AP Physics C – Mechanics
Unit i – Introduction to Physics
Assessment

*The beginning is a very delicate time…*

-Princess Irulan, *Dune*

Name: _____ Period: _____

Directions: Your first AP Physics C assessment! In physics (as well as in math, engineering, and chemistry), it is often advantageous to do the work on separate paper. Work in steps and put a square around your final answer.

<u>Questions</u>

1) For centuries, horses have been measured in a unit called "hands." This is the height of the horse from the ground to its withers. Today, this has been standardized to be about 4 inches, but in the past it simply referred to the owner's hand width. Why is this a poor standard of length?
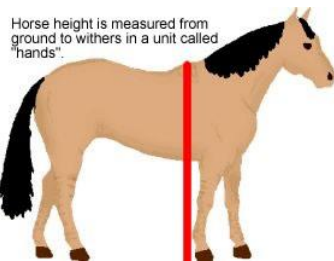
2) In algebra and especially in physics, constants of proportionality are used. Can a unit analysis (dimensional analysis) on the variables in an expression give you any information of the nature of the constant? Explain.

3) Suppose you have two physical quantities A and B that you measured in the lab. However, they have different dimensions. Which of the following algebraic expressions could be physically meaningful:

    a. $A + B$ b. A/B c. $B-A$ d AB

<u>Problems</u>

4) Consider a hollow spherical shell made of copper that has an inner radius of 5.70 cm and an outer radius of 5.75 cm. What is the mass of the sphere? The density of copper is 8.93 g/cm^3.

5) Here's an "out-of-this-world" question: Jupiter is the fifth planet from the Sun and the first of the Gas Giant planets. Jupiter's mass is 317.4 times that of Earth, and it has a radius 10.95 that of Earth (equatorial). Assume both bodies are perfect spheres. What is the ratio of Jupiter's mass density to the mass density of Earth?

6) Verify that the following equation, the period of a simple pendulum, is correct, by doing a unit analysis. T is the period in seconds, L the length of the pendulum, and g is the acceleration due to gravity (length divided by the square of time).

$$T = 2\pi \sqrt{\dfrac{L}{g}}$$

7) Consider the following expression

$$s = ct^3$$

Where: s is displacement in meters
        t is time in seconds

What are the dimensions of the constant c?

8) A given piece of lead occupies a volume of 2.10 cm^3 and is found to have a mass of 23.94 g. What is the density of lead in SI units?

9) The speed of light is 3.00 x 10^8 m/s. How far will a photon of light travel, in miles, in one hour? (Note: 1 mile = 1.61 kilometers)

10) Unfortunately, refueling docks often had a lot of oil that is spilled into the water. One particular oil spill contains 1.0 m^3 of oil. Assuming that the oil slick consists of a layer only one molecule thick and that one atom may be modeled as a cube measuring 1 μm of each side, find the area of this oil slick.

11) Without making any references to Mr. Webber's old age and deteriorating health, estimate the number of times the average human heart will beat in an individual who lives to be 70. Assume the heart beats an average of 60 times per minute over a lifetime.

12) Don't ever let physics beat you down – you are significant! Prove it by stating the number of significant figures in the following:
    a. 23 cm   b. 3.962 s   c. 4.67 x 10^3 m/s   d 0.0032 m