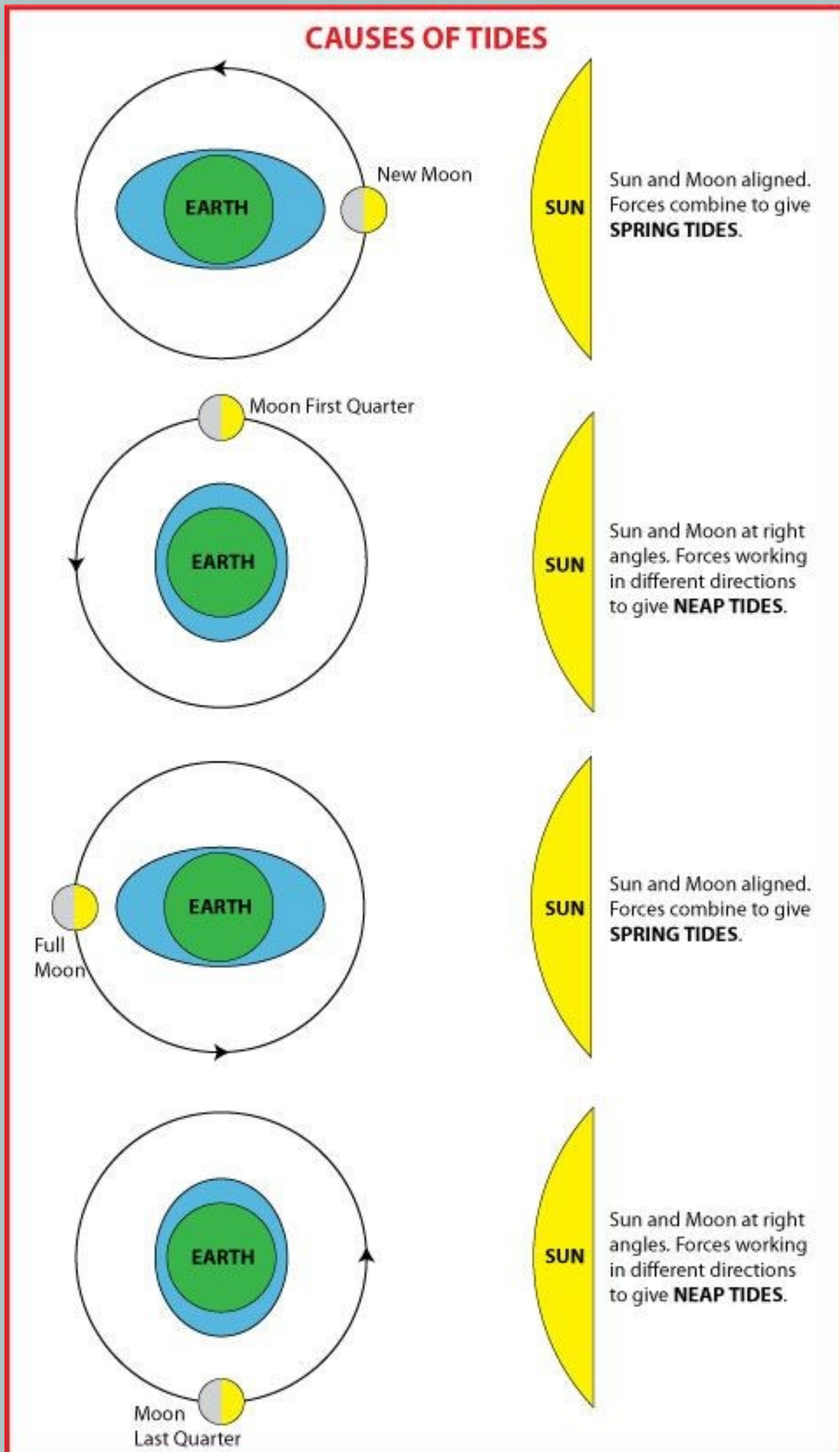
When the sea level is rising or falling, water is flowing to or from the ocean. This flow causes currents called tidal currents.

- Flood current - A flood current occurs as the sea level is rising towards high tide. Water is flowing towards the shore and away from the ocean.
- Ebb current - An ebb current occurs as the sea level is dropping towards low tide. Water is flowing away from the shore and towards the ocean.
- Slack water - At the exact time of high tide or low tide there is no current. This time is called slack water.

Tidal Range

The tidal range is the difference in sea level between low tide and high tide. The tidal range will vary in different locations depending on the location of the Sun and the Moon as well as the topography of the shore line.

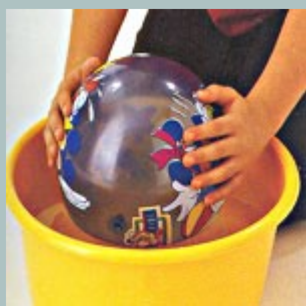
In the open ocean the tidal range is typically around 2 feet. However, tidal ranges can be much larger near the shore. The largest tidal range is on the coast of the Bay of Fundy in Canada where the tides can change by as much as 40 feet from high to low tide.


CAUSES OF TIDES
New Moon
EARTH
SUN
Sun and Moon aligned. Forces combine to give SPRING TIDES.
Moon First Quarter
EARTH
SUN
Sun and Moon at right angles. Forces working in different directions to give NEAP TIDES.
Full Moon
EARTH
SUN
Sun and Moon aligned. Forces combine to give SPRING TIDES.
EARTH
Moon Last Quarter
SUN
Sun and Moon at right angles. Forces working in different directions to give NEAP TIDES.

Activity: - How Tides Occur

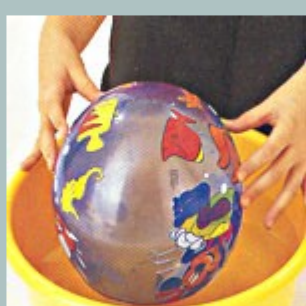
High and Low Tide - You will need:

⇒ **plastic bowl, water, plastic ball to represent the world**



STEP 1
Place the bowl on a firm, flat surface, then half fill it with water. Place the ball gently in the water so that it floats in the middle of the bowl, as shown in the picture.

STEP 2
Place both hands on top of the ball, and push it down into the water gently but firmly. Look what happens to the level of water. It rises in a "high tide".



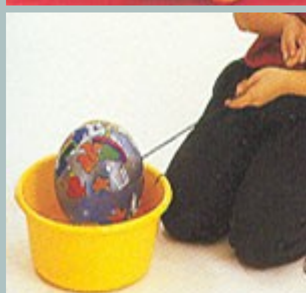
STEP 3
Let the ball gently rise again. Now you can see the water in the bowl dropping again. So the tide has risen and fallen, even though the amount of water is unchanged.

The Tidal Bulge - You will need:

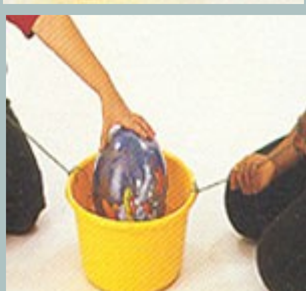
⇒ **strong glue, one 8in length and two 16in lengths of thin string, plastic ball to represent the world, plastic bowl, hand drill, water**

STEP 1
Glue the 8in length of the string very firmly to the ball and leave it to dry. Meanwhile, ask an adult to drill two holes in the rim of the bowl, one on each side.

STEP 2
Thread a 16in length of string through each hole, and knot the string around the rim. Half fill the plastic bowl with water and float the ball in the water.



STEP 3
Ask a friend to pull the string on the ball toward him or her. There is now more water on one side of the ball than the other. This is called a tidal bulge.



STEP 4
The Moon pulls on the water as well as the Earth. So now ask the friend to hold the ball in place, while both of you pull out the strings attached to the bowl until it distorts.

STEP 5
There is now a tidal bulge on each side of the world. One of you slowly turn the ball. Now you can see how, in effect, the tidal bulges move around the world as the world turns.

Activity - Rocork Launch

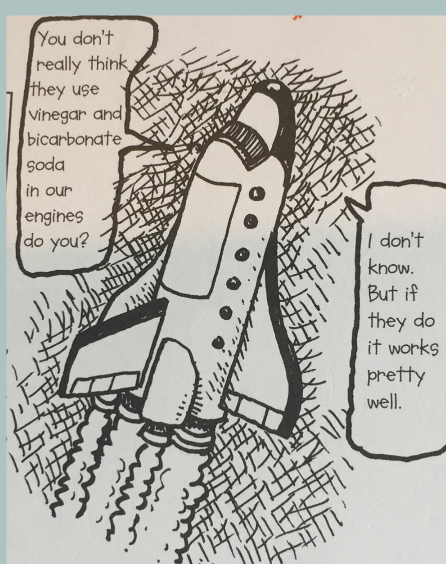
Launch a mini rocket.

You will need:

⇒ Teaspoon of bicarbonate soda, paper towel about 10cm x 20cm (4 x 8in), 1/2 cup of water, 1/2 cup of vinegar, paper streamers or ribbons, thumb tack, plastic bottle, cork that fits the bottle

Steps

1. Place the bicarbonate soda on the middle of the paper towel
2. Roll up the towel and twist the ends to keep the bicarbonate soda inside
3. Pour the water and vinegar into the bottle
4. Cut out some streamers or ribbons and with a thumb tack attach them to the cork.
5. Drop the paper towel into the bottle and very quickly push the cork into the bottle.
6. Place the bottle in an outside area that is away from windows etc.
7. Stand well away and watch



Did you Know?

A chemical reaction between the vinegar (representing liquid oxygen) and the bicarbonate soda (representing fuel) produces carbon dioxide gas. The pressure inside the bottle bushes against the cork. In real rockets the gas is jetted out of the actual spacecraft, propelling it forward!

Warning: When the rocork is about to launch make sure you are a safe distance away.

Balloon rocket

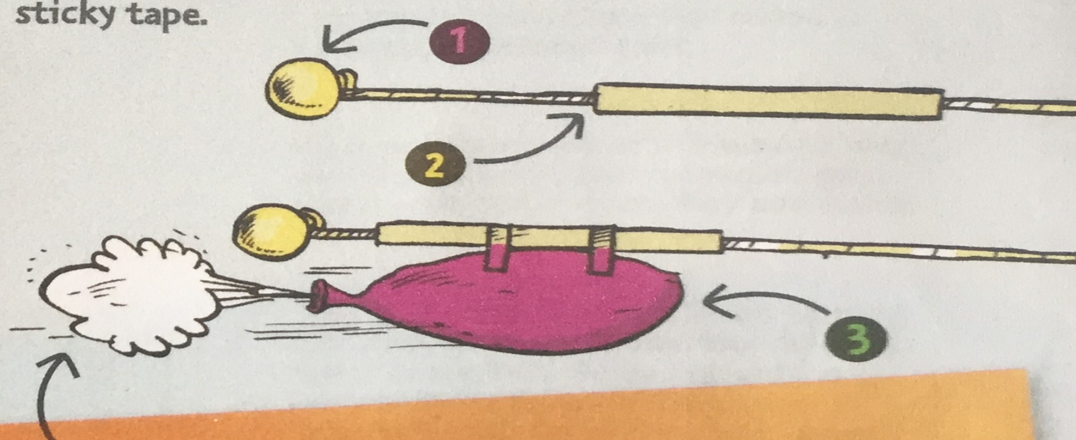
The rockets that launch spacecraft power themselves into space on a jet of gas. Make a balloon rocket to see how this works.

SUPPLIES

string • drinking straw • long balloon • sticky tape

HOW TO MAKE

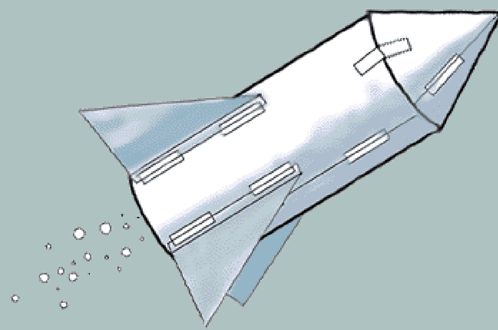
1. Tie one end of the string to something solid and secure, like a doorknob.
2. Thread the string through the drinking straw and tie the other end to something solid and secure several metres away, so that the string is tight.
3. Blow up the balloon and, while holding the neck, stick the balloon to the drinking straw with the sticky tape.



HOW TO USE

Let go of the balloon and watch it fly along the string. The air escaping from the balloon pushes it along, like the fiery jet of burning gas from a rocket. The pushing force that moves the balloon and a real rocket is called thrust.

Activity: Build a Bubble-Powered Rocket!



Build your own rocket using paper and fizzing tablets! Watch it lift off.

How high does your rocket go?

Suggestion: Find a grown-up to do this activity with you.

You will need:

⇒ **Paper, regular 8-1/2- by 11-inch paper, such as computer printer paper or even notebook paper**

⇒ **Plastic 35-mm film canister (see hints below)**

⇒ **Cellophane tape**

⇒ **Scissors**

⇒ **Effervescing (fizzing) antacid tablet (the kind used to settle an upset stomach)**

⇒ **Paper towels**

⇒ **Water**

⇒ **Eye protection (like eye glasses, sun glasses, or safety glasses)**

Hints:

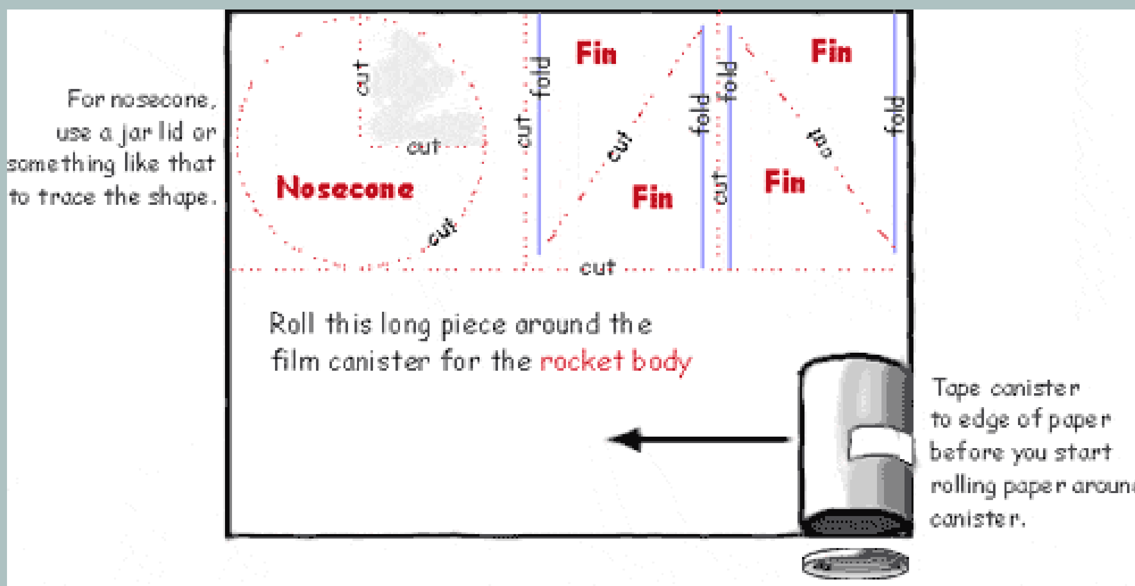
The film canister MUST be one with a cap that fits INSIDE the rim instead of over the outside of the rim. Sometimes photography shops have extras of these and will be happy to donate some for such a worthy cause.

Keep in mind: Just like with real rockets, the less your rocket weighs and the less air resistance (drag) it has, the higher it will go.

Making the Rocket

You must first decide how to cut your paper. You may cut it the short way or the long way to make the body of the rocket. There is no one right way to make a paper rocket. Try a long, skinny rocket or a short, fat rocket. Try a sharp nosecone or a blunt nosecone. Try it with fins or without fins. Experiment!

Here's just one idea for how you might cut your whole rocket from one piece of paper:



Here are the basic steps:

1. Cut out all the pieces for your rocket.
2. Wrap and tape a tube of paper around the film canister. **Hint:** Tape the canister to the end of the paper before you start wrapping.
3. **Important!** Place the lid end of the canister **down**.
4. Tape fins to your rocket body, if you want.
5. Roll the circle (with a wedge cut out) into a cone and tape it to the rocket's top.

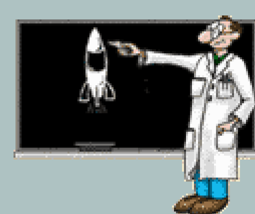
Blasting Off

1. Put on your eye protection.
2. Turn the rocket upside down and remove the canister's lid.
3. Fill the canister one-third full of water.

Now work quickly on the next steps!

1. Drop one-half of an effervescing antacid tablet into the canister.
2. Snap the lid on tight.
3. Stand your rocket on a launch platform, such as your sidewalk or driveway.
4. Stand back and wait. Your rocket will blast off!

So, Dr. Marc, how does the pop-rocket work?



When the fizzy tablet is placed in water, many little bubbles of gas escape. The bubbles go up, instead of down, because they weigh less than water. When the bubbles get to the surface of the water, they break open. All that gas that has escaped from the bubbles pushes on the sides of the canister.

Now when you blow up a balloon, the air makes the balloon stretch bigger and bigger. But the little film canister doesn't stretch and all this gas has to go somewhere!

Eventually, something has to give! So the canister pops its top (which is really its bottom, since it's upside down). All the water and gas rush down and out, pushing the canister up and up, along with the rocket attached to it.

We call this wonderful and useful fact the **law of action and reaction**. The **action** is the gas rushing out of the rocket. The **reaction** is the rocket taking off in the other direction. In other words, for every action there is an equal and opposite reaction. The rocket goes in the opposite direction from the gas, and the faster the gas leaves the rocket, the faster the rocket gets pushed the other way.

Activity - Planet Size Comparison.

Background

The Sun and planets have a wide range of sizes. This exercise will help us get familiar with what they are

relative to one another.

Work Out the Relative Sizes.

Decide on a size for the Sun and use the table below to work out the rest.

The size refers to the diameter. As an example -if you choose an object for the Sun that is

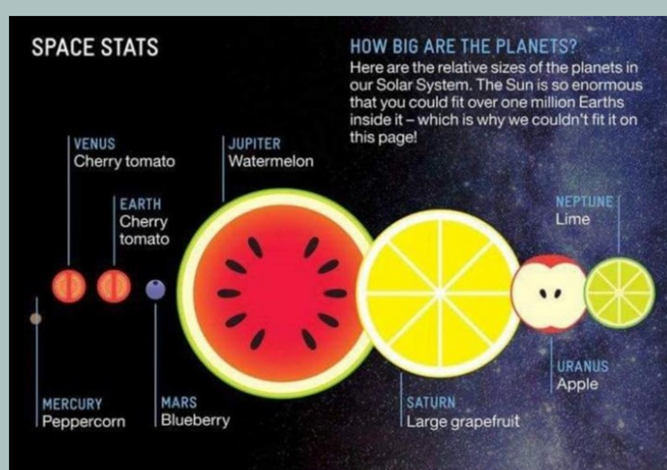
1OOcm in diameter,

Jupiter would be 10cm, earth would lcm and the Moon would be 25mm.

Once you work out the dimensions, choose objects to represent the Sun and planets as in the example below (example basketball for the Sun etc.), make sure you the object is not too small and will let you see the Moon.

Planet	Diameter	Find Object to represent it
Sun	**1**	
Mercury	**3/8 of Earth**	
Venus	**1/10 of Jupiter**	
Earth	**1/10 of Jupiter**	
Moon	**1/4 of Earth**	
Mars	**1/2 of Earth**	
Jupiter	**1/10 of the Sun**	
Saturn	**4/5 of Jupiter**	
Uranus	**1/3 of Jupiter**	
Neptune	**1/3 of Jupiter**	

Line them up and compare the sizes!



Activity - The Cosmic Toilet Paper

Finding the Distances between the Planets.

Background

The distances between the planets in the Solar System can be surprising. This exercise shows the relative distance between the planets and their distance from the Sun, but not their size. If we wanted to represent the size of the planets in this scale, Jupiter would be the size of a grain of salt and the Earth could only be seen through a microscope ...

Getting to Know the Relative Planet Distances on a Toilet Roll.

To get to know the relative distances between the Sun and planets we will mark their positions on a toilet roll. Spread out a toilet roll until you have 100 squares laid on the floor. You will need a stretch of 10 meters in a classroom or a corridor. Put a yellow object at the beginning to represent the Sun. Using different colour markers, mark the location of the planets according to the table below- as an example - Mercury 1.3 means, mark Mercury after 1.3 squares by leaving the first square clear and marking Mercury a third of the way on the second square.
All measurements are counted from the Sun at the start

Planet	Average distance from the Sun in km	Squares of Toilet Roll to Planet orbit
Mercury	58,000,000	1.3
Venus	108,000,000	2.4
Earth	150,000,000	3.3
Mars	228,000,000	5
Jupiter	778,000,000	17.2
Saturn	1,430,000,000	31.7
Uranus	2,870,000,000	63.7
Neptune	4,500,000,000	100

Once finished you will be looking a the relative positions of the planets in the Solar System. Note- In Space the planets never line up but are at different points in their orbit around the Sun. Finally - Astronomers think that there is a vast cloud of frozen comets called the Oort cloud that surrounds the Solar System. It lies 50,000 time further away from the Sun than Earth, or 1600 times further than Neptune. Can you work out how many toilet rolls will you need to reach to the Oort cloud? Assume 250 squares per roll.

Speedy planets

Planets close to the Sun travel through space faster than planets further away. You can see this with a paper planet.

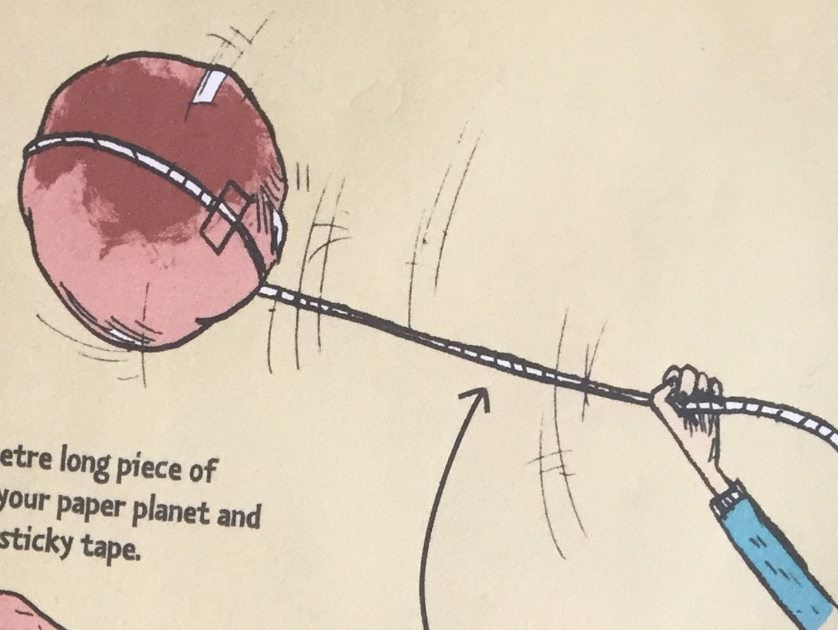
SUPPLIES

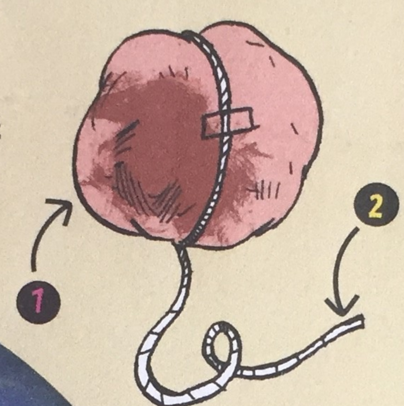
newspaper • water-based paint
string • sticky tape

HOW TO MAKE

1. Make a planet from a ball of tightly scrunched-up newspaper. You could even paint your paper planet to look like a real planet – make it stripy like Jupiter or red like Mars.

2. Tie a one-metre long piece of string around your paper planet and secure it with sticky tape.





HOW TO USE

In an open space outside, hold the end of the string and swing your planet around above your head. The pull of the string acts like gravity and pulls the planet round into a circular orbit. Now hold the string in the middle. You'll find that you have to swing the planet round faster.

5th & 6th Class

Gas Giants

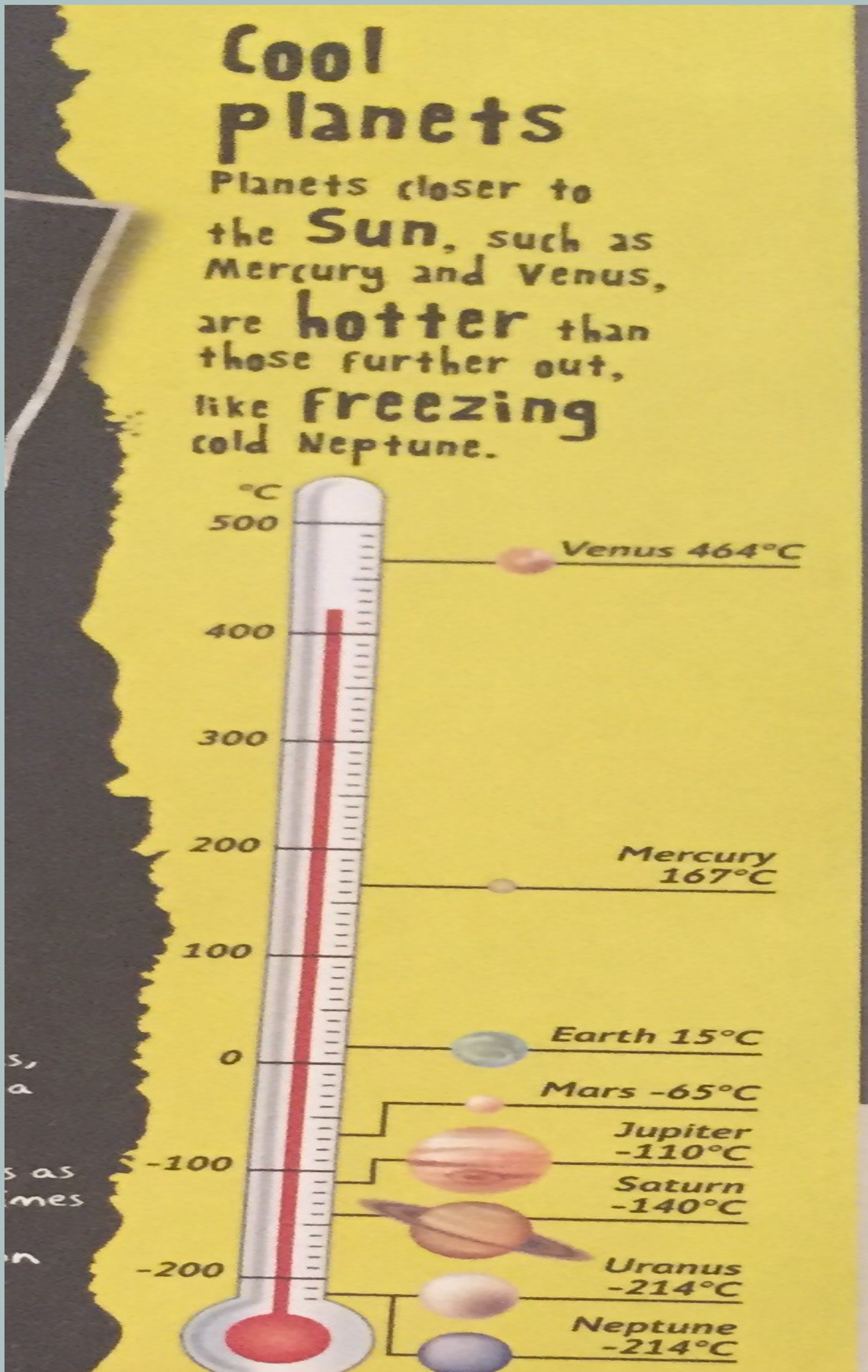
Jupiter

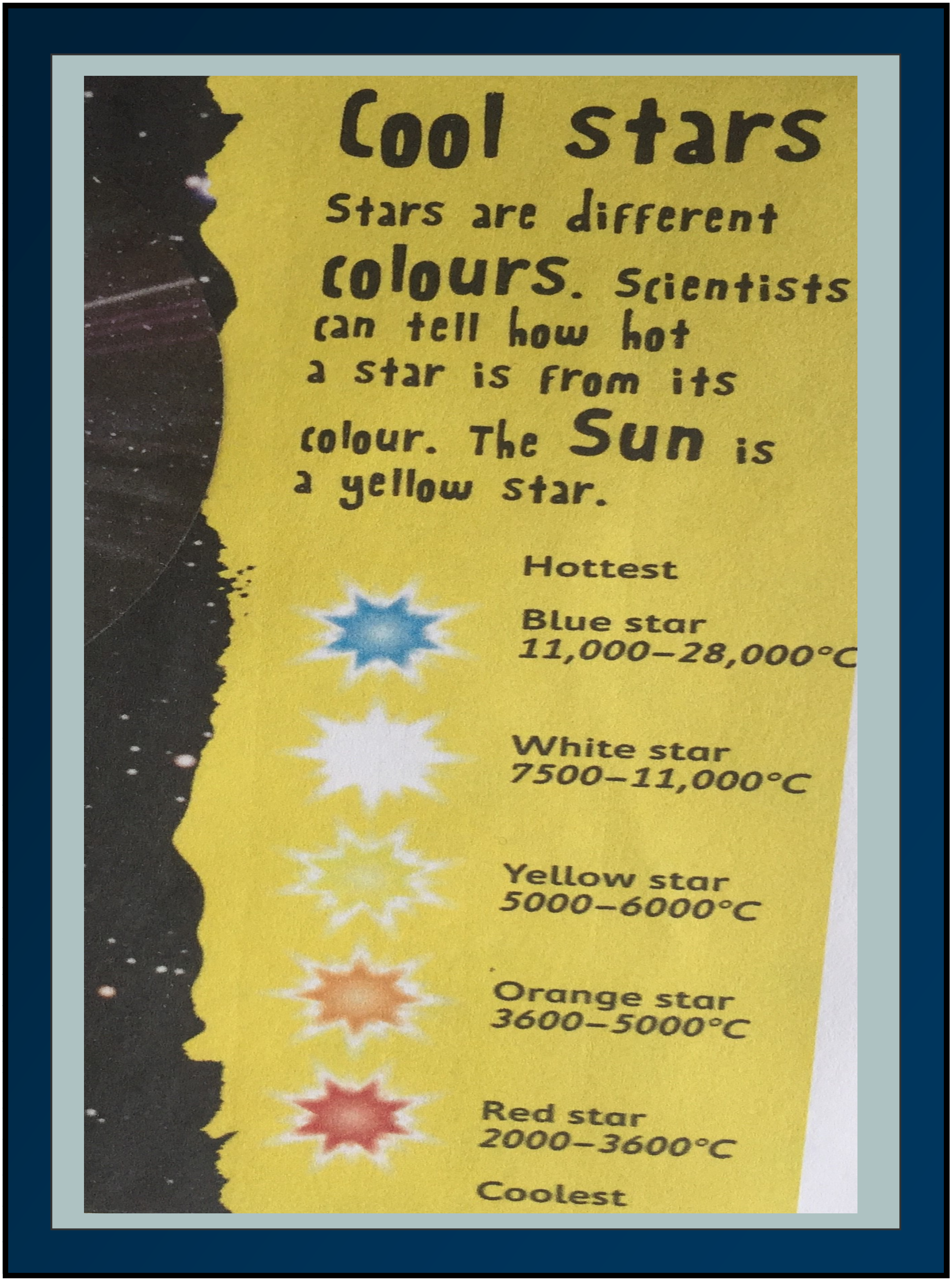
Saturn

Uranus

Neptune

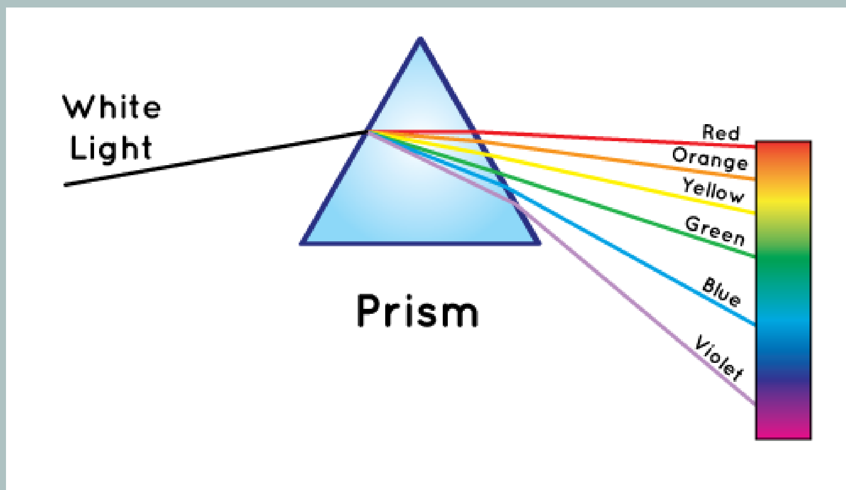
The Sun as a Star


Cool planets
Planets closer to the Sun, such as Mercury and Venus, are hotter than those further out, like freezing cold Neptune.
°C
500
400
300
200
100
0
-100
-200
Venus 464°C
Mercury 167°C
Earth 15°C
Mars -65°C
Jupiter -110°C
Saturn -140°C
Uranus -214°C
Neptune -214°C


Cool stars
Stars are different colours. Scientists can tell how hot a star is from its colour. The Sun is a yellow star.
Hottest
Blue star
11,000–28,000°C
White star
7500–11,000°C
Yellow star
5000–6000°C
Orange star
3600–5000°C
Red star
2000–3600°C
Coolest

The Sun

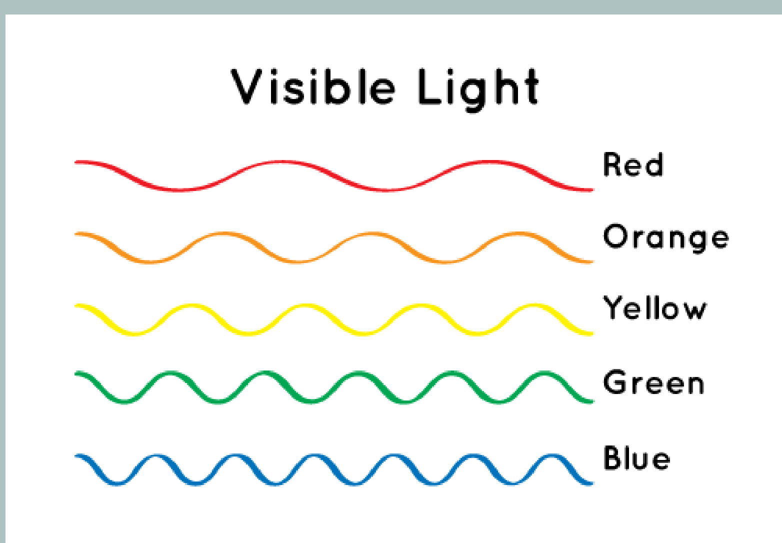
The light from the sun looks white. But it is really made up of all the colours of the rainbow.



When white light shines through a prism, the light is separated into all its colours. A prism is a specially shaped crystal.

If you visited The Land of the Magic Windows, you learned that the light you see is just one tiny bit of all the kinds of light energy beaming around the universe--and around you!

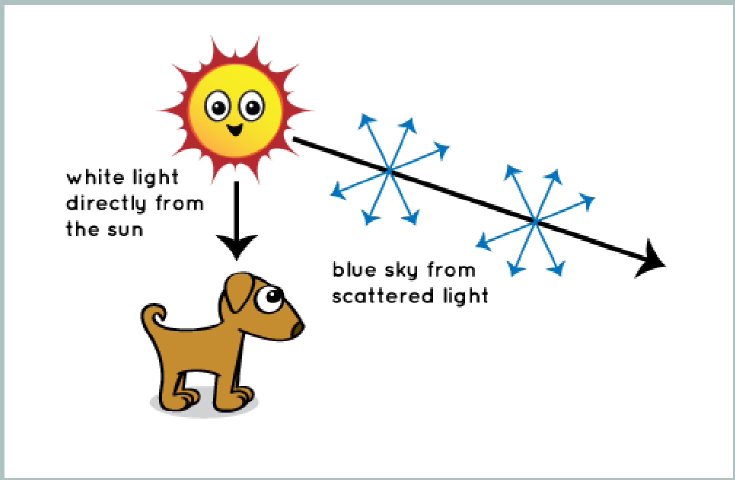
Like energy passing through the ocean, light energy travels in waves, too. Some light travels in short, "choppy" waves. Other light travels in long, lazy waves. Blue light waves are shorter than red light waves.



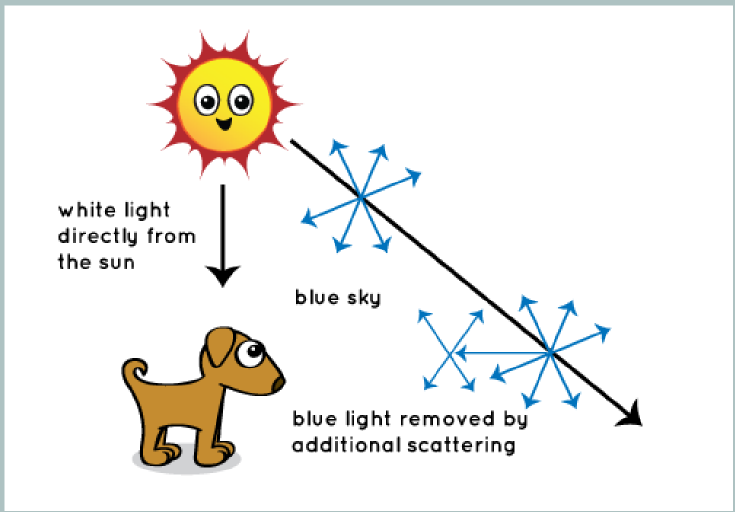
All light travels in a straight line unless something gets in the way and does one of these things:—

- reflect it (like a mirror)
- bend it (like a prism)
- or scatter it (like *molecules* of the gases in the atmosphere)

Sunlight reaches Earth's atmosphere and is **scattered** in all directions by all the gases and particles in the air. Blue light is scattered in all directions by the tiny molecules of air in Earth's atmosphere. Blue is scattered more than other colours because it travels as shorter, smaller waves. This is why we see a blue sky most of the time.



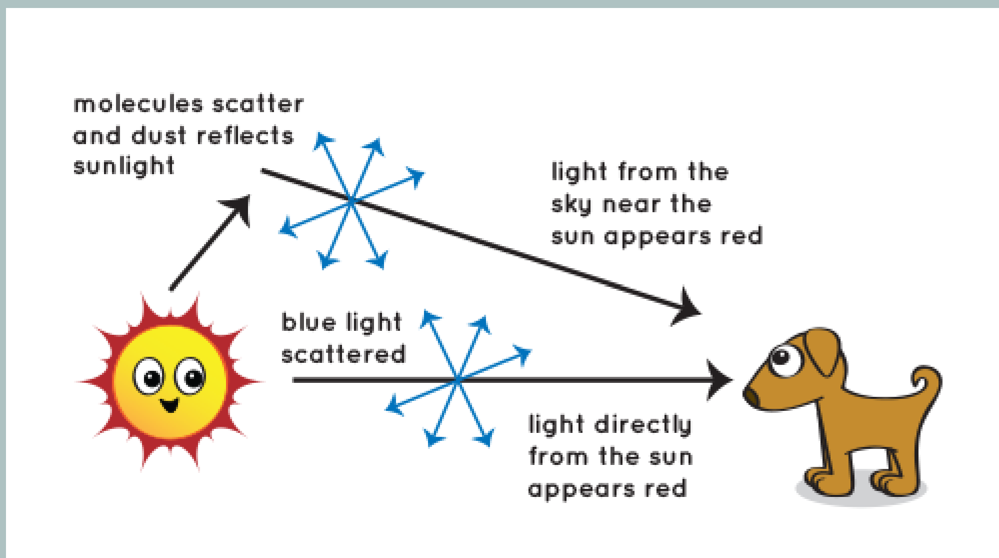
Closer to the horizon, the sky fades to a lighter blue or white. The sunlight reaching us from low in the sky has passed through even more air than the sunlight reaching us from overhead. As the sunlight has passed through all this air, the air molecules have **scattered** and ***re*scattered** the blue light *many times* in *many directions*.



Also, the surface of Earth has **reflected** and **scattered** the light. All this scattering mixes the colours together again so we see more white and less blue.

What makes a red sunset?

As the sun gets lower in the sky, its light is passing through more of the atmosphere to reach you. Even more of the blue light is scattered, allowing the reds and yellows to pass straight through to your eyes.



Sometimes the whole western sky seems to glow. The sky appears red because small particles of dust, pollution, or other aerosols also scatter blue light, leaving more purely red and yellow light to go through the atmosphere.

Activity - Splitting Light

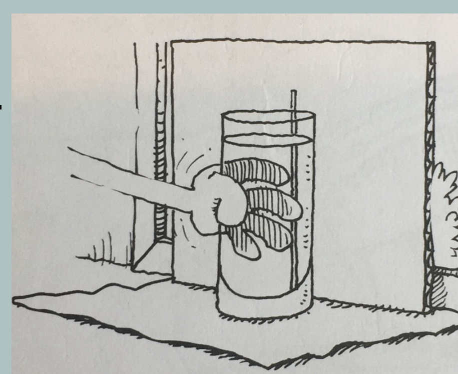
Light is composed of different colours. See how a spectroscope splits the light from stars and planets.

You will need:

⇒ **Thick cardboard, straight drinking glass, water, paper**

Steps:

1. **Make a long, narrow cut from the bottom of the cardboard to just above the height of the glass.**
2. **Sit the glass on the piece of paper in front of a window that lets in a lot of sun and place the cardboard between the glass and the window (remember to have the cut in the cardboard running the length of the glass).**



3. **You should see the light split into colours.**

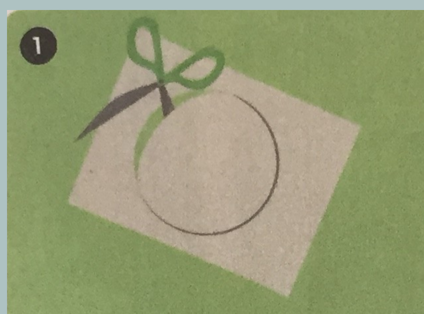
Did you Know?

Spectroscopes have allowed astronomers to study what the Universe is actually made of. Astronomers who study this are called astrophysicists.

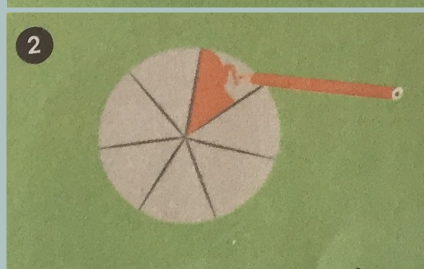
Activity - The light coming from the Sun is white, even though it contains every colour you can think of. Make this colour spinner to see why!

You will need:

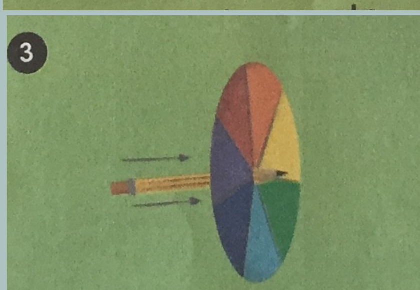
⇒ Card, Scissors, Colouring pens, A compass



1. Use your compass to draw a circle on the card cut it out.



2. Draw lines to create seven equal segments. Colour them red, orange, yellow, green, blue, indigo and violet.



3. With an adult's help pierce the centre of the circle with a pencil.

4. Spin between the palm of your hands. Spin between the palm of your hands. What colour do you see?

When all the colours are mixed together you get White!

Twinkle, twinkle, little star

Stars twinkle because starlight bends and twists as it travels through the air around Earth. You can see this happening by making your own stars and making them twinkle.

SUPPLIES

glass bowl • cardboard (from a cereal box) scissors • pen • aluminium foil • torch

HOW TO MAKE

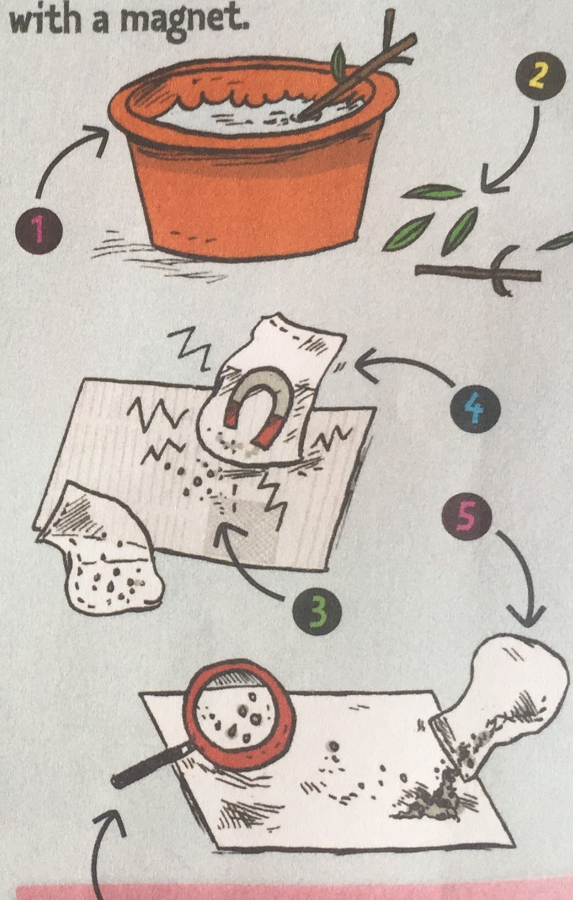
1. Pour cold water into the bowl until it's about two-thirds full.
2. Cut out a piece of cardboard bigger than the base of the bowl.
3. Draw small star shapes on the aluminium foil. Cut them out.
4. Place the stars on top of the cardboard and then place the bowl on top of the stars.

HOW TO USE

Close the curtains to darken the room and switch on the torch. Point the torch down into the bowl. Now tap the bowl and see the stars twinkle. The light from the torch is bent as it passes through the rippling water, in the same way as starlight is bent as it passes through the air around Earth.

Space rock hunt

Space rocks fall to Earth every day. They're called meteorites. Most of them are tiny and harmless. You can look for them with a magnet.



SUPPLIES

bucket or bowl • newspaper • magnet
small plastic bag • sheet of white paper
magnifying glass

WHAT TO DO

1. Put a bucket or bowl outside when it rains. If possible, put it under a drain spout from a roof to collect lots of water.

2. When it's full, take out any large twigs and leaves, and then carefully pour away most of the water. You should find some fine, dark, dusty dirt at the bottom.

3. Pour the last few drops of water with the dark particles onto a sheet of newspaper, and set the paper aside indoors until it dries out.

4. Put a magnet inside a small plastic bag and move it slowly back and forth across the paper. Some of the particles may stick to the outside of the bag.

5. Turn the bag inside out and take the magnet away. The dark dust is now inside the bag. Carefully empty the bag onto a sheet of white paper.

HOW TO USE

Have a look at the particles through a magnifying glass. You've collected micrometeorites — tiny rocks from space. Sand, dust and dirt don't stick to a magnet, but rocks from space do, because they contain iron.

Maths Questions - Please add your own and adjust to age groups

- **Let's work out the speed of light! - Light takes 8.3 minutes to travel from the Sun to Earth. What is the speed of light?**

Answer- the distance from the Sun to Earth is 150,000,000km.

Light from the Sun travels this distance in 8.3 minutes.

There are 500 second in 8.3 minutes (8.3 x 60).

The speed of light is 150,000,000km *I* 500 seconds= 300,000 km/s (distance *I* time).

- **How long it takes light to travel the distance between Earth and the Moon?**

Answer- the distance between the Earth and the Moon is 385,000km.

385,000km /300,000 *km/s* > 5.7 seconds

- **How fast does the Earth spin on its axis?**

Answer- Earth circumference is 40,000km. 40,000124h = 1600km/h

- **How fast do the rest of the planets spin on their axis?**

Find the circumference and divide by the time it takes for 1 revolution, its day.

- **The Moon moves on an elliptical orbit around the Earth. What is the average distance between the Earth and the Moon?**

Answer- find out (from a reference book/site) what is the perigee and the apogee (closest and further distance between the Earth and the Moon). The answer is (perigee+ apogee)/2.

- **The Earth moves on an elliptical orbit around the sun. Find out the average distance of the Earth to the Sun?**

Answer - find out the aphelion and the perihelion from a reference book or site (closest and further distance between the Earth and the sun). The answer is (aphelion + perihelion) 12.

Find this for the rest of the planets.

- **How fast do the planets travel as they orbit the Sun?**

Answer- you will need to work out the circumference of a planet's orbit and divide it by the time it takes it to make this journey (its year)

Use the formula 2π work out the orbit. 'r' in this case is the average distance from the planet to the Sun. Let's take Earth as an example.

Average distance from the Earth to the Sun is 150,000,000km. 2π = 6.28 x 150,000,000 = 942,000,000. Time is takes to travel this distance is 1 year. Let's convert this to a speed unit that we can recognise like hours. 1 year has 8760 hours. 942,000,000 *I* 8760 = 107,534km/h.

True or False Questionnaire

TRUE	FALSE		QUESTIONS
☐	☐	1.	A red giant is hotter than the Sun?
☐	☐	2.	Saturn is almost as big as Jupiter but weighs only a third as much?
☐	☐	3.	Shooting Stars are really meteorites?
☐	☐	4.	The great Red Spot is a storm on Jupiter that has been raging for more than 300years?
☐	☐	5.	Stars last Forever?
☐	☐	6.	The great Red Spot is more than twice as wide as Earth?
☐	☐	7.	Jupiter is a very windy place. The clouds whizzing along at 400km/hr.?
☐	☐	8.	Galaxy is only a chocolate bar not a cluster of stars in the Universe?
☐	☐	9.	Neptune was named after the God of the Sea?
☐	☐	10.	There is no liquid water on Neptune at all?
☐	☐	11.	Uranus is the only planet to spin on its side?
☐	☐	12.	Uranus's rings are easier to see than Saturn's?
☐	☐	13.	Mars is red because its surface is covered in seaweed?
☐	☐	14.	On Mercury it is dark all the time. The Sun rays covers it up?
☐	☐	15.	Venus is the hottest planet in the Solar System?
☐	☐	16.	Earth's land is always moving - just very slowly?
☐	☐	17.	Earth is the only place in The Solar System to have oceans of water on its surface?

Answers - True or False Questionnaire

1. False
2. True
3. True
4. True
5. False
6. True
7. True
8. False
9. True
10. True
11. True
12. False
13. False
14. False
15. True
16. True
17. True