REVIEW EXERCISES

## Review Exercises.

Q1 (a) Calculate the frequency and the wavelength of the line for the $n=6$ to $n=2$ transition.

(b) Is this wavelength longer or shorter than that of the $n=5$ to $n=2$ transition.

Q2. A hydrogen atom emits a photon as its electron changes from $n=5$ to $n=2$. What is the wavelength of the photon? In what region of the electromagnetic spectrum is this photon found?

Q3. Small neon lasers emit $2.0\ mJs^{-1}$ of light at 622 nm. How many photons does such laser emit in one minute?

Q4. Calculate the wavelengths associated with an electron and proton, each traveling at 7.0% of the speed of light.

Q5. It takes $510\ kJmol^{-1}$ to remove electrons completely from sodium atoms. Sodium atom absorb and emit light of wavelengths 592.5 and 598.5 nm.

a) Calculate the energy of these two wavelengths in $kJmol^{-1}$.

b) Draw an energy level diagram for sodium atoms that shows the levels involved in these transitions and the ionization energy.

c) If a sodium atom has already absorbed a 598.5 nm photon, what is the wavelength of the second photon a sodium atom must absorb in order to remove an electron completely?

*more Review Exercises …….*

Q6. The human eye can detect as little as $2.41 \times 10^{-18}$ J of green light of wavelength 522 nm. Calculate the minimum number of photons that can be detected by the human-eye.

Q7. A $He^+$ ion in the 5th energy level may return to the ground state by emitting 3 successive photons: an infrared photon ($\lambda$ = 1015 nm), a green photon ($\lambda$ = 470 nm) and an X-ray ($\lambda$ = 25 nm)

a) Calculate the excitation energies of each of the levels occupied by the $He^+$ ion as it returns to the ground state.

b) Draw an energy level diagram for $He^+$ cations that illustrates these process.

Q8. If the ionization energy for hydrogen atom is $2.178 \times 10^{-18}$ J atom$^{-1}$, calculate the of the Li atom, $\Delta E_{IE}(Li)$ in kJ mol$^{-1}$.

Q9. If the fourth ionization for Be atom (Z = 4) is $2.099 \times 10$ kJ mol$^{-1}$, calculate the sixth ionization energy of the carbon atom (Z = 6) in kJ mol$^{-1}$.

***more Review Exercises …….***

$Q_{10}$. Calculate change in energy, frequency, wavelength and the wave-number for a emission line-spectrum which was produced when a electron move from fourth excited state to second excited state in $B^{4+}$ ion using the following data.

First Bohr radius, $a_0 = 0.529\ \text{Å}$

Electron charge, $e = 1.60217 \times 10^{-19}\ C$

Plank constant, $h = 6.626 \times 10^{-34}\ Js$

light speed in vacuum, $c = 2.998 \times 10^{8}\ ms^{-1}$

$\epsilon_0 = 8.84 \times 10^{-12}\ N^{-1}m^{-2}C^{2}$.

$Q_{11}$. Calculate the second ionization energy of He atom, $\Delta H_{IE}(He)$ using the following data:

Rydberg constant, $R_H = 1.10 \times 10^{5}\ cm^{-1}$

Plank constant, $h = 6.626 \times 10^{-34}\ Js$

$c = 2.998 \times 10^{8}\ ms^{-1}$

$Q_{12}$. If the first Bohr radius, $a_0 = 0.529\ \text{Å}$, calculate the radius and the energy for $Be^{3+}$ ion at the third excited state?

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