Photon Energy Comparisons Worksheet

Scoring guide · one credit per question · review written work against each rubric

Photon Energy Comparisons

Question 1

Choice (3)

E is proportional to f because h is constant.

Question 2

$E = (6.626 \times 10^{-34}\ \text{J·s})(5.00 \times 10^{14}\ \text{s}^{-1}) = 3.31 \times 10^{-19}\ \text{J}$.

Question 3

Choice (1)

At the same wave speed, a shorter wavelength means higher frequency and higher energy per photon.

Question 4

Their energy per photon is the same because their frequencies match. The beam delivering twice as many photons per second delivers twice the energy per second.

Sources for a Photon Detector

Question 5

Choice (3)

The photon energies are about 2.65, 3.64, and 4.64×10^{-19} J for P, Q, and R. Only R meets 4.00×10^{-19} J.

Question 6

$f = E/h = (4.00 \times 10^{-19}\ \text{J})/(6.626 \times 10^{-34}\ \text{J·s}) \approx 6.04 \times 10^{14}\ \text{Hz}$.

Question 7

Choice (1)

P has the lowest frequency, so $\lambda = c/f$ gives the longest wavelength.

Question 8

No. Q’s frequency stays the same, so $E = hf$ gives the same energy per photon, about 3.64×10^{-19} J. That is below the threshold.