Name _____ Date _____ Period _____

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3.12 Properties of Photons

AP Chemistry

Use $c = 2.998 \times 10^{8}$ m/s, $h = 6.626 \times 10^{-34}$ J·s, and 1 nm = 10^{-9} m. Show your work with units and correct significant figures.

1. A radio station broadcasts at a frequency of 1.011×10^{8} s^{-1}. Calculate the wavelength of these radio waves in meters.

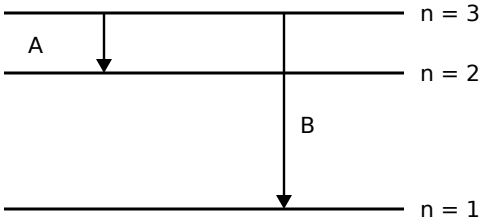
2. A photon of violet light has a frequency of 7.50×10^{14} s^{-1}. Calculate the energy of the photon.

3. A Blu-ray player reads discs with a laser that has a wavelength of 405 nm. Calculate the energy of one photon from this laser.

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4. A sodium atom absorbs a photon, and the atom's energy increases by 3.37×10^{-19} J. Calculate the wavelength of the photon in nm. Is this photon in the visible region?

5. The diagram shows two electron transitions in an atom. Transition A emits a photon with a wavelength of 656 nm. Transition B emits a photon with a wavelength of 103 nm.



(a) Does the atom gain or lose energy during these transitions? Explain.

(b) Which transition has the larger energy gap? Use the wavelengths to justify your answer.

(c) Calculate the energy of the photon emitted in transition B.

6. A microwave oven produces radiation with a frequency of $2.45 \times 10^{9}\ s^{-1}$.

(a) Calculate the energy of one microwave photon.

(b) How many times more energy does the photon in problem 4 (3.37×10^{-19} J) carry than one microwave photon?

(c) A microwave photon makes a water molecule rotate faster but cannot excite its electrons. Use your answer to (b) to explain why.

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