CONCEPT: THE ENERGY OF LIGHT

- Physicists Max Planck and Albert Einstein theorized light was made of "packets or particles" of electromagnetic radiation.
  - □ This light "particle" or "packet" was referred to as a _____ (quantum).
  - □ To calculate its energy we use *Planck's constant*, symbolized by _____ and equal to _____ J•s.

Photon Energy Formulas

This version is used when we deal with **energy** & **frequency**.

Photon Energy Formula (Frequency)

$\triangle E = \_\_\_ \bullet \_\_\_$

- □ $\triangle E$ = Energy of a photon in $\frac{J}{photon}$
- □ ____ = Planck's constant
- □ ____ = Frequency in s^{-1} or Hz.

This version is used when we deal with **energy** & **wavelength**.

Photon Energy Formula (Wavelength)

$\triangle E = \frac{\_\_\_ \bullet \_\_\_}{\_\_\_}$

- □ $\triangle E$ = Energy of a photon in $\frac{J}{photon}$
- □ ____ = Planck's constant
- □ ____ = Speed of Light
- □ ____ = Wavelength in meters

- □ From the equations, energy is _____ proportional to frequency and _____ proportional to wavelength.

EXAMPLE: Calculate the energy of a photon with a wavelength of 293.7 m.

Moles and Energy

- In order to find the energy for a *mole of photons* we can use a **conversion factor** with _____ number.
  - □ The **conversion factor** is *1 mole of photons* = _____ *photons*.

EXAMPLE: Calculate the energy for a mole of photons with a frequency of 4.29×10^{15} s^{-1}.

CONCEPT: THE ENERGY OF LIGHT

PRACTICE: Calculate the energy (in nJ) of a photon emitted by a mercury lamp with a frequency of 6.88×10^{14} Hz.

PRACTICE: A light ray has a wavelength that is 835 μm contains 6.32×10^{-3} J of energy. How many photons does this light ray have?

PRACTICE: How much energy (in kJ) do 4.50 moles of photons contain at a wavelength of 705 nm?