

Homework 1*Due in class April 22, 2009*

Your Name _____

Part 1: Practice Problems on Numbers**Express all your answers in scientific notation, for example 3×10^8 . One digit of accuracy is adequate.**

1. Work out how many meters there are in a light year.

(a) What is the speed of light, in meters per second? _____

(b) How many seconds are there in a year? _____

(c) Multiply to get the answer: _____ meters

(d) Convert your answer above to miles, using $1.61 \text{ km} = 1 \text{ mile}$.

$$\text{_____ meters} \times 10^{-3} \frac{\text{km}}{\text{meter}} \times \frac{\text{mile}}{1.61 \text{ km}} = \text{_____ miles}$$

2. Ratios of big numbers. To find out how much bigger the cosmic horizon (10^{29} cm) is than the earth (10^7 cm), divide: $10^{29} \text{ cm} / 10^7 \text{ cm} = 10^{29-7} = 10^{22}$ times bigger.(a) How much bigger is a galaxy (10^{23} cm) than a person (1 m)? _____(b) How much bigger is a person than an atom (10^{-8} cm)? _____3. (a) Multiply 5×10^{28} times 2×10^7 _____(b) Divide 6×10^8 by 10^7 _____4. The amount of energy E in a kilogram of matter is given by Einstein's famous formula $E = mc^2$, where m is the mass in kilograms and $c = 3 \times 10^8 \text{ m/s}$ is the speed of light (in meters per second) and E is the energy in Joules. $1 \text{ Joule} = 1 \text{ kg (m/s)}^2 = 1 \text{ watt-second}$, so $1 \text{ kilowatt-hour} = 10^3 \text{ watts} \times (60 \text{ seconds/minute}) \times (60 \text{ minutes}) = 3.6 \times 10^6 \text{ watt-seconds} = 3.6 \times 10^6 \text{ Joules}$.

(a) How much energy in Joules is in a kilogram of matter?

- (b) You are billed for electric power at around 10 cents per kilowatt-hour (kwh), and (as we just saw) $1 \text{ kwh} = 3.6 \times 10^6 \text{ Joules}$. How much is the energy in a kilogram of matter worth at that rate?

Part 2: Term Project Thoughts

What is your current favorite topic for your term project?

Which other classmates do you plan to work on this with?

Part 3: One-Paragraph Essay

(Please type it on a separate page and attach to this page. Be sure to proofread it to avoid spelling and grammatical errors.)

In Bertold Brecht's play *Galileo*, Galileo's students are disappointed that Galileo capitulated to the Inquisition and recanted his support for the Copernican system. Do you agree?