

SPASH ASTRONOMY
CHAPTER 7 (THE MOON)
OVERHEAD LECTURE QUESTIONS

THE EARTH'S ONLY NATURAL SATELLITE (a body that orbits around a larger body).

1. Briefly describe the moon:

The moon is about 1/4 the diameter of the earth. **THE MOON IS A ROCKY WORLD SPLOTCHED WITH DARK GRAY FLOWS OF ANCIENT LAVAS AND DOTTED WITH CRATERS FORMED BY EXPLOSIONS WHEN METEORITES HIT IT IN THE ANCIENT PAST. THE MOON HAS NO AIR, NO WATER, NO WEATHER, NO BLUE SKY, NO CLOUDS, and NO LIFE.**

WAXING REFERS TO THE PERIOD OF TIME WHEN THE MOON IS GROWING MORE ILLUMINATED AND **WANING** WHEN THE MOON IS GROWING SLIMMER.

2. How long is one complete cycle of lunar phases?

Thus it takes **29.5 days** for the cycle of lunar phases.

3. Why is the cycle of lunar phases longer than the sidereal period?

The **moon's sidereal period** (one revolution around Earth relative to the stars) is **27.3 days** but during this period the Earth moves roughly 27° around the Sun, so that the Moon has to move through this additional angle to complete its cycle of phases relative to the Sun.

4. Why can't there ever be a blue moon in February?

A blue moon is two full moons in the same month, February has 28 days and it takes 29.5 days to go from one full moon to the next.

5. What is meant by the moon's synchronous rotation?

One curious characteristic of the Moon's motion is called **synchronous rotation**. The moon rotates on its axis with a period equal to its orbital revolution period around Earth, so that the same side keeps facing Earth at all times.

6. Is the dark side of the moon the same as the far side of the moon?

There is always a dark side, but it isn't necessarily the far side. Think of where the sun is shining during new moon and full moon. Another consequence of the moon's synchronous rotation is that an astronaut on the near side of the Moon always sees Earth hanging forever in the same spot in the sky. Earth would not rise and set. Because of a slight Moon wobble we can see at most 59% of the Moon during a period of years.

TIDES: Gravitational forces in the Earth-Moon-Sun system cause tides, or bulges in the shape of Earth and Moon.

The closer two objects are, the stronger the gravitational force each exerts on the other. Thus the side of the Moon facing the Earth has a stronger force on it than the far side, because the facing side is closer.

7. What is a body tide?

The stretching of the earth is called a **body tide**. Similar forces acting on the Earth produce not only a body tide but also an ocean tide. These body tides have enough of an effect to cause the fish feeding periods of the day.

8. What is the range of ocean tides?

The Earth's **body tides** are **hard to detect**, but its **ocean tides** are obvious to anyone who visits a beach for more than an hour. They **range** in height from about **2 ft. to over 50 ft.**

9. Name one of the two reasons why high tides are not always at New Moons?

High tides are **not** always at **New Moons** or **Full Moons** as complications result from motions of water around the irregularly shaped oceans and seas and because of the Earth's rotation. Note: Figure 7-5 Page 138. So called **tidal waves** are related not to tides but to earthquakes or volcanic activity at sea. Japanese call them **tsunamis**.

10. List four major effects that tidal bulges raised on the Earth and the Moon have:

1. Causes the Synchronous Rotation of the moon.
2. Causes a low tidal recession of the Moon away from the Earth because of gravitational forces on tidal bulges. Thus the moon is slowly moving farther away from the Earth.
3. The Moon slows Earth's rotation and thus the day is getting longer. Before the moon can escape our orbit however the tidal bulges raised on the Earth by the Sun will reverse the processes and the Moon will begin to approach Earth again. **This will not happen until the day exceeds the month.** One day now is .07 sec. longer than 4,000 years ago.
4. A small body, if close enough to a large body, can be torn apart by tides. Roche's limit is the distance between any two different-sized bodies within which the tide-raising force exerted on the smaller body is sufficient to disrupt it. The Moon's Roche's Limit is about 11,000 miles and the moon is currently 240,000 miles and increasing currently.

11. What is the moon's terminator?

The **terminator** is the line dividing lunar day from lunar night. More detail can be seen along the terminator than in the high lighting part or the limb. The moon's **limb** is it's edge.

12. What where the following named after on the moon's surface:

craters:

lunar mountains:

mare (MAH ray):

Mare (MAH ray) is Latin for seas. The mares on the moon are actually vast plains covered with dark lava. Mare surfaces cover only 15% of the whole Moon although most of them are on the front side.

In mapping the moon the **craters** where names after will-known **scientists and philosophers**, the **maria** were given **poetic and fanciful names**, such as Mare Imbrium (Sea of Rains), and the **lunar mountains** were named for **prominent terrestrial ranges**, such as the Alps.

13. How do the mountains on the moon compare to mountains on the Earth?

The mountains however are the rims of vast multiringed craters, called basins, which in turn contain the mare plains. Bright streaks called rays, which radiate from various craters but show no relief, are **fine debris** blasted out of the craters.

The surface of the moon is covered almost everywhere by a type of soil called the **regolith** (rocky layer) that is 10 to 100 feet depth. Each crater is covered with a sheet of regolith called an **ejecta blanket**. The powdery surface of the regolith is due to small meteorites (some microscopic), which are so abundant they have "sandblasted" most of the upper few meters into fine dust.

14. How many people have walked on the moon?

Table 7-1 (Page 166) lists the six Apollo lunar landings and two earlier test flights. Twelve men walked on the Moon during the Apollo program from 1969 to 1972.

15. List the each Apollo mission that landed on the moon and the date of each mission:

<u>Apollo</u>	<u>Date</u>	<u>Year</u>	<u>Lbs. Of Lunar Samples Returned</u>
11	July 16-24	1969	22
12	Nov. 14-24	1969	34
14	Jan. 31	1971	44
15	July 26- Aug 7	1971	77
16	April 6-27	1972	97
17	Dec. 7-19	1972	110

The astronauts found the **maria** to be vast flows of **basaltic lava**, 3 to 4 billion years old.

Chemical evidence from the rocks shows that around 4.5 billion years ago, the surface layers of the Moon were molten, forming a vast sea of lava called a **magma ocean**.

Upland sites visited by astronauts revealed overlapping layers of ejecta blankets from many craters, composed of dust, glass droplets, rock chips, and **breccias**, or **rocks composed of cemented rock fragments**.

Many kilograms of lunar rock were brought back from the Moon. Once their appearance was known, an additional dozen were discovered on Earth between 1982 and 1991.

Relative to Earth's mantle, **the Moon is strongly depleted in volatile elements and compounds** -- substances that are driven off by heating, such as water; but the Moon is **enriched in refractory elements** and compounds -- substances with high boiling points, such as aluminum and titanium. All of the huge impact basins formed as part of the intense cratering that occurred before or around 4 billion years ago.

16. List three facts about the Interior of the Moon:

1. The Moon's Mean density (total mass divided by total volume). is much less than that of the Earth - 3300 vs. 5500 kg/m³

This proves that the Moon is mostly rocky, like Earth's mantle, and that it lacks a big iron core.

2. The moon has virtually no magnetic field. This again suggests the lack of a large molten iron core, because scientists believe that the planet's magnetic fields originate in currents in such cores.

3. Seismic data show much less quake activity on the Moon than on Earth. Large lunar quakes rank only .5 to 1.3 on the Richter scale, compared with 5 to 8 for major earthquakes on the earth.

The Apollo data from the Moon thus help clarify the impact history of Earth, paving the way for recent theories that giant impacts may have altered climates and biological evolution.

17. Where did the Moon come from?

The Giant impact hypothesis states that during the final stages of Earth's formation, but after Earth's iron core formed, our fledgling planet was hit by a large interplanetary body -- perhaps as large as Mars. Thus, the impact blasted hot material out of the mantles of both the Earth and the impactor, into a cloud of debris around primordial Earth. The Moon aggregated from those mantle debris.

Ever since Apollo 17 blasted off the Moon in 1972, the Moon has been deserted.