

Name \_\_\_\_\_

## **HOMEWORK #1 – Solar System Exploration**

**Due Friday, April 14<sup>th</sup> IN CLASS**

Answers to the questions must be given in complete sentences (except where indicated), using correct grammar and spelling. Please be as brief and to-the-point as possible (*more is not necessarily better*).

You are encouraged to explore the web for help but **DO NOT COPY DIRECTLY FROM WEBSITES**. Links posted on the course website may be particularly helpful in answering some of the homework questions.

Homework assignments must be legible. Handwritten or typed responses are permitted. Make sure that your assignment is stapled!

### **Grading Summary:**

**Questions 1-10: 5 points each**

**Question 11: 12 points**

**Question 12: 26 points**

**Question 13: 12 Points**

**Total: 100 Points**

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**Questions 1-10 :** Use the following website to answer the questions below. Single-word answers are okay.

<http://science.hq.nasa.gov/missions/>

1. Which mission is destined for the planet closest to the Sun?
2. When will this spacecraft (from Question 1) finally enter orbit about this planet?
3. Which mission is destined for the planet farthest from the Sun?
4. When will this spacecraft (from Question 3) first encounter its destination planet & moon?
5. Which mission directly impacted a comet on July 4<sup>th</sup> of last year?
6. What was the name of the comet that was sampled by this mission (from Question 5)?
7. Which mission collected samples from the tail of Comet Wild 2 and returned these samples to Earth on January 15<sup>th</sup> of this year?
8. Which mission is currently exploring Saturn and its many interesting moons?
9. On which date will this mission (from Question 8) encounter its next flyby of Saturn's moon Titan?
10. Which past mission ended its 14-year successful journey to the outer solar system by plunging into the atmosphere of Jupiter?

## 11. Space Exploration and Inventions

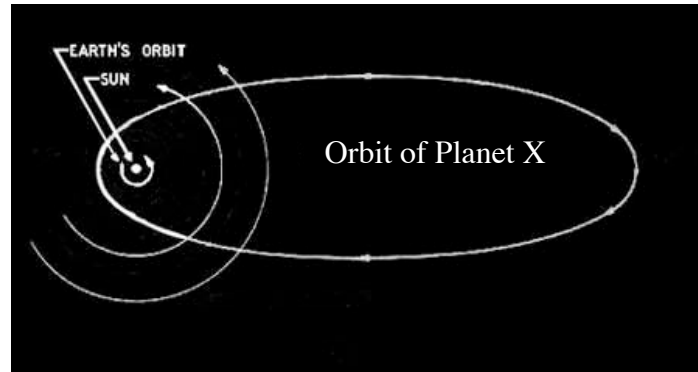
Space exploration over the last four decades has resulted in many inventions and technological developments that have drastically improved the health and lifestyles of people living today. More than likely, you have stumbled across a few of these inventions or know someone who has.

Using the internet, navigate to the following website: <http://space.about.com> (try to ignore the annoying advertisements if you can). In the Search Box near the top of the page, enter “inventions” and follow one of the resulting related links from your search (again, ignore the sponsored links at the top of the page). Use the information from the article of your choice to answer the following questions.

- 11.1) Name one invention or technology resulting from space exploration that you or someone you know has used.
  
- 11.2) Explain how you (or someone you know) have/has benefited from this technology.
  
- 11.3) Name one invention or technology that resulted from space exploration that you found interesting or were surprised by (select different answer than above).
  
- 11.4) Explain briefly (1-2 sentences) how astronauts, scientists, or engineers use this technology for space-related functions.

## 12. Planet X

In the early 1980s, some people began supporting the idea that massive Earth extinctions (like the one that caused the dinosaurs to become extinct) were periodic and occurred about every 26-30 million years. The supporters of this theory claimed that such mass extinctions were caused by a mysterious (and unknown) 10<sup>th</sup> planet orbiting the Sun. The idea behind Planet X was that the planet had a very *elliptical orbit* around the Sun and was undetectable because it *spent much of its time at far distances* from the Sun (and Earth).



12.1) Which three physical laws of astronomy best explain orbital behavior? State these laws and draw figures (by hand) if necessary.

1.

2.

3.

**12.2)** According to this theory, once every 30 million years (Planet X's hypothesized orbital period) X would come close to the planets of the solar system, while at the same time disrupting the orbits of a few comets, setting them up for a collision course with Earth. A giant impact from a stray comet would kill many species of life and produce a massive dust cloud that would block sunlight for hundreds of years.

Use Kepler's 3<sup>rd</sup> law to calculate the average distance of Planet X from the Sun:

$$P^2 \sim a^3$$

where **P** is the orbital period in years (yr) and **a** is the *average* distance in astronomical units (AU, the distance from the Earth to the Sun). ***Please show your work!***

**12.3)** Now compare this Planet X-Sun distance with the average Earth-Sun distance. How much further is Planet X's distance from the Sun, on average, than Earth's?

Note: this large average distance is one (of many) reasons why the Planet X theory is not very popular anymore. The nearest star beyond the Sun is less than 330,000 AU (not *too* far from the Planet X distance, in astronomy terms) and so it would likely knock X out of orbit, or at least significantly change its orbital period. Also note that today many scientists *do* believe that the dinosaurs became extinct because of a giant impact near the Yucatan peninsula about 65 million years ago, although the reasons for this impact are not thought to be due to a mysterious unknown Planet X.

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### **13. Space Exploration and Electromagnetic Waves**

**13.1)** What type of electromagnetic wave (or light) does the Hubble Space Telescope use?

**13.2)** What type of electromagnetic wave did the Magellan spacecraft use to probe the surface of Venus?

**13.3)** Why isn't the Hubble Space Telescope able to image the surface of Venus as Magellan did? (Hint: Why can X-rays image bones but you can't see them?)