

1. For each pair of photons below, circle the photon with higher energy.

- a. a photon with a wavelength of 10^{-7} m or a photon with a wavelength of 10^{-10} meters.
- b. a photon with a frequency of 102.3 MHz or a photon with a frequency of 105.5 MHz.
- c. an X-ray or a radio wave
- e. a photon with a frequency of 1.7×10^{15} Hz or a photon with a frequency of 7.1×10^{14} Hz.
- f. a photon of yellow light or a photon of green light
- g. a photon with a wavelength of 480 nm or a photon with a wavelength of 1200 nm

2. For each question, circle the correct *answer*.

- a. Which of these has a higher photon energy? *infrared* *radio* *these two have the same energy*
- b. Which of these has a higher frequency? *blue* *orange* *these two have the same frequency*
- c. Which of these has a longer wavelength? *ultraviolet* *gamma* *these two have the same wavelength*
- d. Which of these has a higher speed, in a vacuum? *yellow* *microwave* *these two have the same speed*
- e. Which of these has a longer wavelength? *red* *infrared* *these two have the same wavelength*

3. For each pair, circle the photon with the higher energy.

- a. A photon with a wavelength of 2200 nm or one with a wavelength of 15 nm.
- b. A photon of microwave radiation or a photon of infrared radiation.
- c. ultraviolet radiation or x-rays
- d. A photon with a wavelength of 1 meter or a photon with a wavelength of 1 nanometer
- e. ultraviolet radiation or visible light
- f. A photon with a frequency of 6.8×10^{14} Hz or a photon with a frequency of 5.8×10^{15} Hz.

There will be an OPTIONAL Quiz on Electromagnetic Radiation (wavelength, frequency, energy). Study WS 4.0, 4.1, 4.15, and the practice quiz (below).

Possible QUIZ times: Beginning of lunch on Weds, February 26.
 Beginning of lunch on Thursday, February 27
 After school on Thursday, February 27
 Beginning of lunch on Friday, February 28

I will only enter the quiz into your grade if it brings your grade UP.

Quiz Topics!

Know the value for c, including the units. ($c = 3.00 \times 10^8$ m/s)

Know the formulas for wavelength, frequency, and energy, and how to use them.
($h = 6.63 \times 10^{-34}$ J·s will be given)

Be able to convert between meters and nanometers. (the conversion will not be given).
Wavelength, frequency, and energy – which are related directly? Inversely? What does this mean?

Know the order of the electromagnetic spectrum (For example, can you list them, in order, from highest to lowest energy, or from highest to lowest frequency, or from shortest to longest wavelength, etc)

Practice Quiz: (Report wavelength answers in both meters and nanometers.)

1. Find the photon energy of EM radiation with a wavelength of 45 nm.
2. Find the wavelength of EM radiation with a frequency of 2.37×10^{15} Hz.
3. Find the wavelength of EM radiation with a photon energy of 2.2×10^{-20} J
4. Find the frequency of EM radiation with a wavelength of 1242 nm.
5. Find the photon energy of EM radiation with a wavelength of 6.8×10^{-5} m. \
6. Find the energy of EM radiation with a frequency of 9.42×10^7 Hertz.
7. Find the frequency of EM radiation with a photon energy of 9.7×10^{-13} J.
8. Find the energy of EM radiation with a wavelength of 1111 nm.

9. For each pair, determine which has more energy.
 - a. blue light or infrared
 - b. EM radiation with a wavelength of 166 nm or EM radiation with a wavelength of 55 nm
 - c. microwaves or Infrared
 - d. green or orange
 - e. Radiation with a frequency of 1.5×10^{15} Hz or Radiation with a frequency of 6.7×10^{14} Hz.
10. Which of these has a longer wavelength?
 - a. X-rays or ultraviolet
 - b. Light with a photon energy of 6×10^{-18} J, or one with an energy of 5×10^{-18} J.
 - c. Light with a frequency of 10 MHz (MegaHertz) or light with a frequency of 500 kHz (kiloHertz).
 - d. yellow light or green light

Answers: 1. 4.4×10^{-18} J 2. 1.27×10^{-7} m or 127 nm. 3. 9.0×10^{-6} m or 9.0×10^3 nm

4. 2.42×10^{14} Hz 5. 2.9×10^{-21} J 6. 6.25×10^{-26} J 7. 1.5×10^{21} Hz 8. 1.79×10^{-19} J

9. blue, 55 nm, IR, green, 1.5×10^{15} Hz. 10. uv, 5×10^{-18} J, 500 kHz, yellow