THE CHILDREN'S UNIVERSITY OF MANCHESTER

MANCHESTER 1824
The University of Manchester

The Earth and Beyond

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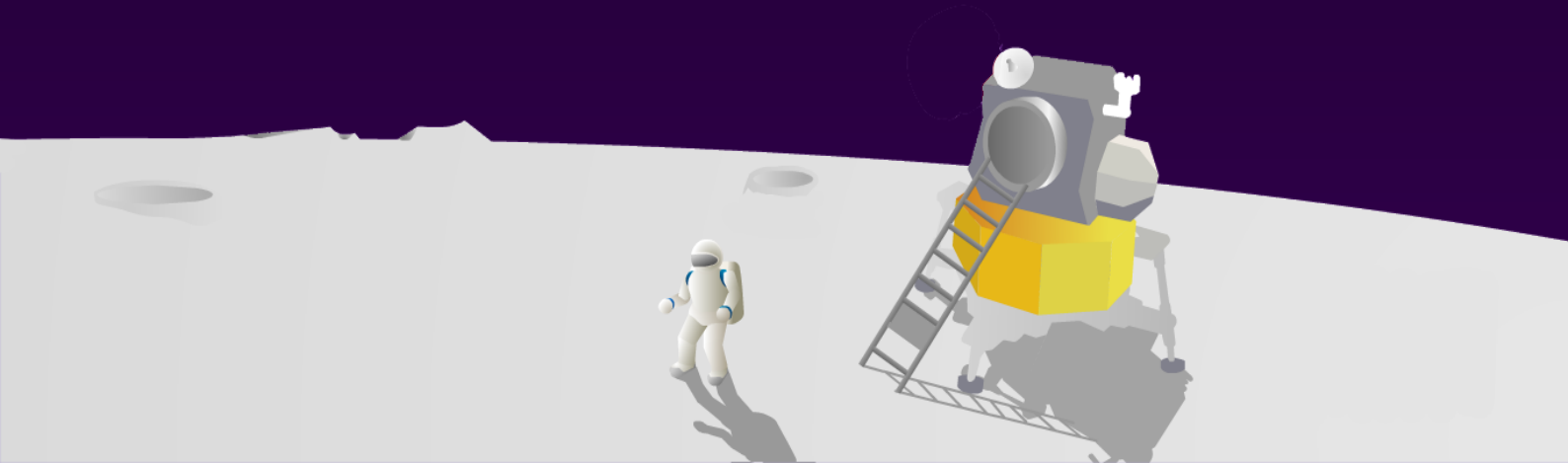
Welcome to the Earth and Beyond

Hello, my name is Tim O'Brien. I'm an astronomer working at The University of Manchester's Jodrell Bank Observatory.

As an astronomer my job is to try and understand how the universe works and my main interest is why some stars explode – more about this later!

I also get to visit lots of schools and share amazing facts with children and teachers about the Sun, Earth and Moon, the stars and planets, and the Universe as we know it!

Now, in the Children's University, I can share the excitement with you. I hope you enjoy the journey!



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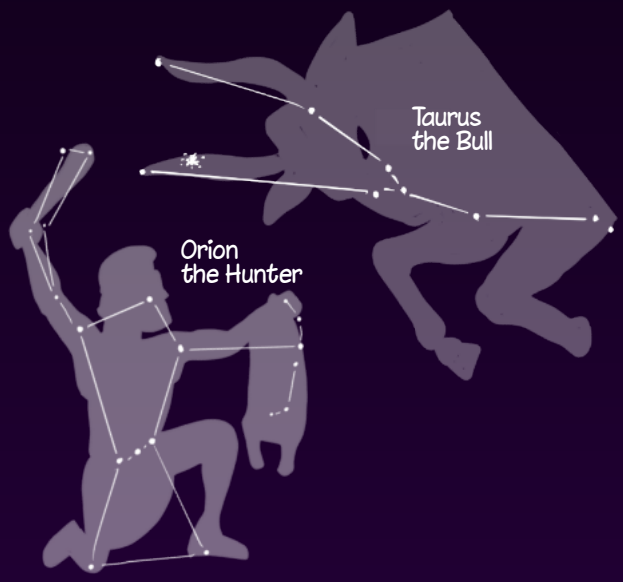
Exploding stars

You may know the names of some patterns of stars (called constellations) such as Orion or the Great Bear. Every now and again a new star appears amongst these well-known patterns. Ancient people used to think these were stars being born. We now know they're old stars which are exploding!

This picture shows Orion the Hunter and Taurus the Bull with the position of an exploded star known as the Crab Nebula. This was first spotted by astronomers in China in the year 1054.



We're all made of stars

Understanding why stars explode is very important because most of the chemical elements (carbon, oxygen, nitrogen and so on) were made inside stars and are spread out into space when they explode.

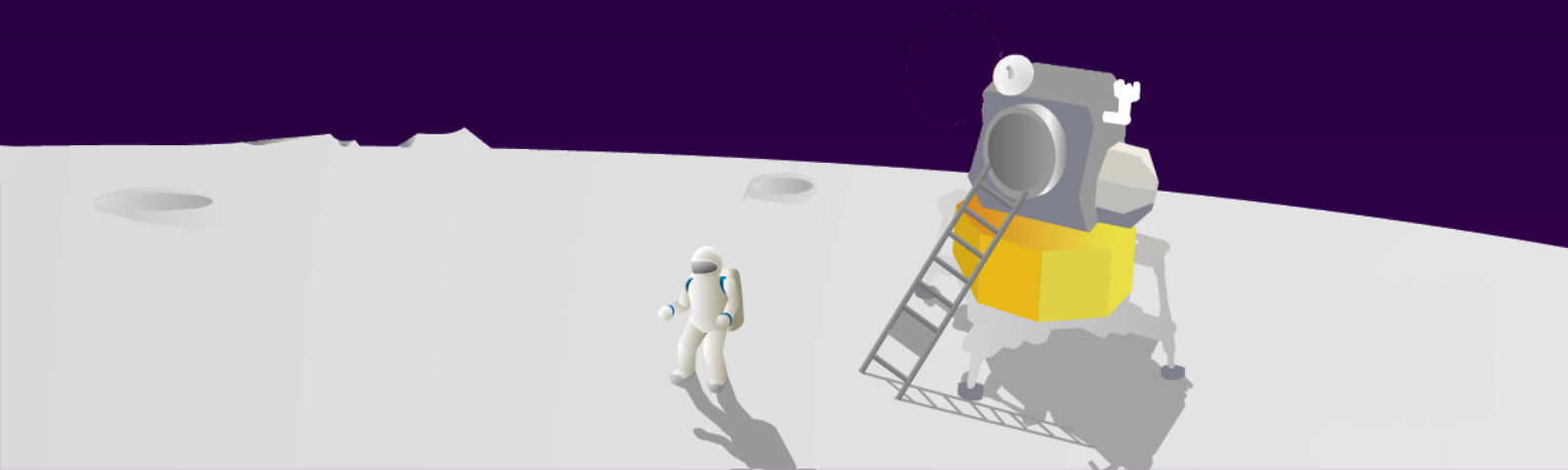
Billions of years ago the Sun, Earth and the other planets formed out of the leftovers from one of these gigantic explosions. Amazingly we're all made of stuff that was created inside a star!

Learn about astronomy

Exploding stars is just one example of why astronomy is important and fun. I hope you enjoy using this website and find it helpful in understanding the Earth and Beyond section of your schoolwork.

There's also lots of other useful information, including what you can see in the sky each month, the size of the Universe and more about the work we do as astronomers at Jodrell Bank. There's even a chance to ask a question and get an answer from one of the astronomers at The University of Manchester.

1. Shadows
2. Day and night
3. Planets - ordering and mnemonics
4. Sun, Moon and Earth orbits
5. Sunrise, sunset and day length
6. The phases of the Moon



Shadows

Don't forget!

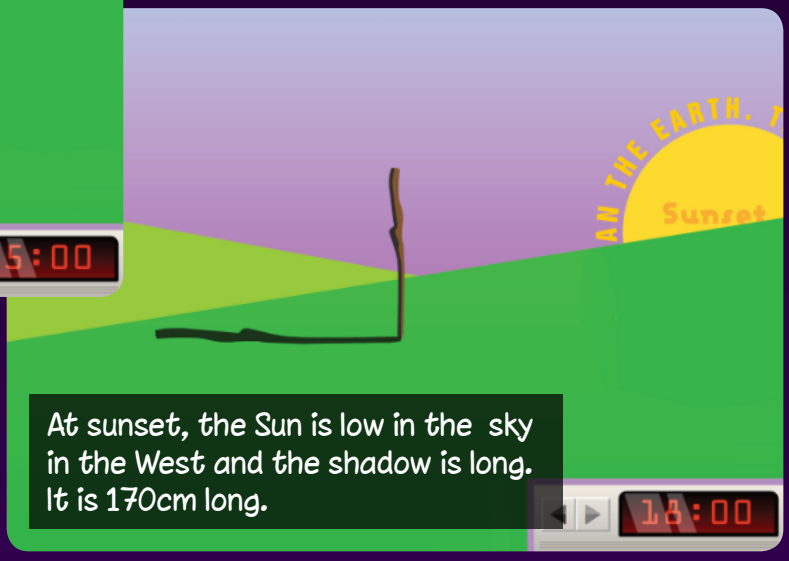
The Sun isn't moving at all! It is the Earth which is spinning around on its axis, making the Sun appear to rise in the East, move across the sky in a curved path during the day, and finally set in the West.

At sunrise, the Sun is low in the sky in the East and the shadow is long. It is 170cm long.

In the morning, as the Sun gets higher in the sky, the shadow gets shorter. It is 45 cm long.

At mid-day, the Sun is at its highest point in the sky. The shadow is at its shortest. It is 25cm long.

In the afternoon, as the Sun gets lower in the sky, the shadow gets longer again. It is 45cm long.



At sunset, the Sun is low in the sky in the West and the shadow is long. It is 170cm long.

Did you Know?

The University of Manchester's giant radio telescope at Jodrell Bank was used to measure the size of the Solar System. This was done by bouncing radio signals off Venus, and measuring the time it took for the signal to come back to Earth!

Shadows Quiz!

1. Where does the Sun rise?

a) The North.
b) The East.
c) The South.
d) The West.

2. When are shadows longest?

a) Late morning.
b) Midday.
c) Early afternoon.
d) Sunrise & sunset.

3. Where does the Sun set?

a) The North.
b) The East.
c) The South.
d) The West.

4. When are the shadows shortest?

a) Late morning.
b) Midday.
c) Early afternoon.
d) Sunrise & sunset.

See the answers at the end of the module

Day and night

As the Earth spins on its axis, light from the Sun falls on different parts of the Earth causing day and night.

Because the Earth is roughly spherical, half of it is in sunlight at any one time.

The Sun

● MANCHESTER 13:00 (Midday)

When it's night time in Manchester, we're facing away from the Sun. As the Earth turns toward the East, Manchester comes into sunlight, and the Sun appears to "rise" in the East.

The Sun

● MANCHESTER 00:00 (Midnight)

Did you Know?

A day on Earth lasts 24 hours, because that's the amount of time it takes for the earth to rotate once around its axis. Although Jupiter is the biggest planet in the Solar System, it spins so quickly that a day on Jupiter lasts less than 10 hours!

Day and night Quiz!

1. Day and night are caused by movement of..

a) The Earth.

b) The Sun.

2. How long does it take for the Earth to complete one full turn on its axis?

a) 12 Hours.

b) 24 hours.

3. Which part of the Earth is in daytime?

4. Which part of the Earth is in night-time?

See the answers at the end of the module

Planets, ordering and mnemonics

Mercury

Mercury is the planet nearest the Sun, and it moves around the Sun faster than any other planet. Mercury is dry, extremely hot, and almost airless. The Sun's rays are approximately seven times as strong on Mercury as they are on the Earth.

Venus

Venus is known as the Earth's "twin" because the two planets are so similar in size. However, conditions on Venus are very different from those on Earth - the planet is cloaked in clouds of acid!

Earth

Our home is the fifth-largest planet in the Solar System (Jupiter is 11 times bigger!). Although only a tiny part of the universe, Earth is home to ALL known life! Life is abundant on Earth because we're not too close or too far from the Sun, and there's lots of water, which is thought to be essential for life.

Mars

Scientists have found evidence that water once flowed on the surface of Mars. There are valleys and gullies which could have been made by rivers. The Martian surface has a canyon system that is much deeper and much longer than the Grand Canyon in the USA, as well as mountains that are much higher than Earth's highest peak - Mount Everest.

Jupiter

Jupiter, known as "the giant planet" is the largest planet in the Solar System - it would take more than 1,000 Earths to fill up the volume of Jupiter. in July 1994, fragments of a comet crashed into Jupiter's atmosphere. The impacts caused tremendous explosions, scattering debris over areas larger than the diameter of Earth!

Saturn

Saturn is the second largest planet in the Solar System. Seven thin, flat rings surround Saturn. The rings consist of ice particles that travel around the planet.

Uranus

Uranus is the furthest planet from Earth that can be seen without a telescope. Uranus is a giant ball of gas and liquid, the surface of which is covered in blue-green clouds made up of tiny crystals of methane.

Neptune

Neptune was discovered by mathematics before ever being seen through a telescope. Astronomers had noticed that Uranus was not always in the position they predicted for it, and concluded that the gravity of an unknown planet must have been affecting it. From this they deduced where Neptune should be, and after searching with telescopes, they were proved right!

Poor Pluto!

Pluto was the 9th planet from the Sun.

On Thursday 24th August 2006, it was decided that Pluto is too small to be a planet. This decision is very controversial. Pluto is now called a dwarf planet, and knowing it's position can help us remember the order of planets using the following mnemonic....

Ordering and mnemonics

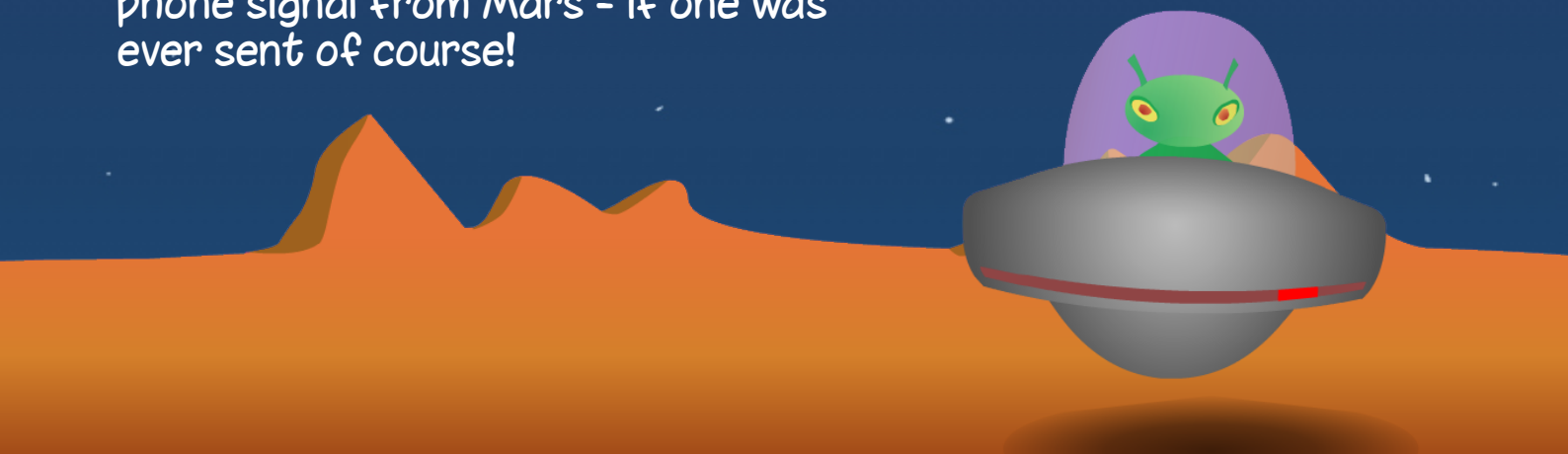
An easy way to remember the order of the planets is to use a "mnemonic". This is a phrase where the first letters of the words are the same as the sequence you're trying to remember, such as...

My **V**ery **E**asy **M**ethod **J**ust **S**peeds **U**p **N**aming **P**lanets

Try using the mnemonic from your own memory. Can you name all the planets in the right order without looking at the picture?

Did you Know?

The Lovell telescope at Jodrell Bank is sensitive enough to receive a mobile phone signal from Mars - if one was ever sent of course!



Planets, ordering and mnemonics quiz!

1. What shape are the planets in the Solar System?

a) Circular.

b) Approximately spherical.

2. How many planets are there in the Solar System?

a) Five.

b) Eight.

3.Which planet is closest to the Sun?

a) Mercury.

b) Venus.

4. Which is the third planet from the Sun?

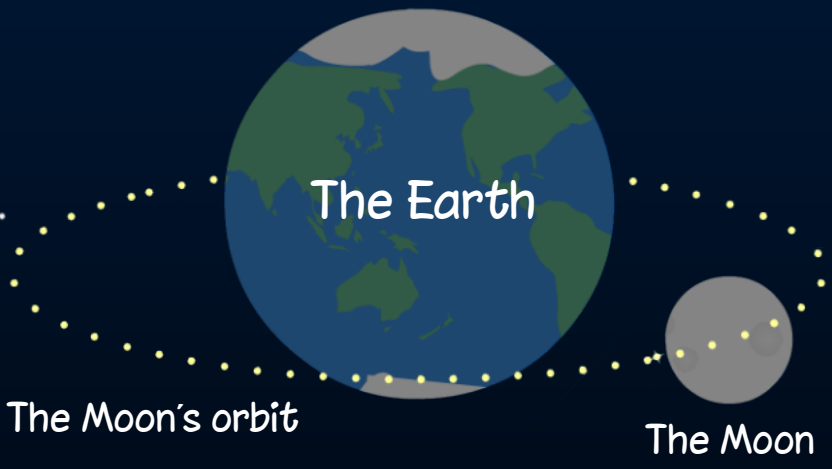
a) Earth.

c) Venus.

Sun, Moon and Earth Orbits

The Sun is the biggest body in the Solar System, about 100 times bigger than the Earth!

The Sun is actually a star! It's the nearest star to Earth, and the only one visible during the day.



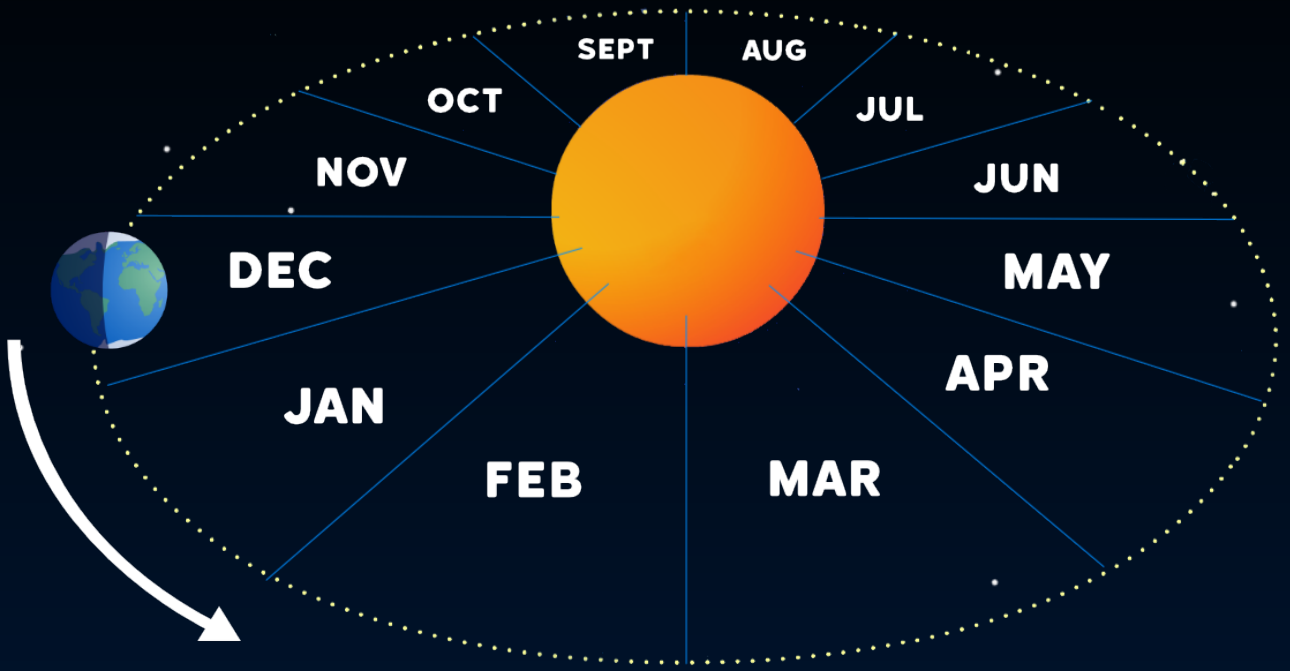
The Earth rotates around the Sun along a circular path. This path is known as its 'orbit'.

The Earth takes 1 year, or 365¼ days, to orbit the Sun completely.

The Moon also travels on a circular path, or "orbit", around the Earth.

It takes 28 days for the Moon to orbit the Earth completely...

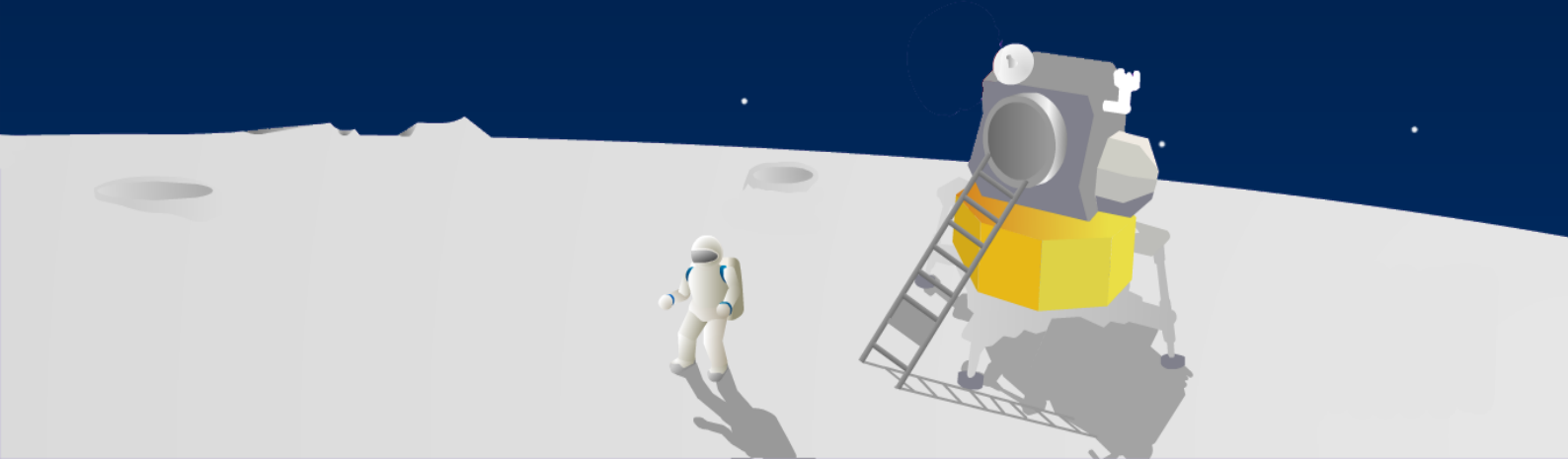
The Earth is about 4 times bigger than the Moon.



Can you count how many months the Earth takes to orbit the Sun?

Did you Know?

A radio telescope at The University of Manchester's Jodrell Bank Observatory was used to track the "Eagle" spacecraft carrying the first humans to land on the Moon.



Sun, Moons and Earth orbits quiz!

1. What shape are the Earth, Sun and Moon?

a) Circular and flat.

b) Spherical.

2. Which is the correct order of size for the Earth, Sun and Moon, largest first?

a) Moon, Sun, Earth.

b) Sun, Earth, Moon.

3. How long does it take for the Earth to go round the Sun?

a) 1 month.

b) 1 year.

4. How long does it take for the Moon to go round the Earth?

a) 28 days.

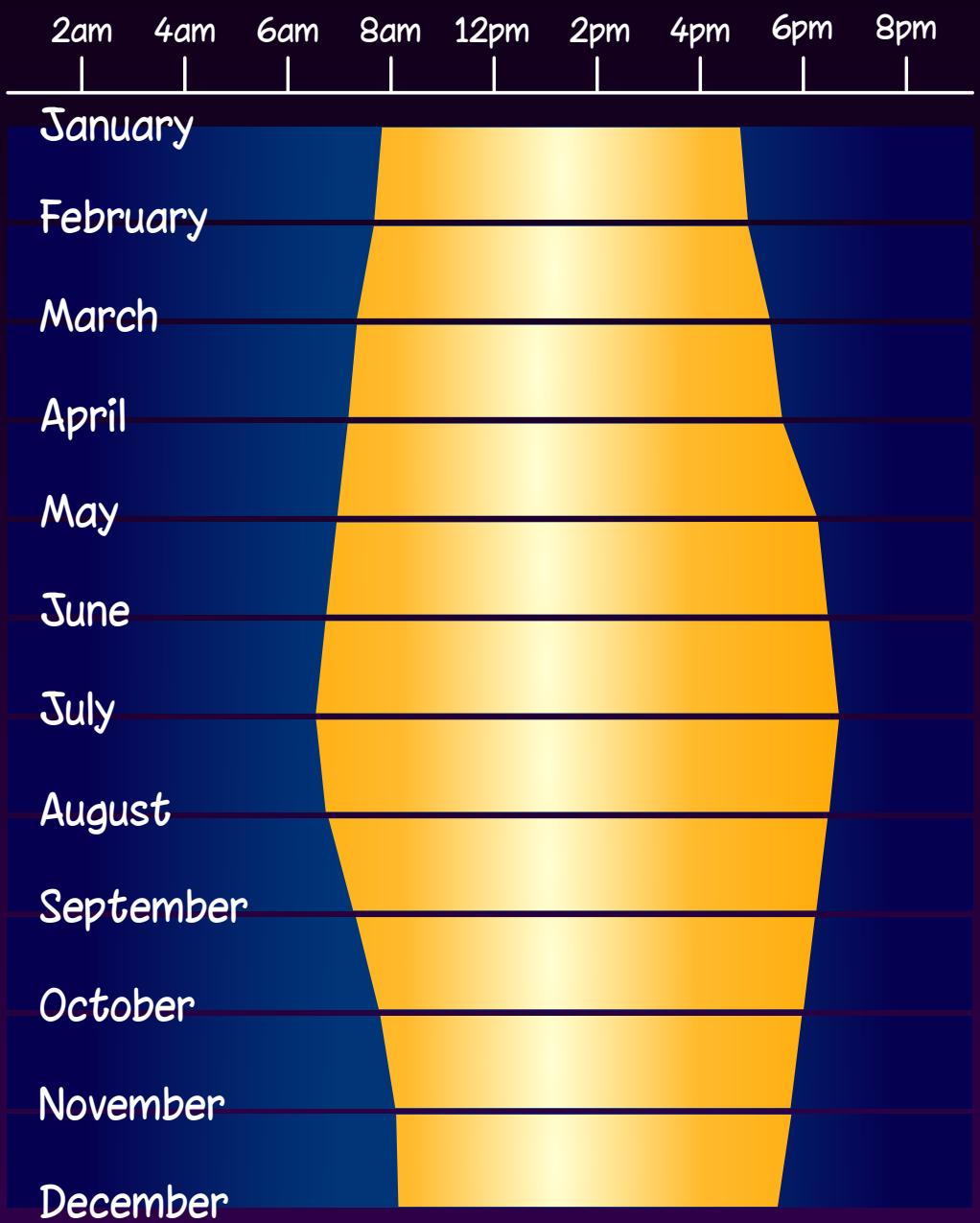
b) 1 year.

Sunrise, sunset And day length

Daytime starts at sunrise and ends at sunset. The time from sunrise to sunset when it is light is the length of the day.

The longest day is on June 21st.

This is the day when the Sun rises earliest in the morning and sets latest at night.



The shortest day is on December 21st.

This is the day when the Sun rises latest in the morning and sets earliest at night.

The yellow sections in this chart show the changes in the time of sunrise and sunset over the duration of a year.

Did you know?

The Arctic is called `The Land of the Midnight Sun´. This is because the North Pole is tilted towards the Sun in summer and it stays in full sunlight even as the earth rotates.

There is no darkness at night.

1. From which direction does the Sun appear to rise?

a) West.

b) East.

2. In which direction does the Sun appear to set?

a) West.

b) East.

3. What happens to the time of sunrise between January and June?

a) Sunrise gets later.

b) Sunrise gets earlier.

4. What happens to the time of sunset between January and June?

a) Sunset gets later.

b) Sunset gets earlier.

The Phases of the Moon

The Sun lights up the side of the Moon which faces towards it...

How much of the light side we can see depends on the angle at which we view the Moon.

The angle changes as the Moon orbits the Earth, so the appearance of the Moon changes over the month.

It takes 28 days for the Moon to orbit the Earth. The appearance of the Moon changes over the 28 day cycle.

These changes are called the "phases of the moon".

Third quarter

Waning crescent

Waning gibbous

New moon

Full moon

Waxing crescent

Waxing gibbous

First quarter

Did you know?

The footprints left by astronauts will still be there in 10 million years because there is no wind or weather on the Moon.

1. How many days does it take for the Moon to orbit the Earth?

a) 28.

b) 365.

2. How many days after a new Moon do we see a full Moon?

a) 7.

b) 14.

3. Why does the shape of the Moon appear to change over its 28 day orbit?

a) The Earth casts a shadow on the Moon.

b) The illuminated side of the Moon is seen from different angles.

4. Why is it called a first quarter Moon when we can see half of the Moon's surface?

a) The Moon is a quarter of the way round its 28 day orbit.

b) Early astronomers were not great mathematicians!

Quiztime Answers!

Shadows

1. Where does the Sun rise?

a) The North **b) The East** c) The South d) The West

The Sun appears to rise in the East, but in fact the Sun does not move, it is the Earth which spins on its axis making the Sun appear to rise in the East.

2. When are shadows longest?

a) Late morning b) Midday c) Early afternoon **d) Sunrise & sunset**

The shadows are longest at sunrise and sunset when the Sun is at its lowest in the sky.

3. Where does the Sun set?

a) The North b) The East c) The South **d) The West**

4. When are shadows shortest?

a) Late morning **b) Midday** c) Early afternoon d) Sunrise & sunset

The shadows are shortest at midday when the Sun is at it's highest in the sky.

Day and night

1. Day and night are caused by movement of..

a) The Earth | b) The Sun

The Earth rotates on its axis. For the part of the Earth facing the Sun, it is daytime, and for the part of the Earth facing away from the Sun, it is night.

2. How long does it take for the Earth to complete one full turn on its axis?

a) 12 Hours | b) 24 hours

It takes a full 24-hours, or a day and a night, for the Earth to complete a full turn on its axis.

3. Which part of the Earth is in daytime?

This side of the Earth is facing the Sun. Light can be seen therefore it is daytime.

4. Which part of the Earth is in night-time?

This side of the Earth is facing away from the Sun. Light from the Sun cannot be seen from here, therefore it is night-time.

Ordering and mnemonics

1. What shape are the planets in the Solar System?

a) Circular | b) Approximately spherical

The planets are all approximately spherical just like the Sun and Moon.

2. How many planets are there in the Solar System?

a) Five | b) Eight

There are eight planets in the Solar System: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

3. Which planet is closest to the Sun?

a) Mercury | b) Venus

Mercury is the closest planet to the Sun. The temperature can rise to over 400°C, that's hot enough to melt tin!

4. Which is the third planet from the Sun?

a) Earth | c) Venus

Earth is the third planet from the Sun. Remember: "My Very Easy Method Just Speeds Up Naming Planets".

Sun, Moon and Earth orbits

1. What shape are the Earth, Sun and Moon?

a) Circular and flat **b) Spherical**

The Earth, Sun and Moon are approximately spherical, 3 dimensional shapes.

2. Which is the correct order of size for the Earth, Sun and Moon, largest first?

a) Moon, Sun, Earth **b) Sun, Earth, Moon**

The Sun is 100 times bigger than the Earth and the Earth is 4 times bigger than the Moon.

3. How long does it take for the Earth to go round the Sun?

a) 1 month **b) 1 year**

It takes 1 year for the earth to orbit the Sun. That's the same as 12 months or 365 days.

4. How long does it take for the Moon to go round the Earth?

a) 28 days b) 1 year

The Moon orbits the Earth once every 28 days.

Sunrise, sunset and day length

1. From which direction does the Sun appear to rise?

a) West **b) East**

The Sun appears to rise in the East - in fact the Sun stays still, it is the Earth which spins on its axis.

2. In which direction does the Sun appear to set?

a) West b) East

The Sun appears to set in the West - in fact the Sun stays still, it is the Earth which spins on its axis.

3. What happens to the time of sunrise between January and June?

a) Sunrise gets later **b) Sunrise gets earlier**

From January to June, sunrise gets earlier and you will see it get lighter earlier in the morning.

4. What happens to the time of sunset between January and June?

a) Sunset gets later b) Sunset gets earlier

From January to June, sunset gets later and you will see that it stays lighter for longer at night.

The phases of the moon

1. How many days does it take for the Moon to orbit the Earth?

a) 28 b) 365

It takes 28 days for the Moon to orbit the Earth.

2. How many days after a new Moon do we see a full Moon?

a) 7 b) 14

The full Moon can be seen 14 days after the new Moon.

3. Why does the shape of the Moon appear to change over its 28 day orbit?

a) The Earth casts a shadow on the Moon.

b) The illuminated side of the Moon is seen from different angles.

The shape of the Moon appears to change because we see the side which is lit by the Sun from different angles as it orbits the Earth.

The Earth only casts a shadow on the Moon when the Sun, Earth and Moon are in perfect alignment and then we get a lunar eclipse instead of a full Moon. This can happen up to 3 times a year.

4. Why is it called a first quarter Moon when we can see half of the Moon's surface?

a) The Moon is a quarter of the way round its 28 day orbit.

b) Early astronomers were not great mathematicians!

The first quarter Moon occurs on day 7 of the Moon's 28 day cycle and as 7 is a quarter of 28, this phase is known as the first quarter Moon.

Thanks for completing this module!