Name _____ Date _____ Class _____

Chapter 4

CONCEPT REVIEW

1. Refer to Figure 4.2 in your textbook. In 1897, J. J. Thomson used a cathode-ray tube to study the effect of a magnetic field on a stream of electrons. A cathode-ray tube is a vacuum tube with a fluorescent screen. A similar effect can be created by using electrically charged plates to create an electric field. Draw the path of a cathode ray on the fluorescent screen shown in Figure 1. Then explain your drawing. Include a general statement on the charge and the charge-to-mass ratio of an electron.

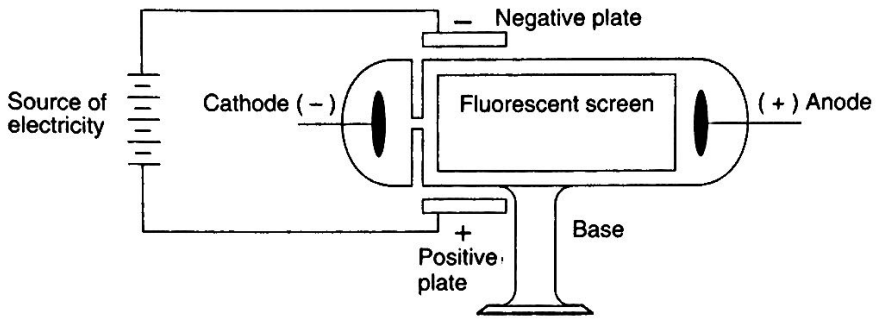

Figure 1

_____

_____

_____

2. a. In Figure 2, A represents _____.
   b. In Figure 2, B represents _____.
   c. Frequency is measured in units called _____.
   d. The wavelength of visible light is between 700 and 400 _____.

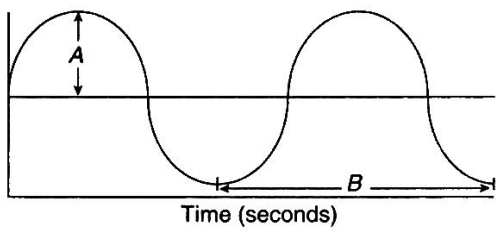

Figure 2

A ball bouncing from one step to another represents the motion of an electron as it falls from one energy level to another. The bottom of the staircase represents the lowest energy level within an atom.

Refer to the hydrogen and electromagnetic spectra in Section 4.2 of your text. The spectrum produced by a compound can be used to determine the elements in the compound. Each line of the spectrum represents one frequency of light, and therefore a certain energy ($E = \lambda\nu$). This energy is determined by the movement of electrons between energy levels that are specific for each element. When an electron falls from a higher level to a lower energy level, a photon is emitted. The greater the difference in energy levels, the greater will be the energy of the light emitted.

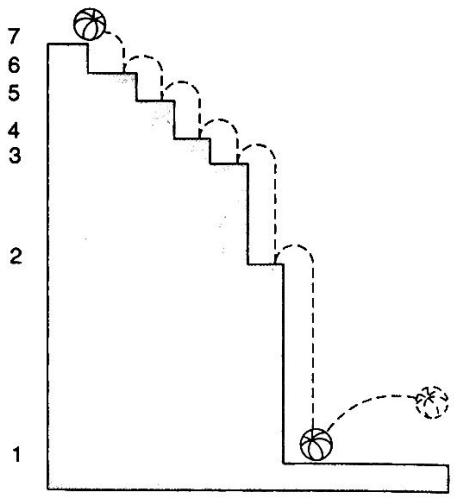

Figure 3

Name _____ Date _____ Class _____

3. a. According to the formula $c = \lambda\nu$, as the frequency ν gets larger, the wavelength λ gets _____.

   b. Which light waves are higher in energy: infrared or ultraviolet? _____

   c. Do radio waves have a very short or a very long wavelength? _____

   d. The lowest energy level of an electron is called its _____ state.

   e. The scientist who first proposed the equation $E = h\nu$ was _____.

   f. An electron is in a(n) _____ state when it has moved from a lower energy level to a higher energy level.

   g. The scientist who used quantum theory and a planetary model of the atom to explain the hydrogen spectrum was _____.

   h. A spectrum produced by exposing atoms to light of all frequencies and that is afterward examined to see which wavelengths are missing is called a(n) _____ spectrum.

4. Use Table 4.2 in your text to complete the following table.

Element	Protons	Neutrons	Electrons	Mass number
boron		6	5	
	24			52
		69	50	

5. The atomic mass of a nuclide is the relative mass of an atom of that nuclide compared to a selected standard, the carbon-12 atom, which is defined as having an the atomic mass of exactly 12 u. The average atomic mass of an element is a weighted average of the atomic masses of its isotopes, by their abundance.

   a. Given that the atomic masses of protons and neutrons are each approximately 1 u, and that the atomic mass of electrons is negligible, what is the approximate atomic mass of a nuclide of phosphorus that has an atomic number of 15 and that has 16 neutrons?

   _____

   b. What is the approximate atomic mass of a nuclide of thorium that has an atomic number of 90 and that has 144 neutrons?

   _____

   c. What is the average atomic mass of the element copper if it is composed of 69.5% of an isotope of atomic mass 62.93 u and 30.5% of an isotope of atomic mass 64.93 u?

   d. Calculate the average atomic mass of chromium, given the following percent abundances and isotope masses: 4.350% 49.946 u; 83.790% 51.941 u; 9.500% 52.941 u; and 2.360% 53.939 u.

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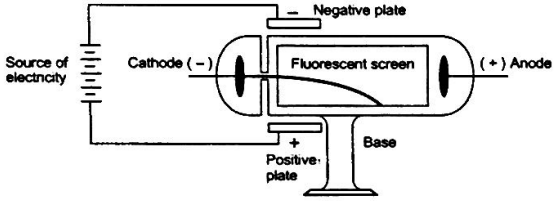

Figure 1

The cathode rays will be repelled by the negative plate and attracted by the positive one because these rays are made up of negatively charged electrons. The amount of deflection depends on the ratio of charge to mass of the electron.

2. a. In Figure 2, A represents amplitude.
   b. In Figure 2, B represents wavelength.
   c. Frequency is measured in units called hertz.
   d. The wavelength of visible light is between 700 and 400 nanometers.

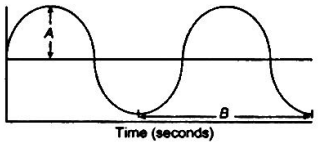

Figure 2

A ball bouncing from one step to another represents the motion of an electron as it falls from one energy level to another. The bottom of the staircase represents the lowest energy level within an atom.

Refer to the hydrogen and electromagnetic spectra in Section 4.2 of your text. The spectrum produced by a compound can be used to determine the elements in the compound. Each line of the spectrum represents one frequency of light, and therefore a certain energy ($E = \lambda\nu$). This energy is determined by the movement of electrons between energy levels that are specific for each element. When an electron falls from a higher level to a lower energy level, a photon is emitted. The greater the difference in energy levels, the greater will be the energy of the light emitted.

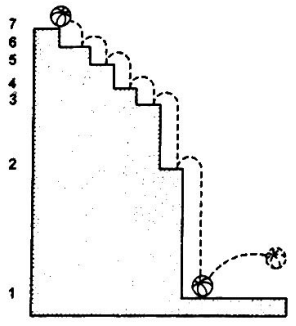

Figure 3

Name _____ Date _____ Class _____

3. a. According to the formula $c = \lambda\nu$, as the frequency ν gets larger, the wavelength λ gets shorter.
   b. Which light waves are higher in energy: infrared or ultraviolet? ultraviolet
   c. Do radio waves have a very short or a very long wavelength? very long
   d. The lowest energy level of an electron is called its ground state.
   e. The scientist who first proposed the equation $E = h\nu$ was Planck.
   f. An electron is in a(n) excited state when it has moved from a lower energy level to a higher energy level.
   g. The scientist who used quantum theory and a planetary model of the atom to explain the hydrogen spectrum was Bohr.
   h. A spectrum produced by exposing atoms to light of all frequencies and that is afterward examined to see which wavelengths are missing is called a(n) absorption spectrum.

4. Use Table 4.2 in your text to complete the following table.

Element	Protons	Neutrons	Electrons	Mass number
boron	5	6	5	11
chromium	24	28	24	52
tin	50	69	50	119

5. The atomic mass of a nuclide is the relative mass of an atom of that nuclide compared to a selected standard, the carbon-12 atom, which is defined as having an the atomic mass of exactly 12 u. The average atomic mass of an element is a weighted average of the atomic masses of its isotopes, by their abundance.
   a. Given that the atomic masses of protons and neutrons are each approximately 1 u, and that the atomic mass of electrons is negligible, what is the approximate atomic mass of a nuclide of phosphorus that has an atomic number of 15 and that has 16 neutrons?
   31 u
   b. What is the approximate atomic mass of a nuclide of thorium that has an atomic number of 90 and that has 144 neutrons?
   234 u
   c. What is the average atomic mass of the element copper if it is composed of 69.5% of an isotope of atomic mass 62.93 u and 30.5% of an isotope of atomic mass 64.93 u?

$$\frac{(69.5 \times 62.93\text{ u}) + (30.5 \times 64.93\text{ u})}{100} = 63.5\text{ u}$$

   d. Calculate the average atomic mass of chromium, given the following percent abundances and isotope masses: 4.350% 49.946 u; 83.790% 51.941 u; 9.500% 52.941 u; and 2.360% 53.939 u.

$$\frac{(4.350 \times 49.946\text{ u}) + (83.790 \times 51.941\text{ u}) + (9.500 \times 52.941\text{ u}) + (2.360 \times 53.939\text{ u})}{100} = 52.00\text{ u}$$