

**SET 3****EXERCISE 1**

- 1/ Calculate the radius of the first and second energy levels of the  $\text{He}^+$  ion.
- 2/ Find the energies for the ground state and for  $n = 2$  and  $n = 3$ , as well as the  $n \rightarrow \infty$  limit. Draw the energy level diagram.
- 3/ Determine the change in energy for the electron in its transitions from the ground state to the first and second excited states,
- 4/ Determine the ionization energy of hydrogen atom and of the  $\text{He}^+$  ion.

**EXERCISE 2**

- 1/ The light radiation with a wavelength  $\lambda = 28,08\text{nm}$  causes the ionization of an unknown hydrogen-like atom X.
  - 1.a/ Calculate the ionization energy of the ion.
  - 1.b/ Deduce its atomic number  $Z$  and specify the ion's charge.
- 2/ For the hydrogen like ion  $\text{C}^{5+}$  in its second excited state, determine the orbital period of the electron.

**EXERCISE 3**

- 1/ How much energy must a hydrogen atom absorb for its electron to move from the ground state to the third excited state?
- 2/ How many spectral lines are emitted by a hydrogen atom when it is raised to the third excited state? Classify them by series. Which transition corresponds to the longest wavelength (without calculation)?

**EXERCISE 4**

- 1/ In the hydrogen atom's emission spectrum, a line corresponds to an energy transition of  $2.85\text{ eV}$ . Assign this line to a spectral series and identify the corresponding electronic transition.
- 2/ You are given the wavelengths of the three emission lines of  $\text{He}^+$ .
$$\lambda_1 = 468.9\text{ nm} ; \lambda_2 = 320.5\text{nm} ; \lambda_3 = 273.5\text{ nm}$$
Assign each line to its electronic transition and indicate the spectral domain it falls into.