**ASTR 1304 Group Project**

**Introduction**

Imagine that we have just discovered a new planet in a solar system very much like our own. The planet orbits a star that is the same mass and age as the Sun. The planet is the 3rd of eight planets visible to the naked eye in this system. It has two somewhat large moons.

You and your intrepid group have been assigned to identify some of the basic characteristics of this new world. It is the summer solstice at your base camp at 40° N latitude. Your group has collected the following observations, and you are now expected to report answers to the attached list of questions.

**Instructions**

1. Click on the “Group Project” link on the class web page to locate your team’s data. Analyze the data in terms of the questions that follow.
2. On the “Message Board” link on the class page, you will find a link for your team’s group. Post your initial responses to these questions to your team’s page to your team’s message board. Review your teammates’ responses, and offer comments, constructive critiques, or suggestions. **I will be grading individual contributions for each stage on the deadlines posted below.** You are encouraged to post early to give your team members and your group leader time to comment on and collate your responses. **Your individual contribution to your team’s review will count for 60% of your project grade!**
3. As a group, you will need to collate all of the team’s responses into a single report. This will require you to choose a leader (or leaders) who will be responsible for the final report submission. **How you choose your leader for this project is up to you.** You may have a volunteer; you may choose a leader by a vote; or you may have some alternative form of selection.
4. The group leader will prepare your team’s final report and post it for you to make any last modifications. The group leader will then submit the final report for each stage to me by the deadline. **The final report will count for 40% of your project grade!** Choose your team leaders wisely, and be sure that you take time to review the final report before submission.

**Planetary Characteristics**

**Part A – Orbit**

1. How does your planet’s orbit compare to Earth’s orbit around the Sun? In particular, how would the star appear to change as seen by an observer on the planet? Consider the following data in your response:
   1. Average distance from the star;
   2. Orbital eccentricity;
   3. Perihelion and aphelion;
   4. Orbital period;
   5. Star’s angular size on the sky.
2. How does the planet’s rotation compare to Earth’s rotation? Consider the following data in your response:
   1. Axis tilt;
   2. Rotation period;
   3. Size of the tropical region;
   4. Size of the polar regions;
   5. Which hemisphere points towards the Sun at perihelion.
3. Using your responses to questions (1) and (2), describe what seasons would be like on your planet. Be as detailed as you can!
   1. Are the seasons stronger or weaker than on Earth?
   2. Do seasons have approximately equal lengths?
   3. Does one hemisphere have stronger seasons than the other hemisphere?
   4. How does the altitude of the star at noon vary during different seasons?

**Part B – Atmosphere**

1. How does the composition of your planet’s atmosphere compare to Earth’s atmosphere?
   1. How is it similar?
   2. How is it different?
   3. Is this atmosphere a primitive or an evolved atmosphere?
   4. What do you think accounts for the relative nitrogen, carbon dioxide, and oxygen concentrations in the atmosphere of your planet?
2. Consider the planet’s rotation rate and seasonal differences from Part A.
   1. Do you expect stronger or weaker warm fronts and cold fronts during seasonal changes?
   2. It takes warm water and a relatively fast planet rotation to create large, rotating tropical storms.
      1. Would you expect to find hurricanes on your planet?
      2. If so, would you expect them to be stronger or weaker than hurricanes on Earth? Why?
      3. Would you expect them to persist for longer or shorter periods?
3. Consider the density/pressure of your planet’s atmosphere, its axis tilt, distance from the Sun, and surface composition to answer the following questions:
   1. Is your planet likely to be warmer or cooler than Earth on average?
   2. Does your planet have a significant greenhouse effect?
   3. Is your planet likely to have an ozone layer?
   4. Is your planet likely to have large desert areas (and therefore dust storms)?

**Part C – Planetary Processes**

1. Consider the surface composition of your planet to answer the following questions:
   1. Is your planet likely to be geologically active? How do you know?
   2. Is your planet likely to have plate tectonics? What evidence (or lack thereof) leads you to this conclusion?
   3. Is your planet volcanically active? What evidence on your surface and/or in your atmosphere might support your conclusions?
   4. Is your planet’s surface susceptible to small impacts, large impacts, or both? Are you likely to see evidence of airbursts?
   5. Is your planet susceptible to significant wind and/or water erosion? What evidence (or lack thereof) would support your conclusions?
2. Your planet is about the same age as Earth. Would you expect it to be hotter or cooler than Earth internally? How do you know?
3. What is your planet’s interior structure?
   1. Is your planet differentiated? What evidence can you use to answer this question?
   2. Based upon your planet’s density and moment of inertia, does your planet have a mantle and a core?
   3. Using your answers from questions (1) and (2), do you expect your planet to have a thick crust or a thin crust? Explain your rationale.
   4. Does your planet have a significant magnetic field? What does this tell you about your planet’s core?

**Part D – Moons**

1. Based upon the sizes and distances of your moons from the planet, would you expect to see a total eclipse of the star by either or both moons from the surface of your planet?
2. Would you expect either or both moons to exert stronger or weaker tidal forces on your planet than Earth’s moon does on Earth? How do you know?
3. Determine whether your moons are regular/native or irregular/captured.
   1. Are either or both of your moons likely to be regular/native moons to your planet? How do you know?
   2. Are either of your moons more likely to be irregular/captured moons? How do you know?

**Part E – Living on Your Planet**

1. Suppose you weigh 150 lbs on Earth. What would you weigh on the surface of your planet? Use the ratio of your planet’s gravitational acceleration to Earth’s gravitational acceleration for the computation.
2. From your observations, do you think that your planet could support eventual human habitation?
   1. Would you consider the atmosphere to be “breathable?”
   2. Would you need to bring water?
   3. Would you need to bring protection from ultraviolet radiation?
   4. Would you need to bring protection from solar flares?
   5. Is there any special equipment might future human colonists need to bring to support a long-term colony?
3. Develop a simple clock/calendar for your planet.
   1. What is the planet’s revolution period about the star?
   2. What is the planet’s rotational period?
   3. What are the revolution periods of your moons?
   4. How many visible objects are in your planet’s sky?
   5. Are seasons going to be approximately the same length or different?
   6. “Hours,” “Days,” “Weeks,” “Months,” and “Years” are Earth-based time units. Be creative in defining time units for your planet’s calendar.