SCH4U1
Atomic Structure Worksheet

1. a) What is the ground state of a hydrogen atom?
    b) What is an excited state of a hydrogen atom?
    c) How is a hydrogen atom in the ground state transformed into a hydrogen atom in the excited state?

2. A radio station broadcasts at a frequency of $105.4\ MHz$ (FM 105.4). What is the wavelength of this electromagnetic wave?

3. A very bright yellow line in the bright-line spectrum of sodium has a wavelength of $590\ nm$ (nanometers). What is the frequency of this light?

4. How much energy must a mole of hydrogen atoms absorb if the electrons are to increase from the first energy level to the fifth energy level?

5. What is the energy of a photon given off by one excited hydrogen atom as the electron moves from energy level 3 to energy level 2?

6. Calculate the frequency of a single electron's electromagnetic radiation (waves) produced when the electrons in a mole of hydrogen atoms change from the fifth to the second energy level.

7. Calculate the frequency of light emitted if an atom gives off electromagnetic radiation with an energy of $3.21 \times 10^{-22} kJ$.

8. a) What amount of energy would be released if an electron moves from the second energy level ($n = 2$) to the ground state ($n = 1$) in a hydrogen atom?

    b) Calculate the wavelength of electromagnetic radiation which is given off.

9. It takes $519\ kJ/mol$ of energy to cause the ionization of lithium ($Li \rightarrow Li^+ + 1e^-$). What would be the frequency of light which would cause ionization?

Answers:

2) $2.85\ m$

3) 5.08×10^{14} cycles/s (Hz)

4) $1260\ kJ$

5) $3.02 \times 10^{-22} kJ/atom$ (or 3.02 x 10⁻¹⁹J/atom)

6) $6.90 \times 10^{14}\ Hz$

7) $4.84 \times 10^{14} Hz$

8) a) $1.63 \times 10^{-18}\ J/atom$

    b) $1.22 \times 10^{-7}\ m = 122\ nm$

9) $1.30 \times 10^{15}\ s^{-1}$