Can you build a shelter on the moon?
Session Leader Notes

You will need:

- Printed worksheets (blue worksheet)
- Access to computer, projector and sound to display Oxplore Challenge presentation
- Writing surface and pens

General pointers on this session:

- This session takes approx. 45 minutes to deliver. An extension activity (pink worksheet) is available if you have more time or fast-paced learners.
- This session works well with group sizes from approx. 8 to 40 pupils.
- Pupils will need to be broken up into small groups. Small groups should ideally not contain more than 4 pupils per group.
- This session is designed to build the Oxplore Key Skills of self-direction (designing a moon shelter), critical thinking and problem solving (overcoming the inhospitable conditions on the moon).
- This session is focused on STEM subjects but skills are transferrable across all subjects.

Session breakdown:

Suggested Timings (minutes)	**Slide Content**	**Discussion Points/Notes**
Prior to pupils entering room	Slide 1: Title	• Move to Slide 2 as soon as pupils begin entering
From first pupil entering room to all pupils seated	Slide 2: Brain teaser (The faster you run, the harder I am to catch. What am I?)	• Pupils may start calling out ideas/discussing aloud.
0.00-1.00 (1 min)	Slide 3: Brain teaser answer (Your breath!)	• Did anybody guess correctly?

1.00-2.00 (1 min)	Slide 4: Skills you'll be building today: Self Direction, Critical Thinking, Problem Solving	• Briefly introduce each skill, give more detail if this is group's first Oxplore Challenge • You could point out here that these skills are essential for careers and further study, and will help you in your GCSEs and A-levels.
2.00-4.00 (2 min)	Slide 5: Video intro (video approx. 45 sec)	
4.00-8.00 (4 min)	Slide 6: Discussion slide activity: Four elements needed for survival (air, water, shelter, food)	• Direct pupils to discuss in pairs or groups • Some groups may require check-ins to keep on task. • Get them to share their answers with the rest of the class
8.00-11.00 (3 min)	Slide 7: Video (video approx. 1 minute)	
11.00-41.00 (30 min)	Slide 8: Activity instructions	• Pupils have 5 minutes to discuss and write down ideas to the three remaining questions on their worksheet. • Give out (or direct pupils to these if placed around the room) "Factsheet 1: Air and Shelter" and "Factsheet 2: Food and Water" – pupils use these to inform their moon shelter design. • Pupils have 25 minutes to design their moon shelter. You can reduce the time if you would like to allow time for pupils to present their designs to the class.
41.00-42.00 (1 min)	Slide 9: Action: Send Team Oxplore your scripts	• If you would like to, please photograph pupils' work and email it to us at, oxploreteach@admin.ox.ac.uk . There is no obligation to do this, but it is very helpful for qualitative evaluation purposes. If uploading, please do not include identifying information about pupils, eg. crop/blur names. • Pupils may ask "Do people at Oxford really read it?", the answer to this is yes, as it helps us to understand whether or not our programmes are helping people to develop their skills

42.00-43.00
(1 min)
	Slide 10: Today's skills:
	Self Direction, Critical Thinking, Problem Solving
		• Pupils are asked to judge whether they have practised each key skill.
		• You could ask pupils to carry out their self-assessment by:
		  ○ Closing their eyes and raising their hands if they feel they have practised each skill
		  ○ Giving a thumbs-up/thumbs-down to say whether they feel they have practised each skill
		  ○ If you are able to record how many pupils feel they have practiced each skill, please email this to us (oxploreteach@admin.ox.ac.uk)
		• This is another good time to build academic self-concept by emphasising that these skills are important for your future, and will get stronger each time you use them.

43.00-44.00 (1 min)	Slide 11: Congratulations	• This could be a good point to gesture forward to future Oxplore Challenge sessions, or tally how many sessions the group has now completed if you are keeping count.
44.00-45.00 (1 min)	Slide 12: If you enjoyed this session, here are some subjects you may be interested in studying in the future…	• If you have additional time, this could be a useful jumping-off point for discussion about super curricular opportunities available within your school/local area.

NAME: DATE:

Can you build a shelter on the moon?

What equipment do explorers need to survive?

If you were an explorer, what special equipment would you need to help you stay alive?

What do humans need to survive?

Where do we find fresh water on Earth?

What do we need to grow food?

What would happen if the Earth's atmosphere changed or disappeared?

Design a blueprint for your shelter on the moon

Use the space below to show how your moon base will provide water, food, breathable air and shelter. You can use words and drawings.

Remember, the moon does not have an atmosphere or liquid water.

Your blueprint (continued)

Your blueprint (continued)

CHALLENGE SKILLS

Tick the skills you have practised.

Self-Direction

Critical Thinking

Problem Solving

Factsheet: Air and Shelter

The Earth has an atmosphere that we can breathe and which protects us. An atmosphere is a layer of gases that surround objects in the Solar System, like planet Earth.

Earth's atmosphere is made of many types of gases, mostly nitrogen and oxygen. Oxygen is important for humans because it fuels our bodies.

The atmosphere gives us air that we can breathe, but it also acts as a shelter by protecting us from harmful radiation from the Sun, like the light that gives some people sunburn. The atmosphere also shields us from small meteors or pieces of asteroids or comets.

Meteor showers are small pieces of rock that burn up as they pass through the atmosphere. Another name for meteors is shooting stars.

On the moon there's no atmosphere. That means two things – first, there's no air to breathe. And second, the way the sunlight hits the moon can cause parts of it to become very hot, and parts of it to become very cold.

-173 °C

127 °C

IMAGE: Photo of dark/light sides of moon. Light side is labelled with "127°C", dark side with "-173°C".

TOP TIP: On the Earth, the atmosphere keeps temperatures stable by moving the warm air around. But that can't happen on the moon, so you will have to think about how to control the temperature in your base.

Lastly, if your moon base is on the surface of the Moon, it will have to be very strong to protect everything inside and make sure no air leaks out.

TOP TIP: One idea for extra protection might be to build the base partially underground or in a cave – this could help with controlling the temperature too.

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Factsheet: Food and Water

Most of Earth's surface is covered in water – around 71%. That sounds like a lot! However, humans need water to drink and keep our bodies healthy, and 97% of Earth's water is salt water in the oceans, which we cannot drink. Only 3% of Earth's water is fresh water found in rivers,lakes, the atmosphere, the ground, and glaciers.

Glaciers are large, slow-moving rivers of ice, located high in mountains or in other very cold places. They store fresh water, and melting water feeds rivers. Earth is the only place we know of that has water as gas, liquid, and a solid – that's ice – on its surface.

But ice is actually one of the most common forms of water in the Solar System. It can be found on planets, moons and comets – including on our moon.

As the sunlit areas of the moon are so hot, for ice to stay frozen it needs to be in shadow all the time. This is possible in craters, which are the round holes or ring shapes we see on the moon, formed when asteroids or meteorites hit the surface at high speeds. Scientists have found ice in craters on other planets too, such as Mars (see picture below).

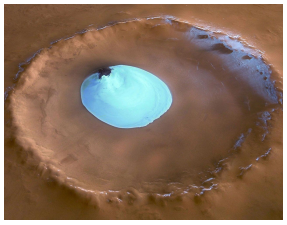

Image source: ESA/DLR/Freie Universitat Berlin (G. Neukum). Accessed via https://science.nasa.gov/resource/mars-crater-ice/

If we use moon ice for our water, we'll have to find a way of extracting it from the moon and melting it to use. If we bring water with us, we'll need to find a way of cleaning it and recycling it to use again. So you'll have to decide which of those options your moon base is going to do.

TOP TIP: As some craters can be very deep and in shadow almost all the time, they are great places to look for ice. You might want to think about placing your base close to one of these.

Last but not least, we're going to need food! Could we make our moon base sustainable by growing our own food?

TOP TIP: The five ingredients for growing plants are soil, water, some kind of fertiliser and space for the plants to grow – as well as some seeds to grow them from. So you'll need to include some space for a garden area in your moon base, and think about where you could get water and fertiliser from.

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Can You Build A Shelter on The Moon?
Transcript pt.1

00.00 Hi, I'm Hoa and I study computer science and philosophy at Oxford University. I spend a lot of my day thinking about AI ethics and thinking about how we can make AI fair and transparent for everyone. One of the challenges that lots of scientists or engineers are working on right now is figuring out how we can get human beings to explore more planets and travel further in space. For our Oxplore challenge today we're going to work on how to solve one of the biggest issues in space travel, how can we keep people alive when they're not on planet Earth?

00:34 Your mission today is to help design a moon base that could keep five research scientists alive and safe for three months on the moon. To do that, we're going to have to remember that humans have four basic needs.

First, air, our scientists will need air with oxygen to breathe. Secondly, water, they will need a supply of clean, fresh water. Third, shelter, we need to protect our scientists from dangers such as meteor showers and keep their body temperature stable so they're not too hot or too cold. And finally, food, they will need a balanced diet to stay healthy.

01:08 So far, the Earth is the only planet we know about that has resources to meet those needs. But is that true of everywhere on Earth?

01:16 On the next screen, there are a few discussion questions. You can go through these in your groups and see what you think.

Can You Build A Shelter on The Moon?
Transcript pt.2

00.00 Now it's time to start designing your moon base. Your session leader has some fact sheets for you with important information about conditions on the moon and some useful tips and tricks.

You'll need to think about those when you're designing your shelter, and remember, in the last exercise you've been thinking about how explorers on Earth have overcome challenges such as; extreme cold, extreme heat, lack of fresh water in the desert and lack of oxygen on high mountains. You could try and think about whether you can use those strategies to design your moon base.

00:26 Your base will also need to be big enough to house five humans and all the facilities they'll need to survive. In front of you now you've got a blueprint to complete. A blue print is a design or technical plan for a building or an invention.

00:39 You'll have a few minutes in your group to plan, then get started.