Quiz 24.1A

The Sun radiates power at a rate of 4.00×10^{26} Watts. That energy is spread uniformly over all space, and Earth receives some fraction of that energy.

a) Assuming an Earth-Sun distance of 93.0 million miles, calculate the **intensity of light** from the Sun at this distance. Answer with 3 SF, and show all work.

b) Suppose we design an orbiting solar panel for the Earth that can collect the Sun's energy with 100% efficiency. This circular array of solar panels has a radius of 225 km. How much **power** would this array collect?

c) Assume that the amount of energy used by all of humanity in one day is 2.20×10^{18} Joules. How much **time** would it take for our solar array to collect that much energy, **in hours**?

a) $r = 93 \times 10^6 \, mi \cdot \frac{1609\, m}{mi} = 1.4964 \times 10^{11} \, m$

$$S = \frac{P}{4\pi r^2} = \frac{4.00 \times 10^{26}}{4\pi(1.4964 \times 10^{11})^2} = \boxed{1420 \text{ Watts}}$$

b) $P = S * \text{Area}$

$$= (1421.58) * \pi (225{,}000)^2$$

$$= \boxed{2.26 \times 10^{14} \text{ Watts}}$$

c) Energy = Power * time

$$t = \frac{\text{Energy}}{\text{Power}} = \frac{2.20 \times 10^{18}}{2.26 \times 10^{14}} = 9731 \, s$$

$$= \boxed{2.70 \text{ hrs}}$$