

Name: \_\_\_\_\_

Section: \_\_\_\_\_

**Homework 3: The Moon, Eclipses, Tides, Radiation, Spectra.**

**Due:** In your section the week of **February 11<sup>th</sup>**. Be neat and concise, show your work, and remember units. An answer without the correct units is wrong.

**Readings:** Ch 2.3, 5, and lectures 5,6 and 7.

1.. [1 point] Which of the following are leap years: 1600 AD, 1900 AD, 2006 AD, 2020 AD?

2. [3 points] Imagine that you are the far side of the Moon. Would you see the Sun during a

(a) solar eclipse?

(b) lunar eclipse?

Explain why or why not.

3. [3 points] The Earth's rate of spin is slowing down and the Moon is getting further from Earth.

(a) Explain why this is happening and

(b) How much further away from Earth will the Moon be in 1000 years?

(c) How much slower will the Earth be rotating in 1000 years?

4. [2 points] Will there always be total solar eclipses on the Earth? Explain why or why not.

5. [2 points] Explain why we on Earth only see one side of the moon. If you were on the near side of the Moon, would you see only one side of the Earth? Would you see the Earth at all? Explain.

6. [2 points] The peak wavelength of electromagnetic radiation emitted by the Sun is around 500 nm. Calculate the energy in Joules that corresponds to a single photon of this wavelength. (Use:  $h = 6.63 \times 10^{-34}$  Js,  $c = 3 \times 10^8$  m/s). A typical rechargeable AA-battery stores 9000 Joules of energy. If you could convert the entire energy of a photon into electrical energy, how many photons would be needed to completely charge a AA-battery?

7. [3 points] Suppose we have a blackbody at temperature  $T$ . Which two laws of physics will govern its behavior? If we double the temperature to  $2T$ , what will happen to the total energy emitted per unit area per unit time ( $E$ )? What would happen to the wavelength of maximum energy emission ( $\lambda_{\text{max}}$ )?

8. [1 point] What does the Bohr model of an atom say about electron orbits? What does this mean?

9. [3 points] In hydrogen, the transition from level 2 to level 1 has a rest wavelength of 121.6 nm. Suppose you see this line at a wavelength of 120.5 nm in Star A and at 122 nm in Star B. Calculate each star's speed. Are the stars moving toward or away from us?