

Directions: Obtain the Media Companion CD for the AP textbook. In this activity you will explore chapter 6 using the cd. Run the cd on the laptop computer.

Once the cd is loaded click on "Enter" and select "Chapter 6 Electronic Structure of Atoms". Click on the section listed below to answer each of the following questions.

Section 6.1 The Wave nature of Light

What does the term wavelength describe? _____

What does the term frequency refer to? _____

Use the interactive electromagnetic spectrum to answer the following questions:

- a) Which form of radiation has a longer wavelength, gamma rays or x-rays? _____
- b) What range (in nm) is the visible spectrum located in? _____
- c) Which form of radiation has a higher frequency, infrared or radio? _____
- d) What type of relationship exists between frequency and wavelength? _____

Write the equation for the relationship between frequency, wavelength and the speed of light in the box below

Answer the questions below and show your work in the space provided.

Questions

1 What is the frequency of light that has wavelength of 4.31 mm?

- ☐ $1.29 \times 10^9 \text{ s}^{-1}$
- ☐ $6.96 \times 10^7 \text{ s}^{-1}$
- ☐ $1.29 \times 10^6 \text{ s}^{-1}$
- ☐ $6.96 \times 10^{10} \text{ s}^{-1}$

2 What color is light of frequency $6.5 \times 10^{14} \text{ s}^{-1}$?

- ☐ Red
- ☐ Orange
- ☐ Blue
- ☐ Yellow

Section 6.2 Quantized Energy and Photons

In 1900 what did Max Planck propose? _____

Write Planck's theory in the box

Complete the following: **According to Planck's theory, energy is always emitted** _____

Watch the Photoelectric Video and answer the following questions:

What is the photoelectric effect? _____

Where did the electrons emitted from the metal get their kinetic energy from? _____

This may be somewhat of a tough question, but give it a try. Show your work in the space provided.

Question

1 If it takes 283.4 kJ/mol to eject electrons from the surface of a particular metal by the photoelectric effect, what is the longest wavelength of light that can be used for this purpose?

- ☐ $4.71 \times 10^{-19} \text{ s}^{-1}$
- ☐ $7.028 \times 10^{-28} \text{ m}$
- ☐ 423 nm
- ☐ $423 \times 10^{-4} \text{ m}$

Examine the EMS interactive demo. What is the relationship between frequency and the amount of energy a photon possesses?

Compare the energy of a photon of red light vs. a photon of blue light. Which one has more energy? Why?

Section 6.3 Bohr's Model of the Hydrogen Atom

What is a line spectrum? _____

What did Bohr propose about the electron in a hydrogen atom? _____

How did Bohr express this relationship? Write the equation in the box provided.

What is the ground state? _____

What is an excited state? _____

Complete the following: **Bohr assumed that the electron could** _____

For the transition from $n = 5$ to $n = 2$

$$\nu = \frac{\Delta E}{h} = \frac{2.18 \times 10^{-18} \text{ J}}{6.63 \times 10^{-34} \text{ J} \cdot \text{s}} \left(\frac{1}{25} - \frac{1}{4} \right) = -6.90 \times 10^{14} \text{ s}^{-1}$$

By examining a solution used with the above equation, we notice that the answer has a negative sign in front of the number. What does the negative sign mean?

Answer the following questions and show your solutions in the space provided.

Questions

1 Calculate the wavelength of light emitted when an electron in a hydrogen atom goes from $n = 8$ to $n = 3$.

- ☐ $4.54 \times 10^{-19} \text{ m}$
- ☐ 956 nm
- ☐ $3.14 \times 10^{14} \text{ m}$
- ☐ 438 nm

2 In what region of the electromagnetic spectrum does the light in Question 1 occur?

- ☐ visible
- ☐ infrared
- ☐ ultraviolet
- ☐ microwave

Section 6.4 The Wave behavior of Matter

What did Louis de Broglie propose? _____

de Broglie used a specific term to describe these waves, what is that term? _____

Write the equation proposed by de Broglie that related matter and energy in the box below.

What are the units of Planck's constant?

Does everything that contains mass also contain **observable** wavelengths? Why or why not?

On the heels of de Broglie Werner Heisenberg made a fundamental proposition. What did he propose? _____

How is this applied to electrons? _____

Answer the following question and show your solutions in the space provided.

Question

1

What is the de Broglie wavelength of a 350-g object moving at a speed of 5.00 m/s?

- ☐ $1.26 \times 10^{-18} \text{ m}$
- ☐ $3.79 \times 10^{-34} \text{ m}$
- ☐ $3.79 \times 10^{-37} \text{ m}$
- ☐ $1.89 \times 10^{-33} \text{ m}$