ABINGDON SCIENCE PARTNERSHIP

Topic 9
Exploring the Moon

Edexcel GCSE Astronomy Course

Topic specification summary:

9.1 Understand the Moon’s major internal divisions in comparison with those of the Earth

9.2 Understand the major differences between the appearance of the Moon’s near and far sides

9.3 Understand how information has been gathered about the Moon's far side

9.4 Understand that a spacecraft traveling to the Moon must reach the Earth’s escape velocity, the energy requirements of which can be met only by the use of rockets

9.5 Understand the Giant Impact Hypothesis and alternative theories of the Moon’s origin, including Capture Theory and Co-accretion Theory

What do you know and don’t you know about the Moon?

Take this online quiz to find out - make a note of the answers you didn’t know and then test yourself again at the end of this topic:

https://play.howstuffworks.com/quiz/can-you-answer-these-basic-questions-about-the-moon

(6mins)

Take a look at the Moon:

Use this NASA link to download an observing sheet and use it to record what you see for a month of lunar observations:

https://moon.nasa.gov/resources/12/moon-observation-journal/

Scroll down on the NASA page to see if you can answer the questions about the Moon and your observations.

9.1 Understand the Moon's major internal divisions in comparison with those of the Earth

Make your own scale diagram of the interior structure of Moon Structure, similar to the one for Earth Structure in Topic 1. You can print out a ready made diagram from this document or use the suggested dimensions to make one of your own on A4 or A3 paper:

Moon Structure

For an extra challenge, try drawing the Earth and Moon structures next to each other to the same scale - this makes a useful comparison of both their size and interior structures.
More details about the interior of the Moon can be found here if you have time to read it:
https://moon.nasa.gov/about/what-is-inside-the-moon/

Moon rocks, Houston Museum of Natural Science, Texas, USA

9.2 Understand the major differences between the appearance of the Moon's near and far sides

Start with a REVISION task - can you still locate these features of the Moon's surface from Topic 2?

a Sea of Tranquility b Ocean of Storms c Sea of Crises d Tycho e Copernicus f Kepler g Apennine mountain range

Try to find them on the image at this link - check back to the Topic 2 slides to see if you are correct: https://moon.nasa.gov/resources/127/lunar-near-side/

Compare this with an image of the far side and make a list of all the differences you can spot: https://www.nasa.gov/mission_pages/LRO/news/lro-farside.html

Using the next link, change latitudes and longitudes to see the Moon's surface from different viewpoints e.g. latitude 0 degree (equator) and longitude 0, 90, 180 and 270 degrees - make a sketch or take a screenshot of the different views: https://www.fourmilab.ch/cgi-bin/Earth

cont...

9.2 continued - UNDERSTANDING the differences:

You will see that item 9.2 on the previous slide requires you to understand the differences between features on the near and far sides of the moon, not just know that they look different. Here is a link with more information about this. As you read it, find the answers to the questions below and make a note of them:

https://earthsky.org/space/why-the-moons-near-and-far-sides-look-different

1.What are the major features that are not seen on the far side?
2.What is different about the crust on the far side?
3. What two theories could explain the differences?
4. Which space mission provided evidence to investigate these theories?
5. Describe the type of object now thought to have collided with the Moon.
6. Describe the effects of the collision on the surface of the far side.

9.3 Understand how information has been gathered about the Moon's far side

The Apollo 8, 10 and 13 missions orbited the Moon and Apollo 11,12,14,15,16 and 17 orbited it and landed astronauts on it. If each Apollo capsule carried 3 astronauts, how many people have seen the far side of the Moon directly?

This link discusses some interesting history of lunar missions - use it to answer and make notes on the questions that follow:

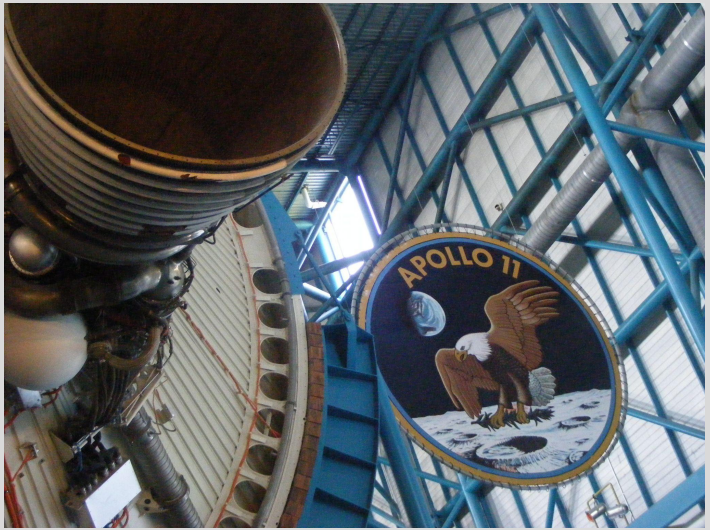
https://physicsworld.com/a/exploring-the-far-side/

1. What was the name and nationality of the first mission to image the far side?
2. Why are Moon landers usually sent to the near side?
3. How did the Chinese send signals back from the Chang'e-4 lander?

Extra information about Moon missions

If you have time, take a look at this interesting and interactive link showing information about Moon landings up to 2019:

https://www.smithsonianmag.com/science-nature/interactive-map-shows-all-21-successful-moon-landings-180972687/



9.4 Understand that a spacecraft traveling to the Moon must reach the Earth's escape velocity, the energy requirements of which can be met only by the use of rockets

This may involve some physics you haven't met before, like Newton's Law of Gravity or gravitational potential energy vs. kinetic energy of a spacecraft. However, the basic idea is this:

- At a distance from the Earth's centre, a spacecraft stores a certain amount of potential energy, PE
- This depends on the size of Earth's gravitational force, distance from the centre and mass of the spacecraft m
- PE at the Earth's surface = GM/r Joules for every 1kg of spacecraft mass, if r = radius of the Earth
- To escape the Earth completely, not just go into orbit, this amount of kinetic energy must be transferred to every 1kg of the spacecraft, or ½ v^2 Joules where v is its escape velocity
- Doing some algebra then gives the equation $v = \sqrt{2GM/r}$ for calculating escape velocity from the surface of an object with mass M and radius r
- For Earth this turns out to be about 11 km/s or 11000 m/s - for comparison an airliner takes off at about 70m/s and top athletes can run at 10 m/s
- The conclusion is that leaving the Earth needs BIG rockets!

Here is a link to a great explanation and an interactive way to find escape velocities for the Earth and other bodies, including the Moon itself http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

9.5 Understand the Giant Impact Hypothesis and alternative theories of the Moon's origin, including Capture Theory and Co-accretion Theory

Item 9.5 begins with the command word 'understand' which means that a GCSE question could ask you to describe the theories and give evidence for them.

In your notes, you should make a table with these headings and fill in the columns with information on each of the three theories from the link that follows.

Name of Theory	Description of the Theory	Evidence for the Theory

Watch the short video, then read the text to get more details:

https://www.space.com/19275-moon-formation.html

What do you know now about the Moon?

Take the online quiz again to see if you have learnt things you didn't know before:

https://play.howstuffworks.com/quiz/can-you-answer-these-basic-questions-about-the-moon