Part 1: Light Problems *Solve the following problems. SHOW YOUR WORK!!! Use the handout showing the electromagnetic spectrum.*

1. What is the frequency of a wave if its wavelength is 3.6×10^{-9} m and its velocity is 3.0×10^{8} m/s?

8.3×10^{16} Hz

2. As you move across the continuous spectrum from red to violet, what happens to...
   a. wavelength? shortens
   b. frequency? increases

3. A beam of microwaves has a frequency of 1.0×10^{9} Hz. A radar beam has a frequency of 5×10^{11} Hz. Which type of radiation...
   a. has the longer wavelength? microwave
   b. is nearer to visible light in the electromagnetic spectrum? radar
   c. is closer to X-rays in frequency value? radar

4. A bright line spectrum contains a line with a wavelength of 518 nm. Determine...
   a. the wavelength, in meters. (Hint: 1×10^{9} nm = 1 m) 5.18×10^{-7} m
   b. the frequency. 5.8×10^{14} Hz
   c. the energy. 3.8×10^{-19} J
   d. the color of the line. green

5. A photon has an energy of 4.00×10^{-19} J. Find...
   a. the frequency of the radiation. 6.1×10^{14} Hz
   b. the wavelength of the radiation. 4.9×10^{-7} m
   c. the region of the electromagnetic spectrum that this radiation represents. visible light - green

6. A photon of light has a wavelength of 3.20×10^{5} m. Find...
   a. the frequency of the radiation. 9.4×10^{2} Hz
   b. the energy of the photon. 6.2×10^{-31} J
   c. the region of the electromagnetic spectrum that this radiation represents. radio waves

7. Determine the frequency of light with a wavelength of 4.257×10^{-7} cm.

7.05×10^{16} Hz

Part 2: Bohr Model and the EM Spectrum *Answer using the Bohr model handout.*

1. When an electron in an excited state moves from n=6 to n=2, what wavelength of energy is emitted? What region of the EM spectrum is this wavelength located?

410nm Visible

2. In what region of the EM spectrum is energy emitted when an electron moves from n=5 to n=3?

IR

3. When an electron in an excited state moves from n=4 to n=1, what wavelength of energy is emitted? In what region of the EM spectrum is this wavelength located?

97nm UV

4. When an electron in the excited state moves from n=3 to n=2, what wavelength of energy is emitted?

656nm

5. An emission spectrum containing three lines is obtained from an excited atom. For each line in Column A, write the letters of the matching transitions shown in Column B.

Column A	Column B
C line x, 434 nm	a. 6 to 2
D line y, 656 nm	b. 3 to 2
A line z, 410 nm	c. 5 to 2

6. What color of visible light will each line emit?

blue — line x, 434 nm = 4.34×10^{-7} m
red — line y, 656 nm = 6.56×10^{-7} m
violet — line z, 410 nm = 4.10×10^{-7} m

7. A fourth transition also occurs at 103 nm. Why doesn't this line show up on the line spectrum?

UV - we cannot see with our eyes

8. What end of the EM spectrum consists has the highest frequency?

gamma

9. What end of the EM spectrum consists of the longest wavelengths?

radio

10. Which portion of the EM spectrum might energy be emitted as color that can be seen?

visible light

11. If energy is emitted from an atom with a wavelength of 10^{-5}m, what kind of radiation is emitted?

infrared

12. A wavelength of 5.8×10^{-7} m is emitted from an atom. What type of radiation is emitted? (Be specific.)

visible light - yellow

13. What types of electromagnetic energy has a frequency just less than that of ultraviolet light?

visible

14. What types of waves have energy just less than that of visible light?

infrared

15. Wavelengths of 10^{-13}m are emitted from a source. In what region of the EM spectrum is this energy located? Should there be any concern with handling of this source?

gamma - yes, dangerous to your health