

Name: .....

## ASTRONOMY 1102 - Section 1

Instructor: Juhan Frank

Fall 1999

Homework # 1 due Wed. Sep. 8

Powers of Ten, Mass & Energy

1) Calculate using powers of ten (without calculators) the length of a light-year, a unit of length commonly used for stellar distances, which equals the distance travelled by electromagnetic waves (take speed =  $3 \times 10^5$  km/s) in one year (take  $1 \text{ yr} = 3.15 \times 10^7$  s).

2) Assuming we are heading for a collision with M31, how long will it take for this to happen given that M31 is 2.5 million LY away and that we are travelling toward it at a speed of 80 km/s?

3) The average human needs 2500 Calories to cover his/her daily needs for energy. Supposing we could convert directly matter to energy according to  $E = mc^2$ , how long could we live off one kilogram of matter?

4) Compare the kinetic energies of a 1 ton (1000 kg) car moving at a speed of 100 km/hr with that of a 2 ton pick-up truck moving at 50 km/hr.

5) Explain why it is more dangerous to fall in a freezing lake than to stand naked in freezing air.