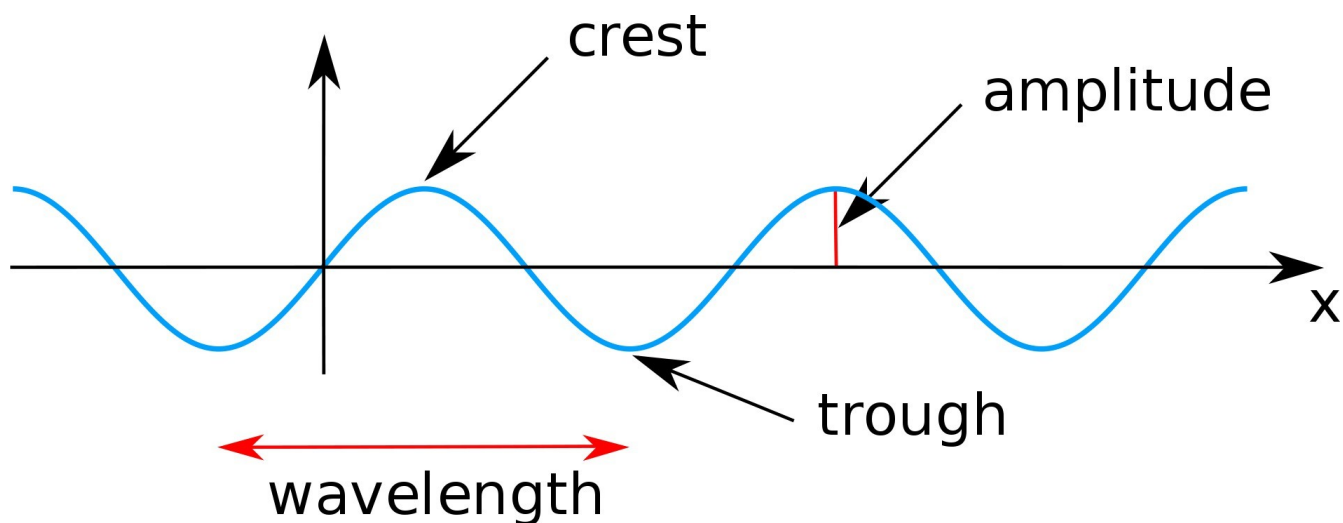# Light, Waves, Matter, and Energy
CH2000: Introduction to General Chemistry, Plymouth State University

1. In the table below, list the relevant equations you will need to do calculations for a) matter, and b) light:

a) Matter	b) Light

2. Define each of the variables used in the equations above:

λ:_____   m: _____

v:_____   v / u: _____

c: _____   R: _____

h: _____

3. Using the formulas $E = h\nu$ and $\lambda\nu = c$, derive a formula to find Energy from the wavelength.

4. A wave is traveling at 355 m/s with a wavelength of 3.5 m. What is the frequency?

5. A wave is traveling at 0.75 km/hr with a frequency of 0.15 Hz. What is the wavelength?

6. A wave has a wavelength of 2.65 cm and a frequency of 250 Hz. How fast is it traveling?

7. A photon of light has a frequency of 6,540 Hz. What is the wavelength? What type of light is it?

8. Which has a longer wavelength: Ultraviolet light or X-rays?

9. Which has a lower frequency: AM radio or FM radio waves?
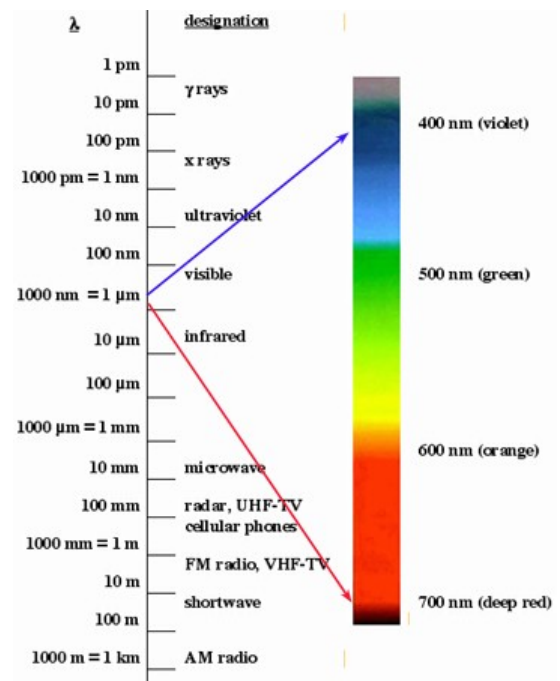
10. A photon of yellow light has a wavelength of 585 nm. What is the frequency?

11. A photon has a frequency of 3.56×10^{10} Hz. What is it's energy?

12. A photon has energy of 9.83×10^{-25}. What is the frequency?

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13. What is the approximate energy of a photon produced by your cell phone?

14. What is the wavelength of an electron ($m_e = 9.10938188 \times 10^{-31}$ kg) moving at 1×10^8 m/s?

15. What is the wavelength of a 25g mass moving at 15 m/s?

16. What is the wavelength of a 1500 kg mass moving at 100 km/hr?

17. What is the energy of an electron in a hydrogen atom in the shells with the principle quantum numbers (n) below?

a) $n = 1$

b) $n = 3$

c) $n = 8$

18. What energy of photon is required to promote a hydrogen electron in the $n=3$ shell to the $n=8$ shell?

19. If a hydrogen electron in the $n=8$ shell falls to the $n=1$ shell,

a) What is the energy of the photon that will be emitted?

b) What is the frequency of the photon that will be emitted?

c) What is the wavelength of the photon that will be emitted?

d) What type of light will this photon be?