

### Chapter 33 Problem 55 †

**Given**

$$P = 10^9 \text{ W}$$

$$m = 1 \text{ g}$$

**Solution**

Find the time city could be powered.

From the rest mass energy we have

$$E = mc^2$$

Power is just the energy used per time

$$P = E/t$$

Solving for time gives

$$t = \frac{E}{P} = \frac{mc^2}{P}$$

Substituting in the provided values gives

$$t = \frac{(1.0 \times 10^{-3} \text{ kg})(3.0 \times 10^8 \text{ m/s})^2}{10^9 \text{ W}} = 9.0 \times 10^4 \text{ s}$$

The city could be powered for 25 hours.

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†Problem from Essential University Physics, Wolfson