

Physics Department/Astronomy 201 NAME: \_\_\_\_\_

## ASSIGNMENT1 : DISTANCE in the Universe

### PART 1

**goto and read this article as you answer the questions below.**

<http://astrobioloblog.wordpress.com/2011/03/22/life-in-our-solar-system-%E2%80%93-europa-ganymede-calisto/>

- 1) List the moons where life is likely to happen (3 moons) and for each moon, give its planet. (to find the planets, use google)
- 2) What are the 4 largest moons of Jupiter and who discovered them ?
- 3) The planets Mars and Venus are in the habitable zone. Why life is not possible there?
- 4) Why Io can't be suitable for life.
- 5) where does the heat that drives Io's volcanoes come from ?
- 6) Which moon of Jupiter is best suited for life ? And why ? and where ?
- 7) what discovery was made in 1977 and how the discovery supports the hypothesis of life below Europa's crust?
- 8) In the food chain around the smokers, what organism is at the base of the chain ?
- 9) Nasa and Esa plan a trip to Europa for which year?

### PART II - goto :

<http://astrobioloblog.wordpress.com/2011/04/30/life-in-our-solar-system-%E2%80%93-titan-and-enceladus/#more-752>

- 1) Enceladus and Titan orbit which planet ?
- 2) Where does the heat, that drives Enceladus's volcanoes comes from ? (2 sources)
- 3) How the volcanism on Enceladus different from the volcanism on Io /

- 4) Cassini analyzed some of the water vapor found on Enceladus. What was found out ?
- 5) What are the 3 facts that make Titan so special?
- 6) Why the gas oxygen never stays long in an atmosphere ? How come we have 20% of oxygen in our atmosphere on Earth ?
- 7) How life happened to be on Earth ?
- 8) As for now, is life possible on Titan ? Why not?

### **PART III – goto:**

<http://www.pbs.org/deepspace/timeline/index.html>

- 1) How long after the Big Bang, stars and galaxies formed ?
- 2) How old our Sun is ?
- 3) How long ago :
  - earliest life evolve ?
  - mammals evolve ?
  - homo sapiens evolve ?
- 4) year Galileo made the first telescope ?
- 5) the cosmic microwave background is the after glow of the Big Bang. It was detected in ....

### **PART IV**

1)

How long it take a signal to reach Neptune from the Earth ?

Hint: Find in km the distance Earth-Neptune (google). Then you can use light takes 1 year to travel  $10^{13}$  km. (solve the proportion aske me for help). Convert to hours. (1 year = 365 days about = 365x24 hours)

2) .

Kepler found a relationship between the mass of the Sun, the orbital period of a planet **p** (time for the planet to go around the Sun ) and the average distance between the Sun and the planet noted **a**. He used the relationship for our solar system. Thanks to the relationship, he was able to compute the distance **a** between the planets and the sun, given their orbital period **p**.

This is called Kepler third's law.  $1 = a^3 / p^2$  or  $a^3 = p^2$  or  $a = p^{2/3}$  or  $p = a^{3/2}$

**p** is the orbital period in Earth years, a the average distance in AUs

(1 AU = distance Earth-Sun)

A) Mars orbits the Sun every 1.88 years ( $p=1.88$ ).

How far is Mars from the Sun in AU (solve for  $a$ , average distance Mars-Sun in AUs)?

B) An asteroid's semi-major axis  $a$  (average distance  $a$  from the Sun ) is 3.5AU ( $a = 3.5$ ).

What is its period  $p$  ? (solve for  $p$ , time to go around the sun in Earth years)

C) Newton later derived Kepler's third law. If  $a$  is in meters and  $p$  in seconds, the relationship becomes:  $\frac{GM}{4\Pi^2} = \frac{a^3}{p^2}$  where  $G$  is a constant,  $M$  the mass of the Sun,  $\Pi = 3.14 \dots$   
So if we have  $a$  and  $p$  for any planet, what physical quantity can we derive ?

D) This relationship works for anybody orbited by moons or satellites.  $M$  is the mass of the body orbited by moons or satellite. During the mission Apollo on the moon, the space craft orbited the Moon. How was the mass of the Moon found ?

