

## PROBLEM SET 9

### Physics 2021

1. The angular diameter and distance of the Moon are 31 arcminutes and 384,400 km. Use the small angle equation to find the linear diameter of the Moon.
2. What is the angular diameter of the Earth as seen from the Moon?
3. When flight controllers on Earth spoke to Apollo astronauts on the Moon, there was a noticeable time delay in the communications. How long does it take a radio signal to travel to the Moon?
4. Verify that the Moon's average density is about  $3.3 \text{ g/cm}^3$ . Explain why this average density implies that the Moon's interior contains much less iron than the interior of the Earth.
5. How much would an 80-kg person weigh on the Moon? How much does that person weigh on the Earth?
6. The last manned spacecraft to land on the Moon was the *Apollo 17* lunar module *Challenger* in December 1972. After lifting off from the lunar surface and returning to the command module *America*, in which they would return to the Earth, the *Apollo 17* astronauts sent the unoccupied *Challenger* to crash into the lunar surface. The seismic waves from this impact were detected by seismometers left by the crews of *Apollo 12*, *14*, *15*, *16*, and *17*. Why was it useful to do this? Why was it not enough to detect seismic waves from naturally occurring moonquakes?
7. The youngest lunar anorthosites are 4.0 billion year old, and the youngest mare basalts are 3.1 billion years old. Would you expect to find any impact breccias on the Moon that formed less than 3.1 billion years ago? Explain your answer.
8. If the Earth and the Moon had formed independently in the same region of the Solar System, we would expect that iron would be present in each world in about the same percentage. Explain how the different relative sizes of the Earth's core and the Moon's core suggest that the Moon formed instead by collisional ejection.