Electromagnetic Radiation
Basic Principles

Consider the photons which have the following wavelengths:

   a. 1000 nm
   b. 400 nm
   c. 10 nm

1. In what region of the electromagnetic radiation spectrum is each photon found?

   1000 nm: IR
   400 nm: visible light
   10 nm: x-ray or UV

2. What is the propagation velocity (in a vacuum) of each photon?

   All electromagnetic radiation propagates at 3.00 x 10^8 m/s

3. What is the frequency of each photon?

   Only the solutions to the 1000 nm photon shown.

   $$c = \lambda \nu \quad \text{so} \quad \nu = \frac{c}{\lambda}$$

   $$\lambda = 1000 \text{ nm} \times \frac{1 \text{ m}}{10^9 \text{ nm}} = 1.00 \times 10^{-6} \text{ m}$$

   $$\nu = \frac{3.00 \times 10^8 \text{ m/s}}{1.00 \times 10^{-6} \text{ m}} = 3.00 \times 10^{14} \text{ Hz}$$

4. What is the energy of each photon?

   Only the solutions to the 1000 nm photon shown.

   $$E = h\nu \quad h = 6.63 \times 10^{-34} \text{ J} \cdot \text{s}$$

   $$E = (6.63 \times 10^{-34} \text{ J} \cdot \text{s})(3.00 \times 10^{14} \text{ Hz}) = 1.99 \times 10^{-19} \text{ J}$$