

EXPERIENCE THE MOON

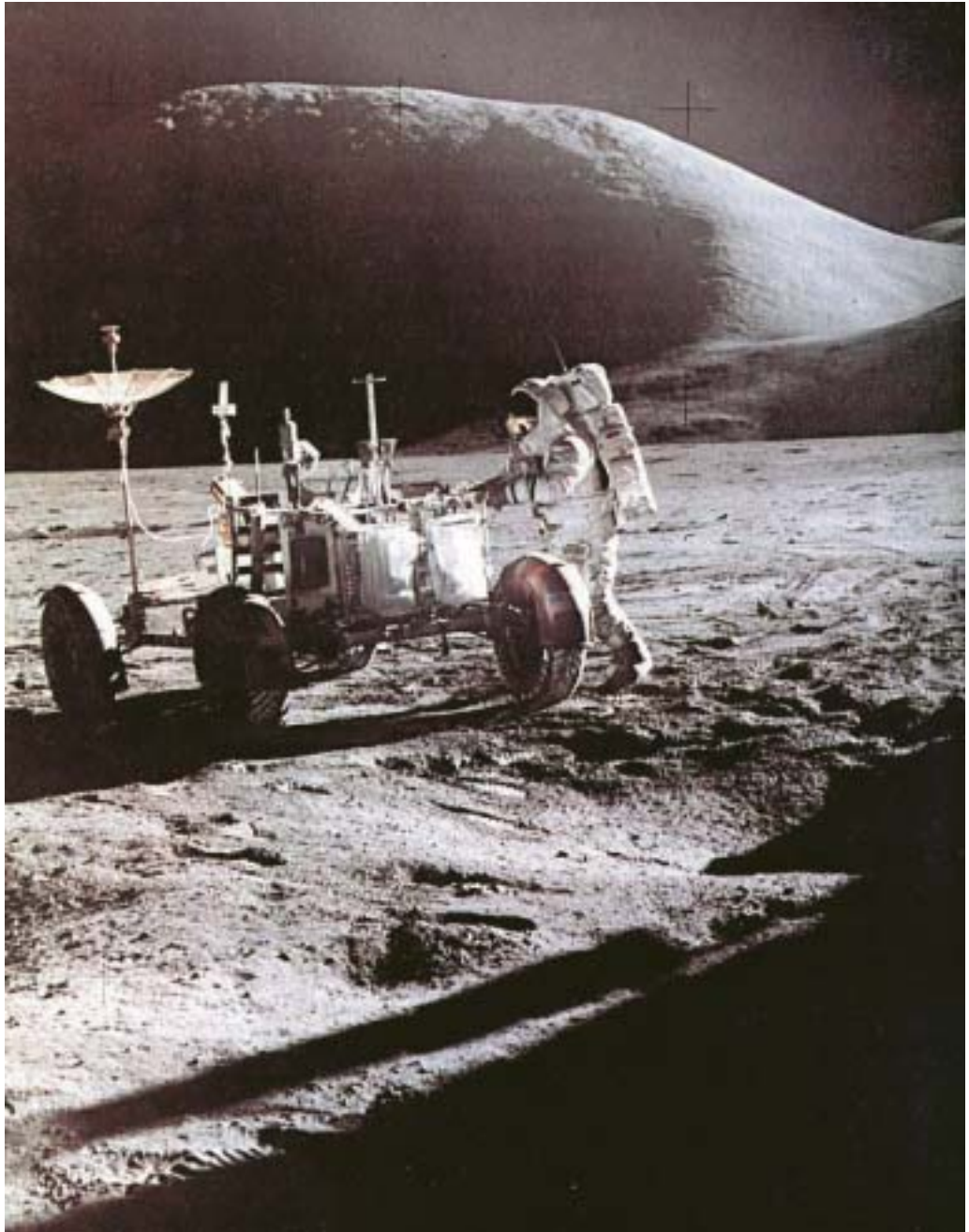
Challenging more able pupils

Developed by Hertfordshire County Council the material asks a newly appointed Sales Executive with Universal Tours Limited to develop package holidays to LUNAR PARK, on the Moon.

The classroom material, **CHALLENGE 12**, is available as a separate pdf file within this CD.

Feedback

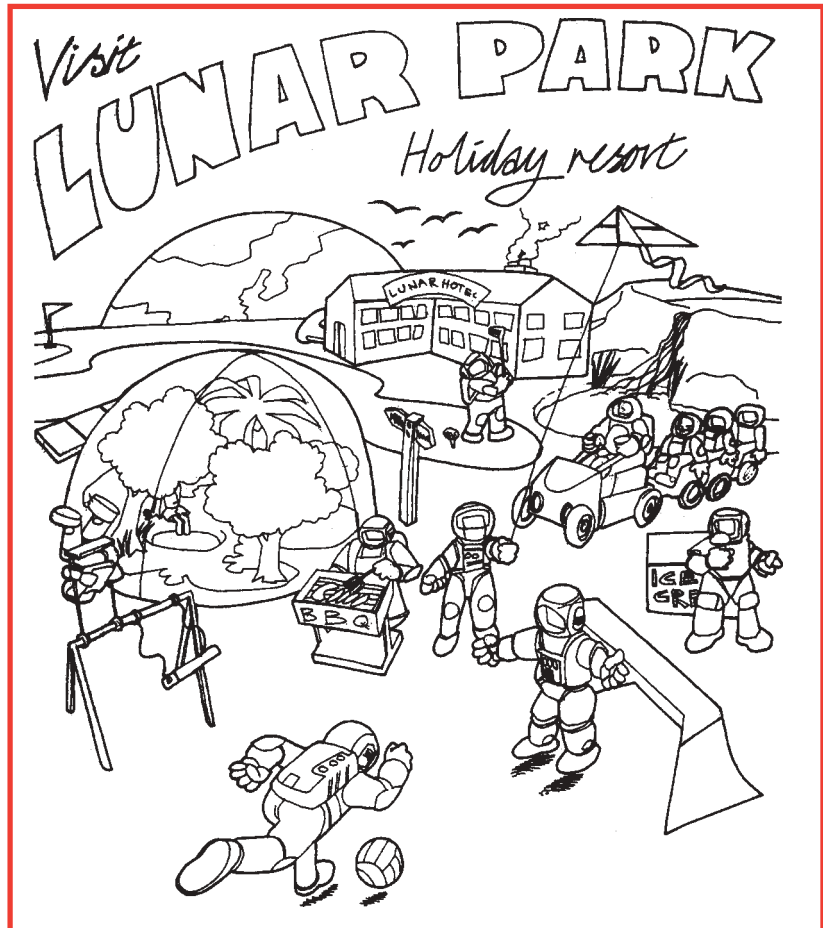
The following extract from *Primary Science Review* (72 March/April 2002; ASE) illustrates the responses to this topic of children in two Hertfordshire schools.



Visit
SPACE AGE
Holiday Park

Original poster

*Extract from teaching materials produced
by Hertfordshire County Council*



Children’s responses

Table 1 shows one child’s attempt to analyse the poster.

There are many statements indicating good application of knowledge relating oxygen being necessary for life processes and combustion, friction being present to enable an electric buggy to move, the absence of air affecting the speed of motion, and the impact of reduced gravity. However, her knowledge of gravity is confused, exemplified by the statement that ‘There is no gravity to keep the water flowing downwards’ (waterfall), which contradicts the earlier statements on golf and swing (as well as not identifying the absence of water!).

Table 1

One child’s responses to the poster task

Things that could not occur on the Moon	Why
<i>Any plants or animals (birds) outside of an air-bubble</i>	Living things need an atmosphere with oxygen and carbon dioxide to survive
<i>Ice cream</i>	You could not have ice cream in the day because it is 100 °C; you could not eat without removing your visor so you would not be able to breathe while you ate
<i>A kite</i>	There is no wind or any other weather on the Moon, and no air to even keep it up
<i>Plants in an air-bubble</i>	Too hot in the lunar day(14.15 Earth days); too cold in lunar night(14.15 Earth days)
<i>Waterfall</i>	There is no gravity to keep the water flowing downwards
<i>Earth view</i>	The Earth would be distant and cloudy because most of the time the Moon is 384,000 km away
<i>Barbecue (smoke)</i>	You could not have fire on the Moon because there is no oxygen

Things that could, or could not, occur on the Moon	Why	Possible problems
<i>A mode of transport similar to an automobile with an electric engine</i>	An automobile needs friction to move, there is no friction on the Moon	Any luggage would need to be strapped down
<i>Golf</i>	There is enough gravity to keep a golf ball down	You would have to have a heavier golf ball and hit the ball lighter because there is no air resistance
<i>Swing</i>	This is still enough gravity to make you go round	There is no air resistance so you would go over the top with very little effort
<i>Football</i>	You could still kick the ball	

Table 2 presents another child's work.

Once again there are some very good explanations but also confusion regarding friction and air resistance. When discussing the possibility of vehicles on the Moon the child states 'There would still be friction between the wheels and the ground', but when commenting about the possibility of playing golf states 'There is no friction on the Moon, but if you hit the ball lightly it would go a long way'. The idea of the hotel being possible because of its mass is an interesting notion and again challenges secure understanding of gravity. One teacher was surprised to discover that quite a few children thought that gravity was a unique property of the Earth: 'You can't play golf on the Moon because there isn't any gravity'. When asked why they thought there wasn't any gravity they replied 'Because there is no air'. It took only a few focused questions (why the Earth and planets orbit the Sun, what causes tides, how Armstrong walked on the Moon) for them to reach the conclusion that objects as well as the Earth have a force of gravity and the strength of the force is based on the object's mass. Without this level of intervention these ideas would not have been taken forward. Even so, following this discussion, one child still insisted that there couldn't be a waterfall because there was no gravity!

Table 2

Another child's responses to the poster task

Things that could, or could not, occur on the Moon	I decided this because ...
<i>You could play football</i>	There is still a sixth of the Earth's gravity, but the ball would go far even if you tapped it because there is no friction; it would also be harder to move
<i>You can use vehicles</i>	There would still be friction between the wheels and the ground
<i>You can walk</i>	Walking is difficult because there is less gravity than on Earth, but you can bounce
<i>You could play golf</i>	There is no friction on the Moon, but if you hit the golf ball lightly it would go a long way
<i>You could grow plants</i>	You could grow plants but you would need to be careful with the temperatures and the light and dark
<i>You can't have an ice cream</i>	It would melt in the heat on the Moon
<i>You can't have a kite flying</i>	There is no atmosphere so the kite would just fall down; also the tail wouldn't flutter
<i>You can have a hotel</i>	It would be heavy enough to stay on the ground
<i>You can't have a barbecue outside</i>	A barbecue needs oxygen to burn; there is no oxygen on the Moon
<i>You can swing</i>	The swing would go round and eventually come to a swinging action
<i>Birds wouldn't be able to fly</i>	There is no atmosphere so the birds wouldn't be able to survive
<i>The Earth would look much further away</i>	The Earth would look like a marble

Figure 1

Extract from a pupil's brochure advertising holidays on the Moon

Leisure

Around the holiday park, there are lots of activities to keep you busy during your stay. Some are these are trampolining, ice - skating and golf. Also away from the sports, is the famous, "Spa of Artemis" and local pub, "The Mars Bar" with brilliant beer and crazy cocktails! Visit the moons most famous landmark, Neil Armstrongs footprint! His footprint of when he first stepped on the moon, has been preserved for years due to the fact there is no wind on the moon to blow them away. Make your mark on the moon today!

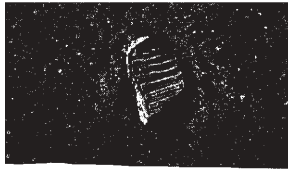
Breathing

You will be supplied with special spacesuits before lift-off. These suits contain oxygen tanks that will supply you with oxygen for the whole of your visit. You must never take your suit off.

Health and Safety

The following are rules which you must keep on your stay on the moon.

- Exercise every day or when you return to earth, you will find that your muscles have grown smaller.
- Beave about the risk of radiation. As there is no atmosphere on the moon



to protect you from the sun, there is quite a high risk of cancer.
 • At daytime on the moon it is 107°C. After 500 you are not allowed out of the hotel because of the freezing temperature of -125°C.

Figure 2

A pupil's brochure cover



Introduction and organisation

This task involves using scientific knowledge from a variety of aspects of science, not just Earth and Beyond.

Its main purpose is to engage the pupils in thinking about life on a different planet, to consider the implications for supporting life and the effects of different environmental conditions on everyday happenings. Statements and conclusions must be justified by a scientific reason.

National Curriculum references

- Sc1.1a that science is about thinking creatively to try to explain how living and non-living things work, and to establish links between causes and effects
- [There is no specific knowledge content reference, but the task utilises knowledge from all aspects of Sc2, 3 and 4.]

Required prior knowledge for the pupils

- knowledge of conditions on the Moon such as day length and temperatures (or time to research these), knowledge of forces, particularly the effect of gravity and the effect of lack of air, knowledge about processes requiring oxygen
- independent research skills

Required prior knowledge for the teacher

- as above
- answers to the initial challenge

Expected outcomes

- a well-reasoned analysis of the original advertisement
- a travel brochure that is informative and scientifically correct

Learning objectives

Pupils will have:

- increased knowledge and understanding of the effects of gravity and the presence of oxygen on everyday life

Pupils are able to:

- use existing scientific knowledge to provide reasoned arguments in unknown situations
- select appropriate information for a task

Pitstops

I Discuss the responses and check the validity of the reasons given.

Ensure pupils are clear about the next part of the activity; you may wish to negotiate information to be included in the poster.

FLAG Discuss appropriateness of detail provided, use of scientific terminology.

Encourage self-reflection and evaluation, and invite critical appraisal from the other pupils or audience specified.

Resources

- information books / resources about conditions on the Moon
- access to websites such as www.sciencenet.org.uk and www.ask.co.uk

Health and safety

Encourage safety awareness by imagining what hazards lunar tourists would be likely to face. For instance, movement in one-sixth accustomed gravity may lead to accidents; fatal consequences of tearing spacesuits in airless conditions; complete darkness of shadowed areas; intrepid explorers might run out of oxygen or just get lost. Lunar travel is not covered by *Be safe!*

Timing

2 x 1 hour sessions. Longer may be needed if a wider range of conditions on the Moon needs to be researched.