Discussion Questions

1) *Light Travel Time*: Because of the finite speed of light, we see more distant objects as they were in the past. For example, we see our nearest star Alpha Centauri as it was 4.4 years ago, and the Andromeda Galaxy as it was 2.5 million years ago. Astronomers are often asked how we know that these objects still exist when we look at them in the night sky. How would you try to answer this question?

2) Briefly explain why an expanding universe implies a beginning (called a Big Bang).

3) *Cognitive Dissonance*? You are talking to a friend who insists that the seasons are caused by a varying Earth–Sun distance over the course of a year. What other fact can you use to contradicts this view of how the seasons are caused? How would you explain the cause of seasons to your friend?

4) Describe one major accomplishment for each of the following people:
   Ptolemy:

   Copernicus:

   Tycho Brahe:

   Kepler:

   Galileo:

5) Explain what *synchronous rotation* is. What is it caused by? Give an example.

6) Briefly explain how we can use spectral lines to determine an object's radial motion (toward or away from us). Can we also learn the object's tangential motion (across our line of sight) from its spectral lines?

7) **MATHEMATICAL COMPUTATIONS: FOR THE NEXT SET OF PROBLEMS, YOU CAN ANSWER MOST BY READING THE TEXT. IF YOU STILL NEED HELP TALK WITH A FEW CLASSMATES. IF NEEDED GO TO ONE OF THE TUTORING CENTERS ON CAMPUS. MAKE SURE YOU UNDERSTAND IT, DON'T SIMPLY COPY THEIR SOLUTION. PLEASE TAKE YOUR TEXTBOOK.**

The speed of light is 300,000 km/s. How far is a light–year? Be sure to show all work clearly on your calculation.
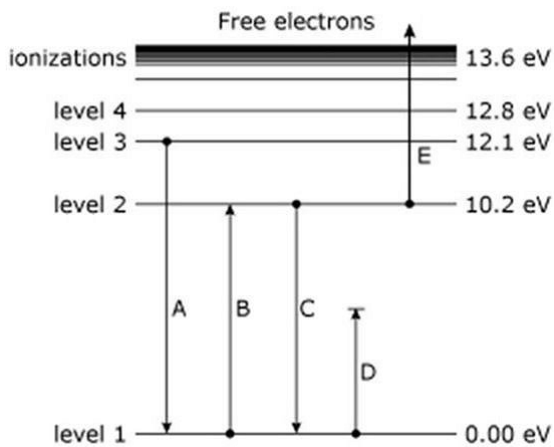
8) From Kepler's third law, $p^2 = a^3$, an asteroid with an orbital period of 8 years lies at an average distance from the Sun equal to

9) According to the *universal law of gravitation*, $F_g = G M_1 M_2 / d^2$,

a) If the distance between two objects increases, what happens to the gravitational force between them? Explain.

b) What would happen to the gravitational force if you doubled the distance.

c) What would happen to the gravitational force if you doubled the mass of one object?

Free electrons

ionizations	13.6 eV
level 4	12.8 eV
level 3	12.1 eV
E	
level 2	10.2 eV
A B C	
D	
level 1	0.00 eV

10) The diagram represents energy levels in a hydrogen atom. The labeled transitions (A through E) represent an electron moving between energy levels. Answer the question and expalin why.

a) Which labeled transition represents an electron that *absorbs* a photon with 10.2 eV of energy?

b) Which transition represents an electron that is breaking free of the atom?

c) Which transition represents the electron that emits a photon with the highest energy?

d) Which transition, as shown, is *not* possible?

11) An atom of the element iron has an *atomic number* of 26 and an *atomic mass number* of 56. If it is neutral, how many protons, neutrons, and electrons does it have?

12) The simplified spectra for four stars is shown here. Which star has the lowest temperature?

Spectra of several stars

4
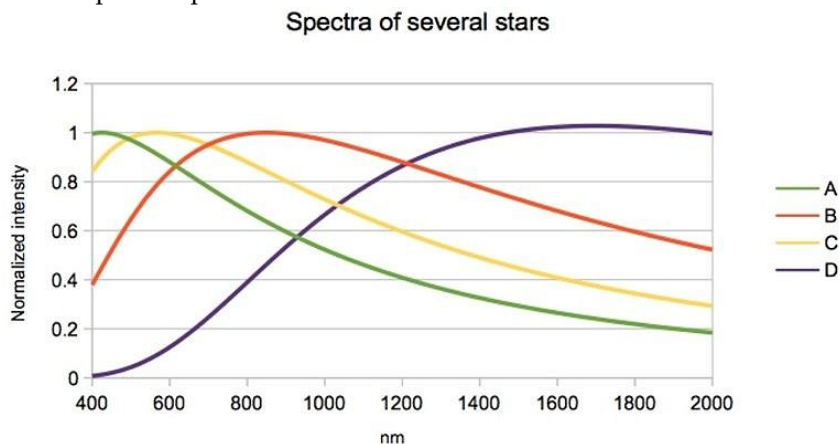
Name: _____

Lunar Phases and Time of Day.

The following diagram represents the Moon's orbit as seen from above Earth's North Pole (not to scale):
Discuss and answer the following questions as a group:

Group members name: _____ _____ _____

1) How would the Moon appear from Earth at each of the eight Moon positions? Draw and label each one with the corresponding phase.
2) What time of day corresponds to each of the four tick marks on Earth? Label each tick mark accordingly.
3) Indicate at what time each phase will rise, set and be at it's highest point.
4) At what times of day would a full moon be visible to someone standing on Earth? Write down when a full moon rises and explain why it appears to rise at that time.

5) At what times of day would a third quarter moon be visible to someone standing on Earth? Write down when a third quarter moon sets and explain why it appears to set at that time.

6) Why doesn't the Moon's phase change during the course of one night? Explain your reasoning.

7) Assume you came home late from a night out. As you make your way to your front door you happen to stumble and fall flat on your back. You notice a waxing crescent moon at it's highest point in the sky. What time did you arrive home?

Earth

sunlight