PHYSICS

BOOKS - OSWAAL PUBLICATION PHYSICS (KANNADA ENGLISH)

ATOMS

Very Short Answer Type Questions

1. How does nuclear radius of an atom depend on its mass number ?

Watch Video Solution

2. Write any two limitations of Bohr's theorem.

Watch Video Solution

3. When is H_α line of the Balmer series in the emission spectrum of hydrogen atom obtained ?

Watch Video Solution

4. What is the maximum number of spectral lines emitted by a hydrogen atom when it is in the third

excited state ?

Watch Video Solution

5. What is the maximum number of spectral line emitted by a hydrogen atom when it is in the fourth excited state?

Watch Video Solution

6. What is the ratio of radii of the orbits corresponding to first excited state and ground state in a hydrogen atom?

Watch Video Solution

7. Define ionisation energy. What is its value for a hydrogen atom?

Watch Video Solution

Short Answer Type Questions I

1. The last member of Lymann series of Hydrogen atom is 912Å Calculate The wavelength of series limit of blamer series.

Watch Video Solution

2. Assuming the expression for radius of the orbit, derive an expression for total energy of an electron in hydrogen atom.

Watch Video Solution

3. Derive an expression for the radius of n^{th} Bohr's orbit of hydrogen atom hence write the expression for the radius of first orbit of hydrogen atom.

Watch Video Solution

4. In the first excited state of hydrogen atom, its radius is found to be 21.2×10^{-11} m. Calculate its Bohr radius in the ground state. Also calculate the total energy of the atom in the second excited state.

Watch Video Solution

5. If electron in the atom is replaced by a particle (muon) having the same charge but mass about 200 times as that of the electron to form a muonic atom, how would : (i) the radius and (ii) the ground state energy of this be affected ?

Watch Video Solution

6. Calculate the wavelength of the first spectral line in the corresponding Lyman series of the hydrogen atom.

Watch Video Solution

Short Answer Type Questions Ii

1. Given de- Broglie's explanation of quantisation of angular momentum as proposed by Bohr.

Watch Video Solution

2. Write three postulates of Bohr. Mention two limitation of Bohr model.

Watch Video Solution

3. Show that 1 amu = $932MeV$.

Watch Video Solution

4. A 12.5eV electron beam is used to bombard gaseous hydrogen at room temperature What

series of wavelengths will be emitted.

Watch Video Solution

5. Show that the electron revolving around the nucleus in a radius 'r with orbital speed 'r' has magnetic moment evr/2.

Hence, using Bohr's postulate of the quantization of angular momentum, obtain the expression for the magnetic moment of hydrogen atom in its ground state.

Watch Video Solution

6. (a) Using Bohr's second postulate of quantization of orbital angular momentum, show that the circumference of the electron in the nth orbital state in hydrogen atom is n times the de-Broglie wavelength associated with it.

(b) The electron in hydrogen atom is initially in the third excited state. What is the maximum number of spectral lines which can be emitted when it finally moves to the ground state ?

Watch Video Solution

7. In a Geiger-Marsden experiment, calculate the distance of the closest approach to the nucleus of Z = 80, when an a-particle of 8 MeV energy impinges on it before it comes momentarily to rest and reverses its direction.

How will the distance of the closest opproach be affected when the kinetic energy of the o-particle is doubled?

Watch Video Solution

8. The ground state energy of hydrogen atom is -13.6 eV. If an electron makes a transition from an

energy level - 0.85 eV to -3.4 eV, calculate the wavelength of the spectral line emitted. To which series of hydrogen spectrum does this wavelength belong?

Watch Video Solution

9. The energy levels of a hypothetical atom are shown below. Which of the shown transitions will result in the emission of a photon of wavelength 275 nm ? Which of these transitions correspond to emission of radiation of the (i) maximum and (ii) the minimum wavelength ?

View Text Solution

10. (a) Using de Broglie's hypothesis, explain with the help of a suitable diagram, Bohr's second postulate of quantization of energy levels in a hydrogen atom.

The ground state energy of hydrogen atom is -13.6 eV. What are the kinetic and potential energies of the electron in this state ?

Watch Video Solution

Long Answer Type Questions

1. Derive an expression for the radius of n^{th} Bohr's orbit of hydrogen atom hence write the expression for the radius of first orbit of hydrogen atom.

Watch Video Solution

2. Write the expression for the radius of n^{th} orbit of the hydrogenic atoms and give the meanings of the symbols used.

Watch Video Solution

3. Explain the terms 'mass defect' and 'packing fraction'. What is the relation between mass defect and binding energy.

Watch Video Solution

4. Explain the terms 'mass defect' and 'binding energy'. How are they related ? Draw binding energy curve.

Watch Video Solution

5. (a) Using Bohr's postulates, derive the expression for the total energy of the electron in the stationary states of the hydrogen atom.

(b) Using Rydberg formula, calculate the wavelengths of the spectral lines of the first member of the Lyman series and of the Balmer series.

Watch Video Solution

Numerical Problems

1. The first member of the Balmer series of hydrogen atom has wavelength of 656.3 nm. Calculate the wavelength and frequency of the second member of the same series. Given, $c = 3 \times 10^8 m/s$.

Watch Video Solution

2. Calculate the shortest and longest wavelength of Balmer series of hydrogen atom. Given $R = 1.097 \times 10^7 m^{-1}$.

Watch Video Solution

3. Calculate the binding energy and binding energy per nucleon (in MeV) of a nitrogen nucleus $\left({}_{7}^{14}N\right)$ from the following data:

Mass of proton=1.0078 u

Mass of neutron=1.00867 u

Mass of nitrogen nucleus=14.00307 u

Watch Video Solution

4. The wavelength of first line in Balmer series is 6563 Å. Calculate the longest and the shortest wavelengths of the first spectral lines in the Lyman series.

Watch Video Solution

5. The wavelength of the first line of Balmer series of H-atom of 6561Å. The wavelength of the second line of the series is

Watch Video Solution

6. On the basis of Bohr's theory, calculate the velocity and time period of revolution of the electron in the innermost orbit (n = 1) of the hydrogen atom. Given : Bohr's Radius $(r_1) = 0.53\text{Å}$

.

Data:

$n = 1, r_1 = 0.53, \text{Å} = 0.53 \times 10^{-10} m, v = ?, T = ?$

Watch Video Solution

7. The Rydberg constant for hydrogen is $1.097 X 10^7 m s^{-1}$. Calculate the short and long wavelength limits of Lyman series.

Data: $R = 1.097 \times 10^7 m s^{-1}$

For short wavelength limit of Lyman Series,

$n_f = 1, n_i = \infty, \lambda_s = ?$

For long wavelength limit of Lyman series,

$n_f = 1, n_i = 2, \lambda_i = ?$

Watch Video Solution

8. Hydrogen atom in its ground state is excited by means of a monochromatic radiation of wavelength 970.6 Å. How many different transitions are possible in the resulting emission spectrum? Find the longest wavelength amongst these. (Ionisation energy of hydrogen atom in its ground state is 13.6 eV and take $h = 6.6 \times 10^{-34} Js$)

Data : Wavelength of incident radiation $= 970.6 Å = 970.6 X 10^{-10} m$ Ionisation energy of hydrogen atom in its ground state = 13.6 eV

(i) Number of possible transitions = ?

(ii) Longest wavelength emitted = ?

Watch Video Solution

9. is found experimentally that 13.6 eV energy is required to separate a hydrogen atom into a proton and an electron. Compute the orbital radius and the velocity of the electron in a hydrogen atom.

Watch Video Solution

10. A 10 kg satellite circles earth once every 2 h in an orbit having a radius of 8000 km. Assuming that Bohr's angular momentum postulate applies to

satellites just as it does to an electron in the hydrogen atom, find the quantum number of the orbit of the satellite.

Watch Video Solution

11. Using the Rydberg formula, calculate the wavelengths of the first four spectral lines in the Lyman series of the hydrogen spectrum.

Watch Video Solution