

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

Astronomy 141  
Winter Quarter 2012

**Homework #1**  
Due Tuesday, January 17 in class

**Instructions**

This handout is your worksheet. Please write your answers in the spaces provided. In cases where a calculation is called for, please show your work including any sketches, so we can evaluate your answer and assign partial credit as appropriate. Answers given without showing at least some of the calculation will receive no credit. **We will only accept homework turned in on this worksheet.**

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This homework assignment consists of the 5 questions below. Each question has equal weight.

1. Rewrite the following numbers using scientific notation

- a. 0.00038 = \_\_\_\_\_
- b. 123.56 = \_\_\_\_\_
- c. 182.3 Million = \_\_\_\_\_
- d. 25/1,000 = \_\_\_\_\_
- e. 12 Billionths = \_\_\_\_\_

2. When talking about planets, we will usually express the masses of planets in units of the Earth Masses ( $1 M_E$ ) or Jupiter Masses ( $1 M_J$ ) instead of in kilograms, where the conversion factor are:

$$1 M_E = 5.9736 \times 10^{24} \text{ kg}$$

$$1 M_J = 1.8986 \times 10^{27} \text{ kg.}$$

a. What is the mass of Jupiter in units of Earth Masses ( $M_E$ )?

b. What is the mass of Earth in units of Jupiter Masses ( $M_J$ )?

c. The mass of the Sun is  $1.9891 \times 10^{30}$  kg. What is the mass of the Sun expressed in  $M_E$  and  $M_J$ ?

3. On a neglected shelf in a dusty old basement you find a sealed jar labeled “Radioactive Unobtainium-123 ( $^{123}\text{Un}$ ) – 100% Pure”, but the date on the label says only “January” with the year worn off. You (carefully) open the jar in the lab and analyze its contents, and discover that it contains 25%  $^{123}\text{Un}$  and 75% Illudium-36, the stable daughter product of  $^{123}\text{Un}$  radioactive decay. **The half-life of  $^{123}\text{Un}$  is 40 years.** In what year was the jar sealed?
4. The average human is composed of about 18.5% carbon by mass. The mass of a single carbon atom ( $^{12}\text{C}$ ) is  $1.9926 \times 10^{-26}$  kg.
- What is your body mass in kg (use 1 kg = 2.2 pounds to convert pounds to kg)?
  - What is the approximate number of carbon atoms in your body?
  - Compare the number of carbon atoms in your body to the estimated number of stars in the visible universe (about  $10^{22}$ ).
5. The Earth is about 4.6 Billion years old. The bulk of the rock that makes up the Front Range of the Colorado Rockies, however, is about 1.7 Billion years old as determined from radioactive dating methods. Why do they differ?