

# Honors Physics – Ch 21-22 Practice Problems

1. A neutron has 939.57 MeV of energy. If a photon had the same energy as a neutron, what would be the photon's wavelength? The visible part of the spectrum ranges from 700 nm – 400 nm. Would this wavelength lie within the visible spectrum?
2. What is the energy of a photon of blue light, having a wavelength of 430.8 nm?
3. Wireless "cable" television transmits images using radio-band photons with energies of around  $1.85 \times 10^{-23}$  J. Find the frequency of these photons.
4. Values for the work function have been experimentally determined for most nonradioactive, elemental metals. The smallest work function, which is 2.14 eV, belongs to the element cesium. The largest work function, which is 5.9 eV, belongs to the element selenium.
  - a. What is the wavelength of the photon that will just have the threshold energy for cesium?
  - b. What is the wavelength of the photon that will just have the threshold energy for selenium?
5. Carbon is a nonmetal, yet it is a conductor of electricity, and it exhibits photoelectric properties. Calculate the work function and the threshold frequency for carbon if photons with a wavelength of  $2.00 \times 10^2$  nm produce photoelectrons moving at a speed of  $6.50 \times 10^5$  m/s.

$$E_4 \text{-----} E = 5.24 \text{ eV}$$

$$E_3 \text{-----} E = 4.69 \text{ eV}$$

$$E_2 \text{-----} E = 3.15 \text{ eV}$$

6. If an electron drops from the  $E_4$  energy level to  $E_1$ , what is the wavelength of the emitted photon? (Use the diagram to the right)
7. Although beryllium, Be, is toxic, the  $\text{Be}^{2+}$  ion is harmless. When a  $\text{Be}^{2+}$  ion is accelerated through a potential difference of 240 V, the ion's de Broglie wavelength is  $4.4 \times 10^{-13}$  m. What is the mass of the  $\text{Be}^{2+}$  ion?

$$E_1 \text{-----} E = 0 \text{ eV}$$

8. The average mass of the bee hummingbird is about 1.6 g. What is the de Broglie wavelength of this variety of hummingbird if it is flying at 3.8 m/s?
9. Calculate the difference in the binding energy of  $^{12}_6\text{C}$  and  $^{16}_8\text{O}$ .
10. Thorium-228, the most toxic of radioactive substances, has a half-life of 1.91 years. How long would it take for a sample of this isotope to decrease its toxicity by 93.75 percent?
11. The oldest living tree in the world is a bristlecone pine in California named Methuselah. Its estimated age is 4800 years. Suppose a sample of  $^{226}_{88}\text{Ra}$  began to decay at the time the pine began to grow. What percent of the sample would remain now? The half-life for  $^{226}_{88}\text{Ra}$  is 1600 years.