PHYSICS

BOOKS - CENGAGE PHYSICS (HINGLISH)

ATOMS

Question Bank

1. N^{th} level of Li^{2+} has the same energy as the ground state energy of the hydrogen atom. If r_N and r_1 be the radius of the N^{th} Bohr orbit of Li^{2+} and first orbit radius of H atom respectively, then the ratio $\frac{r_N}{r_1}$ is

Watch Video Solution

2. The ionization potential of the hydrogen atom is 13.6 V. The energy needed to ionize a hydrogen atom which is in its first excited state is about

Watch Video Solution

3. In the spectrum of hydrogen, the ratio of the longest wavelength in the Lyman series to the longest wavelength in the Balmer series is $\frac{x}{27}$. Find x.

Watch Video Solution

4. If an electron in a hydrogen atom jumps from the 3rd orbit to the 2 nd orbit, it emits a photon of wavelength λ. When it jumps from the 4 th orbit to the 3 rd orbit, the corresponding wavelength of the photon will be $\frac{m}{n}\lambda$. Find $(m+n)$.

Watch Video Solution

5. The electron of a hydrogen atom revolves the proton in a circuit nth of radius $r_0 = \frac{\in_0 n^2 h^2}{\pi m e^2}$ with a speed $v_0 = \frac{e^2}{2 \in_0 nh}$ The current the to circulating charge is proportional to

Watch Video Solution

6. The ratio of the binding energies of the hydrogen atom in the first and the second excited states is

Watch Video Solution

7. When a hydrogen atom emits a photon in going from n=5 to n=1, its recoil speed is almost

Watch Video Solution

8. The ratio between acceleration of the electron in singly ionised helium atom and doubly ionised lithium atom (both in ground state) is

Watch Video Solution

9. Ionization potential of hydrogen is $13.6V$. If it is excited by a photon of energy $12.1eV$, then the number of lines in the enission spectrum will be

Watch Video Solution

10. According to the Bohr theory of the hydrogen atom, electrons starting in the 4^{th} energy level and eventually ending in the ground state could produce a total of how many lines in the hydrogen spectra?

Watch Video Solution

11. A certain species of ionized ATOMS (hydrogen like) produces an emission line spectrum according to Bohr model. A group of lines in the spectrum form a series in which the smatlest energy is $4.896eV$ and the maximum energy is $13.6eV$. The atomic number of the atom is

Watch Video Solution

12. An energy of $24.6eV$ is required to remove one of that electrons from a neutal helium atom. The enegy (in eV)required to remove both the electrons from a netural helium atom is

Watch Video Solution

13. The electron in a hydrogen atom makes a transition from $n = n_1$ to $n = n_2$ state. The time period of the electron in the initial state (n_1) is eigh times that in the final state (n_2). The possible values of n_1 and n_2 are

Watch Video Solution

Watch Video Solution

14. A photon of energy $12.09eV$ is completely absorbed by a hydrogen atom initially in the ground state. The quantum number of excited state is

Watch Video Solution

15. Consider the radiation emitted by large nu,ber of singly charged positive ions of a certain element. The sample emit fifteen types of spectral line. One of which is same as the first line of lyman series. What is the binding energy in the hinhest energy state of this configuration ?

Watch Video Solution

16. An electron collides with a dfixed hydrogen atom in its ground stat. Hydrogen atom gets excited and the collding electron loses all its kinetic energy. Consequently the hydrgogen atom may emits a photon corresponding to the alrgest wavelength of the Balmer series. The K.E. of colliding electron will be 24.2/N eV. Find the value of N.

Watch Video Solution

17. The ratio of frequencies of the first line of the Lyman series and the first line of Balmer series.is $\frac{p}{q}$. Find (p+q).

Watch Video Solution

18. The electron in a hydrogen atom makes a transition $n_1 \to n_2$ where n_1 and n_2 are the principal qunatum numbers of the two states. Assume the Bohr model to be valid. The frequency of orbital motion of the electron in the initial state is $1/27$ of that in the final state. The possible values of n_1 and n_2 are

Watch Video Solution

19. The wavelength of the first line in balmer series in the hydrogen spectrum' is λ. The wavelength of the second line is $\frac{y\lambda}{27}$. Find y.

Watch Video Solution

20. A monochromatic light is just able to ionize a hypothetical one electron atom in its ground state having energy levels -đefined by $E_n = -\frac{17}{n^2}eV$, where n is principal quantum number. In an experimental set-up, same light is incident on a metal plate and it was found out that electrons have $2eV$ as maximum kinetic 'energy. If the work function of the metal is $5PeV$, then find the value of P.

Watch Video Solution

21. In a transition to a state of ionization potential $30.6V$, (a) hydrogen like atom emits a $541.17A^o$ photon. Determine the principal quantum number of the initial state.

Watch Video Solution

22. A $(He)^+$ ion in ground state is fired towards a Hydrogen atom in'the ground state and at rest. What should be the minimum kinetic energy (in eV) of $(He)^+$ ion so that both the single electron species may get excited?

View Text Solution

23. A Bohr hydrogen atom unđergoes a transition $n = 5 \rightarrow \ n = 4$ and emits a photon of frequency v. Frequency of circular motion of electron in $n = 4$ orbit is v_4. Find the ratio $\frac{V}{(v)_4}$

View Text Solution

24. The atom of a hydrogen' like gas are in a particulạr excited energy level. When these ATOMS de-excite, they 'emit photons of different energies. The maximum and minimum energies of emitted photons are

$E_{\max} = 204 eV$ and $E_{\min} = 10.57 eV$, respectively. The principal quantum number of initially. excited energy level is

Watch Video Solution

25. The electron in the ground state of hydrogen atom produces a magnetic field B ạt the nucleus. This magnetic field' depends on the value of many constants. If e is electronic charge, B is found to be proportional to e^n. Find n.

Watch Video Solution

26. Neutron in thermal equilibrium with matter at $27^\circ C$ can be brought to behave like ideal gas. Assuming them to gave speed of v_{rns}, what is their De broglie wavelength λ (in mm). Fill $\left(\frac{156}{11}\right)\lambda$ in the OMR sheet.

(Take

$m_n = 1.69 \times 10^{-27} kg.\ k = 1.44 \times 10^{-23} J / K, h = 6.60 \times 10^{-34} J \sec$

]

Watch Video Solution

27. Hydrogen like atom of atomic,number Z is in an excited state of quantum number $2n$. It can emit a maximum energy photon of $204eV$. If it makes a transition to quantum state n, a photon of energy $40.8eV$ is emitted. Find $\frac{Z}{n}$.

View Text Solution

28. An electron moving along x -axis is confined between two walls at $x = 0$ and at $x = L$. There is no loss of energy during collision between the electron and the wall. Initially, the electron is in quantum state $n = 2$ and then it jumps to quantumi state $n = 1$. The emitted photon is incident on a metal having work function equal to energy of electron in quantum state $n = 1$. If maximum possible kinetic energy of emitted photoelectron is x times the energy of electron in quantum state $n = 1$, then find x.

Watch Video Solution

29. The wavelength of K_α line for an elèment of atomic number 29 is λ. The wavelength of K_α line for an element of atomic number 15 is $\beta\lambda$. Find β. Take Moseley's constant, $b = 1$ for both elements)

Watch Video Solution

30. An electron in the hydrogen atom jumps from excited state n to the ground state. The wavelength so emitted illuminates a photo-sensitive material having work function $2.75eV$. If the stopping potential of the photoelectron is $10V$, the value of n is

Watch Video Solution

31. A photon of wavelength $12.4nm$.is used to eject an electron from the ground state of He^+. The de-Broglie wavelength of the ejected electron is $\lambda_b A^\circ .F \in d$lambda_(delta)^(2) .` (Round off answer to two places of decimal.)

Watch Video Solution

32. An electron of stationary hydrogen atom passes from the fifth energy level to the ground level. The velocity that the atom acquires as a result of photon emission is khR, Find k. (Here, $m =$ Mass of electron, $h =$ Planck's $\overline{25m}$ constant and $R =$ Rydberg constant)

Watch Video Solution

33. A graph of $\sqrt{v}$ (where v is the frequency of K_α line of the characteristic X-ray spectrum) is plotted against the atomic number Z of the elements emitting the characteristic X-ray .The intercept of the graph on the z -axis is 1 and the slope of the graph is 0.5×10^8 in SI units. The frequency of the K_α line for an element of atomic number 41 is given as $\alpha \times 10^{16} Hz$. Find the value of α.

Watch Video Solution

34. In an X-ray experiment, target is made up of copper $(Z=29)$ having some impurity. The K_{α} line of copper have wavelength λ_0. It was observed that another K_{α} line due to impurity have wavelength $\frac{784}{625}\lambda_0$. The atomic number of the impurity element is

Watch Video Solution

35. The K, L and M energy levels of platinum lie roughly at $78keV, 12keV$ and $3keV$, réspectively. The ratio of wavelength of K_{α} line to that of K_{β} line in X-ray spee- trum is $\frac{\alpha}{22}$. Find α.

Watch Video Solution

36. The wavelength of the K_{α} line for an element of atomic number 57 is λ . What is the wavelength of the K_{α} line for the element of atomic number29 ?

Watch Video Solution

37. The hydrogen ATOMS are excited to $n = 3$. During de-excitation, whatever photons are emitted are being used to eject photoelectrons from a metal surface. What should be the maximum work function.of the metal (in eV) so that the photon of minimum energy can also eject photoelectron from the metal?

Watch Video Solution

38. Light from a discharge tube containing hydrogen ATOMS falls on a piece of sodium due to the transition of electron from $4^t h$ orbit to $2^n d$ orbit. Work function of sodium is $1.83eV$. The fastest moving photoelectron is allowed to enter in a magnetic field, which is perpendicular to the direction of motion of photoelectron as shown in the figure. Find the distance (in μm) covered by the electron in the magnetic field. $B = 1T\pi^2 = 10r.$, Mass of electron $= 9 \times 10^{-31}kg$ and $R =$ Radius of the path that the most energetic electron takes in the presence of applied magnetic field)

'(##CEN_KSR_PHY_JEE_C29_E01_038_Q01##)'

Watch Video Solution

39. Radiation from hydrogen gas excited to first excited state is used for illuminating certain photoelectric plate. When the radiation from some unknown hydrogen like gas excited to the same level is used to expose the same plate, it is found that the de-Broglie wavelength of the fastest photoelectron has decreased 2.3 times. It is given that the energy corresponding to the longest wavelength of the Lyman series of the unknown gas is 3 times the ionization energy of hydrogen gas $13.6eV. F \in dthew$ or $kfunction(\in eV)ofpho \to e \leq ctricplate. [Take$

View Text Solution

40. An X -ray tube is working at a potential difference of $38.08kV$. The potential difference is decreased to half its initial value. It is found that difference of the wavelength of $K_{\alpha}X$ -rays and the most energetic continuous X-rays becomes 4 times of the difference prior to the change of voltage. Assuming K_{α} line is present in both cases, find the atomic number of the target element. (Take $Rch = 13.6eV$)

Watch Video Solution