Light, Waves, Matter, and Energy CH2000: Introduction to General Chemistry, Plymouth State University Crest amplitude x trough wavelength

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:	

© Copyright Plymouth State University and Jeremiah Duncan. May be distributed freely for education purposes only. 1

- 3. Using the formulas E = hv and $\lambda v = c$, 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. designation λ What is the wavelength? What type of light is it? 1 pm yrays 10 pm 400 nm (violet) 100 pm xrays 1000 pm = 1 nm 10 nm ultraviol 100 nm 8. Which has a longer wavelength: Ultraviolet light visible 500 nm (green) 1000 nm = 1 µm or X-rays? infrared 10 µm 100 µm 1000 µm = 1 mm 600 nm (orange) 10 mm microway 9. Which has a lower frequency: AM radio or FM radar, UHF-TV 100 mm radio waves? cellular phones 1000 mm = 1 mFM radio, VHF-10 m 700 nm (deep red) shortwave 100 m

1000 m = 1 km

AM radio

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?

۱

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?