



# PHYSICS

## BOOKS - R G PUBLICATION

### ATOMS AND NUCLEI

#### Exercise

1. How are  $\beta$ -rays emitted from a nucleus, when it does not contain electrons?



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2. Mention two limitations of Rutherford's model of atom.



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3. Explain what is red shift and blue shift of light wave.



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4. Obtain Bohr's quantisation condition on the basis of the wave nature of an electron.



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5. Describe in brief the process of gamma radiation.



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6. Deduce the expression for the total energy of the electron in the  $n$  orbit of a hydrogen atom in the Bohr model.



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7. In hydrogen spectrum the shortest wavelength in Balmer Series is  $\lambda$  What will be the shortest wavelength in Brackett Series.?



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8. Write down the results of Rutherford's  $\alpha$ -particle scattering experiment. Which result nullifies the idea of uniform distribution of positive and negative charges in an atom?



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9. In the light of Rutherford's atom model discuss the stability of an atom and state its inability to explain line emission spectrum.



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**10.** State Bohr's postulates regarding Bohr's model of the hydrogen atom.



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**11.** State one drawback of Rutherford's model of the atom. What modifications of Rutherford's model were suggested by Bohr? State two limitations of Bohr's model of the atom.



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## 12. Fill in the blanks

Rutherford's experiment suggested the size of the nucleus to be about\_



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## 13. Fill in the blanks

In an hydrogen atom the value of Bohr radius is\_\_\_\_\_



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#### 14. Fill in the blanks

Atom, as a whole is electrically neutral and therefore contains equal amount of \_\_\_ and \_\_\_ charges.



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15. Who did proposed the first model of an atom.



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**16.** The total energy of an electron is negative.

If it were positive, what will happen?



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**17.** What is the value of Rydberg's constant?



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**18.** Write the different types of Hydrogen Spectral series.





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19. What is spectral absorption lines?



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20. What is the energy possessed by an electron for  $n=3$ ?



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21. What is the diameter of hydrogen atom?



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22. Define energy level. How is it represented?



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23. What is the ionisation energy of hydrogen atom?



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**24.** State Bohr's quantam condition.



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**25.** Name the series of hydrogen spectrum lying in the infrared region.



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**26.** What is the energy power by an electron when  $n=10$ ?



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**27.** What is the difference between orbit and orbital?



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**28.** What is the limitation of Rutherford atomic model?



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**29.** An electron revolving around, the nucleus.  
Who provided the centripital force.



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**30.** Why total energy in the orbit of an electron is negative?



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**31.** Describe the Thomson's atomic model.



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**32.** Show that the total energy of an electro is

$$E = - \frac{e^2}{8\pi \epsilon_0 r}$$



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33. What are the  $H_\alpha$ ,  $H_\beta$  and  $H_\gamma$ . Describe.



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34. The total energy of the electron in an hydrogen atom is

$$E_n = - \frac{13.6}{n^2} eV$$

What is the significance of the negative sign?



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**35.** Using the Rydberg formula calculate the wavelengths of the first four spectral lines in the Lyman. Series of the hydrogen spectrum.



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**36.** What are the limitations of Bohr's model?



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**37.** Draw a diagram of a standing wave on a circular orbit where four de Broglie wavelengths fit into the circumference of the orbit.



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**38.** Write a short note on laser light.



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**39.** Draw the different energy level diagram for a hydrogen atom.



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**40.** The total energy of electron in the ground state of hydrogen atom is 13.6 eV. Find the kinetic energy of an electron in the first excited state



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**41.** What is the relation of radii of various Bohr's orbit?



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**42.** Describe the basic postulates of Bohr's theory.



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**43.** What are the limitations of Bohr's model?





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**44.** Draw the energy level diagram to show different series of hydrogen atoms.



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**45.** Name the various series of hydrogen atoms.



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**46.** Calculate the minimum wavelength of the spectral line present in Balmer series of hydrogen.



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**47.** How much energy in joule, is required to shift an electron of hydrogen atoms from 3rd orbit to 4th orbit?



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**48.** How many orbits are there in a hydrogen atoms?



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**49.** Obtain Bohr's quantum condition of angular momentum on the basis of wave picture.



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**50.** The electron in the hydrogen atom passes from  $n=4$  to  $n=1$  level. What is the maximum number of photons that can be emitted?



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**51.** Distinguish between spontaneous and stimulated emission.



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**52.** Give a brief description of Rutherford's Nuclear Model of atom.



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**53.** Give the schematic arrangement of the Geiger Marsden experiment.



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**54.** Give a brief description of Rutherford's Nuclear Model of atom.



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**55.** It is found experimentally that  $13.6\text{eV}$  energy required to separate a hydrogen atom into a proton and an electron. Calculate the velocity of the electron in hydrogen atom.



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**56.** Write a short note on atomic spectra.



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**57.** What is spectral series? Draw a diagram to show the balmer series in the emission spectrum of hydrogen.



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**58.** Write the Bohr model of a hydrogen atom.

What are the Bohr's postulates?



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**59.** Derive an expression for the radius of the first orbit of the electron of the hydrogen atom.



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**60.** Name the various series of hydrogen atoms.



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**61.** What is the shortest wavelength present in the paschen series of spectral lines?



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



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**63.** The radius of the inner most electron orbit of a hydrogen atom is  $5.3 \times 10^{-11}$  m. Find out the radii of the  $n=2$  and  $n=3$  orbits?



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**64.** Distinguish between Thomson's model and Rutherford's model of an atom.



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**65.** Derive an expression for the radius of the first orbit of the electron of the hydrogen atom.



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**66.** Deduce the expression for the total energy of the electron in the  $n$  orbit of a hydrogen atom in the Bohr model.



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**67.** Find the frequency of revolution of an electron in Bohr's 2nd orbit; if the radius and speed of electron in that orbit is  $2.14 \times 10^{-10}$  m and  $1.09 \times 10^6$  m/s respectively.



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**68.** The wave length of first line of Lyman series is  $1216\overset{\circ}{\text{A}}$ . Calculate the wave length of 1st line of Paschen series.



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



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70. Calculate the approximate quantum number for an electron of hydrogen atom revolving in orbit of radius 1 mm.



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71. Calculate the longest wavelength of Paschen series.



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**72. What are the limitations of Bohr's model?**



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