University of Mohamed Khider, Biskra
Faculty of Exact Sciences, Natural and Life Sciences
Department: Materials Science
First Year - Common Trunk

Academic Year: 2023/2024
Course: Chemistry 1

Series N° :3

Exercise 1:

- If the threshold wavelength for lithium is λ_0 = 5200 Å, are the wavelengths of radiations capable of ejecting electrons from lithium metal longer or shorter than λ_0?
- Calculate the energy required to remove an electron in electron volts (eV).
- Calculate the energy and velocity of electrons emitted from a plate of lithium metal exposed to radiation with a wavelength of 4500 Å.

$h=6,62.10^{-34}$J.s, $c= 3.10^{8}$m/s

Exercise 2:

1. An excited hydrogen atom electron transitions from energy level n=2 to energy level n=1. Draw an illustrative diagram of this transition, then calculate the energy and wavelength of the emitted photon.
2. The series is characterized by the following wave numbers: 2468, 3809, 4617 cm^{-1}.

   • Provide the relationship between electronic transition energy and the corresponding wavelength for this series, then deduce the transition associated with the lowest energy.

   • Calculate in nanometers the wavelength associated with this transition. To which region of the spectrum does this wave belong?

Exercise 3:

Assuming that the He^+ ion's spectral lines in the ultraviolet radiation obey a similar relationship to that used in the hydrogen atom:

$$\bar{\nu} = R_{He^+}\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right), \qquad n_1<n_2$$

And the corresponding line to the longest wavelength in the ultraviolet radiation has a wavelength of: $\lambda = 3.03 \times 10^{-8}$m. If the ultraviolet radiation spectrum falls into the Lyman series,

Calculate:

1. The constant R_{He^+} and deduce the relationship between R_{He^+} and R_H and calculate the atomic number for helium (He).
2. The ionization energy for the first ionization of helium-like hydrogen (He^+).

$$R_H = 1.1.10^5\ \text{cm}^{-1};\ c = 3.10^8\ \text{m/s};\ h = 6{,}62.10^{-34}\ \text{J.s.}$$

Exercise 4:

The frequency of emitted radiation for a hydrogen-like atom is given by the following equation:

$$\nu = K\left(\frac{1}{r_{n_1}} - \frac{1}{r_{n_2}}\right),\quad \text{where } r_{n_1} < r_{n_2}$$

r_{n_1} and r_{n_2} The radii of the specified Bohr orbits for the allowed energy levels of the electron.

- Determine the relationship that connects the constant K to the Rydberg constant for the hydrogen atom.
- Calculate the value of this constant in the International System of Units (M.K.S.A.) for the He^+ ion.

Exercise 5:

In the emission spectrum of the hydrogen atom, we consider the transitions shown in the following diagram: The wavelength of the final (limiting) line λ_{lim} = 828.8 nm.

- Calculate the value of n?
- Calculate the wavelength λ_2.