

Answer Key Light worksheet, Frequency, and Energy

1. blue 489 nm ✓
indigo 454 nm

$$1 \text{ m} = 1 \times 10^9 \text{ nm}$$

2. inverse relationship; as wavelength goes up, frequency goes down
 $c = \lambda f$

red $f = \frac{3.00 \times 10^8 \text{ m/s}}{7.00 \times 10^{-7} \text{ m}} = 4.3 \times 10^{14} \text{ Hz}$ red

yellow $f = \frac{3.00 \times 10^8 \text{ m/s}}{5.75 \times 10^{-7} \text{ m}} = 5.2 \times 10^{14} \text{ Hz}$ ✓ yellow

3. $E = hf$ yellow $E = (6.63 \times 10^{-34} \text{ J}\cdot\text{s})(5.2 \times 10^{14} \text{ s}^{-1}) = 3.4 \times 10^{-19} \text{ J}$ yellow

$E = \frac{hc}{\lambda}$ green $E = (6.63 \times 10^{-34} \text{ J}\cdot\text{s}) \left(\frac{3.00 \times 10^8 \text{ m/s}}{5.00 \times 10^{-7} \text{ m}} \right) = 3.98 \times 10^{-19} \text{ J}$ ✓ green

4. $c = \lambda f$ $\lambda = \frac{c}{f}$ $\lambda_1 = \left(\frac{3.00 \times 10^8 \text{ m/s}}{7.32 \times 10^{14} \text{ 1/s}} \right) = 4.1 \times 10^{-7} \text{ m}$

$\lambda_2 = \left(\frac{3.00 \times 10^8 \text{ m/s}}{6.0 \times 10^{14} \text{ 1/s}} \right) = 5.0 \times 10^{-7} \text{ m}$ ✓

5. $E = \frac{hc}{\lambda}$ $E_1 = \frac{(6.63 \times 10^{-34} \text{ J}\cdot\text{s})(3.00 \times 10^8 \text{ m/s})}{6.74 \times 10^{-7} \text{ m}} = 2.95 \times 10^{-19} \text{ J}$

$E_2 = \frac{(6.63 \times 10^{-34} \text{ J}\cdot\text{s})(3.00 \times 10^8 \text{ m/s})}{4.80 \times 10^{-7} \text{ m}} = 4.14 \times 10^{-19} \text{ J}$ ✓

6. $c = \lambda f$ $f_{\text{orange}} = \frac{3.00 \times 10^8 \text{ m/s}}{6.00 \times 10^{-7} \text{ m}} = 5.00 \times 10^{14} \text{ Hz}$

$f = \frac{c}{\lambda}$

$f_{\text{indigo}} = \frac{3.00 \times 10^8 \text{ m/s}}{450 \times 10^{-7} \text{ m}} = 6.67 \times 10^{14} \text{ Hz}$ ✓

7. $E = hf$ $E_1 = (6.63 \times 10^{-34} \text{ J}\cdot\text{s})(4.28 \times 10^{14} \text{ s}^{-1}) = 2.84 \times 10^{-19} \text{ J}$ ✓

$E_2 = \frac{(6.63 \times 10^{-34} \text{ J}\cdot\text{s})(3.00 \times 10^8 \text{ m/s})}{(7.25 \times 10^{-7} \text{ m})} = 2.74 \times 10^{-19} \text{ J}$

8. $c = \lambda f$ $\lambda = \frac{3.00 \times 10^8 \text{ m/s}}{(5.21 \times 10^{14} \text{ s}^{-1})} = 5.76 \times 10^{-7} \text{ m} \times \frac{1 \times 10^9 \text{ nm}}{1 \text{ m}} = 576 \text{ nm}$ yellow

9. $c = \lambda f$ $f = \frac{3.00 \times 10^8 \text{ m/s}}{(5.4 \times 10^{-5} \text{ cm}) \left(\frac{1 \text{ m}}{100 \text{ cm}} \right)} = 5.56 \times 10^{14} \text{ Hz}$

$f = \frac{c}{\lambda}$