

## Astronomy 2020 – Space Astronomy & Exploration Fall 2020

### Homework #4

Due: Oct. 21, 2020

In questions 1-3 below, choose the best answer. Then explain your reasoning in a few complete sentences. Why is your answer correct?

- (2 pts.) Which of the following is always true about images captured with X-ray telescopes?
  - They are always very pretty.
  - They are always displayed with the highest possible angular resolution.
  - They are always useful for seeing through things.
  - They are always displayed in false color.
  - They are always displayed with north pointing upward in the images.
- (2 pts.) What is the *giant impact hypothesis* for the origin of the Moon?
  - The Moon formed when two gigantic asteroids collided with one another.
  - The Moon originally was about the same size as Earth, but a giant impact blasted most of it away so that it ended up much smaller than Earth.
  - The Moon formed from material blasted out of the Earth's mantle and crust by the impact of a Mars-size object.
  - The Moon formed just like Earth, from accretion in the solar nebula.
- (2 pts.) Satellites in low-Earth orbits are more likely to crash to Earth when the sunspot cycle is near *solar maximum* because
  - it is too dangerous to send the Space Shuttle to service satellites during solar maximum.
  - Earth's upper atmosphere tends to expand during solar maximum, exerting drag on satellites in low orbits.
  - of increased magnetic interference.
  - they are more likely to have their electronics "fried" by a solar flare during solar maximum.
- (3 pts.) What is the main visual difference between the lunar highlands and the lunar *maria*? What are the implications of this observation?



5. (6 pts). The early Earth-Moon system after formation 4.5 billion years ago looked quite different than today. The Earth's rotation period was only 5 hours and the Moon was only 3.5 Earth radii away from Earth versus the 24 hour Earth rotation period and 60 Earth radii distance of the Moon from Earth today.



- a. How did this dramatic change occur?
- b. Using Newton's version of Kepler's Third Law, calculate the period of revolution of the Moon around the Earth when its orbital radius was only 3.5 Earth radii.

6. (4 pts.) Compare and contrast the component pieces that came together for Project Apollo's Moon landings versus NASA's Project Artemis.

7. (6 pts). Let's do a little more exploration of the Sun's activity. Using your assigned reading, answer the following:



- a. What is the Sunspot cycle?
- b. How are variations in the numbers and sizes of Sunspots related to other activity on the Sun such as flares and Coronal Mass Ejections?
- c. Explain the role of magnetic fields in creating Sunspots and in keeping their temperatures lower than the surrounding photosphere.

8. (4 pts). **Space Weather.** Describe how variations in Space Weather affect the following:
- a. Electronic components on GPS satellites orbiting the Earth.
  - b. Aircraft trajectories across the North Pole of the Earth.
  - c. The U.S. power grid.
  - d. An astronaut in the Orion Crew Vehicle in cis-lunar space on its way to the Moon.

9. (2 pts.) Why is it important to understand the Sun in order to understand the Earth's radiation belts and space weather?