

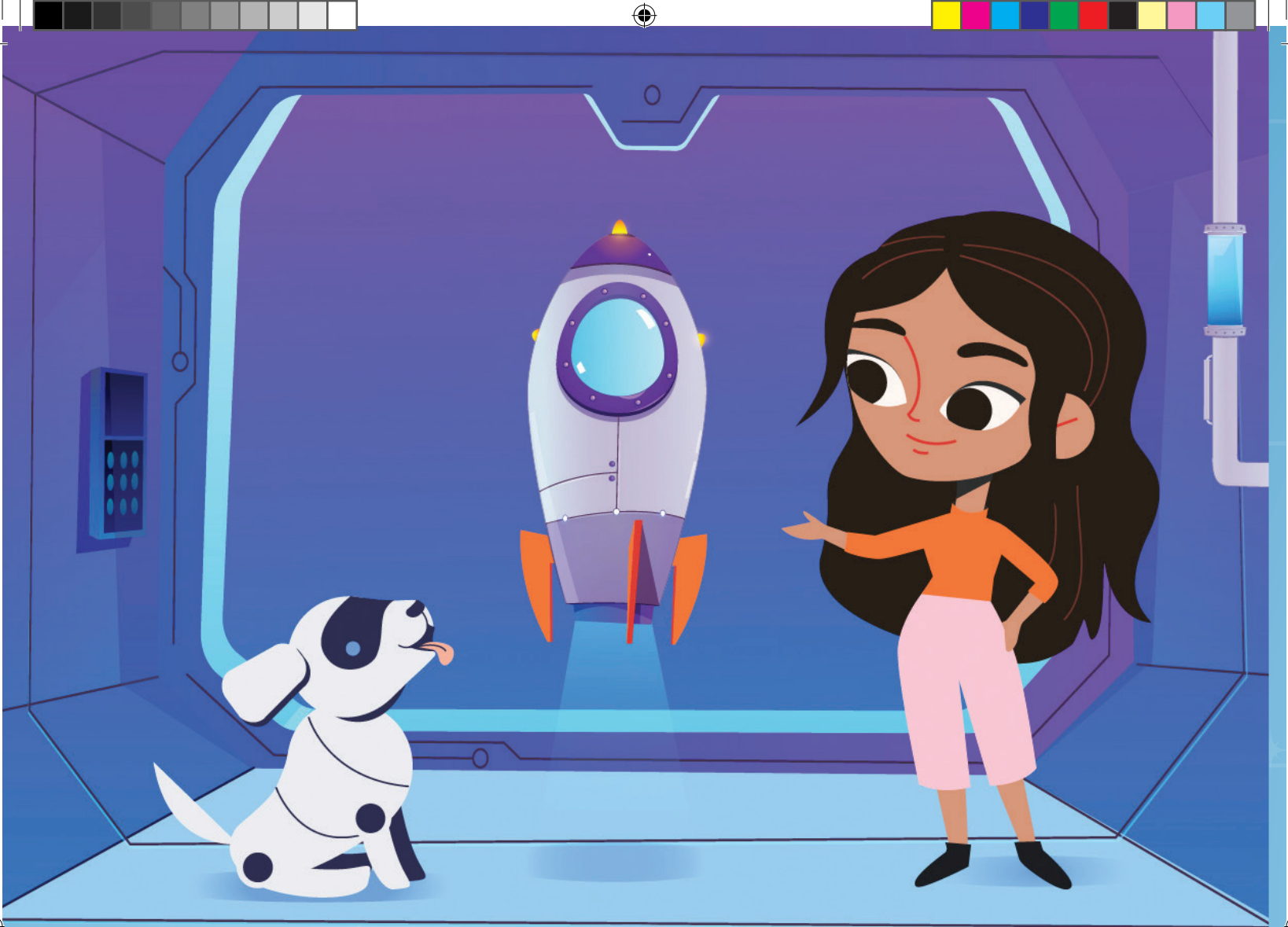
/tech
she
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ROYAL
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KATIE AND TEX

Living in Space activity booklet





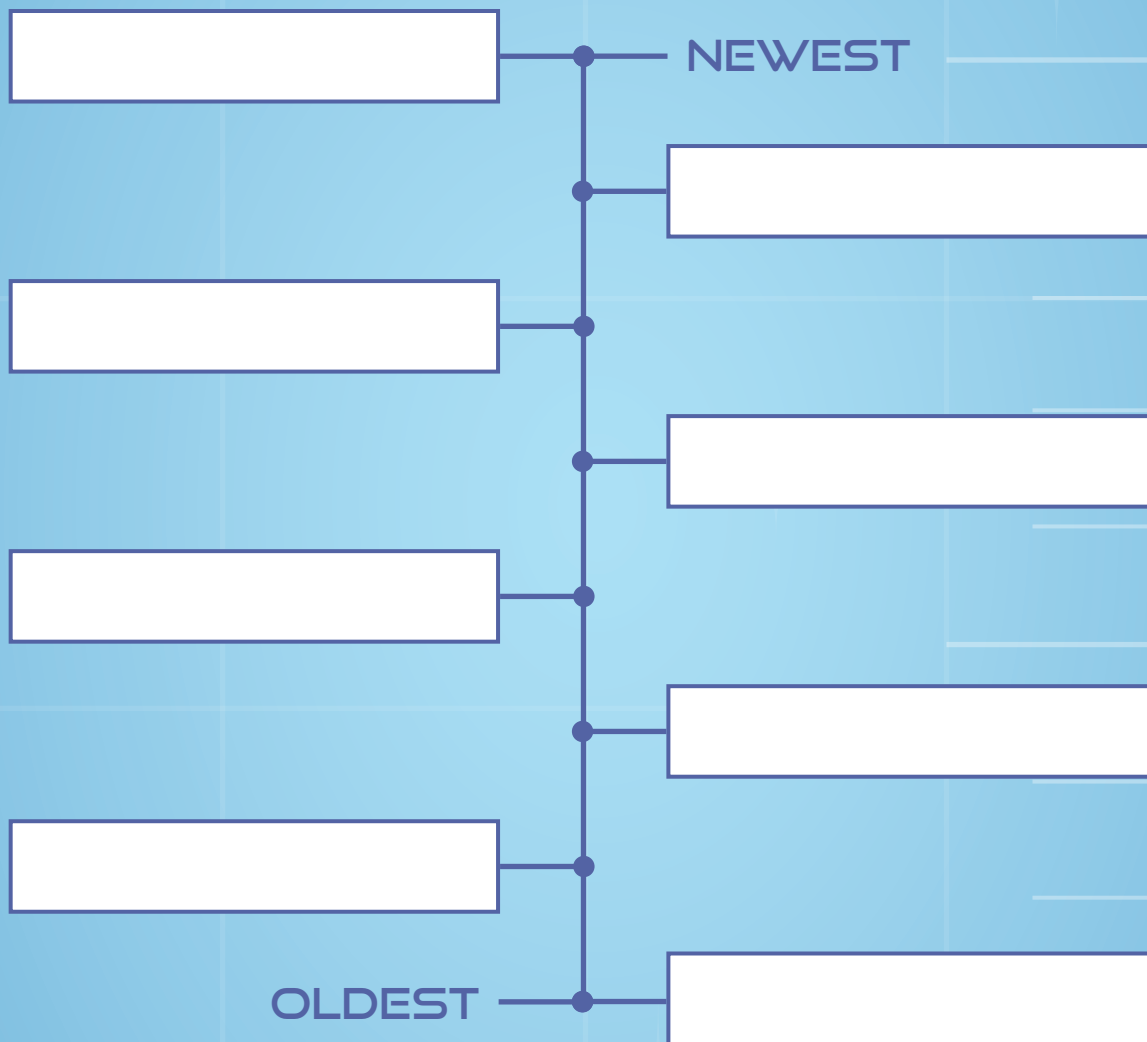
SPACE TRAVEL

Looking up at the sky at night, Katie has always wondered how to reach the moon. It takes many hours just to get to the other side of the country to visit her Nan! How can it be possible to get somewhere that far away?

Space travel is very complicated as there are many things to consider when you leave the Earth. Very special rockets have been designed to get to space which move at 25,000 miles per hour – that's 360 times faster than a car on the motorway! The people who travel inside these rockets are known as astronauts. These are specially trained scientists who go to space to conduct research about space and our planet.

SPACE MISSIONS

As of 23rd March 2024, there have been 383 human spaceflight launches. Katie has been looking back at all of the space flights that have happened, but she doesn't know what order they happened in! **Can you help Katie to order these space missions from oldest to newest?**



Axiom Mission 3 [2024]

STS [1982]

Space Ship One Flight 15P [2004]

Soyuz TM-27 [1998]

Shenzhou 9 [2012]

Apollo 16 [1972]

Voskot 1 [1961]

Crew Dragon Demo-2 [2020]

DISTANT PLANETS

It takes Katie and Tex 30 minutes to get from their house to school, she can't imagine how long it would take them to get to space!

Objects in space are very far away from each other and the distances means that it takes a long time to get anywhere. If a football pitch is approximately 100m, can you work out how many football pitches would it take to get from the Sun to these planets?

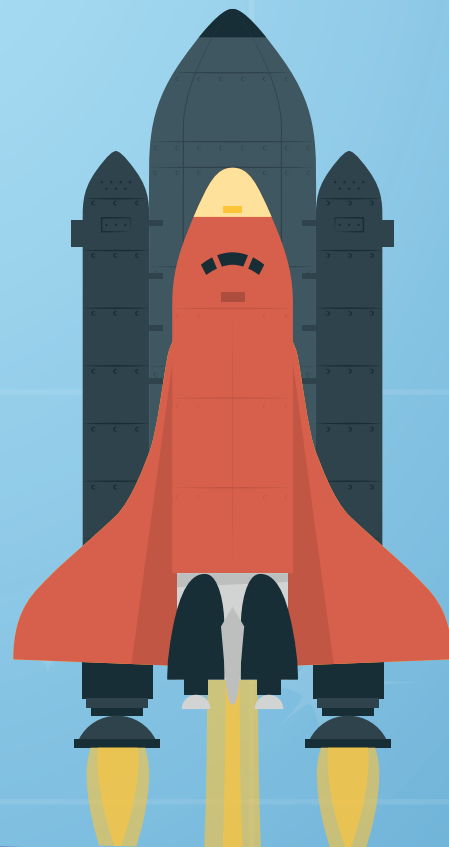
SUN TO MERCURY IS 57936384000 METERS:

SUN TO EARTH 149668992000 METERS:

SUN TO JUPITER 778922496000 METERS:

FUN FACT

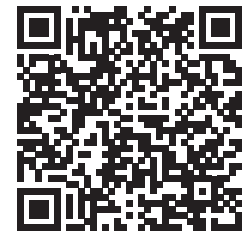
Light years are a way to measure how far away objects are in space. But this is not a measure of time but distance.



GETTING INTO SPACE

One of the most popular ways for Astronauts to get into space was by using a special vehicle called the 'Space Shuttle'.

Can you help Katie and Tex label this space shuttle?



Scan this QR code to find out more about the Space Shuttle

Click me

External Tank: Contains the liquid hydrogen and liquid oxygen fuel used to propel the shuttle at launch.

Primary Parachute: Used to safely slow down the landing of the solid rocket boosters so they can be reused.

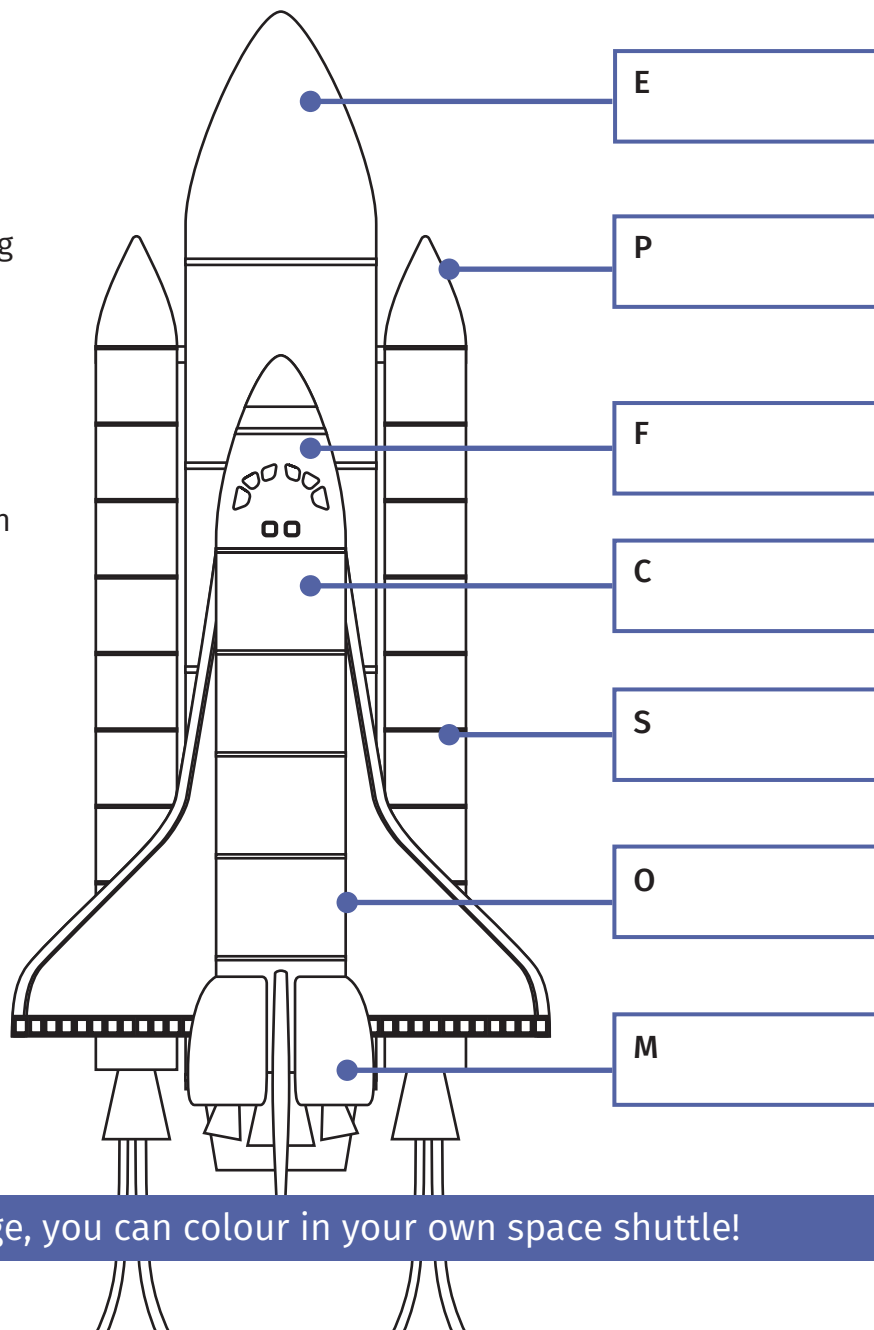
Flight Deck: Where the crew controls and navigates the shuttle in a mission.

Cargo Bay: Storage area with shuttle payloads such as satellites and food.

Main Engine: Engines that propel the shuttle to orbit with the fuel from the external tank.

Orbiter: Part of the shuttle containing crew and cargo that orbits and then returns to Earth.

Solid Rocket Booster: Boosts the shuttle at the start of a launch to lift it off the ground.



If you print out this page, you can colour in your own space shuttle!

GRAVITY IN SPACE

Gravity is a force that pulls objects towards each other, it is what is keeping you on the Earth. But every object will have its own amount of gravitational pull and this needs to be considered when landing on other objects in space. It can make things seem heavier or lighter.

If Katie's mass is 40kg, can you help Katie to calculate her weight on different places in space? We've completed the first calculation for you!

EQUATION

Weight = Mass x Gravity on that object

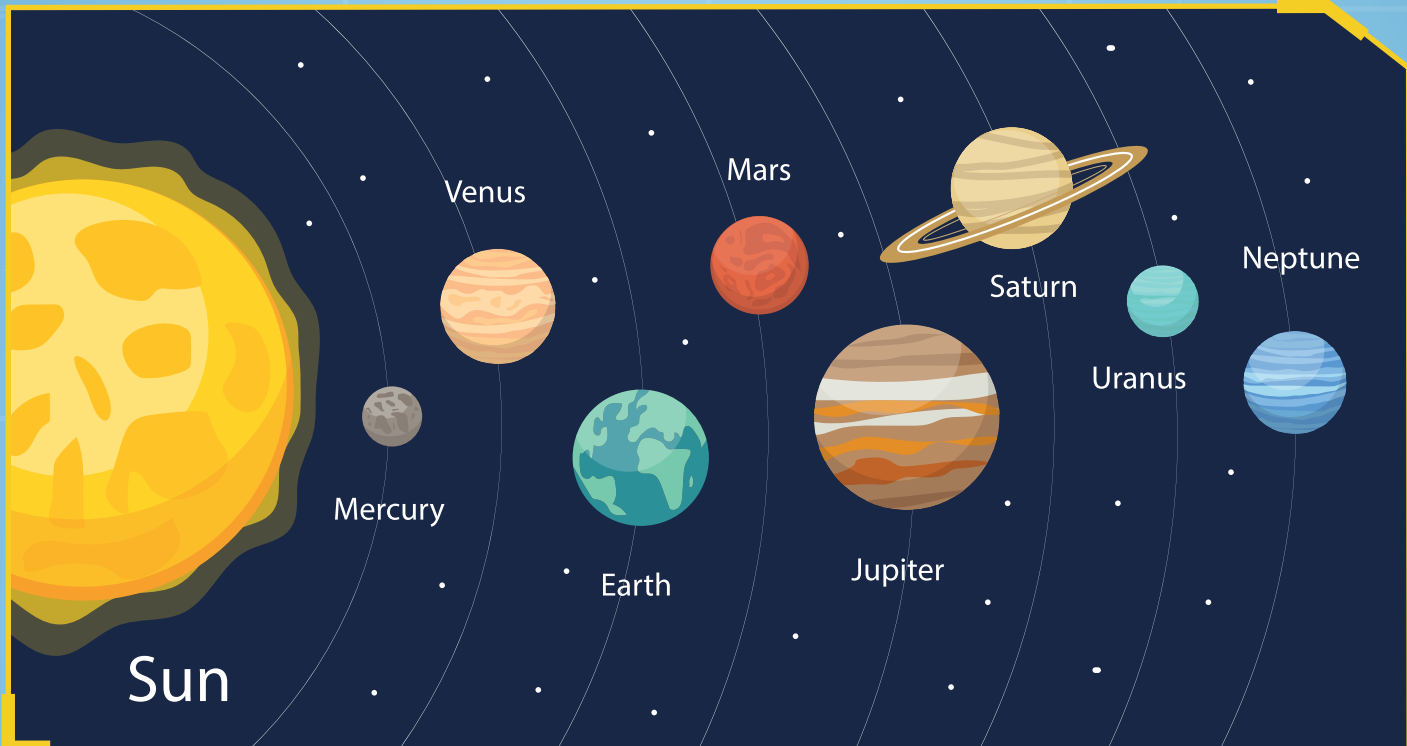
	MASS (KG)		GRAVITY (M/S ²)		WEIGHT (KGM/S ²)
Earth	40	X	9.8	=	392
Moon	40		1.6		
Jupiter	40		24.8		

FUN FACT

Mass is the amount of matter an object contains. The more matter something has, the more it will weigh. For example, an elephant has more matter in it than a mouse so it has a larger mass.

SOLAR SYSTEM

Space travel in our solar system is limited by how far away the planets are from Earth. Take a look at the map of the solar system and answer these questions:



What is the furthest planet from the Earth?

What is the biggest planet?

What is the smallest planet?

What is the only planet with rings visible from earth?

What is the second planet from the sun?

FUN FACT

All of the planets except Earth are named after Greek and Roman Gods.

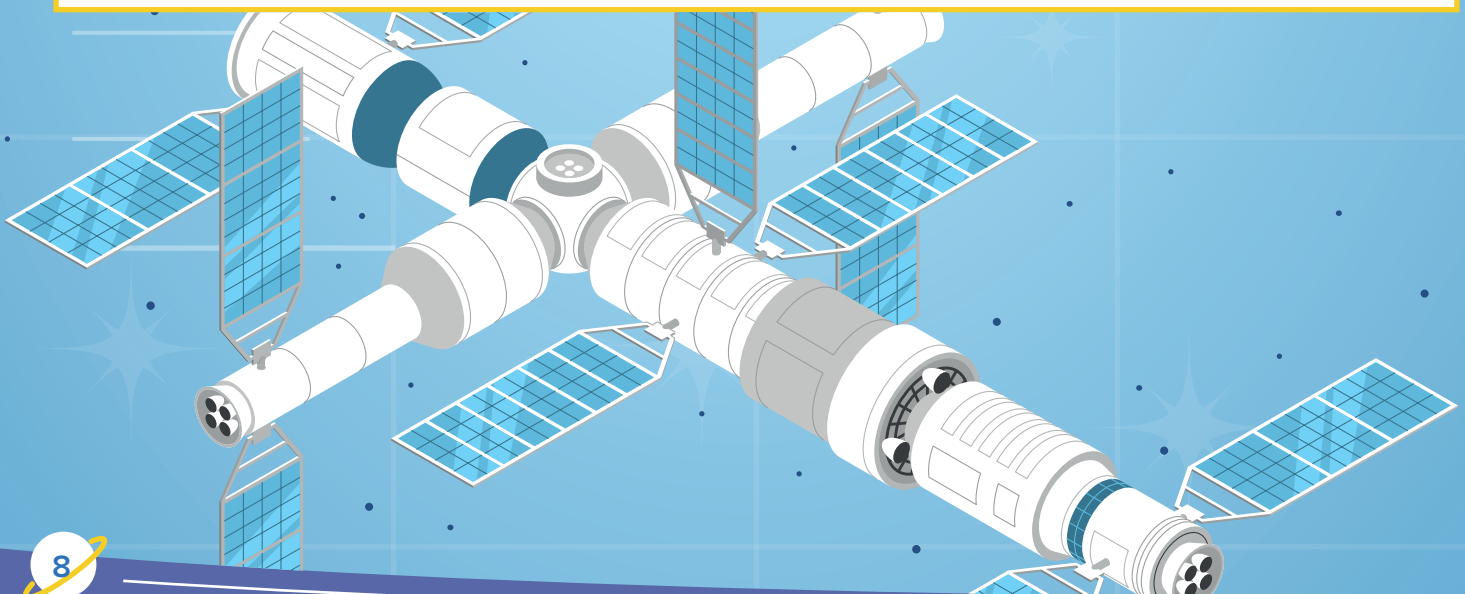
THE INTERNATIONAL SPACE STATION

Very few people get to live in space and those that do will live on the International Space Station. It is a big place and weighs about the same as 320 cars. There is science equipment there for the researchers to do their work and learn more about our universe.

As the International Space Station rotates around the Earth, it will complete a lap every 90 minutes. This means that the astronauts up there will see 16 sunrises every day. It is also the second brightest object in the sky other than the moon, so next time it gets dark try and look up to see it pass by!

FURTHER THOUGHTS:

Where would you like to live in space?



DESIGN A SPACE STATION

The International Space Station is designed for up to seven people to live on it at the same time. There are two bathrooms, six sleeping areas and even a gym!

Katie wants to go up to space with all of her friends. There are 6 of them in total and she would need to make sure they can stay entertained up there in space! **Can you help Katie by designing a space station for her and her friends? Think about what you'd want to do in space and plan the layout.**

Katie's Space Station

WALKING IN SPACE

When astronauts walk in space, they need to wear spacesuits so that the pressure on their bodies and temperature are regulated, allowing them to live and work safely.

Can you calculate the difference between these factors in space and in the spacesuit?

	SPACE	SUIT	DIFFERENCE
Temperature (°C)	-270	21	
Pressure (PSI)	0	14.7	

FUN FACT

Space is a vacuum which means there is nothing in it – not even air.



RADIATION

Radiation is a type of energy that moves as a wave. A big source of radiation in both Earth and space is the Sun, this is why we need to wear sunscreen to protect us from it. The Sun has a cycle so that every 11 years, there is an increase in solar flares which causes an increase in radiation emitted.

Can you help Katie to work out how many cycles the Sun has gone through in each amount of years?

22 YEARS	=	_____	Cycles
110 YEARS	=	_____	Cycles
77 YEARS	=	_____	Cycles

FUN FACT

In space, there is another form of radiation called Galactic Cosmic Radiation which comes from out of our solar system.

ROTATION

As the International Space Station rotates around the Earth, it will complete a lap every 90 minutes.

Can you help Katie solve the calculations below about how many times the space station revolves around the Earth?

How many laps will the station complete in a half a day (12 hours)?

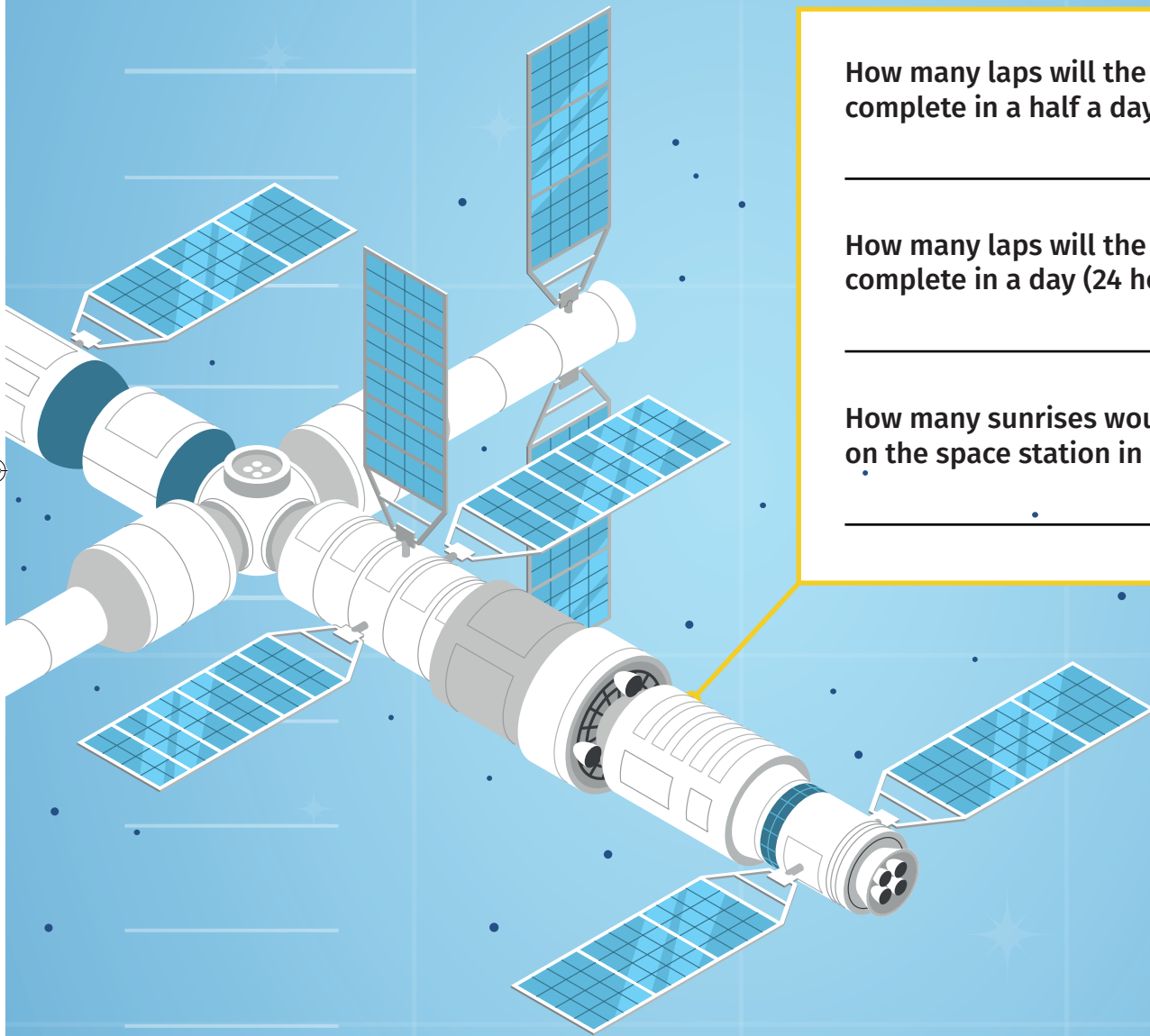
_____ Laps

How many laps will the station complete in a day (24 hours)?

_____ Laps

How many sunrises would be seen on the space station in a day?

_____ Laps



LIVING IN SPACE

Can you help Katie fill in the blanks below about living in space?
All the words you need are below.

Astronaut's _____ and _____ weaken when they spend time in space due to the _____ gravity. They need to _____ everyday through attaching themselves to their fitness equipment to stay _____. Even when they sleep the astronauts need to be strapped into _____ bags to stop from floating away!

As it is so hard to get _____ into space, the water they drink is _____ through filtration systems so that they are able to drink it again. It also means that they have to have _____ amounts of water in their showers to save it. To save water and stop it _____ around the station, special toilets are used that flush away the waste with _____ rather than water.

water

floating

air

recycled

sleeping

grounded

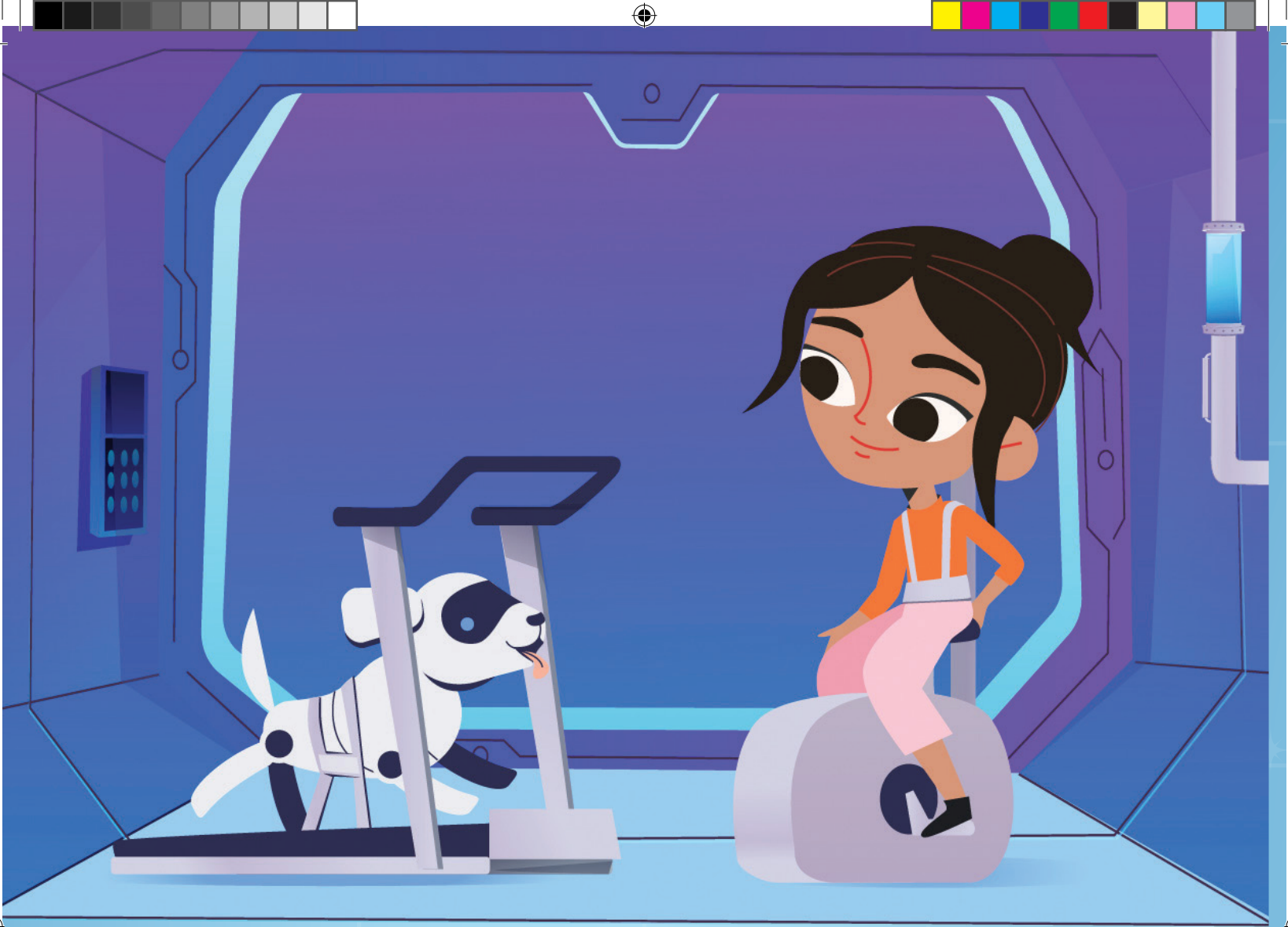
small

bones

muscles

zero

exercise



USE OF TECHNOLOGY

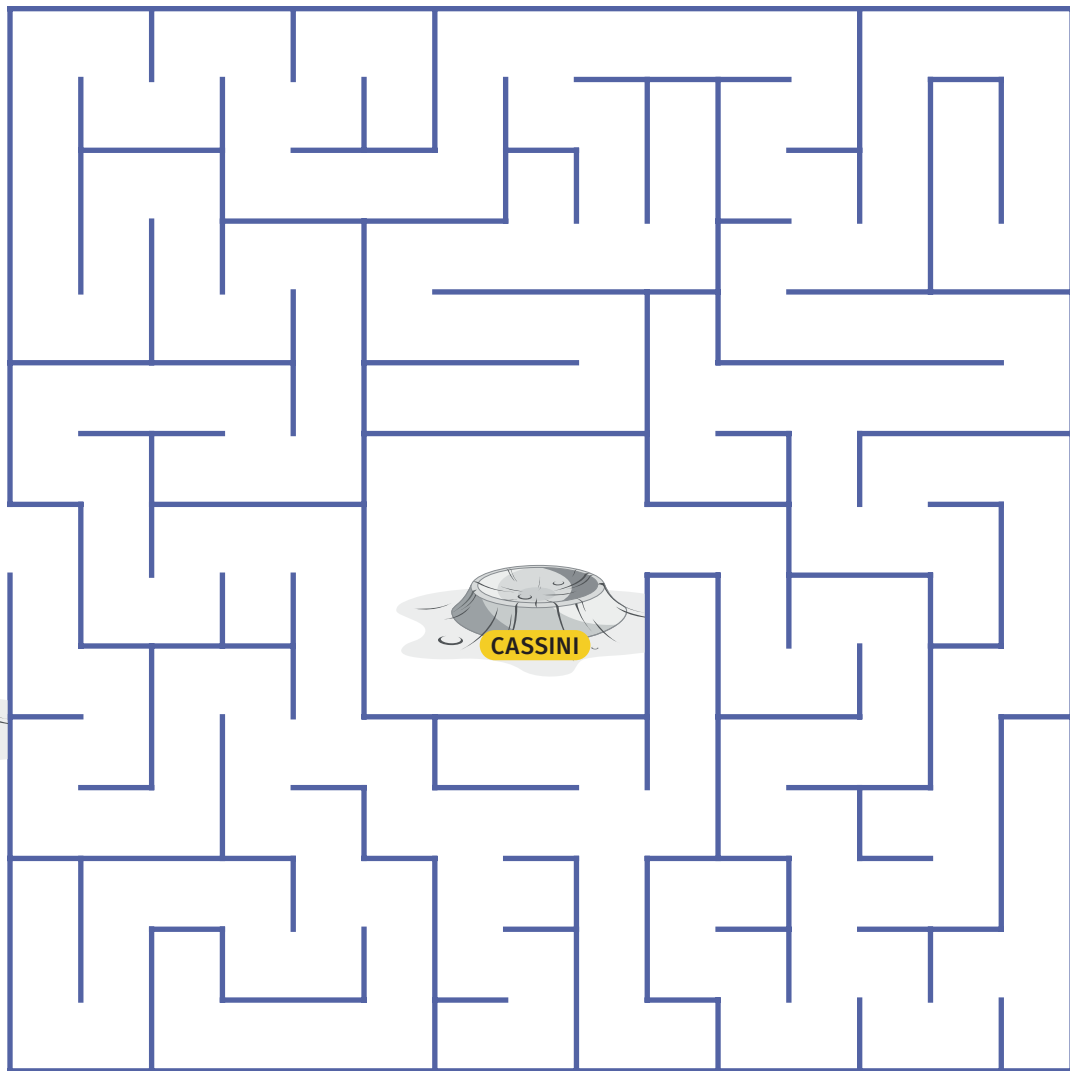
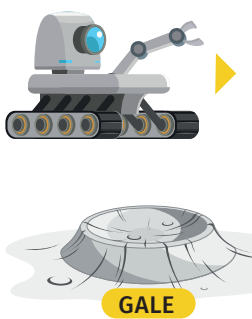
There are many technologies that can be used to explore space. Different machines such as telescopes, space vehicles (or rovers) and satellites have been used to learn more about the universe we live in. These can be used to find new stars and planets, or to explore the ones we already know.

SPACE VEHICLES

Mars is the closest planet to Earth but it looks very different and has a different atmosphere to ours.

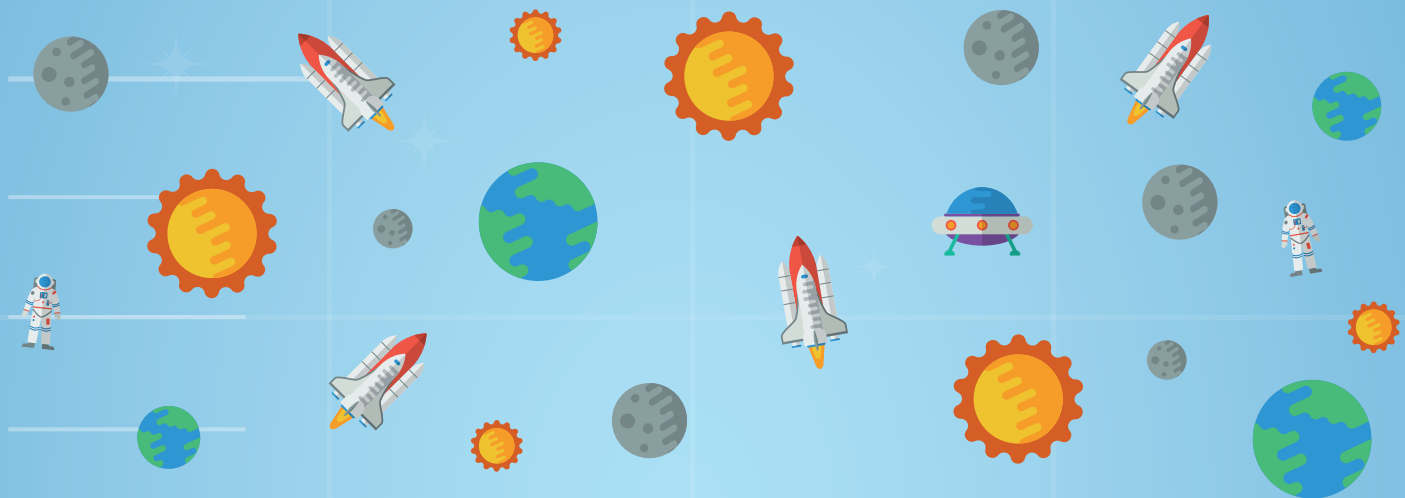
Rovers are scientific research robots that travel around Mars in the search to take samples from the surface and explore whether there is water on the planet. If water is found in liquid form, this would mean that life could exist on Mars.







Scientists send commands to the rovers to tell them where to go in their exploration. **Can you help this rover navigate through the maze from the Gale crater on Mars to the Cassini crater?**



OBJECTS IN SPACE

Looking into space, there are many things to see such as stars, planets and satellites in orbit. **Katie is looking into space with a telescope and seeing many different objects. Can you count how many of each object she sees and create a pictogram chart in the space below?**



THE MOON

Satellites are objects that are in orbit of a body (an example of a body is the Earth). There are many types of satellites that people have put in orbit around our planet for various reasons. **Can you link the kind of satellite to the task for Katie by drawing a line between them?**

Navigation Satellite



Calling her friend.

Communication Satellite

Checking the weather

Earth Observation Satellite



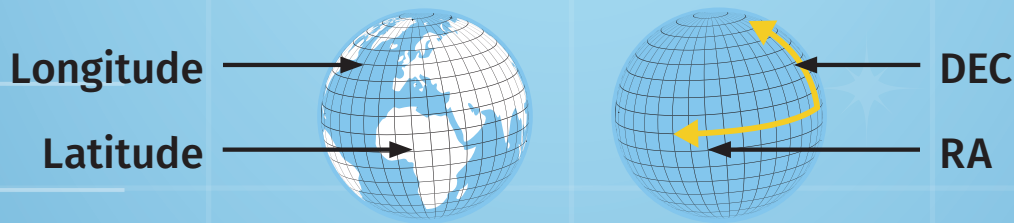
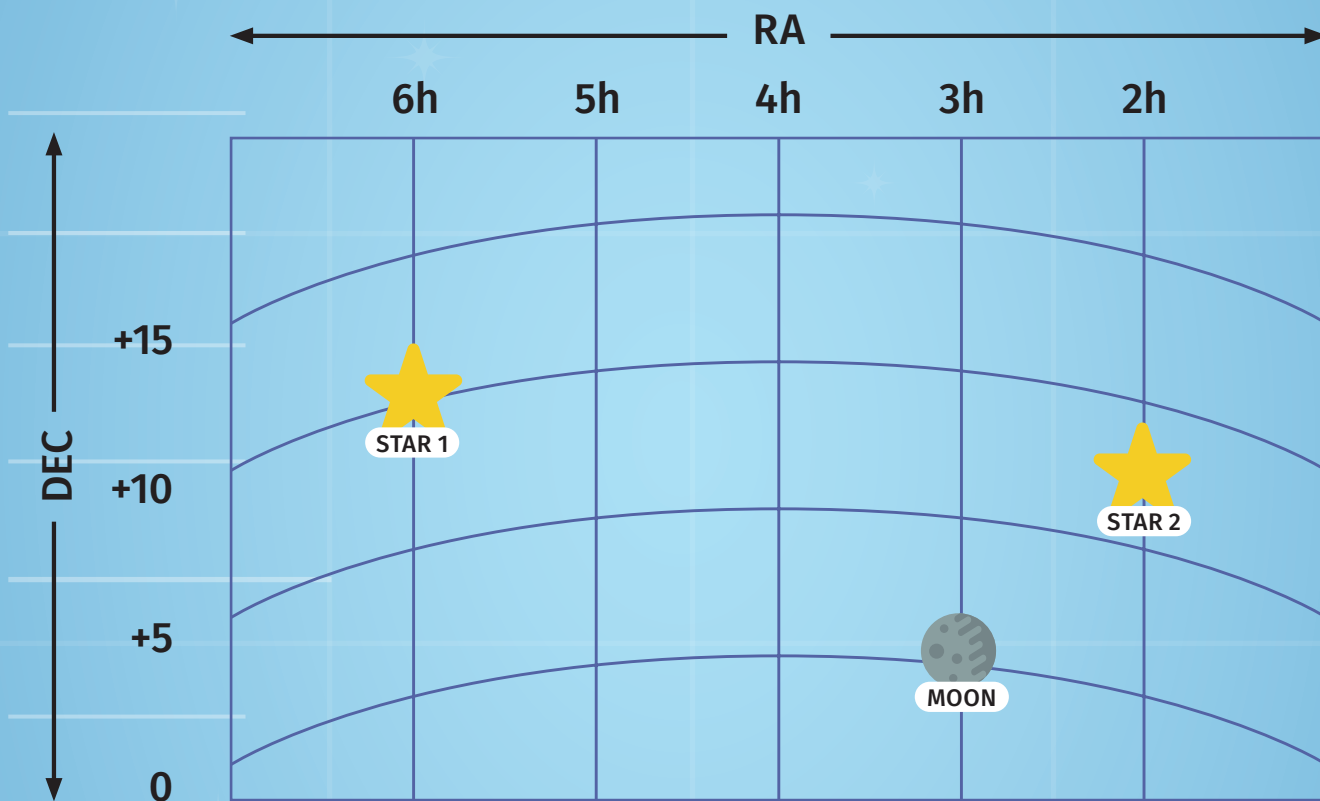
Driving to school

FUN FACT

The moon is a satellite.

SPACE MEASUREMENTS

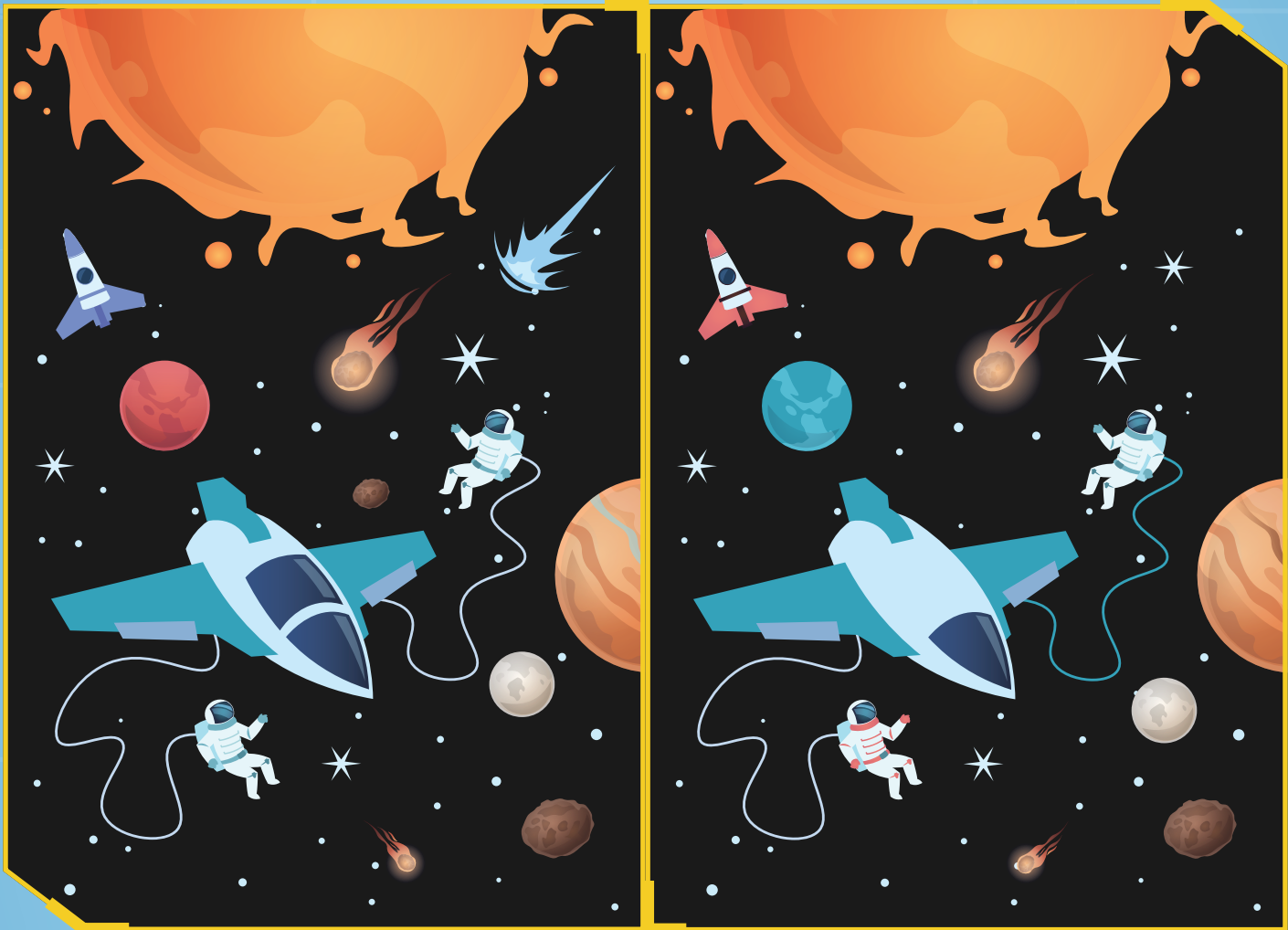
When measurements are taken in space, instead of using the longitude and latitude coordinates we use on Earth, right ascension (RA) and declination (DEC) are used. RA is expressed in hours, minutes and seconds. DEC is expressed in degrees. **Can you read where the objects are on the sky below? Star 1's coordinates have already been given for you.**



STAR 1 =	<u>6h</u>	RA	<u>+10</u>	DEC
MOON =	_____	RA	_____	DEC
STAR 2 =	_____	RA	_____	DEC

SPOT THE DIFFERENCE

Katie is looking through a telescope into space and takes two images of what she sees. Can you help her to spot the 8 differences in the two images? Circle each difference you can find.





SPACE FOOD

Katie knows that you should eat a balanced and healthy diet on Earth, which also applies to eating in space. However, as you can't go to a supermarket in space, food needs to be taken up to the astronauts on the space station. There are many things to consider when taking food into space such as how to preserve it so that it can last the astronauts a long time.

CAN OR CAN'T EAT

Katie was wondering what food astronauts can and can't eat or drink in space. **Can you circle below the food and drink you can have in space?**

Bread

Fizzy Drinks

Cereal

Tea

Salt Granules

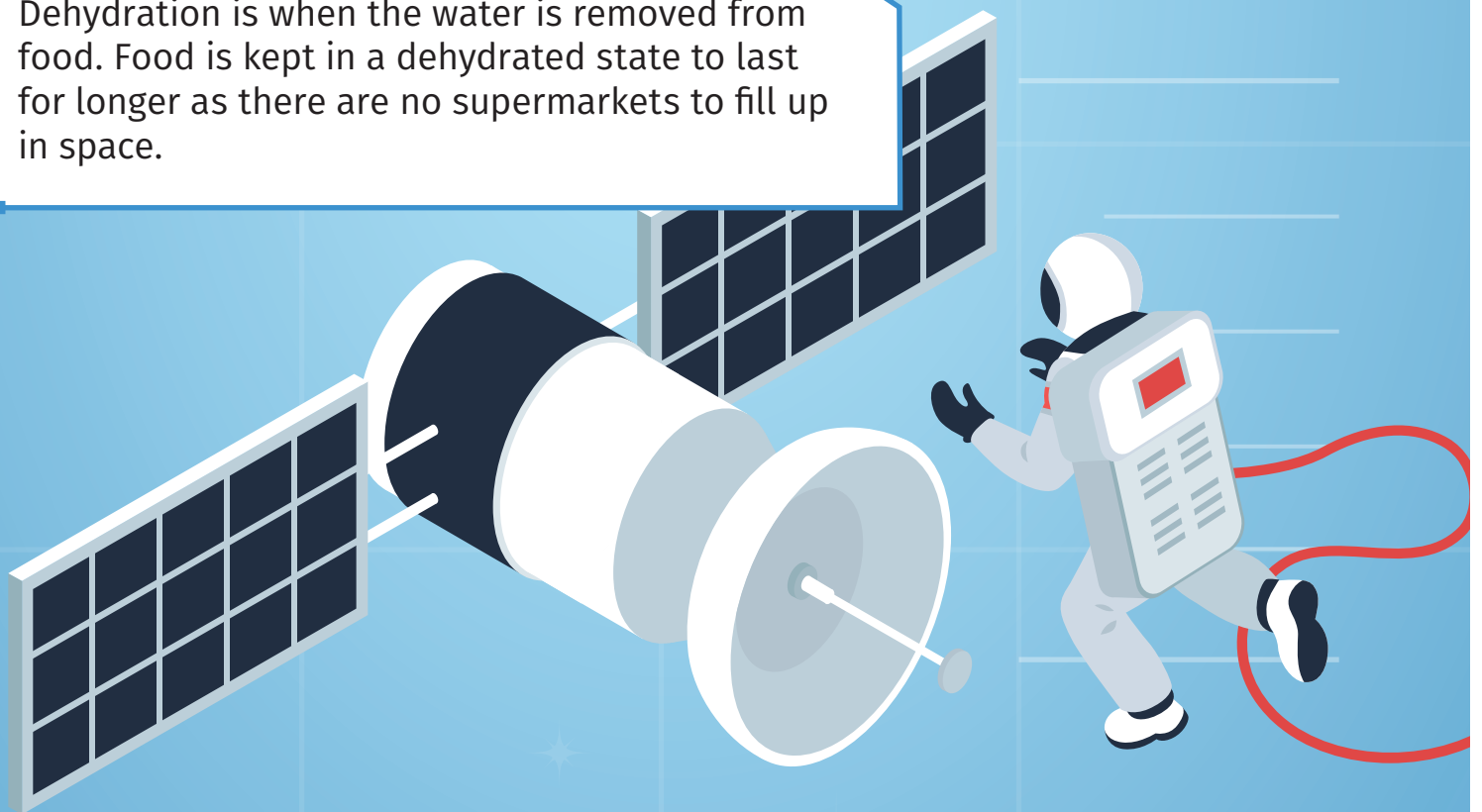
Soup

Macaroni Cheese

Nuts

HINT

Dehydration is when the water is removed from food. Food is kept in a dehydrated state to last for longer as there are no supermarkets to fill up in space.



SPACE FOOD

To maintain their muscle mass in space, astronauts need to eat **2800 calories** every day.



If one cashew nut has 8 calories, how many would an astronaut need to eat in a day to get all of their calories?



1 Cashew nut = 8 calories



_____ Cashew nuts = 2800 calories

VARIED DIET

Astronauts need to get a range of vitamins and minerals and need to eat a varied diet, not just one thing!

PRESERVING FOOD

There are many ways that food can be preserved to take into space. **Can you match the descriptions below to the name of the preservation process?**



Refrigerated

Cooling to -180°C to preserve the food. A food commonly preserved in this way is ice cream.



Dehydrated

Sterilizing with ionizing radiation. A food commonly preserved in this way is seafood.



Thermostabilized

Food has been heated to very high temperatures to destroy any bacteria. A food commonly preserved in this way is canned tuna.



Frozen

The water is taken out from food to prevent any bacteria growing on it. A food commonly preserved in this way is dried fruit like raisins.

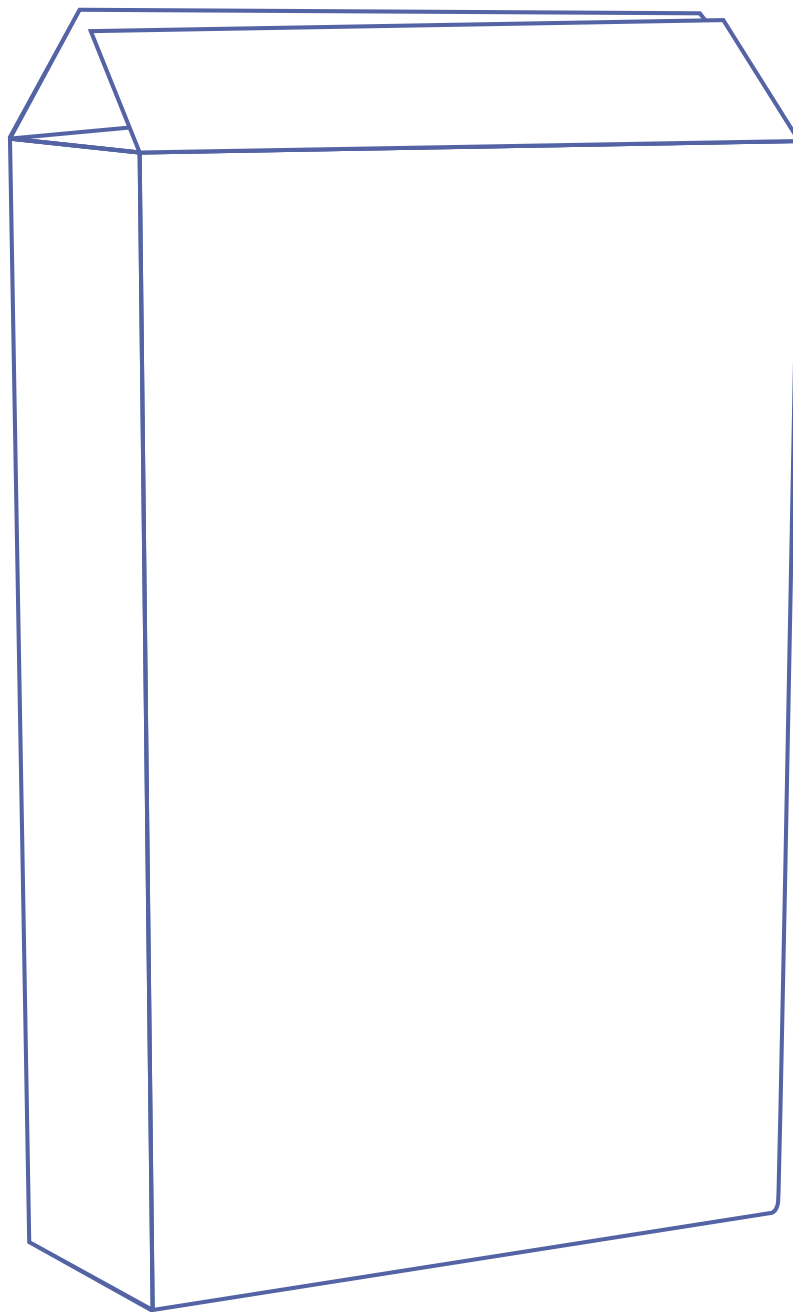


Irradiated

Food has been cooled between $0-50^{\circ}\text{C}$ to slow bacterial growth. A food commonly preserved in this way is milk.

PACKAGING

Packaging on space food is often not very interesting. Food is typically kept in a vacuum sealed container with the name of the product on. **Can you help to improve this through designing your own packaging for your own brand of space cereal? You can come up with the name and packaging look.**



PACKAGING

It has been estimated that each crew member in space receives **1.8kg of food**, including the packaging, per day. **Can you use this figure to calculate the answer, in kilograms?**

How much food would one person need for four days? _____ Kgs

How much food would four people need in one day? _____ Kgs

How much food would 10 people need in 10 days? _____ Kgs

How much food for 4 people in 1 year? _____ Kgs

HINT

There are 365 days in a year





JOBS AND CAREERS

There are lots of jobs that people do to discover more about space. Astronauts have a well-known career that allows them to go into space and orbit the Earth. However, not every job needs to be in space to learn more about it.

Let's join Katie and Tex and find out more about the jobs you can do to explore space.

WORDSEARCH

There are so many jobs and careers that can explore space. Can you help Katie find the ones hidden in this word search?

K P T O C K M C A T J H Z C G G D F R E
R R X T C S U Y S M O R V X L F F X E B
T G E G R G P W T J O K L R I O E L E D
X R D E S L L V R M O I P G Z E U V N E
Y L F I N H Y F O U Q D M H J L S T I M
S L X P C I P W N T U A N O R T S A G K
N H D G U X G F O O T S E H W I B H N T
T S X L Q U G N M H O T D G C D N Q E M
R H U K B M W C E X T X R I E S B G E S
I D J D T A A M R S B F S C E S H N C C
W Q O M F K A J O J C Y U Q Z V Q X A E
S E N E K T B A B A H I I P Q Z H R P G
S E S Z I Q Z R V P Z D T R Z M Z J S K
G X D C K K Q F Y N V I Z O D U I T O R
T S I A M N X M T Y H D L I B G G E R O
C A P U O T V H R R U G J K H O K C E J
N D A T A A N A L Y S E R I J L R Q A I
A Y W U I C V Y F P U L Q L G X P M O X
F L T F D M Q R K F L S N M S M A G P O
W N H I K V J C W J I K T Q J V B B N O

Astronomer

Astronaut

Aerospace Engineer

Data Analyser

Mathematician

Robotics Engineer






Physicist

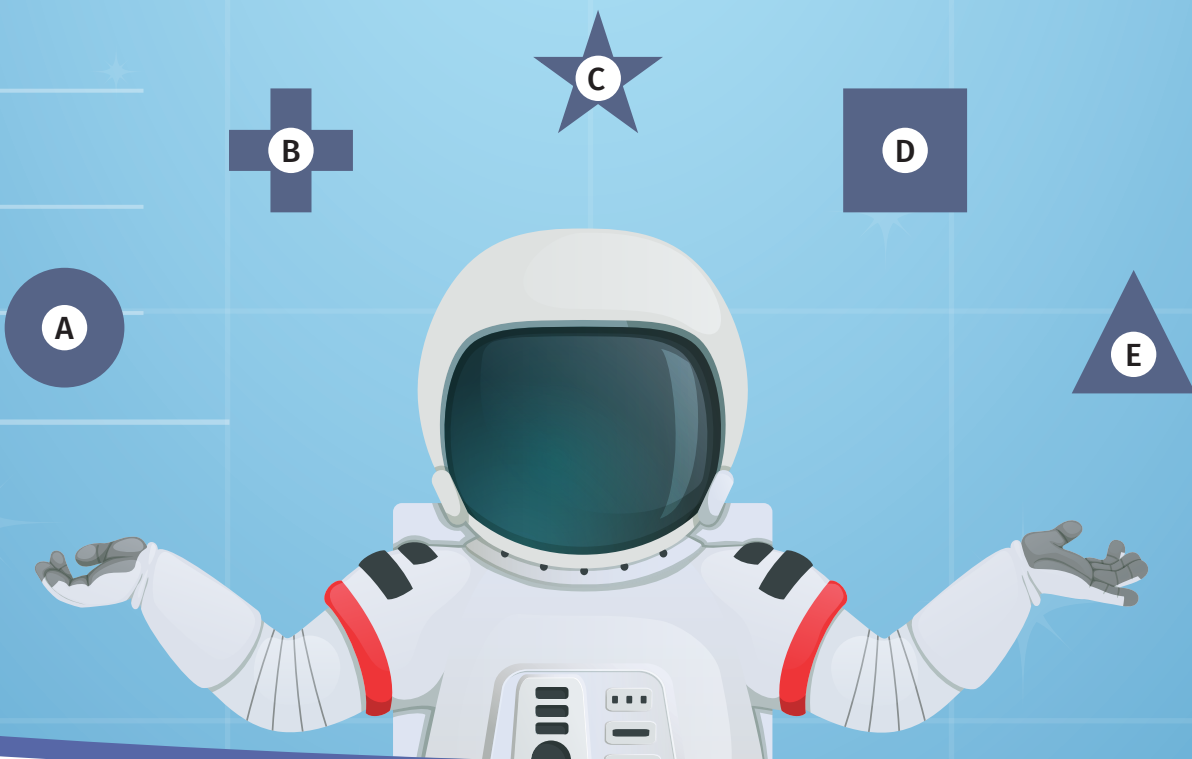
JOBS AND CAREERS

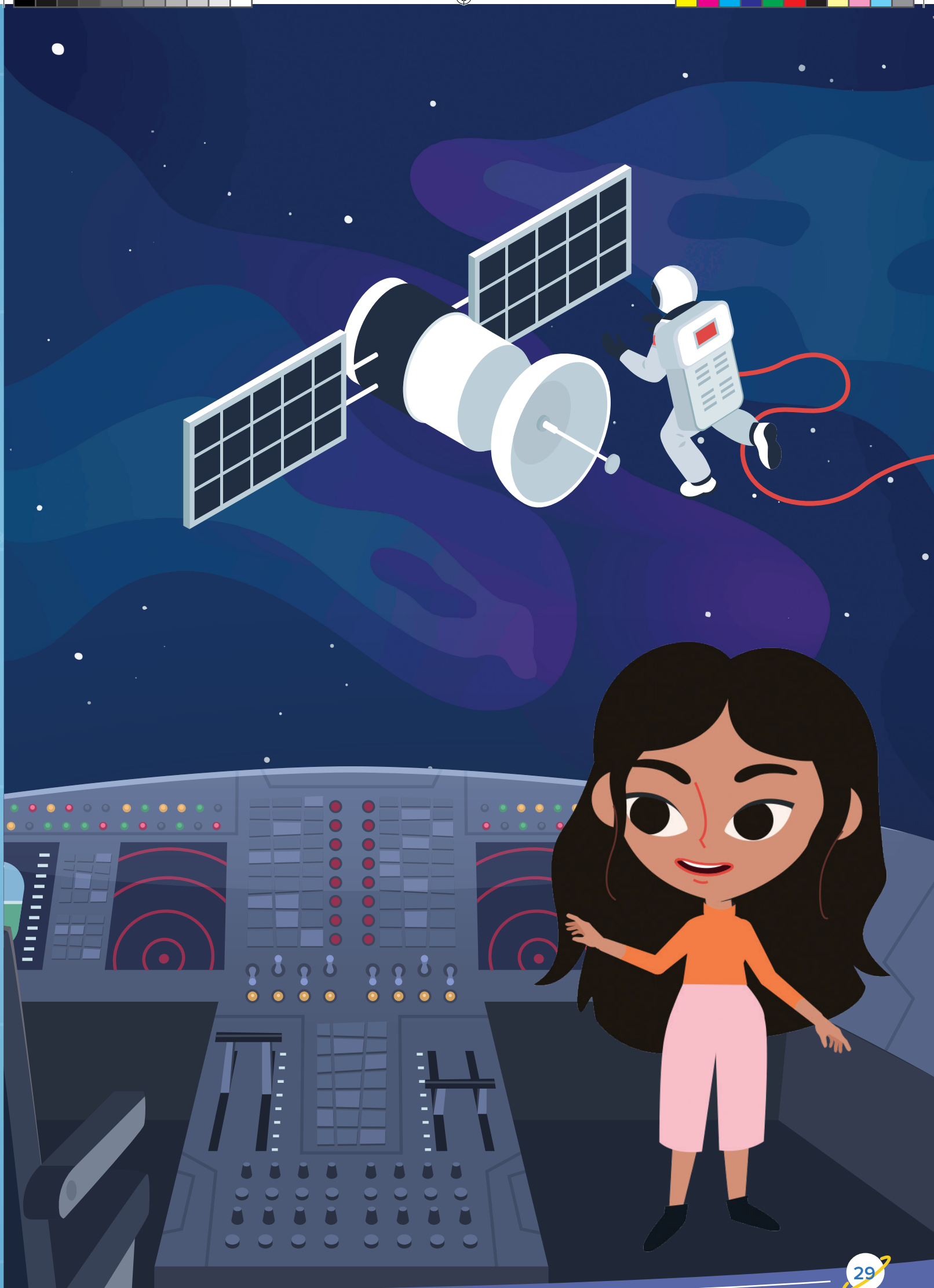
There are many different types of engineers that are part of space missions including satellite, mechanical and communications engineers. These experts can install, maintain, test and repair any technology or machine that are part of space missions.

Can you help Katie to match up items on the control panel below? You need to write down what the shape is and then match it to the correct numbered item below.

MISSION CONTROL

 This shape is a <input type="text"/> It matches <input type="text"/>	 This shape is a <input type="text"/> It matches <input type="text"/>	 This shape is a <input type="text"/> It matches <input type="text"/>	 This shape is a <input type="text"/> It matches <input type="text"/>	 This shape is a <input type="text"/> It matches <input type="text"/>
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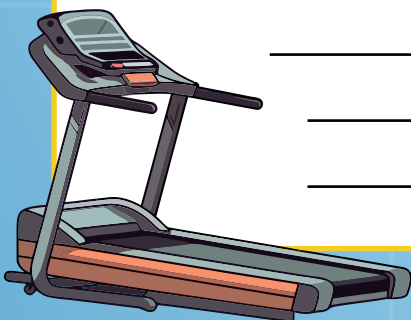
JOBS AND CAREERS

Making sure things work properly in space is really important. A space product designer takes items that are needed in space and changes them so that they can work in the environment up there. Zero gravity and the extreme temperatures and pressures experienced in space mean that items we use easily on Earth can struggle in space. **Write down the problems or challenges that astronauts may have using these everyday items in space.**

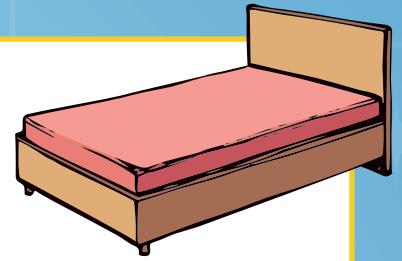
Toilet:



Exercise Equipment:



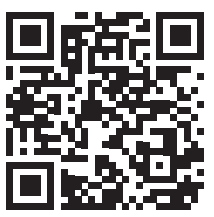
Sleeping Areas:





ABOUT KATIE & TEX

Katie is a research scientist. She carries out experiments and investigations across a wide range of subjects. Katie loves learning about technology and often talks to her friends to find out how it's used in their areas of work. **Tex is an advanced and very clever robotic dog** created by Katie as a research experiment. He's programmed to know lots of facts and to help Katie around the lab - and has a mischievous sense of humour.



Scan the QR code here to access more of Katie and Tex's adventures exploring the world of technology. These short animations, covering a range of technology topics, are aimed at inspiring primary school-aged children to think and talk about technology and the role it plays in their lives.

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 ROYAL
AIR FORCE
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