Chapter 36 Problem 54 [†]

Given
$E = 400\ mJ = 0.400\ J$
$\lambda = 2.94\ \mu m$
$h = 6.63 \times 10^{-34}\ J \cdot s$
$c = 3.0 \times 10^{8}\ m/s$

Solution
Find the number of photons making up the laser pulse.

The energy in each photon is given by the relationship

$$E_\gamma = \frac{hc}{\lambda}$$

Solving for the energy per photon gives

$$E_\gamma = \frac{(6.63 \times 10^{-34}\ J \cdot s)(3.0 \times 10^{8}\ m/s)}{2.94 \times 10^{-6}\ m} = 6.77 \times 10^{-20}\ J$$

Therefore, the number of transitions is given by

$$transitions = \frac{E}{E_\gamma} = \frac{0.400\ J}{6.77 \times 10^{-20}\ J} = 5.91 \times 10^{18}\ photons$$

The wavelength of the photons correspond to the infra-red region of the electro-magnetic spectrum.

[†]Problem from Essential University Physics, Wolfson