Answer on Question #58594, Physics / Quantum Mechanics |

Find frequency, energy and momentum of a photon having wavelength of 46 pm.

Solution:
The frequency is

$$f = \frac{c}{\lambda} = \frac{3 \cdot 10^8 \text{ m/s}}{46 \cdot 10^{-12} \text{ m}} = 6.52 \cdot 10^{18} \text{ Hz}$$

The energy is

$$E = \frac{hc}{\lambda} = hf = 6.625 \cdot 10^{-34} \cdot 6.52 \cdot 10^{18} = 4.32 \cdot 10^{-15} \text{ J}$$

$$E = \frac{4.32 \cdot 10^{-15}}{1.6 \cdot 10^{-19}} = 27 \cdot 10^3 \text{ eV} = 27 \text{ keV}$$

The momentum is

$$p = \frac{h}{\lambda} = \frac{6.625 \cdot 10^{-34} \text{ J} \cdot \text{s}}{46 \cdot 10^{-12} \text{ m}} = 1.44 \cdot 10^{-23} \text{ kg} \cdot \text{m/s}$$