

HANDS ON THE PLANETS

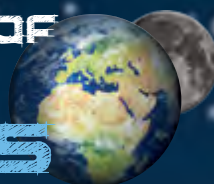


Science and
Technology
Facilities Council



THIS BOOK BELONGS TO:

LITTLE BOOK OF
THE
PLANETS
ACTIVITY BOOK

A small illustration of the Earth and the Moon, with the Earth showing blue oceans and green landmasses, and the Moon showing its grey surface.

WELCOME TO HANDS ON THE PLANETS

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DESIGN AND GRAPHICS: BEN GILLILAND
OTHER IMAGES: NASA, ESA

Now you have read all about the planets and how we explore them in our resource booklet, *'The Little Book of the Planets'*, it is time to get those neurons firing. Here you will find a selection of activities all based around our Solar System: some are science themed, some maths, some literacy, art or cross-curricula – there is something for everyone.



Each activity has been written pitched directly at your students so, as their teacher, all you need to do it print or photocopy the pages you need and away you go – no extra preparation needed. We have included the teachers notes at the back just in case you need to check anything too.

Hands On Planets Daily News

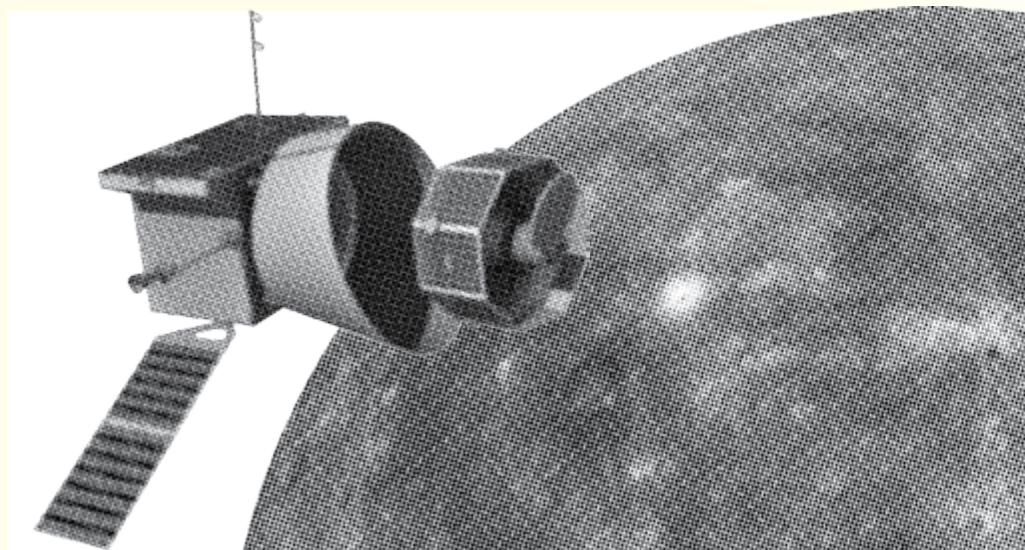
Special edition!

Mercury: the small planet with big stories to tell

Mercury doesn't have wild storms, raindrops the size of mini marshmallows, or lots of moons to investigate, but don't be fooled – this is one interesting planet with much left to learn about it.

The NASA mission Mariner was the first ever to fly past Mercury and check it out. NASA's Messenger was next up and the first to actually orbit the planet. ESA's BepiColombo is next on the list made up of two

spacecraft working together to find out more about this mysterious world. Reporting accurate data on missions is very important so everyone understands what has really been discovered and how.



Left: BepiColombo is a joint mission of the European Space Agency (ESA) and the Japan Aerospace Exploration Agency (JAXA) to the planet Mercury.

Can you be a science writer?

Take the role of a science journalist and write a news article about one, two or all of the missions mentioned if you like and what they found out.

- Was there something especially interesting?
- Did anything go wrong?
- Was it fixed?
- What is next?

You will need to do some research to find out more about the Mariner, Messenger and BepiColombo missions before you get cracking. Once you have your facts, away you go.

2 VENUS WATCH OUT FOR THAT VOLCANO!



BUILD YOUR OWN VENUS-SCAPE (WITH ERUPTING VOLCANOS!)



Venus is a very interesting planet indeed. It is not the closest planet to the Sun but it sure is the hottest. You could even cook a pizza without an oven there! It also has more volcanoes than any other planet in our Solar System which means it would be a pretty tricky place to go for an afternoon stroll around.

We may not fancy a holiday to Venus but we can still experiment with what it might be like on the surface of this fascinating planet. Why not make your very own Venus landscape complete with erupting volcanoes!

YOU WILL NEED:

- Bicarbonate of soda
- Vinegar
- Washing up liquid
- Food colouring
- Cardboard tubes of different shapes and sizes
- An old box



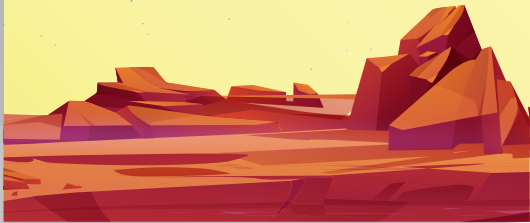
2.1 VENUS WATCH OUT FOR THAT VOLCANO!

HANDS ON THE PLANETS

HOW TO BUILD YOUR VENUS-SCAPE

LANDSCAPE

You can use things you find around your classroom and recycle them into your very own Venus-scape inside your box. Don't forget to add paint to make it extra realistic!



VOLCANOS

One of the things that makes Venus so special is the amount of volcanoes it has – all different shapes and sizes. Using cardboard tubes, papier-mâché mountains, beakers, cups and flasks (whatever you have) set out a collection of different volcanoes on your landscape.

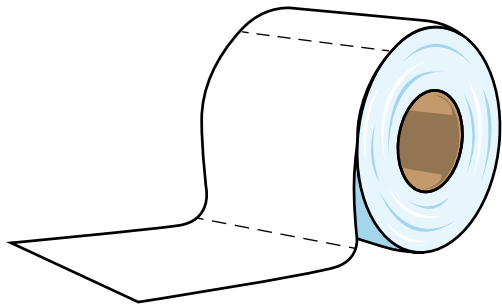


Remember to add some small, big, narrow and even some very wide volcanoes to your Venus landscape – really mix things up so you can test which spews lava the best!

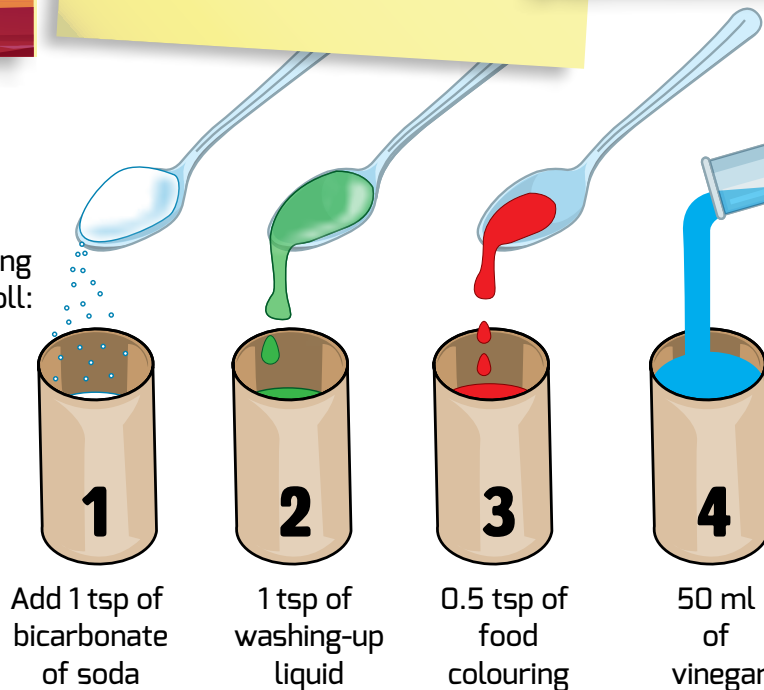
If you are using smaller or larger volcanoes you will need to change the amounts of ingredients you use. Your teacher will be able to help you with this to make sure it isn't one massive Venus mess!

ERUPTION TIME!

Note to scientists - these measurements are based on you using a volcano the same size as a toilet roll:



Use all the loo paper first



1
Add 1 tsp of
bicarbonate
of soda

2
1 tsp of
washing-up
liquid

3
0.5 tsp of
food
colouring

4
50 ml
of
vinegar



STAND BACK!

Chat with your classmates about which volcano you think was the best.

- Why do you think that was?
- Do you think the shapes of the volcanoes had anything to do with it?
- Why?

3 EARTH BLUE SKY THINKING

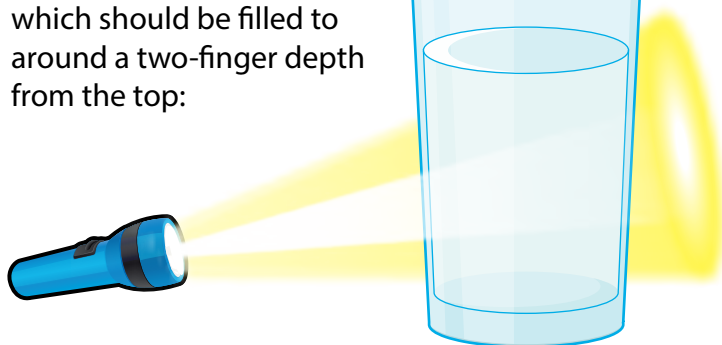


FROM BLUE SKY TO YELLOW SUNSET

If you have ever looked at a sunset and wondered how the sky goes from a beautiful blue colour to reds and yellows then this is the activity for you because you can actually test it out.

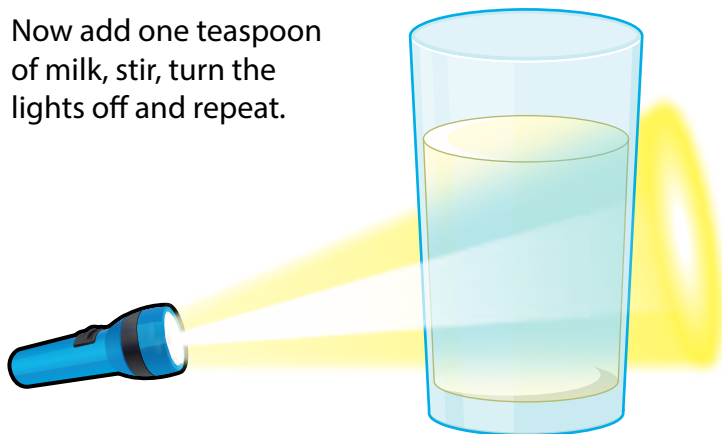
MAKE A BLUE SKY

- 1 First things first – point the torch at the glass of water which should be filled to around a two-finger depth from the top:



What do you see? Nothing much right? This is because the torch is playing the role of the Sun and the glass of water is our Earth's atmosphere all sparkly clean with absolutely no extra particles or dust in it so the light can just pass straight through without any problems – easy-peasy.

- 2 Now add one teaspoon of milk, stir, turn the lights off and repeat.



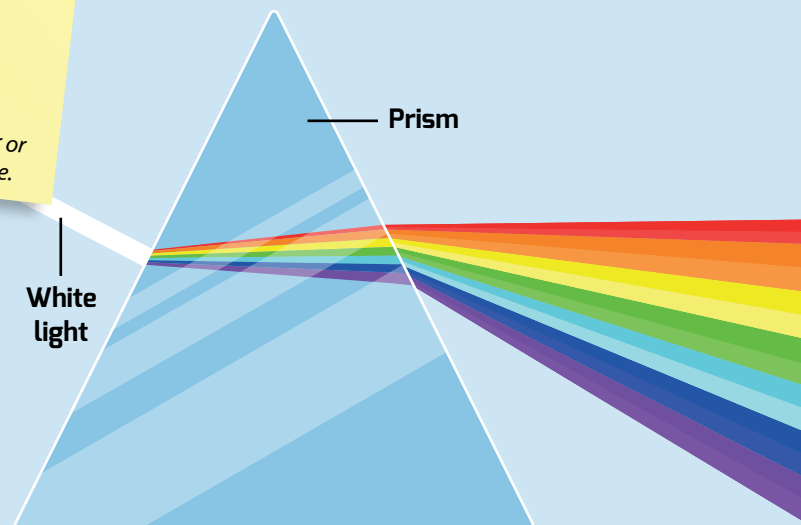
You should start to see the liquid turn a pale blue colour. This is because the clear atmosphere has had a serious amount of extra particles (the milk) added to it. This means that the light doesn't have such an easy time travelling through the liquid and is scattered instead. Blue light is the part of white light that scatters the most. This is what happens with our sky: light from the sun is scattered by particles in our atmosphere like nitrogen and oxygen and, as blue is scattered the most, we see it!

YOU WILL NEED:

- A tall glass or vase
- Milk (full fat works best)
- A teaspoon
- A tablespoon
- A torch

NOTE – the quantities here are for a pint glass of water. If yours is bigger or smaller you will need to adjust a little.

This is how scattering works – the white light is split into a rainbow when it travels through something like a prism or our atmosphere.



WHY NOT A VIOLET SKY?

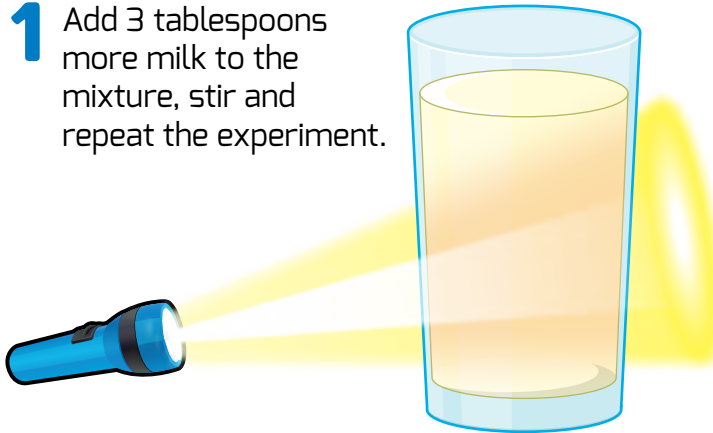
Good question! You may be looking at the diagram above and wondering why our eyes select blue not violet if our eyes pick up the most scattered the most easily.

Well, there isn't a lot of violet in sunlight plus our eyes are much more sensitive to blue light which is why we see it best. Imagine that though – a purple sky would look pretty amazing!

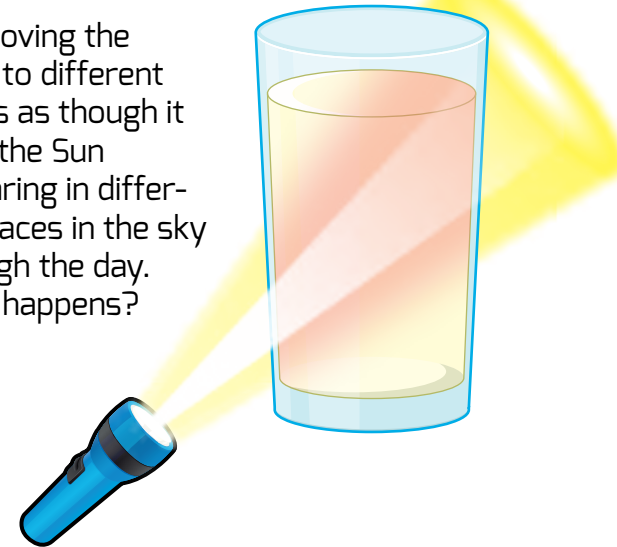
MAKE A SUNSET

We've seen that a little milk causes some blue light to scatter but what happens if we add lots of extra milk? Well, it will simulate what happens when the sun dips closer to the horizon and has much more atmosphere to travel through.

- 1 Add 3 tablespoons more milk to the mixture, stir and repeat the experiment.



- 2 Try moving the torch to different places as though it were the Sun appearing in different places in the sky through the day. What happens?



You should see that the liquid changes from pale blue to a more yellow/orange colour. Bingo! You have made your very own sunset in a glass! Amazing right?

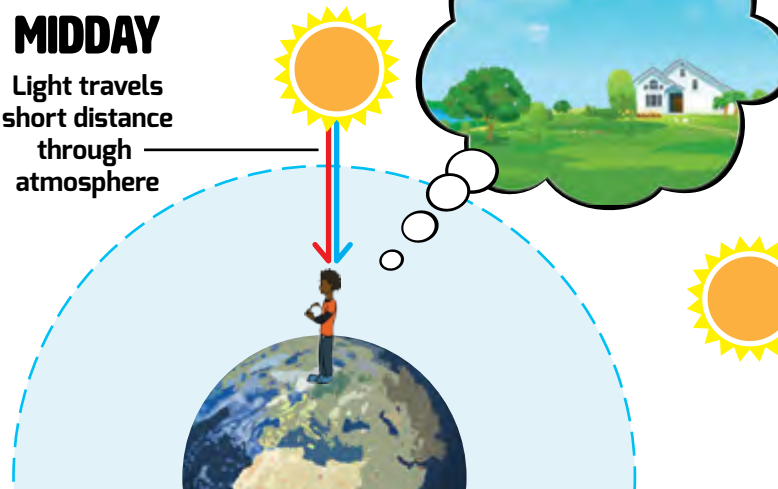
SO WHAT'S REALLY HAPPENING?

When there is more milk in the glass the light is having to interact with a LOT more particles than when there was less milk in the glass.

This is the same thing we see with light travelling through our atmosphere at sunset – it has much further to go so will interact with more particles. This means that as blue light is scattered most strongly it won't reach our eyes and will be scattered away. What is left is the yellow/red light which isn't scattered as much and makes it all the way to our eyes!

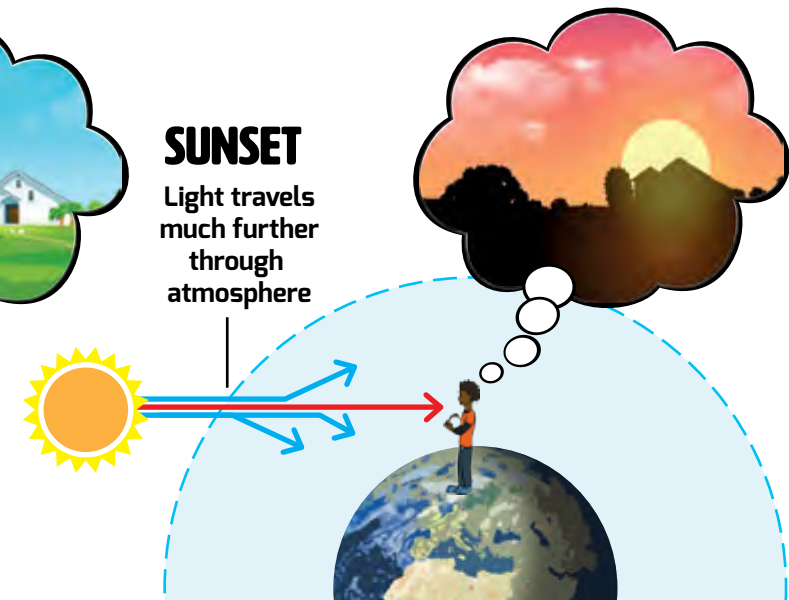
MIDDAY

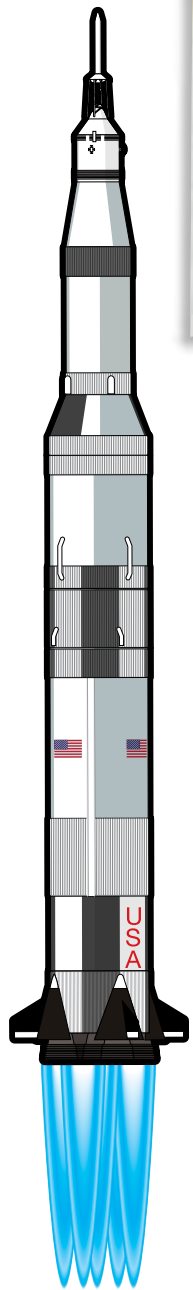
Light travels short distance through atmosphere



SUNSET

Light travels much further through atmosphere





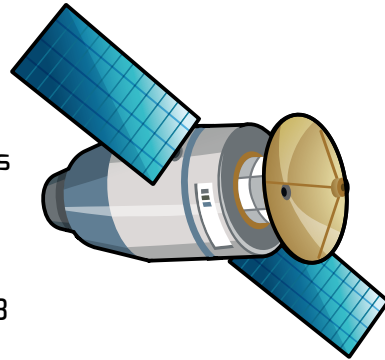
CREATE YOUR OWN MOON MISSION BOARD GAME

In 1969 humankind first stepped foot on the Moon. To get there safely was an absolute mission and involved thousands of people – from those making calculations for a safe flight, to engineers building every inch of the rocket. It was a real team effort that took a lot of thinking about.

Your mission is to take the role of a mission designer and create your own board game all about getting a rocket safely to the moon! Remember there are some important things you need to think about:

LIFT OFF!

You need enough fuel to make sure your rocket actually makes it to space. Maybe you want to set a 'fuel tank' that you need to fill up with a particular number. For example if it was 8 you would could roll: 7+1, 6+2, 5+3, 4+4 if you had two dice, the numbers just need to add up to your fuel meter of 8.



SATELLITES & SPACE JUNK

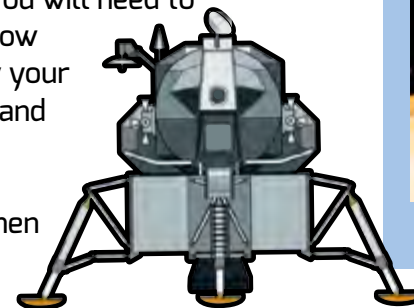
There is a lot of stuff orbiting the Earth, some of it is working at the moment and some has been decommissioned. Whichever is the case, you need to avoid a crash!

THE ISS

The International Space Station (ISS) is pretty enormous so you would think it would be hard to miss but you would be surprised. You really don't want to crash into it – that would be catastrophic. It goes around the Earth once every 90 minutes so you won't want to spend too long in one place or your will have to get in touch with the ISS crew and ask them to move – the question is, will you get there in time?

LANDING

When you get to the Moon you don't want to crash land and destroy your rocket, it needs to be soft, controlled and gentle! You will need to think about how you will slow your rocket down and make sure nothing gets destroyed when it lands.



EXTENTION ACTIVITY

Why not make your game and test it out with our friends and even teachers to see who gets their rockets to the Moon in one piece!

Don't forget to give your game a cool name!

We couldn't resist making our own board game. Turn the page, grab some counters and a single dice to give it a go!*



*We've added a wormhole just for fun!

It's so pretty!
You pause to enjoy
the view. Miss a
turn

Start
Roll an even
number to
escape Earth's
gravity

Wormhole!
Skip ahead
to 12

**Orbiting
satellite.**
Go back two
places to
avoid collision

**Hit a space
rock.** Miss a
turn to make
repairs

Wormhole!
Go back to 8 (unless you
arrived through the wormhole)

Finish
Roll an odd
number to land
safely

Comet ahead!
Fire rockets to
get past before it
arrives. Move
forward 2 spaces

You're too fast!
You can't land
safely at this speed.
Miss a turn to slow
down

4 MARS ROVING AROUND THE RED PLANET



DESIGN A MARS ROVER

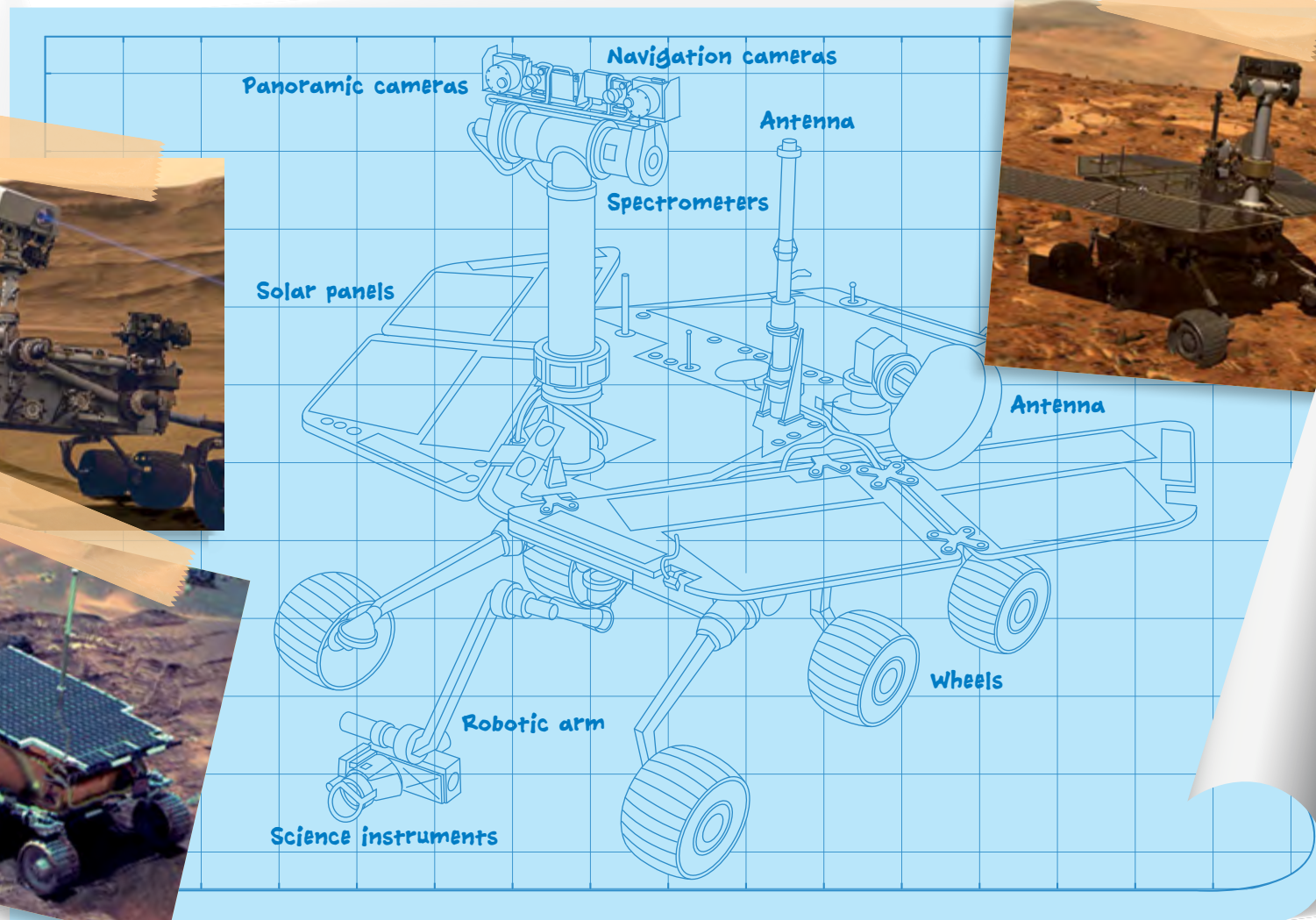
Mars has to be one of the most investigated planets in our Solar System. There have been a lot of rovers over the years sent there to scratch, sniff, dig and experiment. Each rover has had a different mission and been designed especially for that mission.

Take a look at some of the rovers and see how their designs have made them look different.

GET ROVING

Using things from around your school and home design and build your own Mars rover. Think about:

- 1 What will your rover do – what is its super skill? Does it dig, climb rocks, jump, sniff the atmosphere? Gather your materials and get testing what could be good to use.
- 2 Draw some designs – engineers will always work to plans then test things as they go.
- 3 Get prototyping – it is time to build. You may need to change things along the way – that is OK and how science works!
- 4 Report back – talk about your rover with your class. Think about what went really well and what you might change for next time!



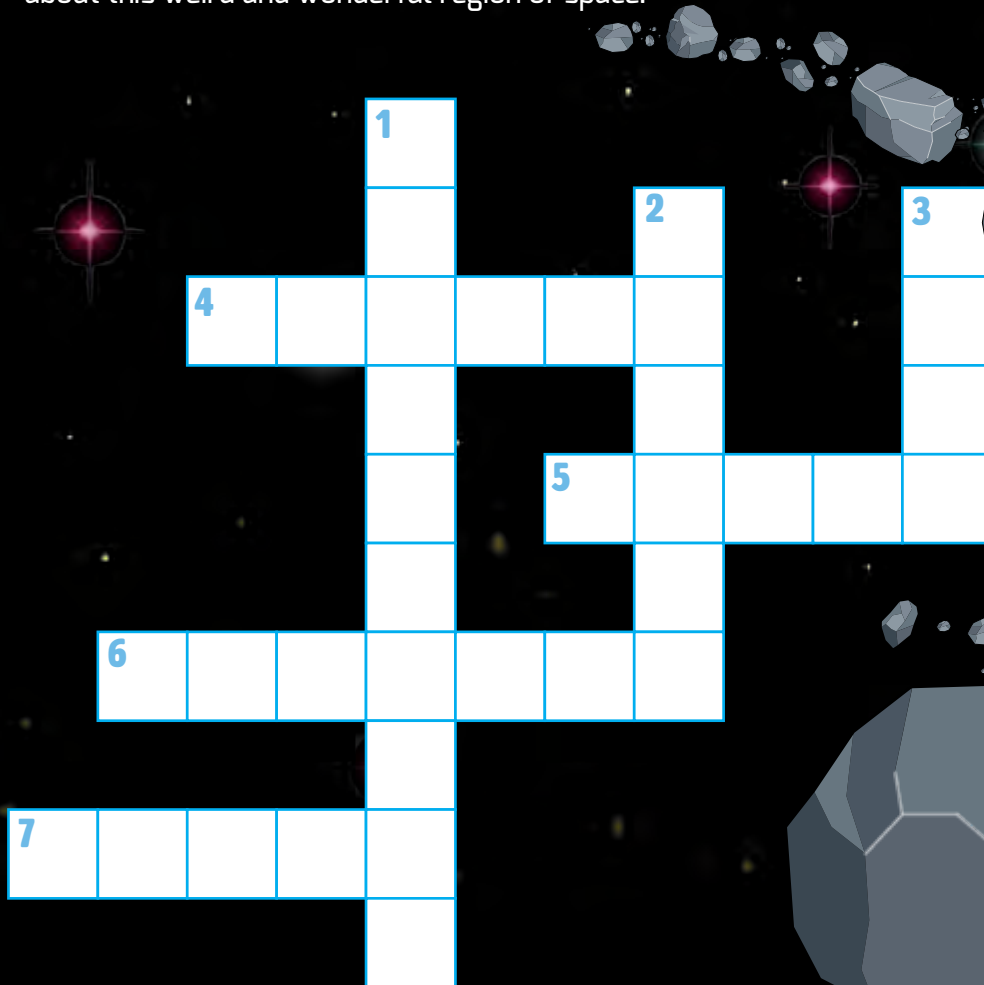
5 ASTEROID BELT

A SOLAR SYSTEM HEAD-SCRATCHER



IT'S A BELTER OF A PUZZLE

The asteroid belt is a region in space where we find lots of space rocks of all different shapes and sizes. Take the crossword below for a spin to find out more about this weird and wonderful region of space.



CLUES

DOWN

1. Some space rocks make it through our atmosphere and land on Earth, these are called _ _ _ _ (10)
2. When meteors crash to Earth they can leave a dent in the ground called a _ _ _ _ (6)
3. Occasionally we are treated to a really spectacular space rock burning up in our atmosphere. These can look like giant _ _ _ _ balls in the sky (4)

ACROSS

4. Throughout the year the Earth ploughs through multiple groups of space rocks. We see some of these burning up in our atmosphere and call them _ _ _ _ showers (6)
5. There are different types of asteroids in space. C-type are made of carbon, M-type are made of metal and S-type are made of _ _ _ _ _ (5)
6. The asteroid belt is found between Mars and _ _ _ _ (7)
7. Asteroids are often referred to as _ _ _ _ rocks (5)

6 JUPITER SWIRLING STORMS



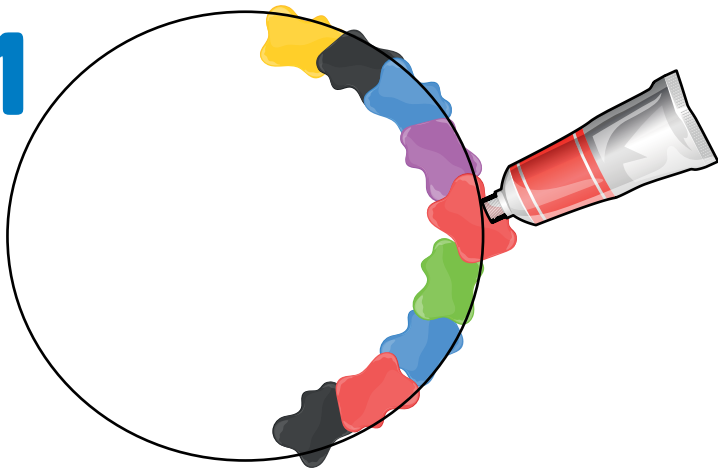
RECREATE THE SWIRLING STORMS OF JUPITER

Jupiter has to be one of the most beautiful planets in the Solar System. Those wonderful big swirling clouds of gas sprinkled with storms make it look more like something straight out of a science fiction film rather than real life – it shows a truly beautiful side of astronomy and space science.

YOU WILL NEED:

- A piece of paper with a circle drawn on it
- A selection of paints
- A drinking straw
- A strong set of lungs!

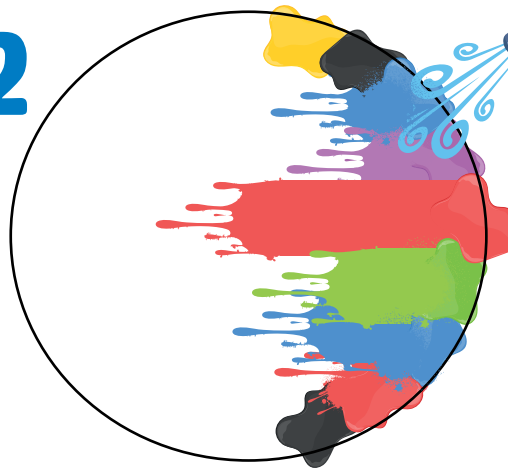
1



1

Draw a circle on a piece of paper and pour paint on to one side of the circle until you have pools of paint all along one side. Make sure you use different colours to show the bands of Jupiter.

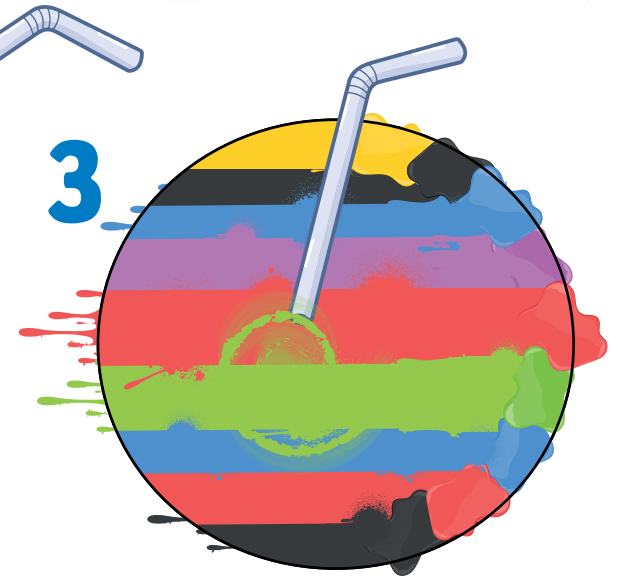
2



2

Use a straw to blow the paint to the other side of the circle so you have a line of paint in a band across your planet. Repeat this until you covered the planet.

3



3

While the paint is still wet use your straw to swirl and swish the different bands together. Don't worry if it looks a little messy – you are painting the gases interacting on Jupiter after all.

You could even add a storm! Choose your storm site and put a nice big splodge of paint, maybe even a few colours. Swirl them together to create your very own gas giant storm.

CRACKING THE CODE OF SATURN

Saturn is a weird and wonderful place that has been interesting scientists for many years. Below you will find some facts about Saturn. The only problem is they are in code and you must break it to complete the facts!

ALPHABET CODE CRACKER

You will need this to work out what each of the letters of the alphabet link to and spell out.

A	B	C	D	E	F	G	H	I	J	K	L	M
0.1	$\frac{7}{8}$	=	5	0.5	+	0.6	$\neq$	-	2	50%	-1	0.4
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
100	0.8	$\frac{5}{8}$	$\frac{3}{5}$	ψ	Δ	0.2	$\frac{1}{8}$	0.9	$\frac{1}{3}$	$\frac{2}{3}$	$\times$	$\div$

CRACK THE CODE!

Below are some calculations you need to solve by finding the missing symbol or number in the red boxes – get those neurons firing!

FACT 1

Match the missing number or symbol to the code cracker to find the letter of the alphabet that makes up the coded word. Use the answer to complete the Saturn fact!

$$20 \boxed{?} 5 = 25 \quad \boxed{?} - 3 = -4 \quad 0.1 + 0.7 = \boxed{?} \quad \boxed{?} + 0.2 = 0.3 \quad 0.4 \div 2 = \boxed{?}$$

Saturn is **LESS** dense than water so if you put it in a bath it would ?

FACT 2

Use those maths skills again to find out what should go in the boxes

$$3 + 5 \boxed{?} 10 \quad \boxed{?} + 0.5 - 1 \quad \frac{1}{3} + \boxed{?} = 1 \quad 1 - 0.9 = \boxed{?} \quad \boxed{?} + 1 = 1.6 \quad 80\% = \boxed{?} = \frac{4}{5} \quad 54 + 46 = \boxed{?}$$

Saturn has a storm the shape of a ?

8 URANUS & NEPTUNE

A HOLIDAY WITH A TWIST



TRAVELLING AROUND THE ICE GIANTS

The ice giants, Uranus and Neptune, get a pretty rough deal: they are freezing cold, stuck right out on the edge of the Solar System and one of them has a comedy name... but we think it's time they got a little love.

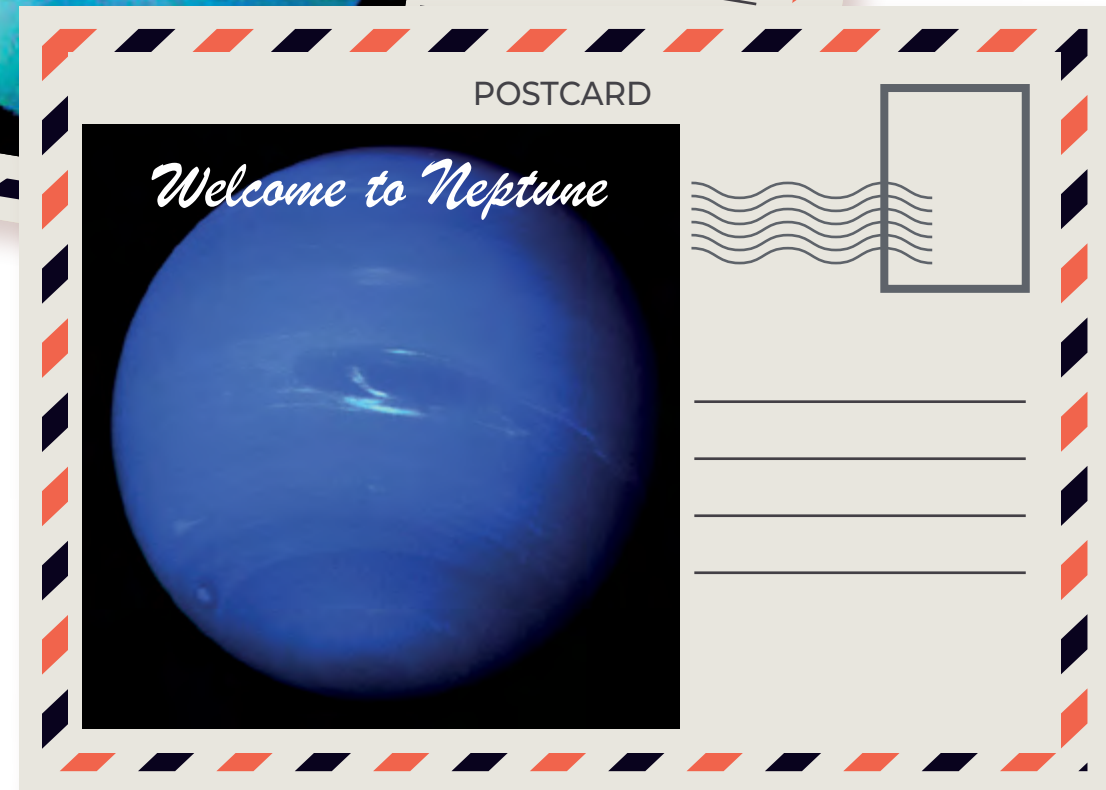
WRITE AN INTERPLANETARY POSTCARD

Imagine you are on a rocket-ship holiday cruising around Uranus and Neptune.

Write a digital postcard back to a family member or friend about the sights you have seen.

YOU MIGHT WANT TO TELL THEM ABOUT:

- The colours you can see.
- The gases the planets are made of.
- Any moons they may have.
- How the two planets look different. They may both be similar colours but they are pretty different places indeed!



9 OORT CLOUD A COMET IN A CUP



TRAVELLING AROUND THE ICE GIANTS

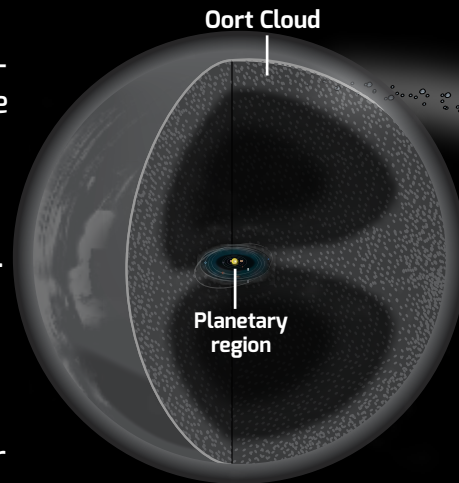
You may have heard people call comets 'dirty snowballs' – nice right? It is pretty accurate though as they are indeed a large chunk of ice with some special cosmic extras sprinkled in for good measure.

As comets make their way from the Oort Cloud through the Solar System towards the Sun, the ones that don't get knocked off course by another space rock will develop beautiful tails.

Some of the comets that make it to the Sun will meet a burning hot end and smash into the surface, while others will make their way around the Sun before starting their incredibly long journey back to the Oort Cloud.

PARDON YOU!

As comets get closer to the Sun they start to 'burp', 'cough' and 'splutter' – how rude! This can cause bits of them to break off, leaving a trail of debris behind. We pass through some of these comet burp trails at different times of the year and see beautiful natural firework displays in the sky called meteor showers.

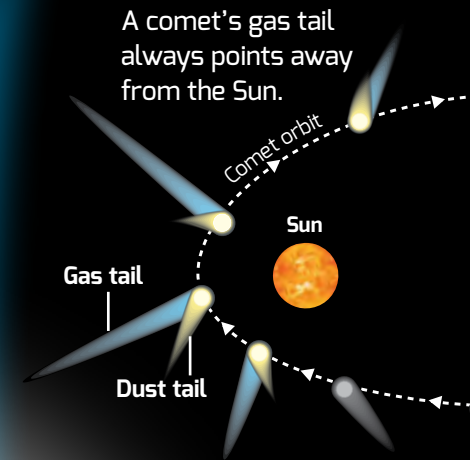
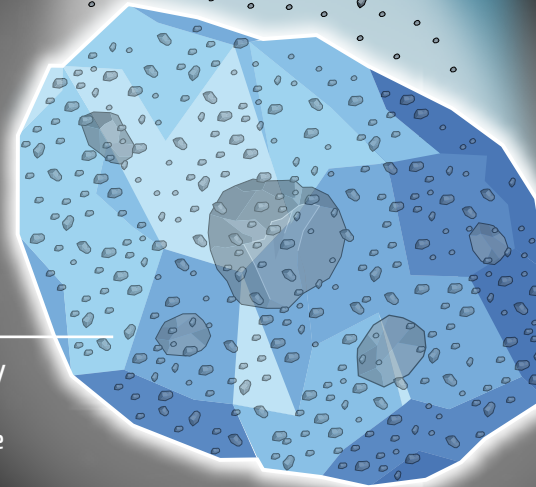


Gas tail: Charged gas particles pushed from the comet by the solar wind

Dust tail: Larger dust particles trail behind the comet

Coma: A hazy cloud of dust and vapour that surrounds the nucleus

Nucleus: 'Dirty snowball', or 'icy dirtball' made up of rock, dust, water ice and frozen gases*



**The nucleus in this diagram is not to scale.
The coma is many times larger than the nucleus.*

9.1 DIRT CLOUD

A COMET IN A CUP



MAKE A DELICIOUS COMETY TREAT

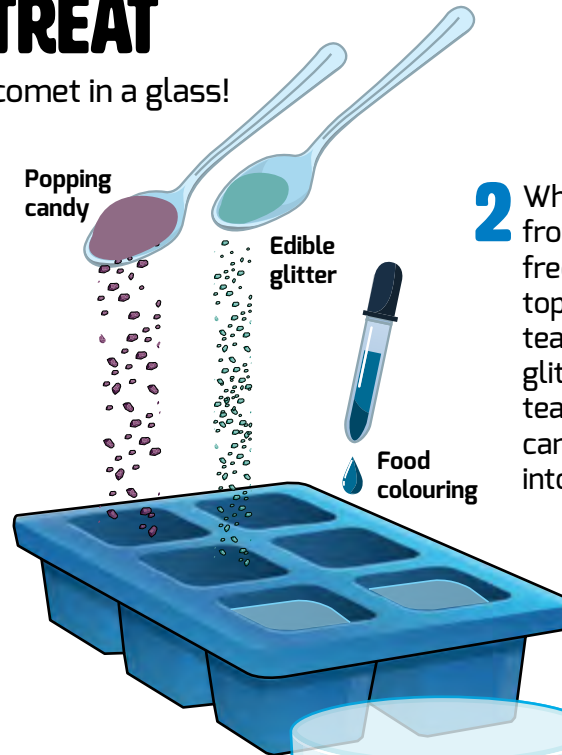
Now it is time for you to make your very own delicious comet in a glass!

YOU WILL NEED:

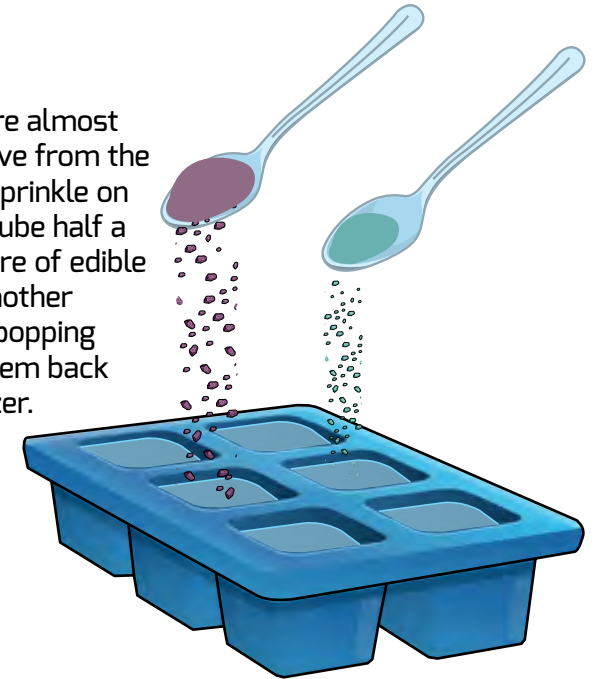
- Water – comets contain lots of water so this will represent that along with, when it freezes, frozen carbon dioxide.
- Popping candy – this will represent amino acids, the building blocks of proteins we find in comets.

- Edible glitter – this will represent silicates that are found in comets.
- Food colouring – this will represent the carbon compounds found in comets. You can choose any colour but black would be the most realistic for a comet!
- Ice cube tray
- Freezer

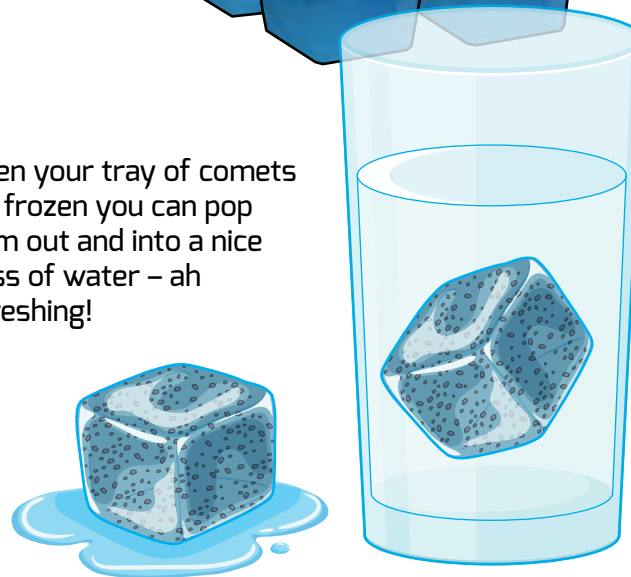
- 1** Add the food colouring, a teaspoon of popping candy, half a teaspoon of edible glitter to the ice cube tray, top up with water and give them a mix. Pop in the freezer until almost frozen.



- 2** When they are almost frozen, remove from the freezer and sprinkle on top of each cube half a teaspoon more of edible glitter and another teaspoon of popping candy. Put them back into the freezer.



- 3** When your tray of comets has frozen you can pop them out and into a nice glass of water – ah refreshing!



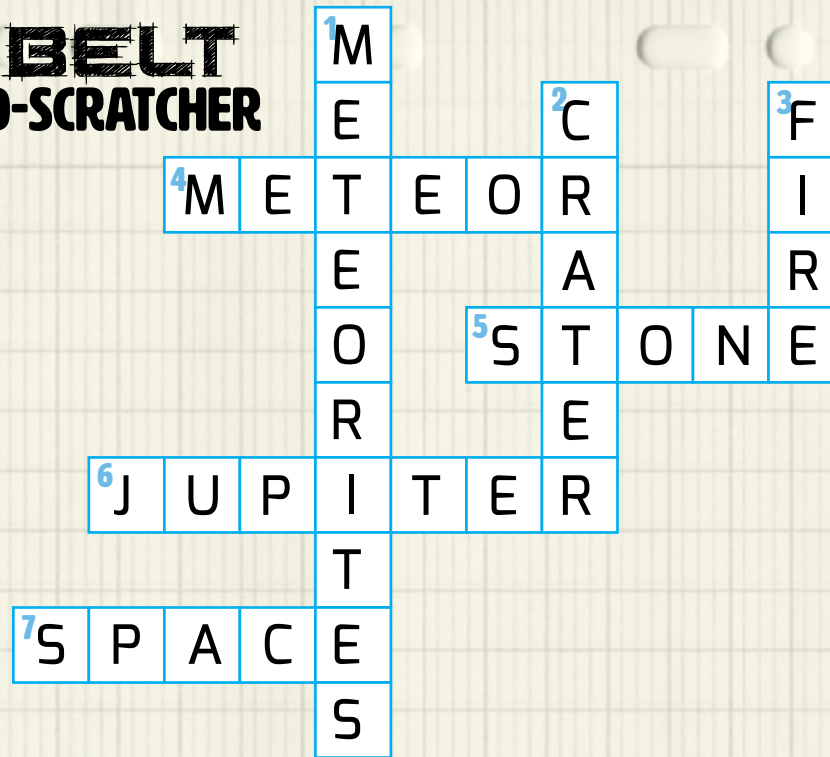
WHAT DO YOU SEE?

When you add the 'comet' to the water you should see it start to cough and splutter, it may even start to move around the glass a little. This is similar to what happens to a comet when it comes close to the Sun and starts to warm up! So there you have it – your very own comet in a glass!

TEACHER'S NOTES

Here you will find the answers to some of the sections within the booklet.

5 ASTEROID BELT A SOLAR SYSTEM HEAD-SCRATCHER



7 SATURN CRACK THAT CODE

FACT 1

$20 + 5 = 25$

$-1 - 3 = -4$

$0.1 + 0.7 = 0.8$

$0.1 + 0.2 = 0.3$

$0.4 \div 2 = 0.2$

Saturn is **LESS** dense than water so if you put it in a bath it would

F L O A T

FACT 2

$3 + 5 \neq 10$

$0.5 + 0.5 - 1$

$\frac{1}{3} + \frac{2}{3} = 1$

$1 - 0.9 = 0.1$

$0.6 + 1 = 1.6$

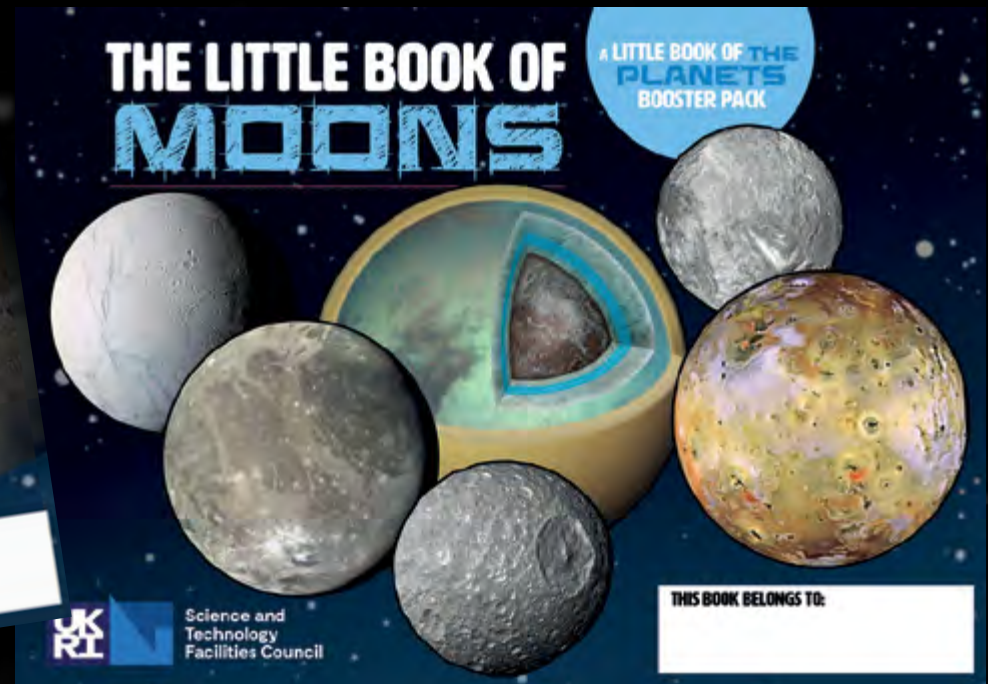
$80\% = 0.8 = \frac{4}{5}$

$54 + 46 = 100$

Saturn has a storm the shape of a

H E X A G O N

CHECK OUT OUR ACCOMPANYING RESOURCES



Science and
Technology
Facilities Council