



Theatre of Science Astronomy 1: Earth's Atmosphere

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Today we'll be hearing about:

Light bends when it speeds up and slows down. This means things are not always where they seem!
Sometimes when we can see the Sun above the horizon it's actually below the horizon!

Sunrise and set is caused by Earth's movements not the Sun's!

Stars twinkle because Earth's atmosphere is constantly moving, so light from the stars constantly changes direction. Sometimes it bounces into your eye and sometimes it doesn't.

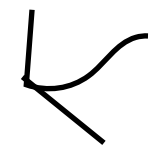
We can't see stars in the day because our atmosphere scatters light everywhere and that makes it very bright, so our eyes are less sensitive.

I'm hoping you'll understand and remember these

You might understand and remember some of this!

To join in with the lesson bring:
Glass of water, coin / key, cereal box, white paper, mobile phone torch or similar, tbsp milk (dairy or non-dairy).

Decide if these statements are true or false. And write **why** you think that!
(Not a test, I just want to see if your answers are better at the end of the lesson)

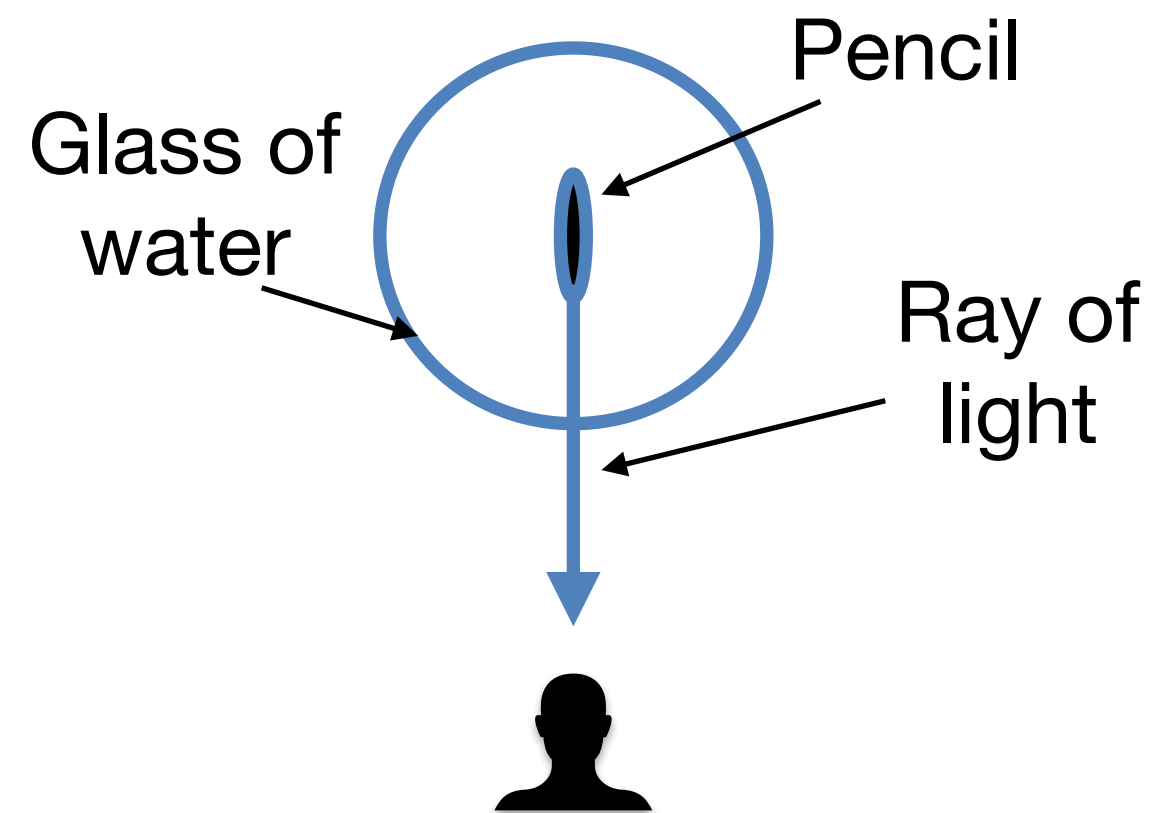
	True/False?	Why d'you think that? 
1. The stars come out at night		
2. The Sun comes up in the morning		
3. No stars are visible during the day		
4. Stars twinkle because they're so far away		

(You might have no clue but I'd still like you to write down any thoughts - good brain exercise!)

Refraction: Light bending when it changes speed.

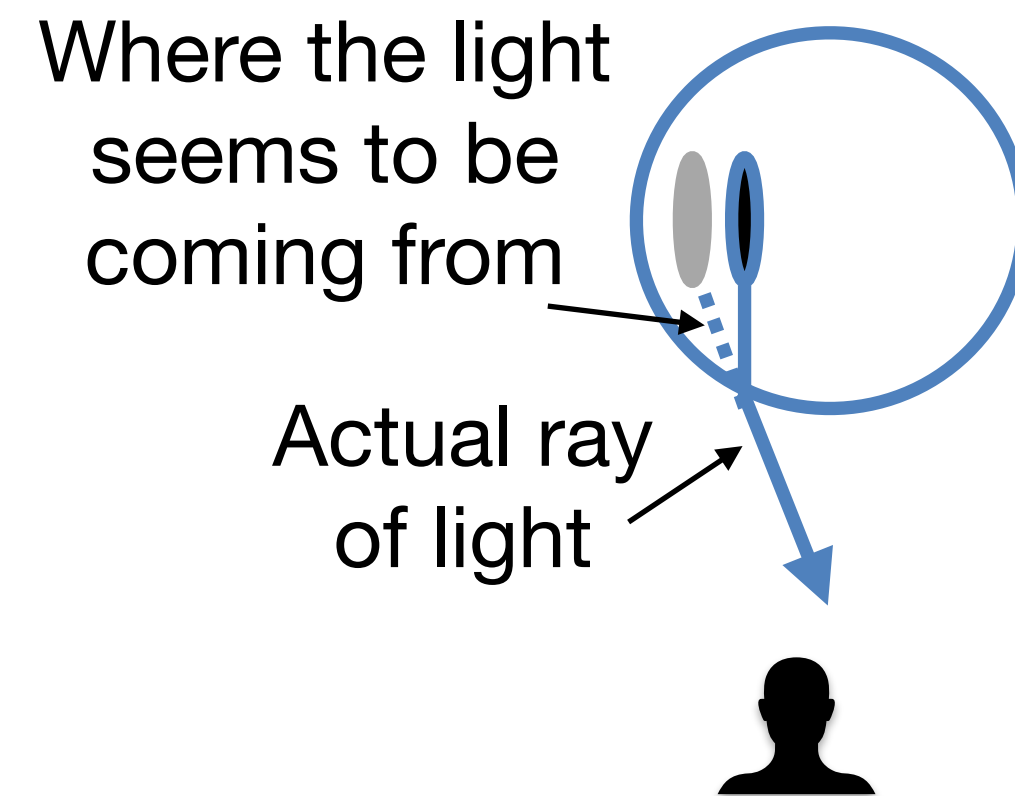
It changes speed when it hits a different 'medium'. Like, when it moves from air to water, or water to glass, or air to glass, etc.

If hitting the medium 'straight on' it doesn't bend.



Person sees the pen in the right place

But if hitting the medium at an angle, it bends.

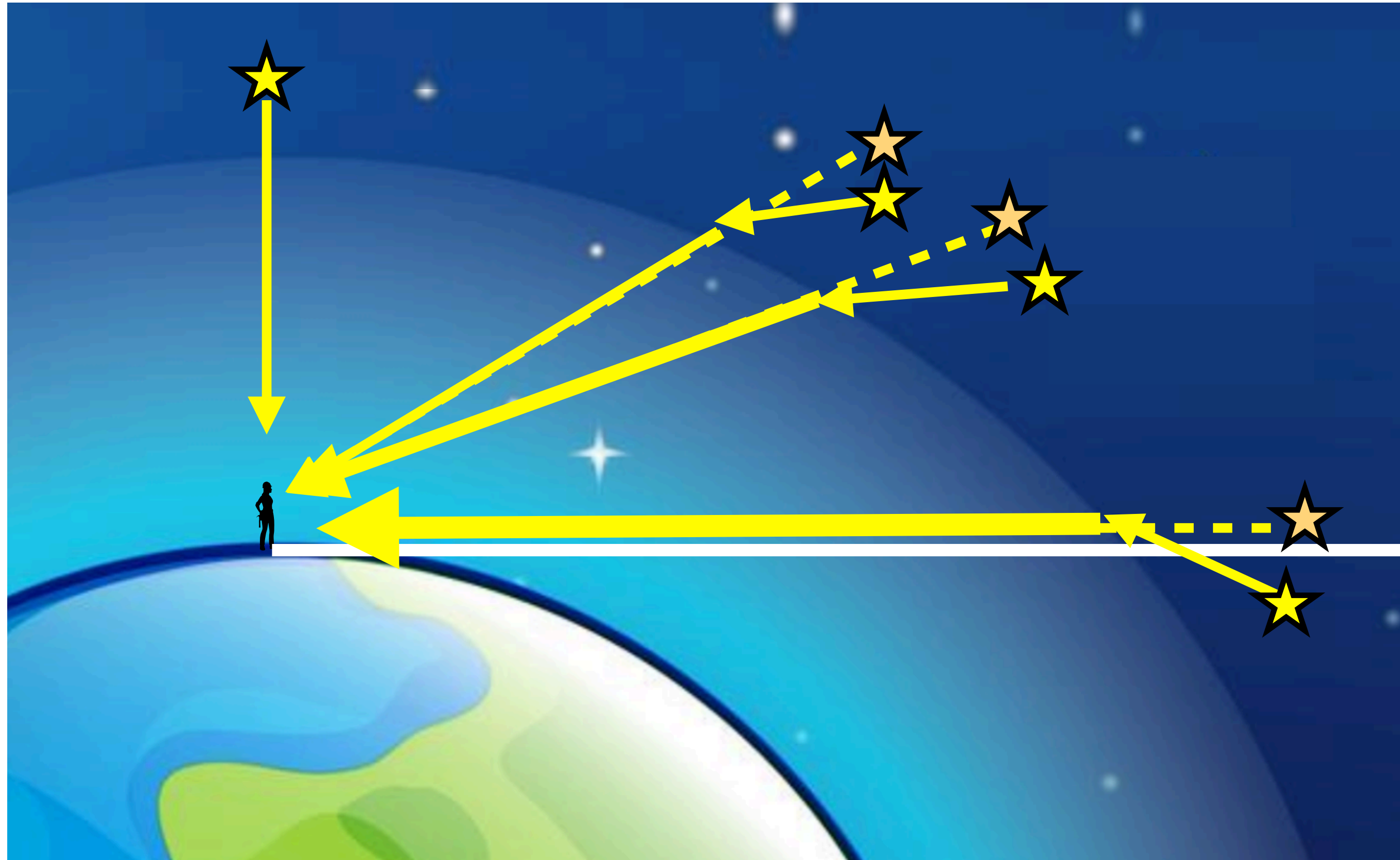


Person sees the pen to the left of where the pen actually is.

Notes

This star appears in the right place

These ones seem to be higher than they actually are.



Study this picture; can you see the cool fact about the sunset?!

Horizon

(the person can't see lower than this white line)

Other problems our atmosphere causes! For your notes.

Stars 'twinkling'.

Chromatic Aberration
(stars looking a bit 'rainbowy'
in a refracting telescope!

Scattering light so our eyes are flooded with it.

Take two! Are these statements true or false?

Can you say **why**?

	True/False?	Why?
1. The stars come out at night		
2. The Sun comes up in the morning		
3. No stars are visible during the day		
4. Stars twinkle because they're so far away		

GCSE questions!

1) Give one disadvantage to using a refracting telescope (1)

2) Why isn't the sky blue on the Moon? (2)

3) What did Galileo see that helped to prove that Earth goes round the Sun?

Saturn's Rings Jupiter's Moons Orion's Belt

Summary questions!

1) Which of these statements is true? (It's more than one!)

-Stars twinkle because their light is bent by Earth's atmosphere.

-Stars twinkle because they alternate between hot and cold.

-Stars twinkle because Earth's atmosphere is constantly moving.

-Stars twinkle because they are very far away so not all their light reaches us.

2) Think of a more scientifically accurate name for 'sunrise' and explain your answer!



Theatre of Science Astronomy 2: The Moon!

THANKS FOR SUPPORTING ME ON KO-FI! I'll send you rainbow glasses, sticker and a magazine for supporting my lessons with £5/£6/£10 a month! It's the only way this can be my job xx

Today we'll be hearing about:

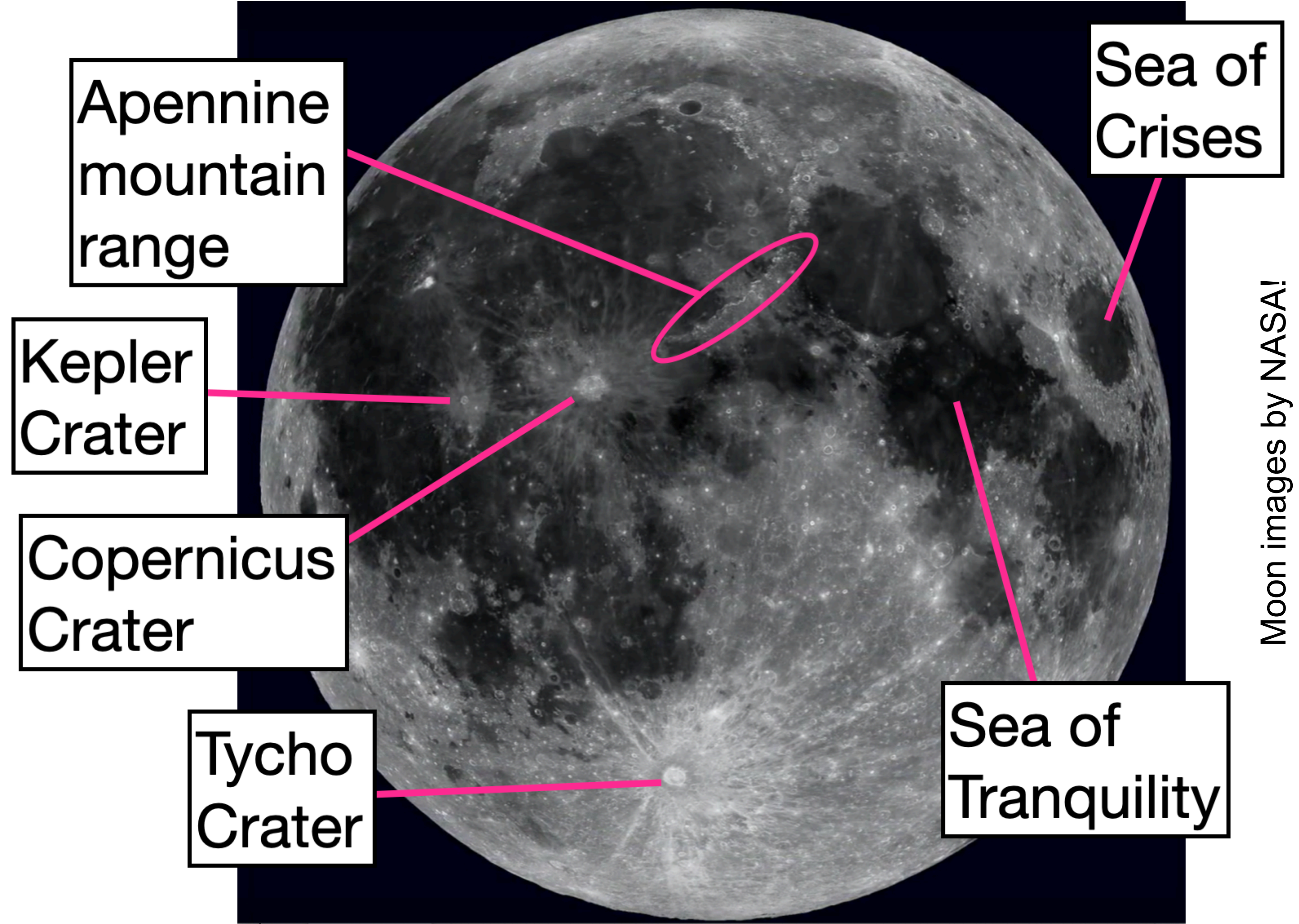
How to recognise a crater and a mare by looking at the Moon.
How craters on the Moon formed
How maria and mountains on the Moon formed

The locations of the Sea of Tranquility, the Sea of Crises, the Tycho, Copernicus and Kepler craters, and the Apennine mountain range

I'm hoping you'll understand and remember these

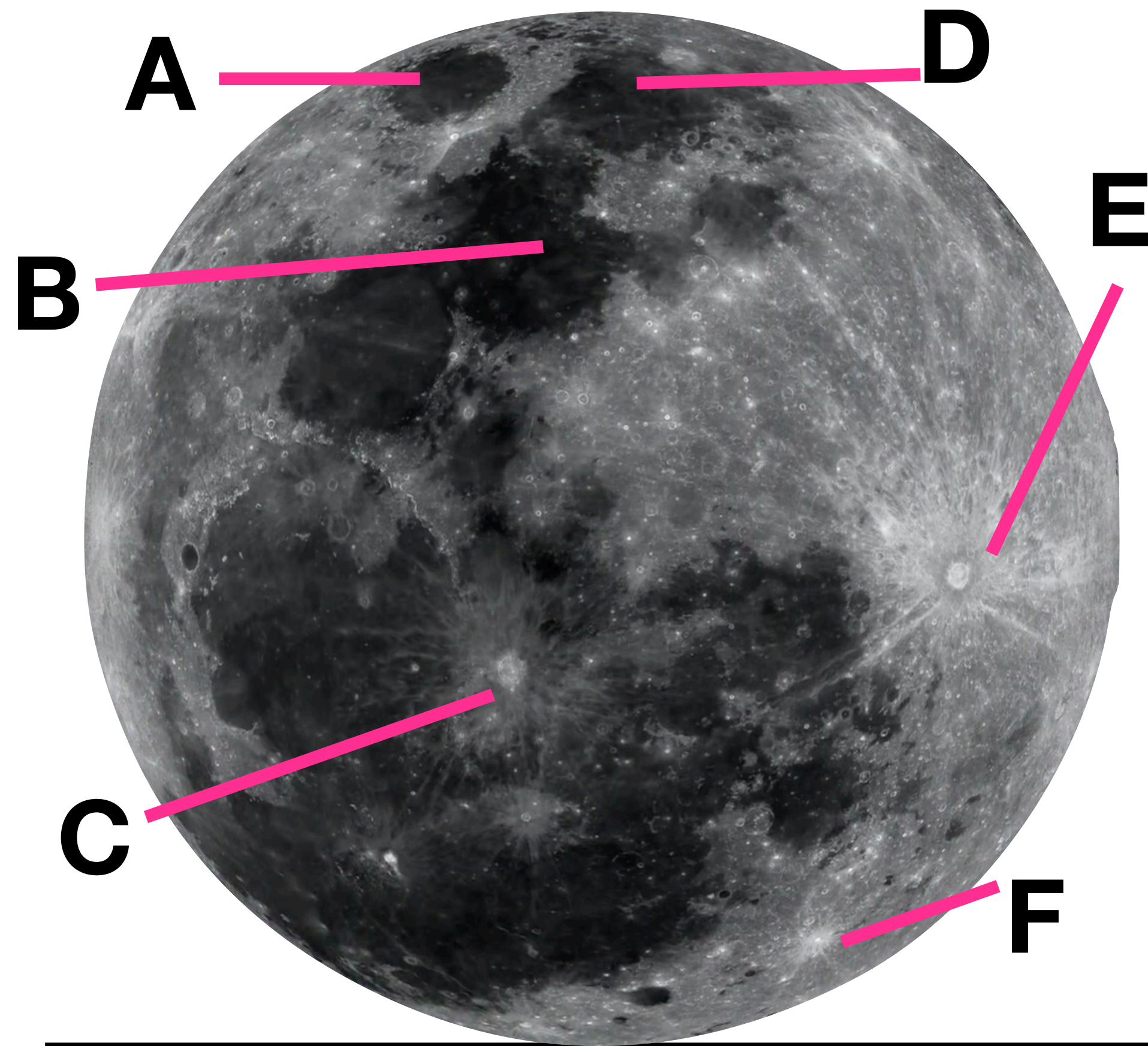
You might understand and remember some of this!

To join in with the lesson bring:
Baking tray, cake tin (or robust bowl!), sieve, flour, cocoa powder (or similar. Powder paint would be good) few pebbles, 100s and 1000s, or similar small cake decorations, or a few crushed pieces of cereal. And, if you don't mind things getting a bit messy, a small jug / glass of water.



Moon images by NASA!

GCSE questions!



1) On the Moon pictured, which letters represent...

The Sea of Crises? _____

The Tycho crater? _____

The Copernicus crater? _____

The Sea of Tranquility? _____ (4 marks)

2) Which sentence best describes the maria?

a. Volcanic rock

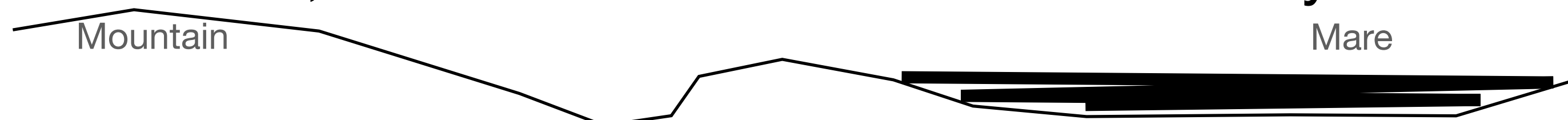
b. Elevated

c. River bed

d. Particulate

Summary task!

Sketch as many features of the Moon from side on as you can think of, and label them to show how they formed.



After-lesson task!

Go outside when the Moon is bright and describe what you can see to a family member!



Theatre of Science Astronomy 3: Sun Moon and Earth

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Today we'll be hearing about:

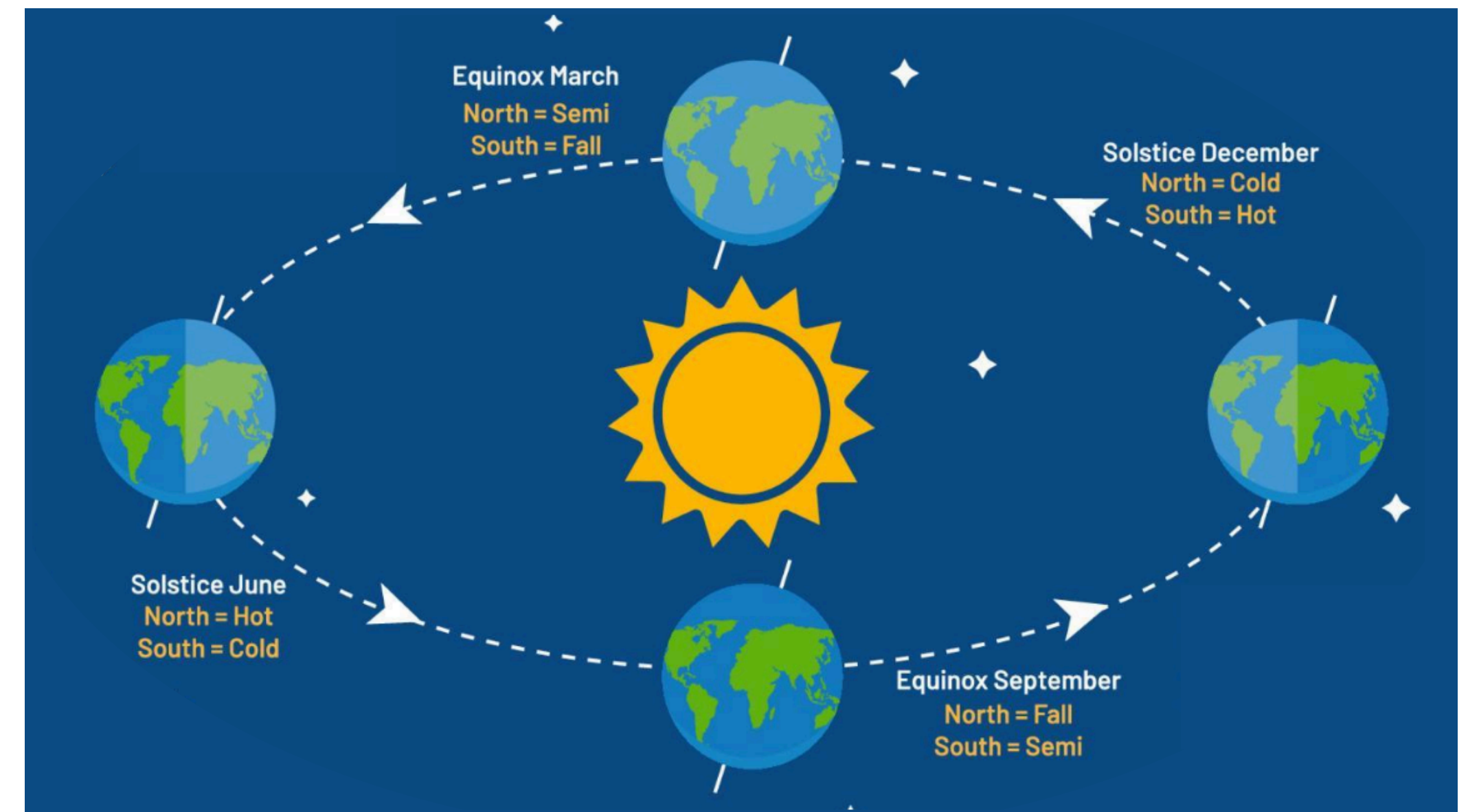
The relative size of the Moon, Earth and Sun
What a solar eclipse is, and why they happen

I'm hoping you'll understand all of this!

The meaning of solstice and equinox, and why they happen
How to make and improve models of the Sun, Moon and Earth's movements.
How to do simple equations to help build scale models

I'm hoping you'll understand and remember some of this!

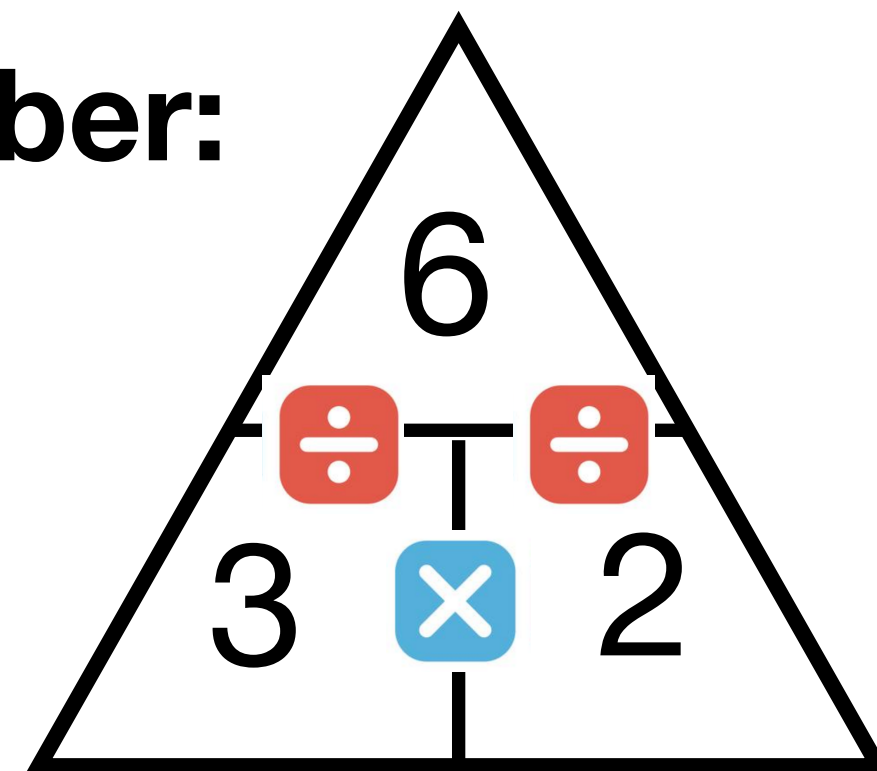
(This might helpful for note-making)



To join in with the lesson bring:
A4 paper, ruler, scissors, colouring pens, calculator, two tins of food (full!), sellotape/blu tack

Try these! Remember:

this $\frac{6}{3} = 2$ this many times
fits into this



3) Using information from 1) and 2), work out the diameter of the Moon.

1) In a scale model, Earth is 5mm and the Moon is 1.4mm. How many Moons would fit across Earth?

2) The moon's about 384 400 km from Earth. Earth's diameter is 12 756km. How many Earths fit between Earth and the Moon?!

4) Sun is 400 times wider than the Moon. A4 paper is 210mm wide. We want to draw scale pictures. If we make the Sun 210mm, how wide must the Moon be?

Reminder: There are LOTS of DIFFERENT people watching. You're not competing with these randoms! If you spend 5 minutes on 1) then understand once I tell you, that's a good lesson.

You walk into a library as two students are leaving, and sit at their table.

2) Why is this a good model, and how could it be improved? (List as many ways as you can).

1) What have they been discussing?

A. Eclipses B. Equinox C. Solstice

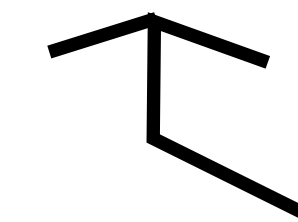
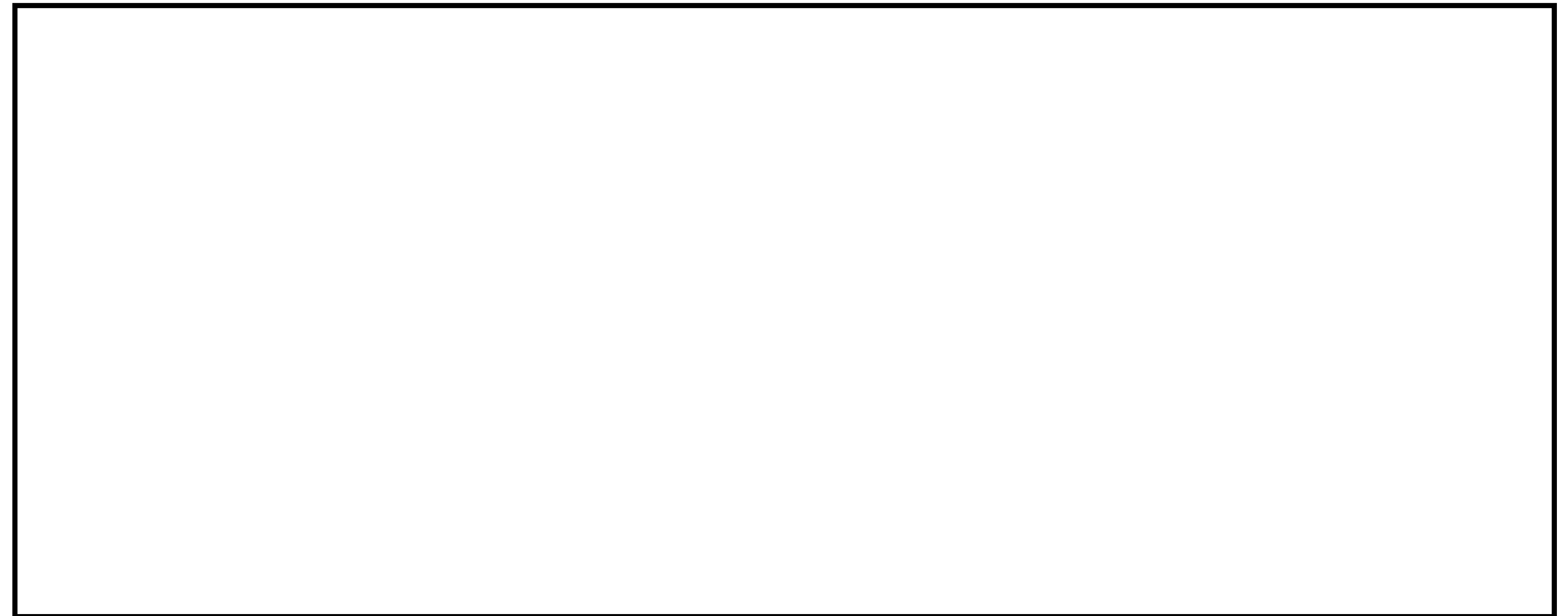
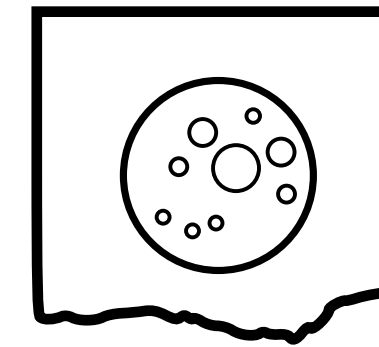
3) Write or say a short paragraph to explain what is going on!



We're in a cafe revising solar eclipses. You say you'll start while I go to the loo, but when I get back you're drinking hot chocolate and eating biscuits!

1) Arrange the biscuit, picture of the Moon and drink on the table to convince me you have been revising eclipses. Label what each thing represents.

2) It's a disposable tablecloth - write notes on it to explain what's happening.



The table

GCSE questions!

1) Which of these is closest to the Moon?

A. Earth B. The Sun C. Mars D. Venus

2) An artist will paint a scale model of the solar system along a main road. If the painting of the Sun is 400m long, how long is the painting of the Moon?

A. 100m B. 10m C. 1m D. 0.1m

3) Sketch and label the Sun, Moon and Earth as they're positioned during a total solar eclipse (2)

Summary questions!

During a total solar eclipse our view of...

- The Moon is blocked by the Sun
- The Sun is blocked by the Moon
- Earth is blocked by the Moon

It's hotter in summer because...

- Earth is closer to the Sun
- Earth is tilted towards the Sun
- The Moon stops blocking the Sun's rays

Explain why during some eclipses, the Sun is visible in a 'ring' around the Moon.



Theatre of Science Astronomy 4: Constellations!

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Today we'll be hearing about:

Whether the stars move in the sky
What a constellation is

I'm hoping you'll understand all of this!

The difference between a constellation and an asterism

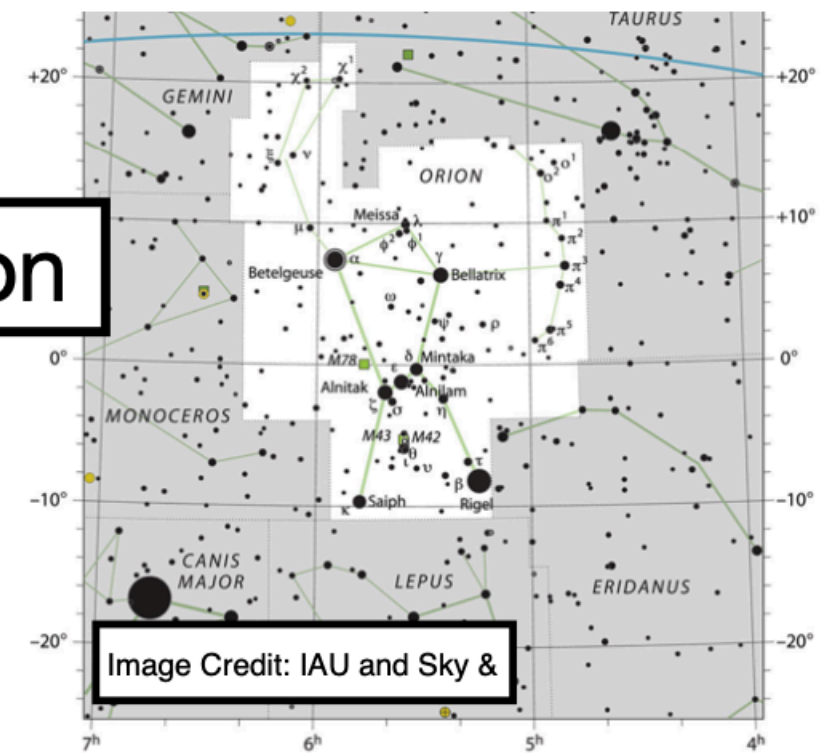
The significance of the zodiac constellations
What precession is and how it affects the North Star

I'm hoping you'll understand and remember some of this!

To join in with the lesson bring:
Full can of food, cardboard (corrugated/cereal box, any!), short, sharp pencil. scissors pen. (Plus adult supervision for stabbing pencil through card! We're making a spinning top.

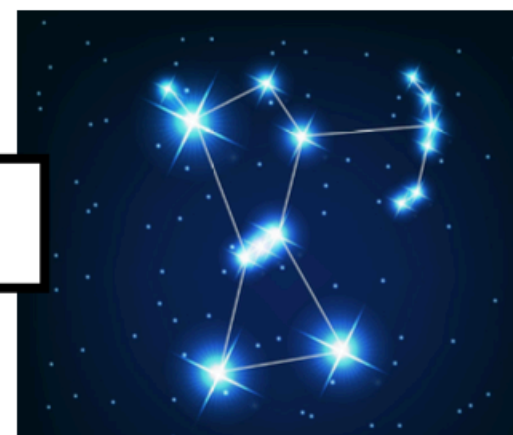
Which one is an asterism, which is a constellation, and which is technically neither?! Draw a line to match them correctly.

1. Orion



Constellation

2. Orion



Asterism

3. Orion's belt



Neither (to be really official about it)

GCSE questions!



- 1) The image shows a close up of a spherical model from the 18th century. What is it a model of? (1)

- 2) Which of the following is an asterism?
- A. Orion
 - B. Ursa Major
 - C. The Plough
 - D. Ursa Minor

- 3) What is the name of the North Star?
- A. Alderamin
 - B. Vega
 - C. Gamma Cephei
 - D. Polaris

Summary questions!

1. Write down three things you know now that you didn't know at the start of the lesson!
2. Why, in some photos, do the stars appear to 'swirl' in the sky?
Explain in **as few words as you can!**
3. Why are the zodiac constellations special to astronomers?
- A. They can predict your personality
 - B. They're the best for navigation
 - C. The Sun 'travels through them' throughout the year



Theatre of Science Astronomy 5: The Planets!

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Today we'll be hearing about:

The order of the planets
The plane of their orbits
How they formed

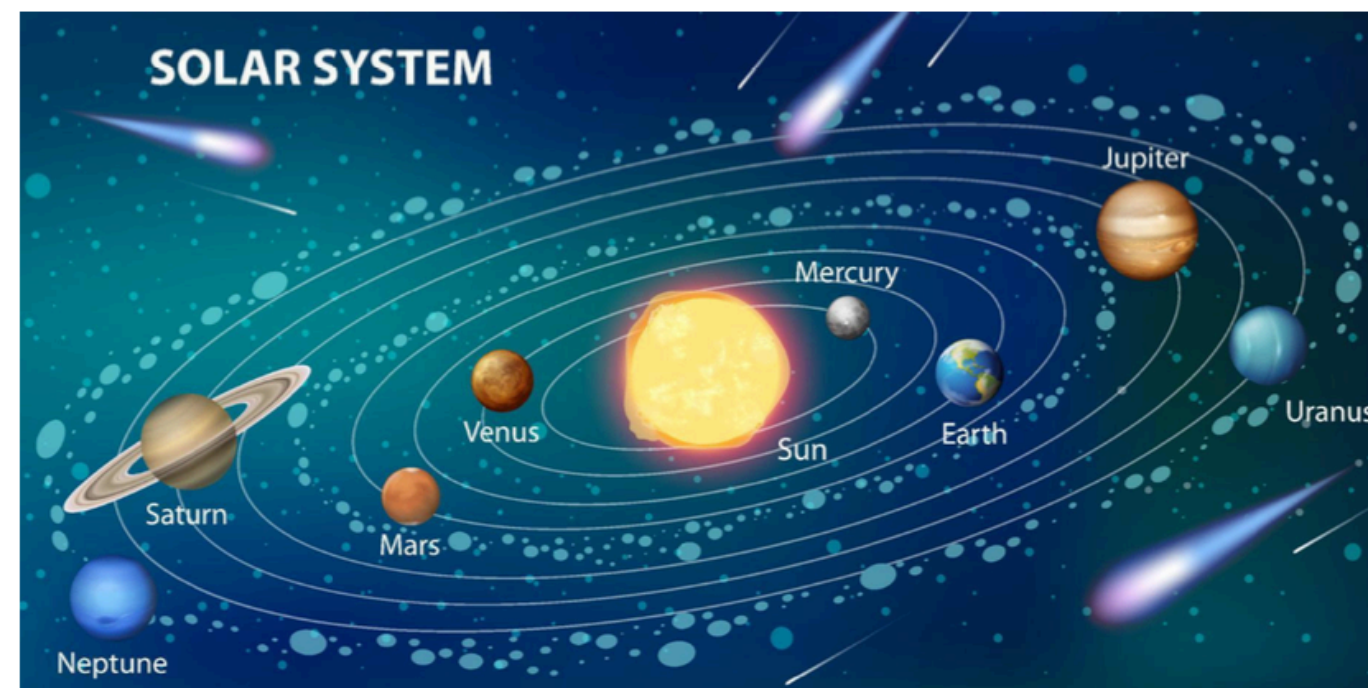
I'm hoping you'll understand all of this!

Why the rocky planets are closer to the Sun
Why Venus is the hottest planet
How Venus is spinning 'backwards' and Uranus is on its side

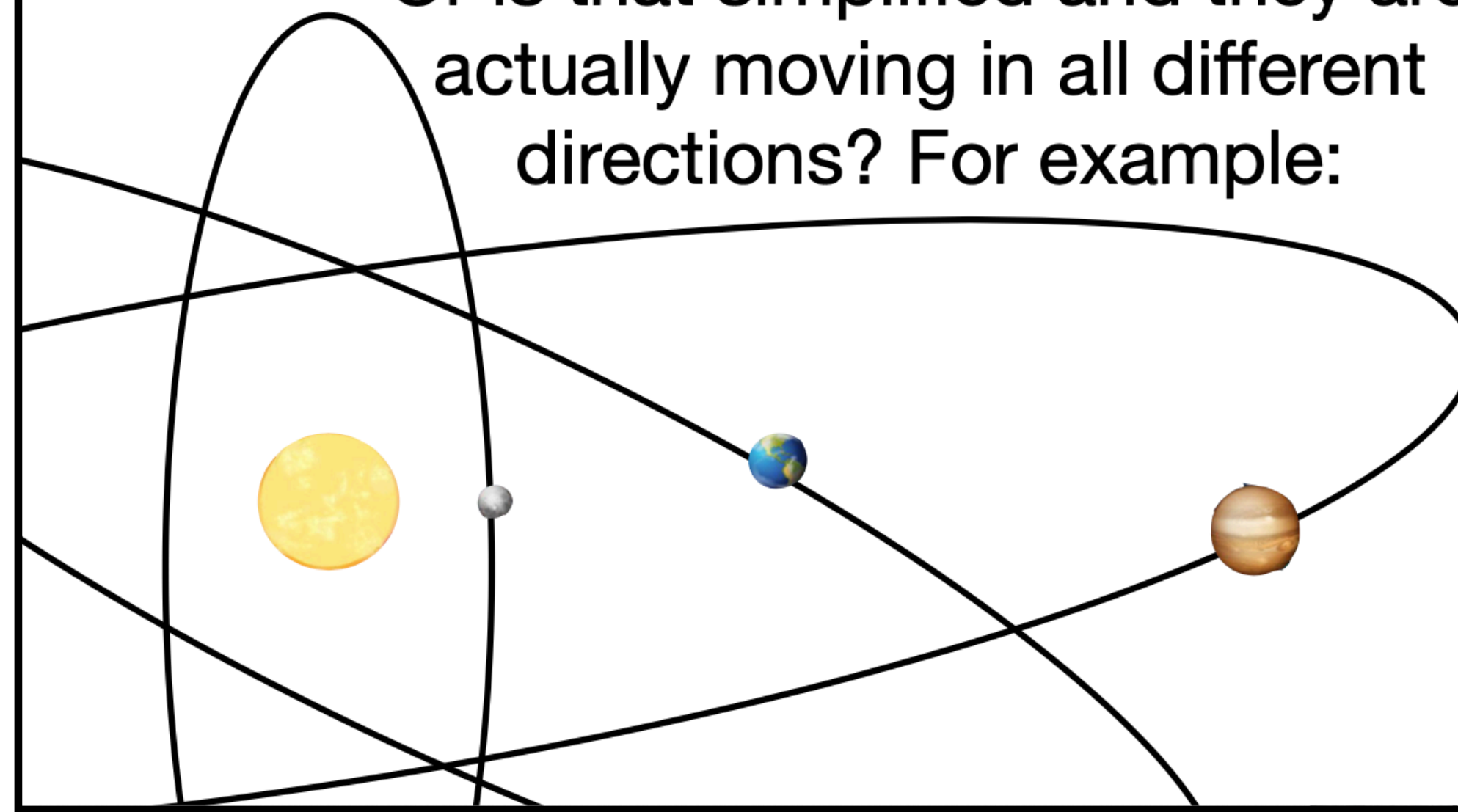
I'm hoping you'll understand and remember some of this!

To join in with the lesson bring:
Baking tray or large plate, tablespoon of flour/powdered spice (eg cinnamon, turmeric), sugar, rice.

How do the planets orbit the Sun?
Do you think this classic image is accurate?

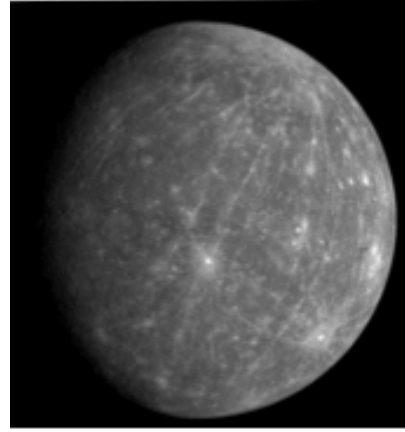


Or is that simplified and they are actually moving in all different directions? For example:

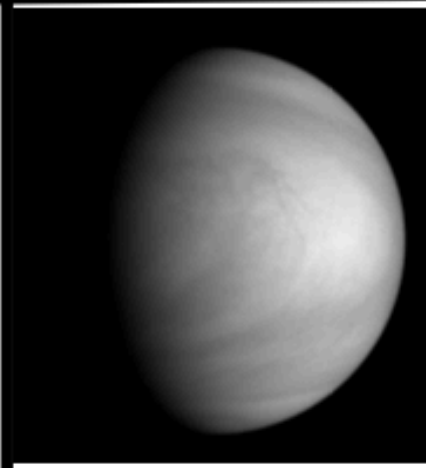


Why do you think that?

The Planets! You may want to make notes on these throughout the lesson!



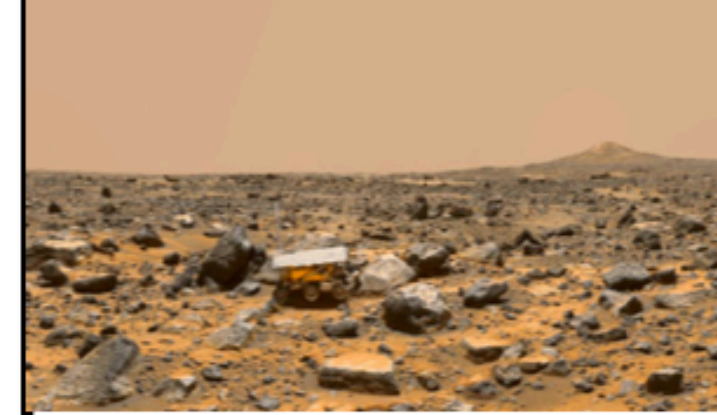
Mercury



Venus



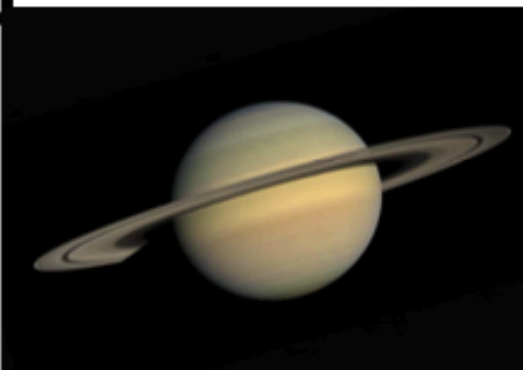
Earth



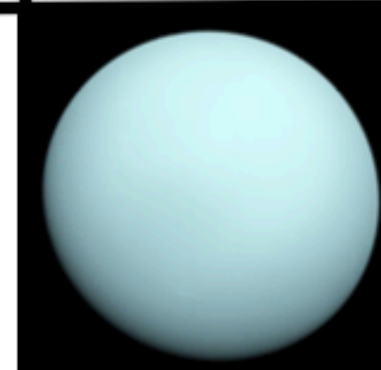
Mars



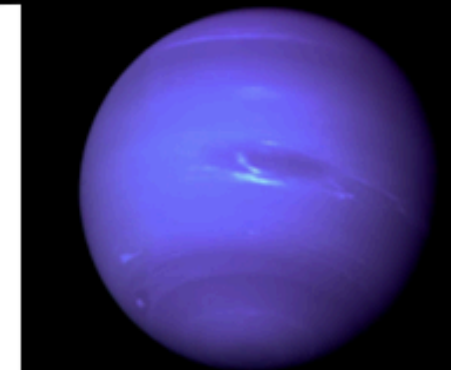
Jupiter



Saturn



Uranus



Neptune

GCSE questions!

- 1) Why isn't Mercury the hottest planet in the solar system? (1)
- A. Other planets are closer to the Sun
 - B. Its atmosphere reflects heat
 - C. It has no atmosphere to trap heat
 - D. It's spinning too fast

2) What shape is Earth?

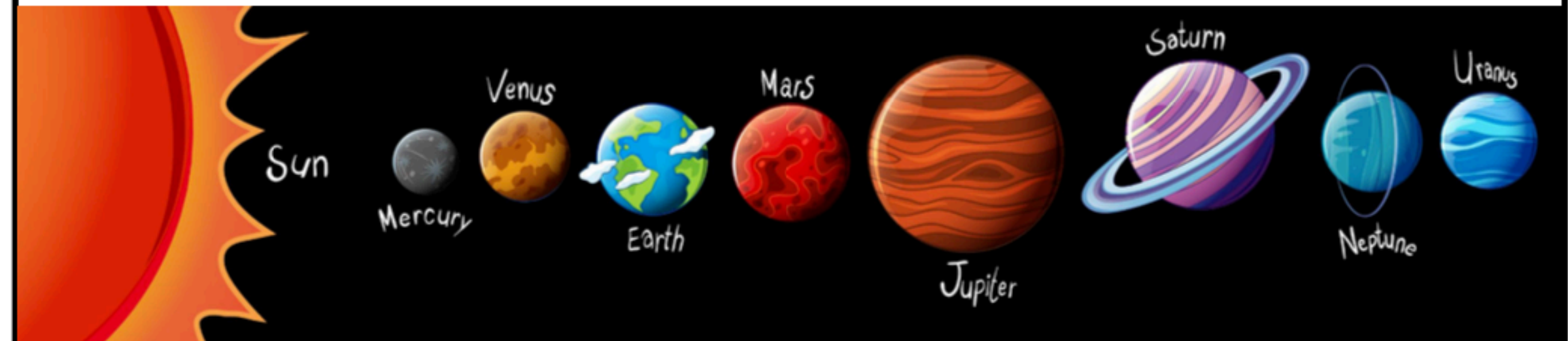
- A. A sphere
- B. A circle
- C. An oblate spheroid
- D. A prolate spheroid

3) How many planets in our solar system have rings?

- A. 1
- B. 2
- C. 4
- D. 6

Summary questions!

Look at the image below.



In what ways is it accurate?

What would you add to improve it?



Theatre of Science Astronomy 6: Comets and Meteorites!

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You might want to add notes and pictures to this solar system throughout the lesson!

Today we'll be hearing about:

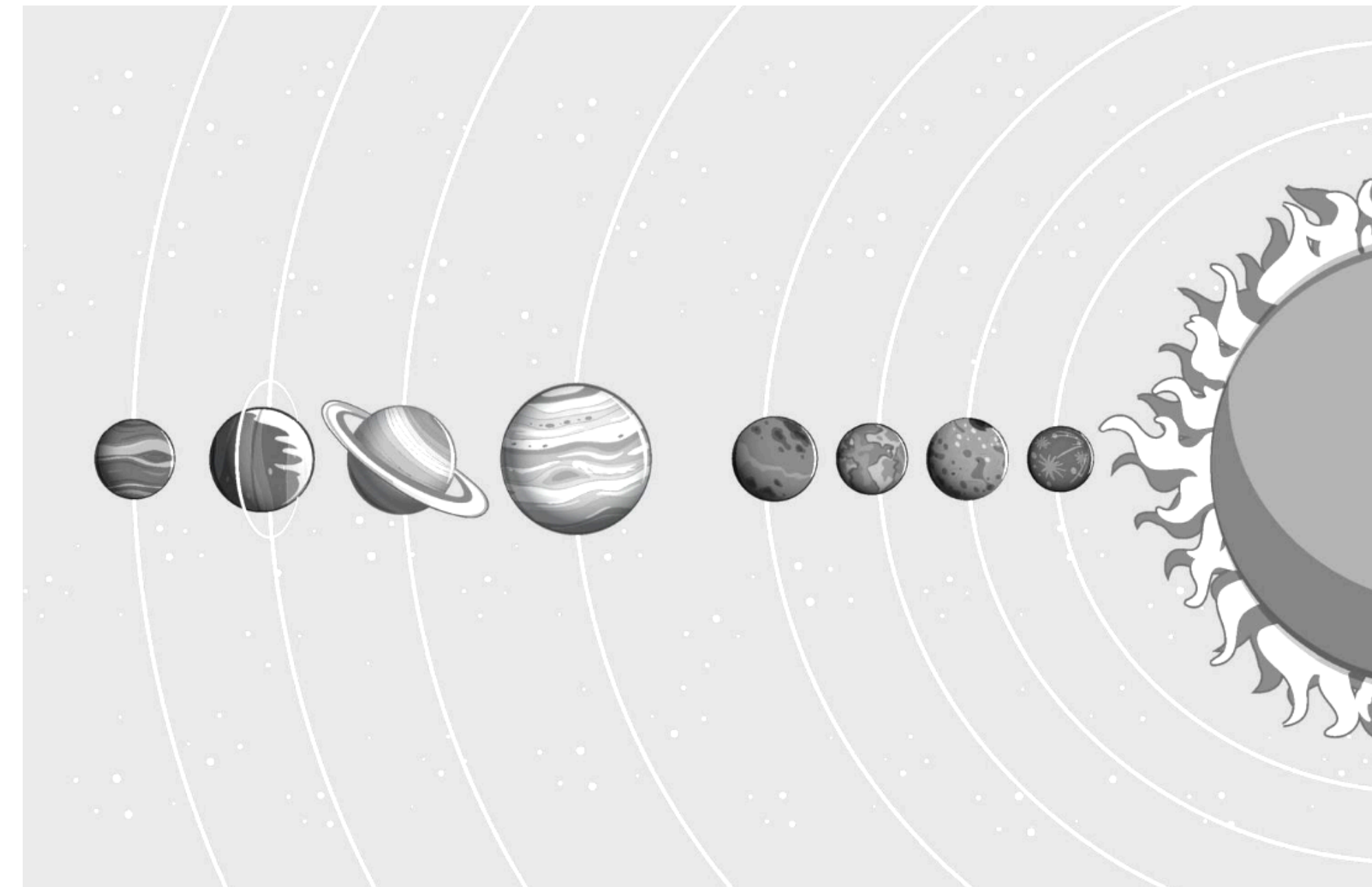
What comets are made of
The basic parts of a comet
The difference between a meteoroid, meteor and meteorite

I'm hoping you'll understand and remember these

The different places comets come from
The difference between short and long period comets and the differences between them

I'm hoping you'll understand and remember some of this!

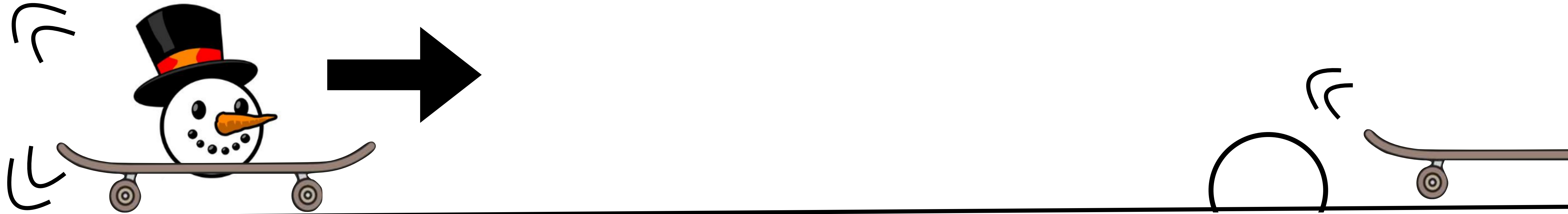
To join in with the lesson bring:
A4 paper, paint, brush and water, baking tray, toilet roll, sellotape, scissors, a sock!



What are comets?

A snowman is riding a skateboard (like they do). As it rolls along, it melts and bits fall off. Draw the mouth, hat, eyes, nose, and melted snow where you think they might land.

The head is the last thing to fall off the skateboard! It has been drawn for you.



Done? Pretend you're floating in the sky and draw what the melted snowman looks like from above.



Why is a comet a bit like this melted snowman?

How is a comet different?

GCSE questions!

1) The comet Swift-Tuttle gets close to the Sun every 135 years. What is Swift Tuttle?

- A. A short-phase comet
- B. A short-period comet
- C. A long-period comet
- D. A long-phase comet

2) The photo shows Halley's Comet in 1910. Which letter might mark the position of the Sun? (Distances are not to scale)



3) In 1992 a rock fell from space and hit a car in New York City. What was the rock?

- A. A meteoroid
- B. A comet
- C. A meteorite
- D. A meteor

Summary questions!

Where do comets come from?

- A. The Oort Cloud
- B. The Kuiper Belt
- C. Both A

Would you be excited to see a comet?

Explain why / why not using as many ideas from this lesson as you can. Do add your own too!



Theatre of Science Astronomy 7: Spotting Stuff in the Sky!

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I'll send you rainbow glasses, sticker and a magazine for supporting my lessons with £5 a month.

Today we'll be hearing:

That stars twinkle and planets don't
That galaxies can be seen from Earth with the naked eye!
How to improve your chances of seeing objects in the night sky.

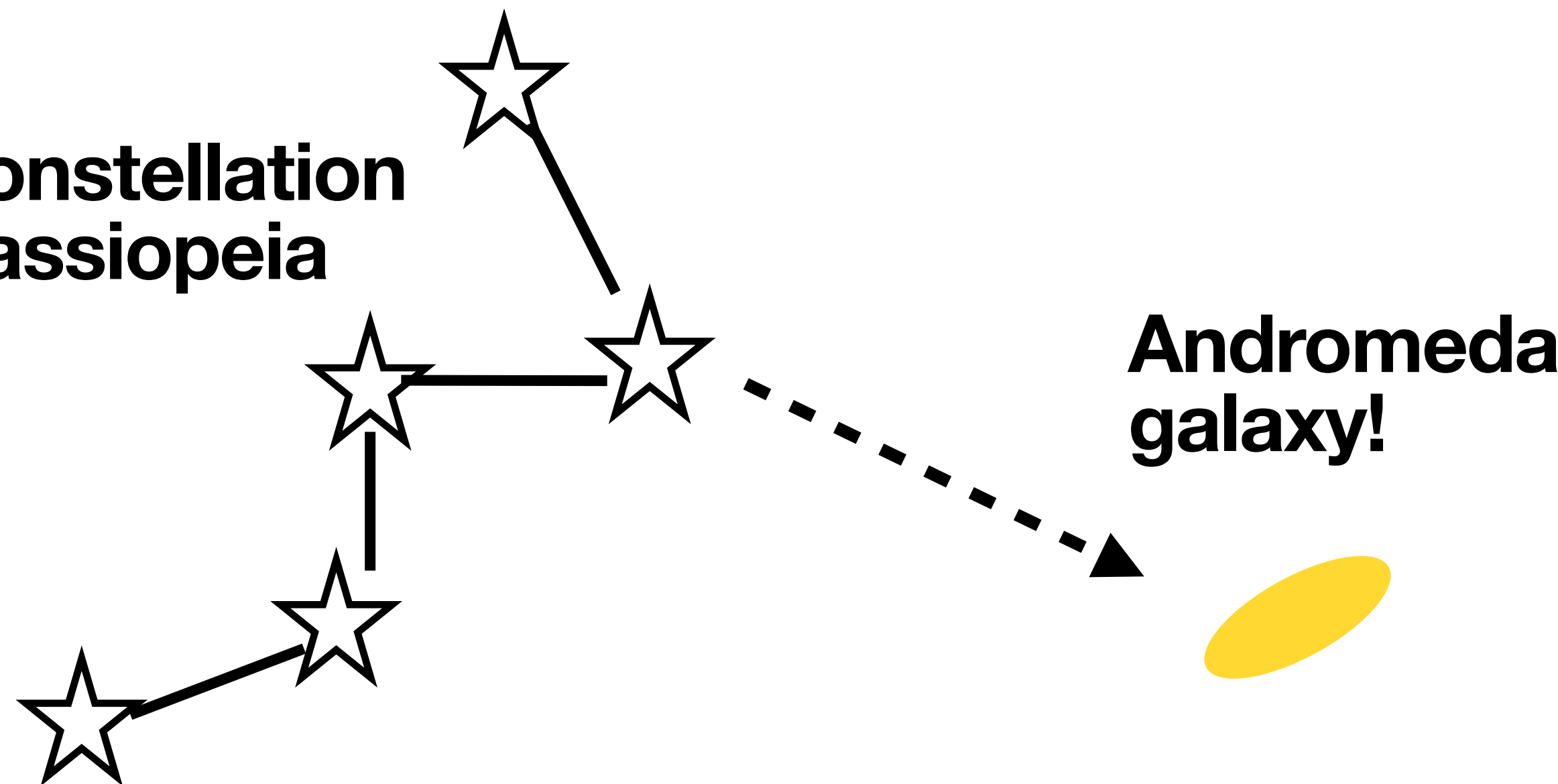
I'm hoping you'll understand and remember these

Why stars twinkle and planets don't
How to tell the difference between a plane, a meteor, a satellite and a comet
How the averted-vision technique can make dim objects appear brighter

I'm hoping you'll understand and remember some of this!

How to spot the Andromeda galaxy

Constellation Cassiopeia



To join in with the lesson bring:
Glass of water, any coin, pen and paper

1. Delete the incorrect words to explain why stars twinkle.

Stars are so far away that they look like *points / diamonds / rays* of light. This light is bounced about by Earth's *atmosphere / clouds* and *always / doesn't always* make it into our eyes. So the star appears to twinkle.

2. Why is it not quite right to say “planets make more light than stars”?

3. Mars looks red in the sky. How could you tell the difference between Mars and an aeroplane that had a red light on it? Write down your ideas.

1. For each sentence, decide what the object is and put the right letter in the box

Satellite	Planet	Plane	Star
T	E	H	S

- Pin point of white light moving slowly across sky
- Flashing red and moving
- Dim red light not moving or blinking
- Pin point of white light blinking on and off
- Dim yellow light not moving or blinking

2. Now do the same but also consider these objects!

Comet	Meteor
R	I

- White and not moving, seen at midnight
- Flashing red and green not moving across the sky
- White, moving fast for 3 secs then disappearing
- A bright light with a long tail
- White and moving slowly across the sky without disappearing

GCSE questions!

1) Which of the following does NOT orbit Earth?

- A. Moon
- B. Comet
- C. Satellite
- D. International Space Station

2) A photographer took a picture of the Andromeda galaxy. They said “it looks the brightest because it’s closest to our own galaxy”. Explain why the photographer is wrong.



3) What do a comet, a planet and a satellite have in common?

- A. None of them give off light
- B. None of them orbit the Sun
- C. None of them can be seen with the naked eye
- D. They all appear to move across the sky

Summary questions!

Fold a piece of paper in half three times so the creases show eight rectangles. Write a different name in each rectangle: **Satellite, Mars, Venus, Jupiter, Plane, Star, Comet, Meteor.** Then write some bullet points explaining how you can spot those objects in the night sky!