PROBLEM SET 10
Physics 2021

1. Find the largest angular size that Mercury can have as seen from the Earth. In order for Mercury to have this apparent size, at what point in its orbit must it be?

2. Suppose you have a superb telescope that can resolve features as small as 1 arcsec across. What is the size (in kilometers) of the smallest surface features you should be able to see on Mercury? How does your answer compare with the size of the Caloris Basin, which as a diameter of 1,500 km? (*Hint*: Assume that you choose to observe Mercury when it is at greatest elongation, 28º from the Sun.)

3. How much would an 80-kg person weigh on Mercury? How does that compare with that person's weight on the Moon? How much does that person weigh on the Earth?

4. When an impact crater is formed, material (called *ejecta*) is sprayed outward from the impact. While ejecta are found surrounding the craters on Mercury, they do not extend as far from the craters as do ejecta on the Moon. Explain why, using the difference in surface gravity between the Moon and Mercury.

5. The orbital period of Mariner 10 is twice that of Mercury. Use this fact to calculate the length of the semi-major axis of the spacecraft's orbit.

6. Give at least two pieces of evidence that Mercury has undergone chemical differentiation.

7. Venus takes 440 days to move from greatest western elongation to greatest eastern elongation, but it needs only 144 days to go from greatest eastern elongation to greatest western elongation. With the aid of a diagram, explain why.

8. (a) How many days elapse from one greatest eastern elongation of Venus to the next? (b) If Venus has an orbital period of 224.7 days, why isn't the time interval you calculated in part (a) equal to 224.7 days?

9. When the *Galileo* spacecraft flew past Venus in 1990 while on its way to Jupiter, it used its infrared camera to view lower-level clouds in the Venusian atmosphere. Why was it necessary to use infrared light to see these clouds?

10. A hypothetical planet has an atmosphere that is opaque to visible light but transparent to infrared radiation. How would this affect the planet's surface temperature? Contrast and compare this hypothetical planet's atmosphere with the greenhouse effect in Venus's atmosphere.