Chemistry: Ch. 5 Worksheet 2: Name: Answer key

1. Fill in the following chart.

Isotope	Symbol	Mass Number	# of Protons	# of Neutrons	#of Electrons
Copper-65	^{65}Cu	65	29	36	29
Silicon-30	^{30}Si	30	14	16	14
Tungsten-184	^{184}W	184	74	110	74

2. Describe the relationship between wavelength, frequency and energy of an electromagnetic wave.

Wavelength + frequency are inverse, energy and frequency are direct

3. What is a photon/quantum?

A small bundle of electromagnetic radiation. Released or absorbed when a e- jumps between energy levels

4. Rank the following waves from shortest to longest wavelengths? Show your work.

a) 8.5×10^{-6} km (3) b) 4.7×10^{-1} cm (2) c) 4250 nm (1)

$8.5\times10^{-6}\text{ km} \left|\frac{1000\text{ m}}{1\text{ km}}\right. = 8.5\times10^{-3}\text{ m}$

$4.7\times10^{-1}\text{ cm} \left|\frac{1\text{ m}}{100\text{ cm}}\right. = 4.7\times10^{-3}\text{ m}$

$4250\text{ nm} \left|\frac{1\text{ m}}{1\times10^{9}\text{ nm}}\right. = 4.26\times10^{-6}\text{ m}$

5. A source produces green light of wavelength 5.11×10^3 Å. What is this wavelength meters?

$5.11\times10^{3}\text{ Å} \left|\frac{1\text{ m}}{1\times10^{10}\text{ Å}}\right. = 5.11\times10^{-7}\text{ m}$

6. KFOR broadcasts at a frequency of 1240 kHz (kilohertz).

a. What is the wavelength for this wave?

$\lambda = \frac{c}{\nu}$

$2.998\times10^{8}\frac{\text{m}}{\text{s}} \left|\frac{\text{s}}{1240\times10^{3}}\right. = 242\text{ m}$

b. What is the energy per photon of this wave?

$E = h\nu$

$6.626\times10^{-34}\text{ J}\cdot\text{s} \left|\frac{1240\times10^{3}}{\text{s}}\right. = 8.22\times10^{-28}\text{ J}$

7. What is the energy in kJ for light with wavelength 250 nm?

$E = \frac{h\cdot c}{\lambda}$

$6.626\times10^{-34}\text{ J}\cdot\text{s} \left|\frac{2.998\times10^{8}\text{ m}}{\text{s}}\right| 250\text{ nm} \left|\frac{1\times10^{9}\text{ nm}}{1\text{ m}}\right. = 7.9\times10^{19}\text{ J}$

8. For the electronic transition (movement of electrons) of $n_i = 5$ to $n_f = 1$ in a hydrogen atom, the energy released in the released photon is -2.09×10^{-18} J. Calculate the frequency and the of this photon, and identify the type of wave this is.

Wavelength

$\nu = E/h$

$-2.09\times10^{-18}\text{ J} \left|\frac{}{6.626\times10^{-34}\text{ J}\cdot\text{s}}\right. = 3.15\times10^{15}\text{ s}^{-1}$

Wave = UV

$\lambda = \frac{c}{\nu}$

$2.998\times10^{8}\frac{\text{m}}{\text{s}} \left|\frac{\text{s}}{3.15\times10^{15}}\right. = 9.52\times10^{-8}\text{ m} = 95.2\text{ nm}$

9. For n = 4 in an atom, what are the possible values of *l*? For *l* = 2, what are the possible values of m?

$n = 4$, $l = 0, 1, 2, 3$

$l = 2$ $m = -2, -1, 0, +1, +2$

10. Which of the following are sets of quantum numbers are acceptable for an electron in a hydrogen atom

(a.) n = 2, l = 1, m = 1, s = + ½ b. n = 1, l = 0, m = -1, s = - ½ c. n = 4, l = 2, m = -2, s = + ½

yes no yes

For any set of quantum numbers that are not acceptable, explain why.

b. if $l=0$ (s-subshell). Then $m=0$; only one orbital

11. Write the correct electron configurations for the following elements

a. Rb - $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^1$

b. Se - $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$

c. Ag - $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^1 4d^{10}$ (note: exception)

12. Draw an orbital diagram for the following elements

a. Ca $\underline{\uparrow\downarrow}:\underline{\uparrow\downarrow},\underline{\uparrow}\,\underline{\uparrow}\,\underline{\uparrow};\underline{\uparrow\downarrow},\underline{\uparrow\downarrow}\,\underline{\uparrow}\,\underline{\uparrow}:\underline{\uparrow\downarrow}$

b. Cu $\underline{\uparrow\downarrow}:\underline{\uparrow\downarrow},\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}:\underline{\uparrow\downarrow},\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow},\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}\,\underline{\uparrow}:\underline{\uparrow}$

c. Kr $\underline{\uparrow\downarrow}:\underline{\uparrow\downarrow},\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}:\underline{\uparrow\downarrow},\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow},\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}:\underline{\uparrow\downarrow},\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}\,\underline{\uparrow\downarrow}$

13. Calculate the number of aluminum atoms in a piece of aluminum wire weighing 1.000 g. (1 amu = 1.661×10^{-24} g)

$$\frac{1.000\text{ g Al}}{1} \left| \frac{1\text{ amu}}{1.661\times10^{-24}\text{ g}} \right| \frac{1\text{ Al atom}}{26.98\text{ amu}} = 2.23\times10^{22}\text{ Al}$$

14. The Kentucky derby is a 10.0 furlong race. The record time for winning this race is 1 minute and 59 2/5 seconds set by Secretariat in 1973. Convert this to miles per hour.

60s + 59.4 = 119.4

$$\frac{10.0\text{ furlong}}{119.4\text{ s}} \left| \frac{660\text{ ft}}{1\text{ furlong}} \right| \frac{1\text{ mi}}{5280\text{ ft}} \left| \frac{60\text{ s}}{1\text{ min}} \right| \frac{60\text{ min}}{1\text{ hour}} = 37.7\text{ mi/hr}$$