

Basic Competence for Mechanics. Please show all work.

- 1) A 5×10^6 ton meteor hurls through space and will hit the earth at 72000 km/hr... Pandemonium Ensues.
- Convert these units to ones that we can use.
 - Calculate the kinetic energy of this meteor.
 - Show how you arrived at the correct units.

$$v = \frac{72000 \times 1000 \text{ m}}{1 \text{ hr} \left(\frac{60 \text{ min}}{\text{hr}} \right) \left(\frac{60 \text{ s}}{\text{min}} \right)} = \frac{7.2 \times 10^7 \text{ m}}{3.6 \times 10^3 \text{ s}} = 2 \times 10^4 \text{ m/s}$$

$$E_k = \frac{1}{2} m v^2 \quad 5 \times 10^6 \text{ ton} \left(\frac{10^3 \text{ kg}}{\text{ton}} \right) = 5 \times 10^9 \text{ kg}$$

$$\begin{aligned} \text{b) } E_k &= \frac{1}{2} m v^2 = \frac{1}{2} (5 \times 10^9 \text{ kg}) (2 \times 10^4 \text{ m/s})^2 \\ &= \frac{1}{2} (5 \times 10^9 \text{ kg}) (4 \times 10^8 \frac{\text{m}^2}{\text{s}^2}) = 10^{18} \text{ kg} \frac{\text{m}^2}{\text{s}^2} = \underline{\underline{10^{18} \text{ J}}} \end{aligned}$$

c) done

- 2) Estimate the sin, cos, and tan of the labeled angle. No calculators allowed. Show your work and reasoning. Put your answer in decimal form. **We should be able to see that the hypotenuse of this triangle is about 10% longer than the opposite side and is many 2.5 times the length of the adjacent side, so $\sin \theta \sim 0.9$, and $\cos \theta \sim 0.4$, $\tan \theta \sim 2.2$.**
- 3) Estimate the area of a solid circle of radius 3 cm. Put answer in square meters. **This area is about 30 cm^2 , or $3 \times 10^{-3} \text{ m}^2$. And the circumference is about 20 cm.**

