

## ASTR 220 Homework #1 Solutions Spring 2005

### 1. Review of scientific notation.

(a) Write The following numbers in scientific notation.

- i.  $503 = 5.03 \times 10^2$
- ii.  $-2000 = -2.0 \times 10^3$
- iii.  $0.00017 = 1.7 \times 10^{-4}$
- iv.  $-0.000000095 = -9.5 \times 10^{-8}$
- v.  $12300000 = 1.23 \times 10^7$

(b) Write the following numbers in the decimal format (not in scientific notation).

- i.  $10^3 = 1000$
- ii.  $3.14 \times 10^1 = 31.4$
- iii.  $-1.5 \times 10^6 = -1500000$
- iv.  $-7.17 \times 10^{-4} = -0.000717$
- v.  $9.99 \times 10^9 = 9990000000$

### 2. $d = v \times t$ where d, v, t represent distance, velocity and time respectively.

(a)

$$1s \times (3 \times 10^8 m/s) = 3 \times 10^8 m$$

There are  $3 \times 10^8 m$  in one light-second.

(b)

$$(60s/min) \times (60min/h) \times (1h) \times (3 \times 10^8 m/s) = 1.08 \times 10^{12} m$$

There are  $1.08 \times 10^{12} m$  in one light-hour.

(c)

$$(365day/year) \times (24hour/day) \times (60min/h) \times (60s/h) \times (1year) \times (3 \times 10^8 m/s) = 9.4608 \times 10^{15} m$$

There are  $9.4608 \times 10^{15} m$  in one light-year.

3. It does not make sense because it uses the wrong unit. The age of Universe should be 14 billion years.

4. It does make sense because the gravitational force only depends on mass.

5. It do not make sense because the energy is conserved so you can not generate more energy from nothing.

6. (a) We have the gravitational force equation as

$$F = \frac{G \times M_{sun} \times M_{me}}{r^2}$$

G is the gravitational constant,  $6.67 \times 10^{-11} m^3/s^2/kg$ .  $M_{me}$  is the mass of the meteoroid, and  $M_{sun}$  is the mass of the sun

$$\frac{(6.67 \times 10^{-11} m^3/s^2/kg) \times (5.97 \times 10^{24}) \times (1000kg)}{(1.5 \times 10^{11} m)^2} = 1.77 \times 10^{-5} kg.m/s^2$$

- (b) We have the kinetic energy equation as

$$E = \frac{1}{2} \times M \times V^2$$

$G$  is the gravitational constant,  $M$  is the mass of the object, and  $V$  is the velocity of the object.

$$E = \frac{1}{2} \times 1000kg \times (10^5 m/s)^2 = 5.0 \times 10^{12} J$$

It is very close to the energy released by fission of 1kg Uranium-235.

- (c) It will be simple because the energy is relatively small.
- (d) If the mass of the meteoroid was double, the kinetic energy would be double!
7. There are four possible answers, you need two.
- (a) It happened a long time ago and it is hard to find pieces and try to interpret it.
- (b) Many scientist believe the dinosaurs die rapidly, it is hard to explain it through disease.
- (c) Although the dinosaurs died, there are some other animals survived.
- (d) Fossilization occurs in only under some rare conditions, so it will hard to find any evidence.
8. (a) K-T boundary is the boundary between the Cretaceous(K) and Tertiary(T) eras.
- (b) it appears to be a one-centimeter layers with reddish color.
- (c) It formed about 65 million years ago.
9. (a) Iridium is a platinum-group metal, its atomic number is 77.
- (b) Because as earth formed, most of the layers melted, and the iridium has sunk with iron to the earth's core.
- (c) In fact, all solar system objects have as much iridium; the iridium in the earth is in the interior, not in the surface.
10. There are many possible reasons, you need three.
- (a) During the late Cretaceous period India had some major volcanic eruptions which may have caused enough dust and soot to block out the sunlight and thus producing the climate change which killed off the dinosaurs.
- (b) The effect of tectonic plate movements taking place could have changed the climate, so causing the dinosaur extinction.
- (c) Their extinction may have been caused by some vicious disease.
- (d) Scientists who argued for another theory didn't want to believe they were wrong.
- (e) Scientists couldn't easily change their beliefs.