**Wavelength, frequency, and Energy Problems name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_per\_\_\_\_\_\_**

**wavelength ranges for visible light**

red 700nm-650nm

orange 649nm-580nm

yellow 579nm-575nm

green 574nm-490nm

blue 489nm-455nm

indigo 454nm-425nm

violet 424nm-400nm

|  |  |
| --- | --- |
| **c = wavelength x frequency** | |
| **c = x ** |  |
| **c=3.00 x 108 m/s or 3.00 x 1010 cm/s** | |
| **Energy = Planck's constant (h) x frequency** | |
| **E = h x ** | **h = 6.6262 x 10 -34 J-s** |

**Conversions**

**1000nm = 1µm**

**1000µm = 1 mm**

**1 meter = 1 x 109 nm**

**Complete the following problems.**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_1. Which has the longer λ, blue or indigo light?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_2. Which has the greater ν, red or yellow light?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_3. Which has the greater energy, a photon of yellow light or a photon of green light?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_4. Which has the longer wavelength, light with a frequency of 7.32 x 1014 Hz or light with a frequency of 6.0 x 1014 Hz?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_5. Which has higher energy, light with a λ of 674 nm or light with a λ of 480 nm?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_6. Which has a higher frequency, orange light or indigo light?

**Solve the following problems. Be sure to show work. Box your answers**

7. What is the wavelength of electromagnetic radiation with a frequency of 6.00x109Hz ?

* Which part of the EMR is this wave from? (Use the EMR diagram on page 139 in your book)

8. What is the frequency of the light from a laser that emits light of wavelength 840 nm? (Be sure to convert nm to meters!)

* Which part of the EMR is this wave from? (Use the EMR diagram on page 139 in your book)

9. The laser in a CD player uses light with a wavelength of 780 nm. What is the frequency of this

light?

* Which part of the EMR is this wave from? (Use the EMR diagram on page 139 in your book)

10. A mercury lamp emits radiation with a wavelength of 4.36x10-7m.

* 1. What is the color of the light from the mercury lamp?
  2. Calculate the frequency of this radiation.
  3. Calculate the energy of this radiation.

11. A very bright yellow line in the emission spectrum of sodium has a frequency of 5.10 x 1014 s-1. Calculate the energy of this yellow light.

* Calculate the wavelength of the light.

12. When an electron falls from the fourth to the second energy level, it emits a photon of green light with a frequency of 5.80 x 1014 s-1. Calculate the energy of this photon.

13. A photon of red light has a wavelength of 6.45x10-7**m**. Calculate the energy of this photon (hint: you will have to use both equations)

14. If it takes 8.17x10-19 J of energy to remove one electron from a gold surface. What is the wavelength of light capable of causing this effect? Is this wavelength of light part of the visible spectrum? (hint: you will have to use both equations.