

NAME: _____

Quiz #8c:
Phys270

Section 0101

1. [10 pts] The sun radiates energy at the rate of 4.0×10^{26} W. The source of this energy is fusion, a nuclear reaction in which mass is transformed into energy. The mass of the sun is 2.0×10^{30} kg.

- a. [6 pts] How much mass does the sun lose each year? [note that 1 year = 3.15×10^7 sec and the speed of light is $c = 3.0 \times 10^8$ m/s]

Using mass-energy equivalence the mass lost in 1 yr. is
given by
$$\frac{\text{Energy lost in 1 yr}}{c^2} = \frac{4.0 \times 10^{26} \times 3.15 \times 10^7 \text{ J}}{(3 \times 10^8 \text{ m/s})^2}$$
$$= 1.4 \times 10^{17} \text{ kg}.$$

- b. [4 pts] Estimate the lifetime of the sun.

Of course the lifetime can't be more than

$$\frac{2 \times 10^{30} \text{ kg}}{1.4 \times 10^{17} \text{ kg/yr}} \approx 1.43 \times 10^{13} \text{ yr}.$$