PHYSICS

BOOKS - KUMAR PRAKASHAN KENDRA PHYSICS (GUJRATI ENGLISH)

ATOMS

Section A Questions Answers

1. What is shown by Thomson's experiments of electric discharge through gases ? And explain the plum pudding model.

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2. State the limitations of plum pudding model of the atom.

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3. Based on which experiment did the Rutherford nuclear model come from?

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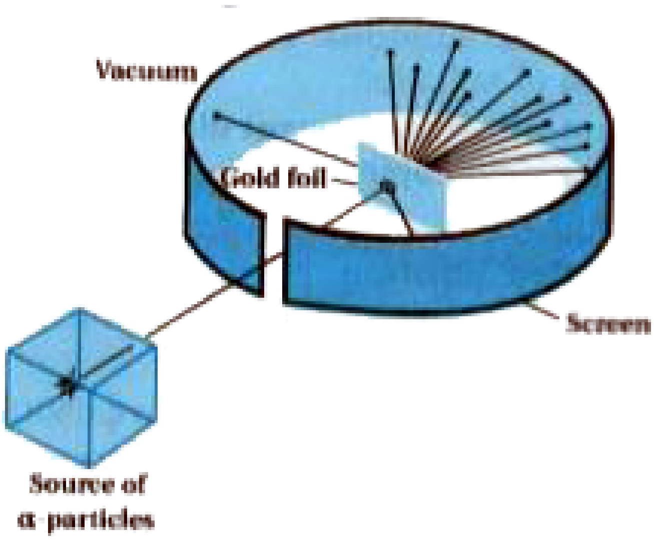
4. Describe Geiger-Marsden scattering experiment.



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5. Discuss the experimental results of GeigerMarsden's a-particle scattering.

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6. Explain Rutherford's argument for scattered α-particles.

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7. Explain Rutherford's explanation for scattered α-particles.

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8. Show the trajectory of a particle of different impact parameter and using it how did Rutherford determine the upper limit of the nuclear size ?

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9. Explain the formulas of energy of electron in atom revolving around the nucleus in different orbits.

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10. Explain emission line spectra and absorption spectra.

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11. What is hydrogen spectral series?

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12. Name the different series obtained in hydrogen spectrum and give formulas for finding the wave number.

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13. Write the Balmer formula in terms of the frequency of light.

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14. State the success of the Bohr's atomic model.

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15. Explain the Rutherford limitation.

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16. Explain Bohr's atomic model.

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17. Using Bohr's atomic model, derive an equation of the radius of the nth orbit of an electron.

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18. Using the formula for the radius of nth orbit $r_n = \frac{n^2 h^2 \varepsilon_0}{\pi m Z e^2}$ derive an expression for the total energy of electron in n^{th} Bohr's orbit.

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19. The total energy of electron $E_n = \frac{Z^2 m e^4}{8 \varepsilon_0^2 n^2 h^2}$ in atom is based on which hypothesis ? When is that true ?

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20. What is the ground state of an atom ? And what is the ionization energy and excitation energy of a hydrogen atom ?

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21. Obtain the equations of frequency of radiation and wave number when electron makes transits from the high energy state to the lower energy state in hydrogen atom.

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22. Explain by drawing a line spectra diagram of the transition between energy levels in an atom.

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23. Explain emission lines and absorption lines.

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24. Explain the quantization of angular momentum to behave an electron as wave in a atom.

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25. Explain Bohr's atomic model.

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Try Yourself

1. Why atoms are electrical neutral ?

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2. What is plum pudding model of the atom ?

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3. Which scientist gave plum pudding model of the atom ?

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4. According to the nuclear model of an atom what is the area of the whole mass of the atom located ?

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5. What radioactive source did the Geiger an Marsden use in the scattering experiment?

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6. How many energy rays of a particles emitte from $^{214}_{83}Bi$ were taken?

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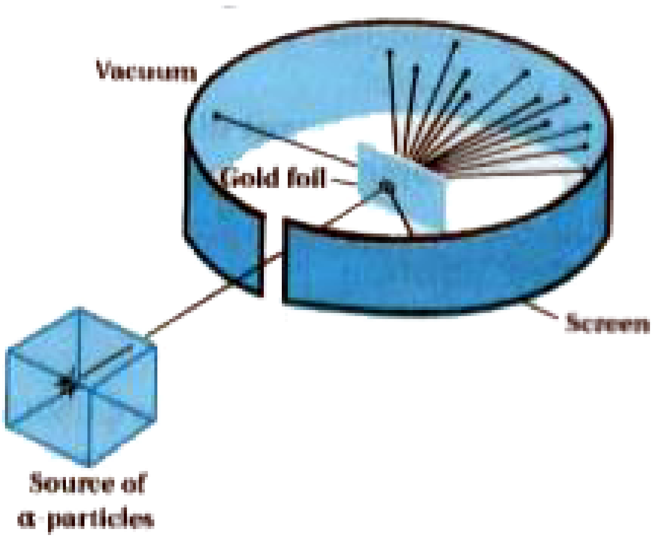
7. Describe Geiger-Marsden scattering experiment.



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8. What does it mean if the α-particle passes: through the foil of gold ?

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9. What is the percentage of α-particles that have more than 1° scattering in Geiger-Marsder experiment?

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10. State the dimension of the nucleus from Rutherford experiment.

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11. From kinetic theory, tell the dimension of an atom.

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12. What is the atomic number of gold?

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13. In the result of the Geiger-Marsden experiment by which the trajectory of the α-particle can be calculated ?

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14. What is impact parameter ?

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15. What is head -on collision ?

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16. Give the relationship between impact parameter and scattering angle.

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17. Give a powerful way to determine an upper limit to the size of the electron.

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18. Give the relationship between orbital radius and velocity of electron for hydrogen atom.

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19. Which fact indicates that the total energy of electron is negative?

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20. What is emission spectrum ?

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21. Explain emission line spectra and absorption spectra.

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22. Which series and who were first seen in the region of the hydrogen spectrum?

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23. What is the maximum wavelength of line in the red region?

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24. Mention the value of Rydberg constant with unit.

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25. Which series is found in the ultraviolet region ?

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26. What are the series found in the infrared region ?

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27. Which series is found in the visible light region ?

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28. Write the formula for the orbital radius of the electron in the atom based on the Bohr atomic model.

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29. What is the ground state of an atom ? And what is the ionization energy and excitation energy of a hydrogen atom ?

Watch Video Solution

30. What is the ground state of an atom ? And what is the ionization energy and excitation energy of a hydrogen atom ?

Watch Video Solution

31. What is the ground state of an atom ? And what is the ionization energy and excitation energy of a hydrogen atom ?

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32. What is the total energy of electron at infinite distance in an atom ?

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33. How much energy is needed is to releases the electron from the second excited state in the hydrogen atom ?

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34. If the electron in the atom transists from the second orbit to first then in what region would the emitted energy ?

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35. what is the maximum wavelength of line of balmer series of hydrogen spectrum?

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36. Which lines has the maximum frequency in each series ?

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37. Mention the value of Rydberg constant with unit.

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38. Mention the value of Rydberg constant with unit.

Watch Video Solution

39. Write the dimensional formula of Rydberg constant.

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40. Explain emission line spectra and absorption spectra.

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41. Who was the first to verify that electron are wave like in nature ?

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42. Write the quantum condition suggested by Bohar for angular momentum of the electron.

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43. What kind of waves that can survive as standing wave ?

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Section B Numericals Numerical From Textual Illustrations

1. In the Rutherford's nuclear model of the atom, the nucleus (radius about 10^{-15} m) is analogous to the sun about which the electron move in orbit (radius $\approx 10^{-10}$ m) like the earth orbits around the sun. If the dimensions of the solar system had the same proportions as those of the atom, would the earth be closer to or farther away from the sun than actually it is? The radius of earth's orbit is about $1.5 \times 10^{11} m$. The radius of sun is taken as $7 \times 10^{8} m$.

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2. In a Geiger-Marsden experiment, what is the distance of closest approach to the nucleus of a 7.7 MeV a-particle before it comes momentarily to rest and reverses its direction?

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3. In a Geiger-Marsden experiment, what is the distance of closet approach to the nucleus of a 5.0 MeV -particle before it comes momentarily to rest and reverses its direction ?

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4. In a Geiger-Marsden experiment, what is the distance of closest approach to the uranium nucleus of a 5.0 MeV α-particle before it comes momentarily to rest and reverse its direction?

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5. 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.

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6. According to the classical electromagnetic theory, calculate the initial frequency of the light emitted by the electron revolving around a proton in hydrogen atom.

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7. 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.

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8. A 100 kg satellite circles Earth once every 4 h in an orbit having a radius of 8000 km. Assuming that Bohr's angular momentum postulate applies to satellite just as it does to an electron in the hydrogen atom, find the quantum number of the orbit of the satellite.

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9. 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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Section B Numerical From Textual Exercise

1. The size of the atom in Thomson's model is .... the atomic size in Rutherford's model. (much greater than/no different from/much less than

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2. In the ground state of .... electrons are in stable equilibrium, while in .... electrons always experience a net force. (Thomson's model/ Rutherford's model.)

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3. A classical atom based on .... is doomed to collapse. (Thomson's modell Rutherford's model.

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4. Choose the correct alternative from the clues given at the end of the each statement:

An atom has a nearly continuous mass distribution in a .... but has a highly non-uniform mass distribution in .... (Thomson’s model/ Rutherford’s model.)

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5. Choose the correct alternative from the clues given at the end of the each statement:

Thepositively charged part of the atom possesses most of the mass in .... (Rutherford’s model/both the models.)

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6. Suppose you are given a chance to repeat the alpha- particle scattering experiment using a thin sheet of solid hydrogen in place of the gold foil. (Hydrogen is a solid at temperatures below 14 K.) What results do you expect?

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7. What is the shortest wavelength present in the Paschen series of spectral lines?

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8. A difference of 2.3 eV separates two energy levels in an atom. What is the frequency of radiation emitted when the atom make a transition from the upper level to the lower level?

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9. 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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10. A hydrogen atom initially in the ground level absorbs a photon, which excites it to the n = 4 level. Determine the wavelength andfrequency of photon.

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11. (a) Using the Bohr's model calculate the speed of the electron in a hydrogen atom in the n = 1, 2, and 3 levels.

(b) Calculate the orbital period in each of these levels.

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13. The radius of the innermost electron orbit of a hydrogen atom is $5.3 \times 10^{-11} m$. What are the radii of the n = 2 and n =3 orbits?

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14. A 12.5 eV electron beam is used to bombard gaseous hydrogen at room temperature. What series of wavelengths will be emitted?

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15. In accordance with the Bohr's model find the quantum number than characterises the Earth revolution around the sun in an orbit of radius $1.5 \times 10^{11} m$ with orbital speed $3 \times 10^{4} ms^{-1}$

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Section B Additional Exercises

1. Answer the following questions, which help you understand the difference between Thomson's model and Rutherford's model better.

(a) Is the average angle of deflection of a-particles by a thin gold foil predicted by Thomson's model much less, about the same, or much greater than that predicted by Rutherford's model?

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2. Answer the following questions, which help you understand the difference between Thomson's model and Rutherford's model better.

Is the probability of backward scattering (i.e., scattering of a-particles at angles greater than 90^{o}) predicted by Thomson's model much less, about the same, or much greater than that predicted by Rutherford's model?

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3. Answer the following questions, which help you understand the difference between Thomson's model and Rutherford's model better.

Keeping other factors fixed, it is found experimentally that for small thickness t, the number of a-particles scattered at moderate angles is proportional to t. What clue does this linear dependence on t provide?

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4. Answer the following questions, which help you understand the difference between Thomson's model and Rutherford's model better.

In which model is it completely wrong to ignore multiple scattering for the calculation of average angle of scattering of a-particles by a thin foil?

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5. The gravitational attraction between electron and proton in a hydrogen atom is weaker than the coulomb attraction by a factor of about 10^{-40}. An alternative way of looking at this fact is to estimate the radius of the first Bohr orbit of a hydrogen atom if the electron and proton were bound by gravitational attraction. You will find the answer interesting.

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6. Obtain an expression for the frequency of radiation emitted when a hydrogen atom de-excites from level n to level (n–1). For large n,show that this frequency equals the lassical frequency of revolution of the electron in the orbit.

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7. Classically, an electron can be in any orbit around the nucleus of an atom. Then what determines the typical atomic size? Why is an atom not, say, thousand times bigger than its typical size ? The question had greatly puzzled Bohr before he arrived at his famous model of the atom that you have learnt in the text. To simulate what he might well have done before his discovery, let us play as follows with the basic constants of nature and see if we can get a quantity with the dimensions of length that is roughly equal to the known size of an atom $\left(-10^{-10}m\right)$

Construct a quantity with the dimensions of length from the fundamental constantse, m_e and c. Determine its numerical value.

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Construct a quantity with the dimensions of length from the fundamental constantse, m_e and c. Determine its numerical value.

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9. The total energy of an electron in the first excited state of the hydrogen atom is about –3.4 eV.

(a) What is the kinetic energy of the electron in this state?

(b) What is the potential energy of the electron in this state?

(c) Which of the answers above would change if the choice of the zero of potential energy is changed?

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12. If Bohr's quantisation postulate (angular momentum = $n\frac{h}{2}\pi\Big)$ is a basic law of nature, it should be equally valid for the case of planetary motion also. Why then do we never speak of quantisation of orbits of planets around the sun?

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13. Obtain the first Bohr's radius and the ground state energy of a muonic hydrogen atom [i.e., an atom in which a negatively charged muon (μ^{-}) of mass about $207m_e$ orbits around a proton].

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Numerical From Darpan Based On Textbook

1. If , λ_1 and λ_2 are the wavelength of the numbers of the Lyman and Paschen seri respectively. Then $\lambda_1 : \lambda_2 =$ .....

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2. Find out the difference of wave number between second and first spectral lines of Lyman series of hydrogen atom's spectrum. $R = 1.09 \times 10^7 m^{-1}$

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3. The wavelength of H_β spectral line of Balmer series is 4860 Å then find out the wavelength of H_α spectral line of the same series

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4. The wavelength of the first line of Lyman series is λ for hydrogen atom. Find out the wavelength of first line of Pfund series.

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5. An electron in hydrogen atom experiences a transition from n = 6 to n = 3. Find out the frequency of the radiation.

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6. An electron in hydrogen atom revolving in a radius of 5.29×10^{-11} m around the nucleus. According to the condition of Bohr's allowed electron orbits, find the principle quantum number corresponds to this orbit.

$h = 6.625 \times 10^{-34} Js, e = 1.6 \times 10^{-19} C. \varepsilon_0 = 8.85 \times 10^{-12} MKS, m = 9.$

Find out conclusion from your answer.

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7. If the electron jumps to the ground state from the third excited state in hydrogen atom, calculate the wavelength and energy of corresponding emitted photon in eV. Rydberg's constant $= 1.097 \times 210^7 m^{-1}$,

$c = 3 \times 10^8 ms^{-1} = 6.62 \times 10^{-34} Js$

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8. Calculate the energy required to remove an electron from He_e^+ ion.

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9. Obtain the mass of an electron in hydrogen atom in terms of its orbital period and radius of orbit.

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10. How many revolutions does an electron in the n = 2 state of a hydrogen atom make before dropping to the n = 1 state ? The average lifetime of an excited state is 10^{-8} s. Bohr radius 0.53Å and velocity $V_1 = 2.19 \times 10^6 m/s$

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Section C Ncert Exemplar Solution Multiple Choice Questions Mcqs

1. Taking the Bohr radius as a_0= 53 pm the radius of Li^{++} ion in its ground state, on the basis of Bohr's model, will be about.

A. 53 pm

B. 27 pm

C. 18 pm

D. 13 pm

Answer: C

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2. The binding energy of a H-atom, considering an electron moving around a fixed nuclei (proton), is $B = -\frac{me^4}{8n^2\varepsilon_0^2h^2}$(m=electron mass). If one decides to work in a frame of reference where the electron is at rest, the proton would be moving around it. By similar arguments, the binding energy would be $B = -\frac{Me^4}{8n^2\varepsilon_0^2h^2}$$M$= proton mass) thsi last expression is not correct because.

A. would not be integral

B. Bohr-quantisation applies only to electron

C. the frame in which the electron is at rest is not inertial

D. the motion of the proton would not be in circular orbits, even approximately.

Answer: C

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3. The simple Bohr model cannot be directly applied to calculate the energy levels of ar atom with many electrons. This is because

A. of the electrons not being subject to a central force

B. of the electrons colliding with each other

C. of screening effects

D. the force between the nucleus and are electron will no longer be given by Coulomb's law.

Answer: A

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4. For the ground state, the electron in the Hatom has an angular momentum = $\frac{nh}{2\pi}$according to the simple Bohr model. Angular momentum is a vector and hence there will be infinitely many orbits with the vector pointing in all possible directions. In actuality, this is not true,

A. because Bohr model gives incorrect values of angular momentum.

B. because only one of these would have a minimum energy.

C. angular momentum must be in the direction of spin of electron

D. because electrons go around only in horizontal orbits.

Answer: A

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5. O_2 molecule consists of two oxygen atoms. In the molecule, nuclear force between the nuclei of the two atoms.

A. is not important because nuclear forces are short-ranged

B. is as important as electrostatic force for binding the two atoms

C. cancels the repulsive electrostatic force between the nuclei.

D. is not important because oxygen nucleus have equal number of neutrons and protons.

Answer: A

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6. Two H atoms in the ground state collide inelastically. The maximum amount by which their combined kinetic energy is reduced is

A. $10.20eV$

B. $20.40eV$

C. $13.6eV$

D. $27.2eV$

Answer: A

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7. A set of atoms in an excited state decays.

A. in general to any of the states with lower energy.

B. into a lower state only when excited by an external electric field

C. all together simultaneously into a lower state.

D. to emit photons only when they collide.

Answer: A

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Section C Ncert Exemplar Solution Multiple Choice Questions More Than One Options

1. An ionised H-molecule consists of an electron and two protons. The protons are separated by a small distance of the order of angstrom In the ground state

A. the electron would not move in circula orbits

B. the energy would be $(2)^4$ times that of H-atom

C. the electrons, orbit would go around the protons

D. the molecule will soon decay in a proto and a H-atom.

Answer: A::C

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2. Consider aiming a beam of free electrons towards free protons. When they scatter, an electron and a proton cannot combine to produce a H-atom,

A. because of energy conservation

B. without simultaneously releasing energy in the form of radiation

C. because of momentum conservation.

D. because of angular momentum conservation.

Answer: A::B

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3. The Bohr model for the spectra of a H-atom

A. will not be applicable to hydrogen in the molecular form

B. will not be applicable as it is for a He-atom

C. is valid only at room temperature

D. predicts continuous as well as discrete spectral lines.

Answer: A::B

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4. The Balmer series for the H-atom can be observed ...

A. if we measure the frequencies of light emitted when an excited atom falls to the ground state.

B. if we measure the frequencies of ligh emitted due to transitions between excite states and the first excited state.

C. in any transition in a H-atom.

D. as a sequence of frequencies with the highe frequencies getting closely packed.

Answer: B::D

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5. Let $E_n = \frac{-1 - me^4}{8\varepsilon_0^2 n^2 h^2}$ be the enrgy of the n^{th} level of H-atom if all the H-atoms are in the ground state and radiation of frequency $(E_2 - E_1)/h$ falls. On it

A. it will not be absorbed at all

B. some of atoms will move to the first excited state.

C. all atoms will be excited to the n = 2 state

D. no atoms will make a transition to the n = 3 state.

Answer: B::D

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6. The simple Bohr model is not applicable to He^4 atom because

A. He^4 is an inert gas.

B. He^4 has neutrons in the nucleus

C. He^4 has one more electron.

D. electrons are not subject to central forces

Answer: C::D

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Section C Ncert Exemplar Solution Very Short Answer Type Questions

1. The mass of a H-atom is less than the sum of the masses of a proton and electron. Why is this?

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2. Imagine removing one electron from He^4 and He^3. Their energy levels, as worked out on the basis of Bohr model will be very close. Explain why ?

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3. When an electron falls from a higher energy to a lower energy level, the difference in the energies appears in the form of electromagnetic radiation. Why cannot it be emitted as other forms of energy ?

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4. Would the Bohr formula for the H-atom remain unchanged if proton had a charge $+\frac{4e}{3}$ and electron a charge $-\frac{3e}{4}$ where $e = 1.6 \times 10 \times^{-19} C$. Given reasons for your answer.

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5. Consider two different hydrogen atoms. The electron in each atom is in an excited state. Is it possible for the electrons to have different energies but the same orbital angular momentum according to the Bohr model ?s

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Section C Ncert Exemplar Solution Short Answer Type Questions

1. Positronium is just like a H-atom with the proton replaced by the positively charged antiparticle of the electron (called the positron which is as massive as the electron). What would be the ground state energy of positronium?

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2. Assume that there is no repulsive force between the electrons in an atom but the force between positive and negative charges is given by

Coulomb's law as usual. Under such circumstances, calculate the ground state energy of a He-atom.

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3. Using Bohr model, calculate the electricitycurrent created by the electron when the H atom is in the ground state

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4. Show that the first few frequencies of light that is emitted when electrons fall to the n^{th} level from levels higher than n, are approximate harmonics (ie, in the ratio 1:2:3...) when $n > > 1$.

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5. What is the minimum energy that must be given to a H atom in ground state so that it can emit an H_{γ} line in Balmer series? If the angular momentum of the system is conserved, what would be the angular momentum of such H_γ photon ?

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Section C Ncert Exemplar Solution Long Answer Type Questions

1. The first four spectral lines in the Lyman series of a H-atom are $2 = 1218Å, 1028Å, 974.3Å \text{ and } 951.4Å$. If instead of Hydrogen, we consider Deuterium, calculate the shift in the wavelength of these lines.

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2. Deutrium was discovered in 1932 by Harold Urey by measuring the small change in wavelength for a particular transition in ${}^1H$ and ${}^2H$. This is because, the wavelength of transition depend to a certain extent on the nuclear mass. If nuclear motion is taken into account then the electrons and nucleus revolve around their common centre of mass. Such a system is equivalent to a single particle with a reduced mass u, revolving around the nucleus at a distance equal to the electron-nucleus separation. Here $\mu = m_e M / (m_e + M)$ where M is the nuclear mass and m_e is the electronic mass. Estimate the percentage difference in wavelength for the 1st line of the Lyman series in ^1H and ^2H. (Mass of ^1H nucleus is 1.6725×10^{-27} kg, Mass of ^2H nucleus is $3.3374 \times 10^{-27} kg$ Mass of electron $= 9.709 \times 10^{-31} kg$)

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3. If a proton had a radius R and the charge was uniformly distributed, calculate using Bohr theory, the ground state energy of a H-atom when $(i) R = 0.1 \text{Å}$ and $(ii) R = 10 \text{Å}$

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4. In the Auger process an atom makes a transition to a lower state without emitting a photon. The excess energy is transferred to an outer electron which may be ejected by the atom. (This is called an Auger electron). Assuming the nucleus to be massive, calculate the kinetic energy of an n = 4 Auger electron emitted by Chromium by absorbing the energy from a n = 2 to n = 1 transition

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5. The inverse square law in electrostatic is $|F| = \frac{e^2}{(4\pi\varepsilon_0)\cdot r^2}$ for the force between an electrona nd a proton. The $\left(\frac{1}{r}\right)$ dependence of |F| can be understood in quantum theory as being due to the fact that the particle of light (photon) is massless. If photons had a mass m force would be modified to $|F| = \frac{e^2}{(4\pi\varepsilon_0)r^2}\left[\frac{1}{r^2} + \frac{\lambda}{r}\right]\exp(-\lambda r)$ where $\lambda = \frac{m_p c}{h}$ and $h = \frac{h}{2\pi}$. Estimate the change in the ground state energy of a H-atom if m_p were 10^{-6} times the mass of an electron

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6. The Bohr model for the H-atom relies on the Coulomb's law of electrostatics. Coulomb's law has not directly been verified for very short

distances of the order of angstroms. Supposing Coulomb's law between two opposite charge $+q_1, -q_2$ is modified to $|F| = \frac{q_2 q_1}{(4\pi\varepsilon_0)}\frac{1}{r^2}, r \geq R_0$
$= \frac{q_1 q_2}{4\pi\varepsilon_0}\frac{1}{R_0^2}\left(\frac{R_0}{r}\right)^e, r < R_0$ Calculate in such a case, the ground state energy of a H-atom if $\varepsilon = 0.1R_0 = 1\text{Å}$

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook

1. According to ..... atomic model positive charge is uniformly distributed uniformly in entire volume of atom.

A. Thomson

B. Rutherford

C. Bohr

D. None of these

Answer: A

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2. What can cause an electron to held in an atom?

A. Coulomb forces

B. Nuclear forces

C. Gravitational forces

D. Van Der Wall forces

Answer: A

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3. Rutherford's a-scattering experiment concludes that ....

A. electron are revolving round the nucleus

B. electrons are scattering in the space around the nucleus

C. there is no heavy mass at centre

D. the velocity of all electrons are same

Answer: B

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4. In Rutherford atomic model central part of atom where whole positive charge of atom is concentrated is called ......

A. centre of atom

B. centre of mass of atom

C. nucleus

D. sphere

Answer: C

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5. Rutherford model shows that ......

A. in central part of atom positive charge resides.

B. radius of orbit of electron is of definite value.

C. atomic spectra of hydrogen can be obtained.

D. it is capable of explaining stability of atom.

Answer: A

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6. The value of impact parameter in head-on collision is ......

A. zero

B. one

C. two

D. three

Answer: A

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7. As the value of impact parameter is larger the scattering angle is ......

A. constant

B. smaller

C. larger

D. medium

Answer: B

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8. When impact parameter is ...., then collision occurs.

A. 0 m, Head on

B. 1 m, Head on

C. 0 m, Head off

D. 1 m, Head off

Answer: A

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9. An α particle of 10 MeV is moving forward fo a head on collision. What will be the distance of closest approach from the nucleus o atomic number Z = 29 ?

A. $8.4 \times 10^{-15} cm$

B. $8.4 \times 10^{-15} m$

C. $4.2 \times 10^{-15} cm$

D. $4.2 \times 10^{-15} m$

Answer: B

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10. A berillium particle (z = 4) having 5.3 MeV energy experience head-on collision with gold atom (z = 79). It can move to what closest distance to gold nucleus ?

A. $10.32 \times 10^{-14} m$

B. $8.58 \times 10^{-14} m$

C. $3.56 \times 10^{-14} m$

D. $1.25 \times 10^{-14} m$

Answer: B

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11. An energetic a-particle experiences head-on collision with nucleus having Z = 85. If distance of closest approach is $1.85 \times 10^{-14} m$ then calculate energy of a particle.

A. 23.13 MeV

B. 13.2 MeV

C. 10 MeV

D. 20 MeV

Answer: B

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12. An α- particle of 10 MeV is moving forward for a head on collision. What will be the distance of closest approach from the nucleus of atomic number Z = 50 ?

A. $1.44 \times 10^{-14} m$

B. $2.88 \times 10^{-14} m$

C. $0.53 \times 10^{-10} m$

D. $\dfrac{0.53 \times 10^{-10}}{50} m$

Answer: A

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13. α- particle having 27 MeV has 1.14×10^{-14} m distance of closest approach from a nucleus of atom. Calculate atomic no. of atom.

A. 100

B. 103

C. 105

D. 90

Answer: B

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14. In experiment of a-scattering if thickness of foil is changed from $2 \times 10^{-7}m$ to 2.5×10^{-6} m what will be increase in number of α-

particle scatered ?

A. about 12 times

B. 100 times

C. remain constant

D. 10 times

Answer: A

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15. According to classical physics, potential energy of electron moving in circular orbit of radius r is.........

A. $-\frac{1}{4\pi \in_0}\cdot\frac{Ze^2}{r}$

B. $-\frac{1}{8\pi \in_0}\cdot\frac{Ze^2}{r}$

C. $-\frac{1}{4\pi}\cdot\frac{Ze^2}{r}$

D. $\frac{1}{8\pi \in_0}\cdot\frac{Ze^2}{r}$

Answer: A

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16. According to classical physics, the kinetic energy K of an electron revolve in orbit of radius r is ....

A. $\frac{1}{8\pi \in_0}.\frac{Ze^2}{r}$

B. $\frac{1}{4\pi \in_0}.\frac{Ze^2}{r}$

C. $-\frac{1}{8\pi \in_0}.\frac{Ze^2}{r}$

D. $-\frac{1}{4\pi \in_0}.\frac{Ze^2}{r}$

Answer: A

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17. If energy of electron in first orbit of H-atom is - y then what will be its energy in fourth excited orbit ?

A. $-\frac{y}{25}$

B. $-\frac{y}{16}$

C. $-\frac{y}{5}$

D. $-\frac{y}{4}$

Answer: A

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18. The kinetic energy of the electron in an orbit of radius r in hydrogen atom is proportional ......

A. $\frac{e^2}{2r}$

B. $\frac{e^2}{r^2}$

C. $\frac{e^2}{r}$

D. $\frac{e^2}{2r^2}$

Answer: C

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19. In any Bohr orbit of the hydrogen atom, the ratio of kinetic energy to potential energy of the electron is ......

A. $\frac{1}{2}$

B. 2

C. $\frac{-1}{2}$

D. -2

Answer: C

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20. Orbital acceleration of an electron is ....

A. $\frac{\pi^2 n^2 h^2}{2m^2 r^3}$

B. $\frac{n^2 h^2}{4\pi^2 m^2 r^3}$

C. $\dfrac{4n^2h^2}{\pi^2m^2r^3}$

D. $\dfrac{n^2h^2}{\pi^2m^2r^3}$

Answer: B

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21. In Thomson atomic model mass of atom is ..... mass of atom in Rutherford model.

A. very large compared to

B. not different than

C. is very less compared to

D. different than

Answer: B

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22. In..... model electron is in steady equilibrium in ground state where as in ...... model electron experience net force.

A. Rutherford, Thomson

B. Thomson, Rutherford

C. Rutherford, Rutherford

D. Thomson, Thomson

Answer: B

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23. In ...... atomic model there is descrete distribution of mass.

A. Thomson

B. Rutherford

C. Bohr

D. Dalten Ins

Answer: B

Watch Video Solution

24. In ...... atomic model there is continuous distribution of mass.

A. Thomson

B. Rutherford

C. Bohr

D. Dalten

Answer: A

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25. In which atomic model positive charge contributes to almost all mass of atom?

A. Thomson

B. Rutherford

C. Bohr

D. All of the above

Answer: D

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook Atomic Spectra

1. When current is passed through gas or vapour stored at low pressure radiation of definite ...... is produced which is called radiation spectrum.

A. frequency

B. velocity

C. numbers

D. wavelengths

Answer: D

Watch Video Solution

2. In Balmer series of hydrogen spectrum line of 486.1 nm wavelength is called ......

A. H_{α}

B. H_{β}

C. H_{γ}

D. H_{δ}

Answer: B

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3. In atom of any element when electron make transition from orbit of higher energy (n_f) to orbit of lower energy (n_i) equation representing wave number is given by .... where $n_i = 1, n_f = 2, 3, 4, \ldots\ldots$

A. $\frac{1}{\lambda} = R\left[\frac{1}{n_i^2} - \frac{1}{n_f^2}\right]$

B. $\frac{1}{\lambda} = RZ\left[\frac{1}{n_i^2} - \frac{1}{n_f^2}\right]$

C. $\frac{1}{\lambda} = R\left[\frac{1}{n_f^2} - \frac{1}{n_i^2}\right]$

D. $\frac{1}{\lambda} = RZ\left[\frac{1}{n_f^2} - \frac{1}{n_i^2}\right]$

Answer: D

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4. Due to the occurrence of transition of electrons in hydrogen atom ...... radiation cannot emitted.

A. ultraviolet

B. infrared

C. visible light

D. gamma

Answer: D

Watch Video Solution

5. Which series of lines obtained in ultraviolet region in hydrogen spectra ?

A. Lyman series

B. Balmer series

C. Paschen series

D. Brackett series

Answer: A

Watch Video Solution

6. When an electrons makes a transition from higher orbit in the hydrogen atom, what are the lines of the Balmer series obtained ?

A. Fourth

B. Third

C. Second

D. First

Answer: C

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7. For hydrogen atom transition from $n=2 \rightarrow n=3$ represent which of the following line ?

A. Absorption line of Paschen series.

B. Emission line of Paschen series.

C. Emission line of Balmer series.

D. Absorption line of Balmer series.

Answer: D

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8. Which series of hydrogen spectrum lies in visible region ?

A. Lyman series

B. Balmer series

C. Paschen series

D. Brackett series

Answer: B

Watch Video Solution

9. Which series of lines obtained in ultraviolet region in hydrogen spectra ?

A. Lyman series

B. Balmer series

C. Paschen series

D. Brackett series

Answer: A

Watch Video Solution

10. The spectral lines of Pfund series lies in the ...... region.

A. ultraviolet

B. infrared

C. visible light

D. none of these

Answer: B

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11. During which of the following orbits in which electrons makes transitions so that the lines Lyman series obtained in hydrogen atom ?

A. From higher orbit to first orbit

B. From higher orbit to second orbit

C. From first orbit to higher orbit

D. From second orbit to higher orbit

Answer: A

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook Bohr Model Of Hydrogen Atom

1. According to Bohr's model the orbit of electron revolving around the nucleus is ......

A. elliptical

B. circular

C. parabola

D. spiral

Answer: B

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2. The energy of an electron revolving in a stationary orbit is always negative because ......

A. electron possesses negative charge

B. the centripetal force acting on the electron

C. it is the binding energy of its orbit

D. it cannot emits energy

Answer: C

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3. An electron revolving in a stationary orbit .....

A. emits energy according to quantum theory

B. does not emit energy

C. remains in excited state

D. posses rotational motion only

Answer: B

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4. For which quantum number of the binding of electron is zero in hydrogen atom ?

A. 1

B. 10

C. 100

D. infinite

Answer: D

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5. According to Bohr's model of atom the orbit of an electron ...... [Where n is quantum number and Z = atomic number].

A. $r_n \propto \frac{n}{Z}$

B. $r_n \propto \frac{n^2}{Z}$

C. $r_n \propto \frac{n^2}{Z^2}$

D. $r_n \propto \frac{Z^2}{n^2}$

Answer: B

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6. If the radius of the second orbit in hydrogen atom is R then radius of the third orbit is ....

A. 3R

B. 2.25 R

C. 9R

D. $\frac{R}{3}$

Answer: B

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7. The ratio of first three Bohr radii is ....

A. $1 : \frac{1}{2} : \frac{1}{3}$

B. $1 : 2 : 3$

C. $1 : 4 : 9$

D. $1 : 8 : 27$

Answer: C

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8. If the atom $._{100}Frn^{257}$ follows the Bohr model and the radius of $._{100}Fm^{257}$ is n times the Bohr radius, then find n.

A. 100

B. 200

C. 4

D. $\frac{1}{4}$

Answer: D

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9. If radius of first orbit in hydrogen atom is 0.53Å, then what will be the radius of fourth orbit?

A. 0.193Å

B. 4.24Å

C. 2.12Å

D. 8.48Å

Answer: D

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10. When electron in hydrogen is in minimum excited state then its radius will become ...... radius of first orbit.

A. double

B. half

C. equal

D. four times

Answer: D

Watch Video Solution

11. the ratio of the radii of n = 10 orbit of hydrogen and Li^{+2} ion is .....

A. 1

B. 2

C. 3

D. 4

Answer: C

Watch Video Solution

12. in which of the following system will the radius of the second orbit be minimum ?

A. H-atom

B. Mg^{+2}

C. Mg^{+2}

D. B-atom

Answer: B

Watch Video Solution

13. Out of following which will have minimum first orbital radius?

A. He^{+}

B. Deuteron

C. Hydrogen atom

D. Li^{++}

Answer: D

Watch Video Solution

14. According to Bohr model, energy of electron in n^{th} orbit is ...... Z = atomic number.

A. $E_n \propto \frac{n^2}{Z^2}$

B. $E_n \propto \frac{Z^2}{n^2}$

C. $E_n \propto \frac{n}{Z}$

D. $E_n \propto \frac{Z}{n}$

Answer: B

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15. The ratio of energies of electron in the first excited state to its second excited state in H-atom is ......

A. $1:4$

B. $4:9$

C. $9:4$

D. $4:1$

Answer: C

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16. The velocity of electron v in the second orbit of hydrogen, then its velocity in the fifth orbit will be ......

A. $\frac{5}{7}v$

B. $\frac{7}{5}v$

C. $\frac{2}{5}v$

D. $\frac{5}{2}v$

Answer: C

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17. In a hydrogen atom, the centripetal force is furnished by the coloumb attraction between electron and proton. If a_0 is the radius of first state orbit and permittivity of vacuum is $\in_0$, then the speed of the electron is....

[m = mass of electron, e = charge on electron]

A. 0

B. $\frac{e}{\sqrt{\in_0 a_0 m}}$

C. $\frac{e}{\sqrt{4\pi \in_0 a_0 m}}$

D. $\sqrt{\frac{4\pi \in_0 a_0 m}{e}}$

Answer: C

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18. The angular speed of the electron in the n^{th} Bohr orbit of the hydrogen atom is proportional to......

A. n

B. n^3

C. $\frac{1}{n}$

D. $\frac{1}{n^3}$

Answer: D

Watch Video Solution

19. The linear speed of the electron in the nth Bohor orbit of the hydrogen atom is proportional to.........

A. n

B. n^3

C. $\frac{1}{n}$

D. $\frac{1}{n^2}$

Answer: C

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20. How much energy is required to send the electron at infinite distance from the n = 3 orbit in He^{+} ?

A. 12.08 eV

B. 6.04 eV

C. 30.2 eV

D. 3.02 eV

Answer: B

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21. Linear momentum of electron revolving in n^{th} orbit of atom $p = \frac{nh}{2\pi r}$.

If $r = 10^{-15}$m is the radius of orbit then the linear momentum in ground state will have .... $kgms^{-1}$.

A. 10.54

B. 1054

C. 1.054×10^{-19}

D. 1.054×10^{19}

Answer: C

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook Line Spectrum Of Hydrogen Atom

1. The spectral line for the Lyman series is transist to Pfund series, the number of spectral lines ......

A. increases

B. decreases

C. unchanged

D. increases or decreases

Answer: B

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2. In an atom when electrons transition from excited state to ground state, which of the statement is true ?

A. K increase and U and E decreases.

B. K decrease and U and E remains constant.

C. K and E decreases and U increases.

D. K, U and E decreases.

Answer: A

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3. The wavelength of spectrum line is inversely proportional to the ....

A. energy difference

B. velocity of electron

C. number of electrons

D. none of these

Answer: A

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4. The wavelength involved in the spectrum of deuterium $\left(._1^2 D\right)$ are slightly different from that of hydrogen spectrum because

A. the mass of both nucleus is different.

B. the dimension of both nucleus is different.

C. the nuclear forces acting on both nucleus is different.

D. the coulomb forces on both nucleus is different.

Answer: A

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5. Hydrogen atom excites energy level from n = 3 to ground state. Number of spectrum lines according to Bohr, is ......

A. 1

B. 2

C. 3

D. 4

Answer: C

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6. Hydrogen atom emits blue light when it changes from energy level n = 4 to n = 2. The colour light would the atom emit when it goes from n = 5 to n = 2 level is .....

A. yellow

B. red

C. green

D. violet

Answer: D

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7. What is the frequency in Hz of emitted radiation when an electron jumps from fourth orbit to secondth orbit in a hydrogen atom ?

[Where $R = 10^5 cm^{-1}$]

A. $\frac{3}{4} \times 10^{15}$

B. $\frac{3}{16} \times 10^{15}$

C. $\frac{9}{16} \times 10^{15}$

D. $\frac{3}{8} \times 10^{15}$

Answer: C

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8. The wavelength of first line of Balmer series in hydrogen atom is 2, the wavelength of first of corresponding double ionized lithium atom is ....

A. $\frac{\lambda}{3}$

B. $\frac{\lambda}{4}$

C. $\frac{\lambda}{9}$

D. $\frac{\lambda}{27}$

Answer: C

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9. Hydrogen atom from excited state comes to the ground state by emitting a photon of wavelength λ, then what is the quantum number of excited states ?

A. $\sqrt{\frac{\lambda R - 1}{\lambda R}}$

B. $\sqrt{\frac{\lambda R}{\lambda R - 1}}$

C. $\sqrt{\lambda R(R - 1)}$

D. $\lambda R(R - 1)$

Answer: B

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10. The shortest wavelength of the spectrum line is that of electron being transits into atom to ion from n = 2 to n = 1 for ....

A. hydrogen atom

B. deuterium atom

C. singly ionized helium

D. doubly ionized lithium

Answer: D

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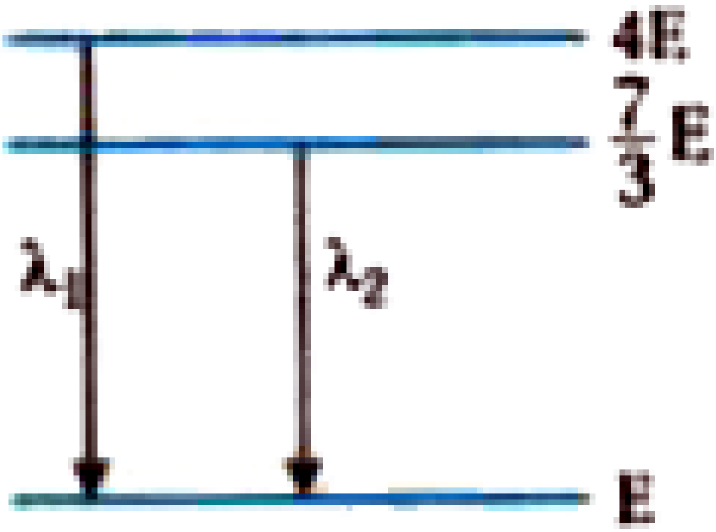
11. Below are shown the energy levels for a particular atom. A photon with wavelength is emitted when the system transist from the fourth energy level (4E) to the first energy level (E). When the system transist from the $\frac{7}{3}E$ energy level to E energy level photons emitted with wavelength λ_2, then $\frac{\lambda_1}{\lambda_2} = ...$



A. $\frac{9}{4}$

B. $\frac{4}{9}$

C. $\frac{3}{2}$

D. $\frac{7}{3}$

Answer: B

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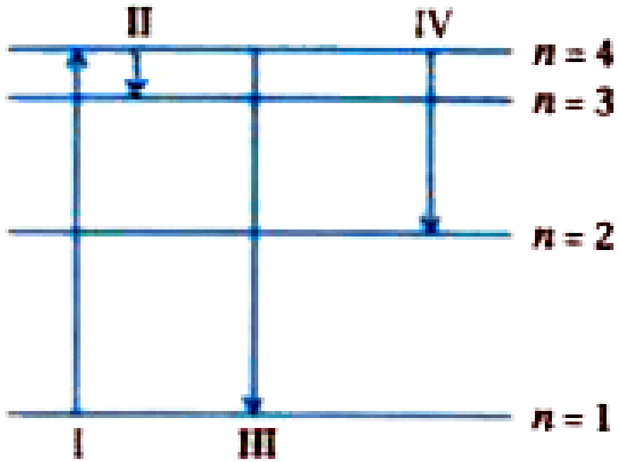
12. The diagram shows the energy levels for an electron in a certain atom.

Which transition shown represent the emission of a photon with the most energy ?



A. I

B. II

C. III

D. IV

Answer: C

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13. The maximum wavelength of Brackett series of hydrogen atom is ......

$\left[R = 1.097 \times 10^7 m - 1\right]$

A. $35, 890\text{Å}$

B. $14, 440\text{Å}$

C. $62, 160\text{Å}$

D. $40, 400\text{Å}$

Answer: D

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14. The shortest wavelength in the Lyman series is 911.6Å. Then the longest wavelength in Lyman series is ......

A. 1215Å

B. ∞

C. 2430Å

D. 600Å

Answer: A

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15. Which of the following lines represents the wavelength of the spectrum of Balmer series?

A. $\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$ where n=3,4....

B. $\lambda = \frac{1}{R}\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$ where n=3,4,.......

C. $\lambda = \left(2^2 - n^2\right)$ where n=3,4.....

D. not one of these three

Answer: A

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16. If the minimum wavelength of Balmer series is λ_1 and the maximum wavelength of Lyman series is λ_2, then ......

A. $\lambda_2 = 3\lambda_1$

B. $\lambda_1 = 3\lambda_2$

C. $\lambda_1 = 4\lambda_2$

D. $\lambda_2 = 4\lambda_1$

Answer: B

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17. Which of the following determine shortest and longest wavelengths in hydrogen atom spectrum ?

A. $\frac{1}{\lambda} = R\left(\frac{1}{1^2} - \frac{1}{\infty^2}\right), \frac{1}{\lambda} = R\left(\frac{1}{5^2} - \frac{1}{6^2}\right)$

B. $\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{\infty^2}\right), \frac{1}{\lambda} = R\left(\frac{1}{5^2} - \frac{1}{\infty^2}\right)$

C. $\frac{1}{\lambda} = R\left(\frac{1}{3^2} - \frac{1}{4^2}\right), \frac{1}{\lambda} = R\left(\frac{1}{4^2} - \frac{1}{5^2}\right)$

D. None of these

Answer: A

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18. The difference in the frequency of series limit of Lyman series and frequency of Balmer series is equal to the frequency of the first line of the ...... series.

A. Paschen

B. Lyman

C. Brackett

D. Pfund

Answer: B

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19. The energy states A, B and C having energy $E_A < E_B < E_C$. If the transition $C \to B, B \to A$ and $C \to A$ have the corresponding wavelength λ_1, λ_2 and λ_3 espectively, then which of following relationship is obtained ?

A. $\lambda_1 + \lambda_2 + \lambda_3 = 0$

B. $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$

C. $\lambda_3 = \dfrac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$

D. $\lambda_3 = \lambda_1 + \lambda_2$

Answer: C

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20. The following energy states are shown for a atom such as hydrogen. The radius of first orbit of Bohr is ......

A. 0.265Å

B. 0.53Å

C. 0.132Å

D. none of these

Answer: A

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21. If the hydrogen atom is initially at n = 2 state, how much work have to do to move the electron and proton far into the hydrogen atom?

A. $13.6 \times 1.6 \times 10^{-19} J$

B. $3.4 \times 1.6 \times 10^{-19} J$

C. $1.51 \times 1.6 \times 10^{-19} J$

D. 0

Answer: B

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook De Broglie S Explanation Of Bohr S Second Postulate Of Quantisation

1. de-Broglie wavelength of electron in ground state is 2.116Å then its velocity will be.......... ms^{-1}

A. 0.034×10^{8}

B. 3.4×10^{8}

C. 34×10^{-8}

D. 0.034×10^{-8}

Answer: A

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2. In hydrogen atom electron makes transist from n = 3 orbit to n = 2 orbit in time 1.2×10^{-8} s. Then calculate the average torque (in Nm) that acts during this transition.

A. 1.055×10^{-26}

B. 4.40×10^{-27}

C. 1.7×10^{-26}

D. 8.79×10^{-27}

Answer: D

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3. The angular momentum of an electron in 4^{th} orbit is 2×10^{-34} Js, then its angular momentum in 5^{th} orbit is ....

A. $5 \times 10^{-34} Js$

B. $2.5 \times 10^{-34} Js$

C. $10 \times 10^{-34} Js$

D. $2 \times 10^{-34} Js$

Answer: B

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4. A hydrogen atom absorbs photon of energy 12.1 eV in ground state, then the change in angular momentum will be ..... Js.

A. 210×10^{-34}

B. 2.1×10^{-34}

C. 13.3×10^{-34}

D. 6.62×10^{-34}

Answer: B

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5. The speed of an electron in first Bohr orbit is $\frac{c}{137}$, where c is the velocity of light in vacuum, then the speed of electron in second orbit is ....

A. $\frac{1}{2}\left(\frac{c}{137}\right)$

B. $2\left(\frac{c}{137}\right)$

C. $\frac{1}{4}\left(\frac{1}{137}\right)$

D. $\frac{1}{4}\left(\frac{1}{137}\right)$

Answer: A

Watch Video Solution

6. Minimum excitation potential of Bohr's first orbit in hydrogen atom is ...... eV

A. 13.6

B. 3.4

C. 10.2

D. 3.6

Answer: C

Watch Video Solution

7. In hydrogen atom electron makes transist from n = 3 orbit to n = 2 orbit in time 1.2×10^{-8} s. Then calculate the average torque (in Nm) that acts during this transition.

A. 1.055×10^{-26}

B. 4.40×10^{-27}

C. 1.7×10^{-26}

D. 8.79×10^{-27}

Answer: D

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8. The energy of an electron in hydrogen atom is -3.4 eV, then its angular momentum is ......

A. $2.1 \times 10^{-34} Js$

B. $2.1 \times 10^{-20} Js$

C. $4 \times 10^{-20} Js$

D. $4 \times 10^{-34} Js$

Answer: A

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9. The ionization energy of 10 times the ionized sodium atom ......

A. 13.6 eV

B. $13.6 \times 11 eV$

C. $\frac{13.6}{11} eV$

D. $13.6 \times (11)^2 eV$

Answer: D

Watch Video Solution

10. The wavelength of electron in ground state is 2.116Å, then its momentum will be ......

A. $313 gcms^{-1}$

B. $313 kgms^{-1}$

C. $3.13 \times 10^{-24} gcms^{-1}$

D. $3.13 \times 10^{-24} kgms^{-1}$

Answer: D

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook Mcqs Based On Textual Illustrations And Exercise

1. According to the classical electromagnetic theory, calculate the initial frequency of the light emitted by the electron revolving around a proton in hydrogen atom.

A. $0.66 \times 10^{15} Hz$

B. $6.6 \times 10^{15} Hz$

C. $0.66 \times 10^{17} Hz$

D. $6.6 \times 10^{16} Hz$

Answer: B

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2. 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.

A. 5.3×10^{22}

B. 5.3×10^{-22}

C. 5.3×10^{-45}

D. 5.3×10^{45}

Answer: D

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

A. 1218Å

B. 1028Å

C. 974.3Å

D. 951.4Å

Answer: A

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

A. 1218Å

B. 1028Å

C. 974.3Å

D. 951.4Å

Answer: B

Watch Video Solution

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

A. 1218Å

B. 1028Å

C. 974.3Å

D. 951.4Å

Answer: A

Watch Video Solution

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

A. 1218Å

B. 1028Å

C. 974.3Å

D. 951.4Å

Answer: D

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7. What is the shortest wavelength present in the Paschen series of spectral lines?

A. 820Å

B. 8204Å

C. 820.4Å

D. $8204 \times 10^{-8} m$

Answer: C

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8. A difference of 2.3 eV separates two energy levels in an atom. What is the frequency of radiation emitted when the atom make a transition from the upper level to the lower level?

A. $1.8 \times 10^{15} Hz$

B. $5.6 \times 10^{14} Hz$

C. $5.6 \times 10^{15} Hz$

D. $1.8 \times 10^{-15} Hz$

Answer: B

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

A. $K = -13.6eV, U = -27.2eV$

B. $K = 13.6eV, U = -27.2eV$

C. $K = \; - 13.6eV, U = 27.2eV$

D. $K = 13.6eV, U = 27.2eV$

Answer: B

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10. The radius of the innermost electron orbit of a hydrogen atom is $5.3 \times 10^{-11} m$. What are the radii of the n = 2 and n =3 orbits?

A. $R_2 = 2.12 \times 10^{-11} m, \; R_3 = 4.77 \text{Å}$

B. $R_2 = 2.12 \times 10^{-10} m, \; R_3 = 4.77 \text{Å} \times 10^{-11} m$

C. $R_2 = 2.12 \text{Å}, \; R_3 = 4.77 \text{Å}$

D. $R_2 = 2.12 \times 10^{10} \text{Å}, \; R_3 = 4.77 \times 10^{-10} \text{Å}$

Answer: C

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11. In accordance with the Bohr's model find the quantum number than characterises the Earth revolution around the sun in an orbit of radius $1.5 \times 10^{11} m$ with orbital speed $3 \times 10^4 ms^{-1}$

A. 2.6×10^{39}

B. 2.6×10^{45}

C. 2.6×10^{69}

D. 2.6×10^{73}

Answer: D

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Section D Mcqs Asked In Competitive Exams Mcqs Asked In Aieee And Jee Main

1. If 13.6 eV energy is required to ionize the hydrogen atom, then the energy required to remove an electron from

A. 10.2 eV

B. 0 eV

C. 3.4 eV

D. 6.8 eV

Answer: C

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2. The wavelength involved in the spectrum of deuterium $\left(._1^2 D\right)$ are slightly different from that of hydrogen spectrum because

A. the size of the two nuclei are different

B. the nuclear force are different in the two cases.

C. the masses of the two nuclei are different.

D. the attraction between the electron and the nucleus is different in the two cases.

Answer: C

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3. If the binding energy of the electron in a hydrogen atom is 13.6 eV, the energy required to remove the electron from the first excited state Li^{+2} is ....

A. 30.6 eV

B. 13.6 eV

C. 3.4 eV

D. 122.4 eV

Answer: A

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4. An α particle of energy 5 MeV is scattered through 180° by a fixed uranium nucleus. The distance of the closest approach is of the order of ....

A. 1Å

B. $10^{-10} cm$

C. $10^{-12} cm$

D. $10^{-15} cm$

Answer: C

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5. An another point charge q, thrown towards the stationary point charge Q at speed v, it returns at a distance r from Q. If 2v speed is given instead of v then distance of closest approach will be ....

A. r

B. 2r

C. $\frac{r}{2}$

D. $\frac{r}{4}$

Answer: D

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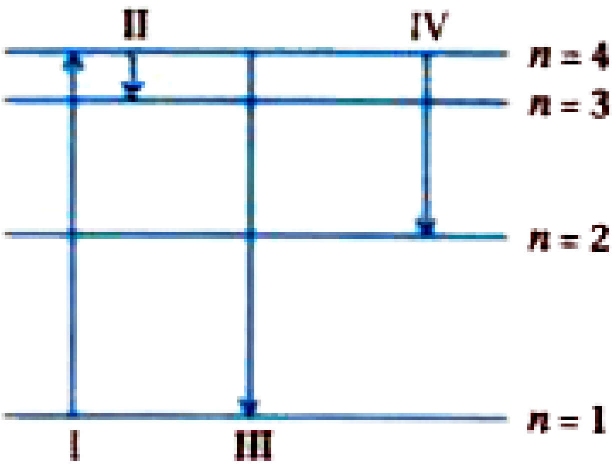
6. The diagram shows the energy levels for an electron in a certain atom. Which transition shown represent the emission of a photon with the most energy ?



A. I

B. II

C. III

D. IV

Answer: C

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7. An α-nucleus of energy $\frac{1}{2}mv^2$ bombards a heavy nuclear target of charge Ze. Then the distance of closest approach for the O-nucleus will be proportional to ......

A. $(Ze)^{-1}$

B. v^2

C. m^{-1}

D. v^{-1}

Answer: C

Watch Video Solution

8. Which of the following transitions in hydrogen atoms emit photons of highest frequency?

A. n = 2 to n = 6

B. n = 6 to n = 2

C. n = 1 to n = 2

D. n = 2 to n = 1

Answer: D

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9. Suppose an electron is attracted towards the origin by a force $\frac{k}{r}$ where k is a constant and r is the distance of the electron from the origin.

By applying Bohr model to this system, the radius of the n^{th} orbital of the electron is found to be r_n and the kinetic energy of the electron to be T_n. Then which of the following is true?

A. $T_n \propto \frac{1}{n}, r_n \propto n^2$

B. $T_n \propto \frac{1}{n^2}, r_n \propto n^2$

C. T_n is independent then n, $r_n \propto n$

D. $T_n \propto \frac{1}{n}, r_n \propto n$

Answer: C

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10. The transistion from the state $n = 4$ to $n = 3$ in a hydrogen like atom results in ultraviolet radiation infrared radiation will be obtained in the transition from :-

A. $2 \rightarrow 1$

B. $3 \rightarrow 2$

C. $4 \rightarrow 2$

D. $5 \rightarrow 4$

Answer: D

Watch Video Solution

11. The energy required for electron to transist from n = 1 to n = 3 in Li^{+2} is ......

A. 12.1 eV

B. 36.3 eV

C. 108.8 eV

D. 122.4 eV

Answer: C

Watch Video Solution

12. Hydrogen atom is excited from ground state to another state with principle quantum number equal to 4. Then the number of spectral lines in the emission spectra will be ......

A. 2

B. 3

C. 5

D. 6

Answer: D

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13. The ionisation potential for ...... nucleus will be minimum.

A. ${}_{7}N^{14}$

B. ${}_{53}C_{s}^{133}$

C. ${}_{18}Ar^{40}$

D. ${}_{8}O^{16}$

Answer: B

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14. In a hydrogen like atom electron makes transition from an energy level with quantum number n to another with quantum number $(n-1)$. If $n > \; > 1$, The frequency of radiation emitted is proportional to

A. $\frac{1}{n^3}$

B. $\frac{1}{n}$

C. $\frac{1}{n^2}$

D. $\frac{1}{n^{\frac{3}{2}}}$

Answer: A

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15. The radiation corresponding to $3 \to 2$ transition of hydrogen atom falls on a metal surface to produce photoelectrons.These electrons are made to enter a magnetic field of 3×10^{-4}T.If the radius of the largest circular path followed by these electrons is 10.0 mm the work function of the metal is close to:

A. 1.1 eV

B. 0.8 eV

C. 1.6 eV

D. 1.8 eV

Answer: A

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16. Hydrogen $\left({}_1H^1\right)$, Deuterium $\left({}_1H^2\right)$, single ionised Helium $\left({}_2He^4\right)^+$ and doubly ionised lithium $\left({}_3Li^6\right)^{++}$ all have one electron around the nucleus. Consider an electron transition from n=2 to n=1. If the wavelength of emitted radiation are $\lambda_1, \lambda_2, \lambda_3$ and λ_4 respectively then approximately which one of the following is corrent ?

A. $\lambda_1 = \lambda_2 = 2\lambda_3 = \lambda_4$

B. $\lambda_1 = \lambda_2 = 4\lambda_3 = 9\lambda_4$

C. $\lambda_1 = 2\lambda_2 = 3\lambda_3 = 4\lambda_4$

D. $4\lambda_1 = 2\lambda_2 = 2\lambda_3 = \lambda_4$

Answer: B

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17. Dia-atomic molecule is composed of masses m_1 and m_2 and distance between them is r. By using the principle of quantisation of angular momentem of Bohr its energy of rotation is given by the formula .... [Where n is integer and $h = \frac{h}{2\pi}$]

A. $\frac{n^2h^2}{2(m_1 + m_2)r^2}$

B. $\frac{2n^2h^2}{(m_1 + m_2)r^2}$

C. $\dfrac{(m_1+m_2)n^2h^2}{2m_1m_2r^2}$

D. $\dfrac{(m_1+m_2)^2n^2h^2}{2m_1m_2r^2}$

Answer: C

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18. As an electron makes a transition from an excited state to the ground state of a hydrogen like atom/ion.

A. its kinetic energy increases but potential and total energy decreases

B. kinetic energy, potential energy and total energy decrease.

C. kinetic energy decreases, potential energy increases but total energy remain same.

D. kinetic energy and total energy decreases but potential energy increases.

Answer: A

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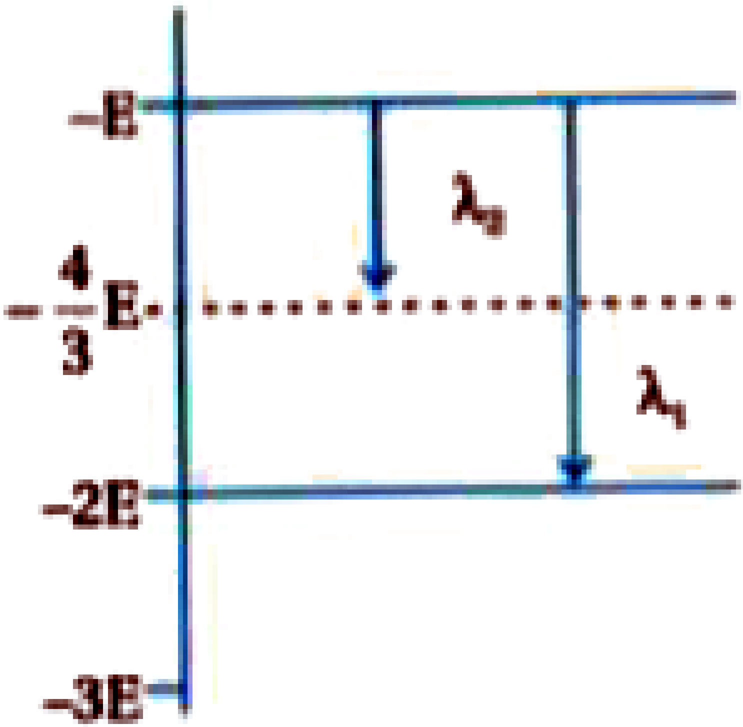
19. Some energy levels of a molecule are shown the figure. The ratio of the wavelength $r = \frac{\lambda_1}{\lambda_2}$ is given by ....



A. $r = \frac{3}{4}$

B. $r = \frac{1}{3}$

C. $r = \frac{4}{3}$

D. $r = \frac{2}{3}$

Answer: B

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20. An electron from various excited states of hydrogen atom emit radiation to come to the ground state. Let λ_n, λ_g be the de Broglie wavelength of the electron in the n^{th} state and the ground state respectively. Let A_n be the wavelength of the emitted photon in the transition from the n^{th} state to the ground state. For large n, (A, B are constant)

A. $A_n \approx A + \frac{B}{\lambda_n^2}$

B. $A_n \approx A + B\lambda_n$

C. $A_n^2 \approx A + B\lambda_n^2$

D. $A_n^2 \approx \lambda$

Answer: A

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21. If the series limit frequency of the Lyman series is v_L, then the series limit frequency of the Pfund series is ......

A. $25v_L$

B. $16v_L$

C. $\frac{v_L}{16}$

D. $\frac{v_L}{25}$

Answer: D

Watch Video Solution

22. The time period of revolution of an electron in its ground state orbit in a hydrogen atom is 1.6×10^{-16} s. The frequency of the electron in its first excited state (in s^{-1}) is :

A. 7.8×10^{14}

B. 7.8×10^{16}

C. 3.7×10^{14}

D. 3.7×10^{16}

Answer: A

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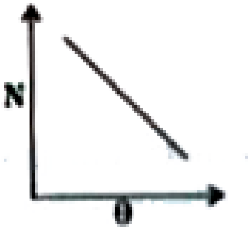
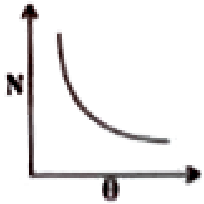
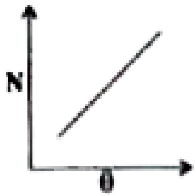
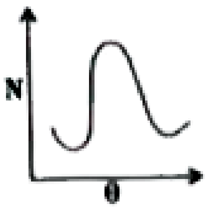
23. Number of the a-particle deflected in Rutherford's a-particle scattering experiment varies with the angle of deflection. The graph between the two is best represented by

A. 

B. 

C. 

D. 

Answer: C

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24. The ionisation energy of hydrogen atom is 13.6 eV, the ionisation energy of a singly ionised helium atom would be ......

A. 13.6 eV

B. 27.2 eV

C. 6.8 eV

D. 54.4 eV

Answer: D

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25. To explain his theory, Bohr used.........

A. conservation of linear momentum

B. conservation of angular momentum

C. conservation of quantum frequency

D. conservation of energy

Answer: B

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26. In terms of Bohr radius a, the radius of the second Bohr orbit of a hydrogen atom is given by ....

A. $4a_0$

B. $8a_0$

C. $\sqrt{2}a_0$

D. $2a_0$

Answer: A

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27. The radius of hydrogen atom in its ground state is 5.3×10^{-11}m. After collision with an electron it is found to have a radius 21.2×10^{-11}

m, then principle quantum number n of the final state of the atom ......

A. n=4

B. n=2

C. n=16

D. n=3

Answer: B

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28. J.J.Thomson's cathode ray tube experiment demonstrated that ......

A. the $\frac{e}{m}$ ratio of the cathode ray particles changes when a different gas is placed in the discharge tube.

B. cathode rays are streams of negatively charged ions.

C. all the mass of an atom is essentially in the nucleus.

D. the $\frac{e}{m}$ of electrons is much greater than the $\frac{e}{m}$ of protons.

Answer: B

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29. In which of the following system will the radius of the first orbit (n = 1) be minimum ?

A. Hydrogen atom

B. Doubly ionized lithium

C. singly ionized helium

D. Deuterium atom

Answer: B

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30. The Bohr model of atom ......

A. predicts the same emission spectra for all types of atoms

B. assumes that the angular momentum of electrons is quantized.

C. uses Einstein's photo-electric equation

D. predicts continuous emission spectra for atoms.

Answer: B

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31. Energy of a hydrogen atom with principal quantum number n is shown by $E = \frac{-13.6}{n^2} eV$. The energy of a photon ejected when the electron jumps from n = 3 state to n = 2 state of hydrogen is approximately.

A. $1.9 eV$

B. $1.5 eV$

C. $0.85 eV$

D. $3.4 eV$

Answer: A

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32. The total energy of an electron in the first excited state of the hydrogen atom is about –3.4 eV.

(a) What is the kinetic energy of the electron in this state?

(b) What is the potential energy of the electron in this state?

(c) Which of the answers above would change if the choice of the zero of potential energy is changed?

A. $3.4eV$

B. $6.8eV$

C. $3.4eV$

D. $-6.8eV$

Answer: A

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33. Ionization potential of hydrogen atom is 13.6 eV. Hydrogen atoms in the ground state are excited by monochromatic radiation of photon energy 12.1 eV. According to Bohr's theory, the spectral lines emitted by hydrogen will be ......

A. three

B. four

C. one

D. two

Answer: A

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34. The ground state energy of hydrogen atom is - 13.6 eV. When electron is in excited state its excitation energy is ......

A. $3.4 eV$

B. $6.8eV$

C. $10.2eV$

D. 0

Answer: C

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35. The ionization energy of the electron in the hydrogen atom in its ground state is 13.6 eV. The atoms are excited to higher energy levels to emit radiation of 6 wavelengths. During which of the following transitions will the maximum wavelength radiation be emitted ?

A. n=3 to n=1

B. n=2 to n=1

C. n = 4 to n=3

D. n=3 to n = 2

Answer: C

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36. In a Rutherford's scattering experiment when a projectile of chargez $Z_1$and mass M_1 approaches a target nucleus of Z_2 and mass M_2 the distance of closest approach is r_0. The energy of the projectile is........

A. directly proportional to Z_1, Z_2

B. inversely proportional to Z_1

C. directly proportional to M_1

D. directly proportional to M_1, M_2

Answer: A

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37. The energy of a hydrogen atom in the ground state is -13.6 eV. The energy of a He+ ion in the first excited state will be .....

A. $-13.6eV$

B. $-27.2eV$

C. $-54.4eV$

D. $-6.8eV$

Answer: A

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38. The wavelength of the first line of Lyman series for hydrogen atom is equal to that of the second line of Balmer series for a hydrogen like ion. The atomic number Z of hydrogen like ion is ....

A. 3

B. 4

C. 1

D. 2

Answer: D

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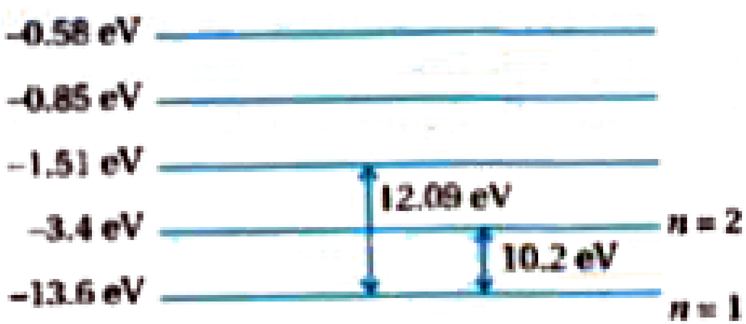
39. Out of the following which one is not a possible energy for photon to be emitted by hydrogen atom according to Bohr's atomic model?



A. $1.9eV$

B. $11.1eV$

C. $13.6eV$

D. $0.65eV$

Answer: B

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

A. 3

B. 4

C. 5

D. 2

Answer: B

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41. The ratio of maximum wavelength of Lyman and Balmer series in hydrogen emission spectra will be ......

A. $\frac{9}{31}$

B. $\frac{5}{27}$

C. $\frac{3}{23}$

D. $\frac{7}{29}$

Answer: B

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42. Hydrogen atom in ground state is excited by a monochromatic radiation of wavelength $\lambda = 975\text{Å}$ then number of spectral lines in resulting spectrum emitted will be ......

A. 3

B. 2

C. 6

D. 10

Answer: C

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43. Consider 3rd orbit of Het (Helium), using non-relativistic approach, the speed of electron in this orbit will be given $k = 9 \times 10^9$ constant, Z = 2 and h(Planck's Constant) = $6.6 \times 10^{-34} JK)$

A. $2.92 \times 10^6 m/s$

B. $1.46 \times 10^6 m/s$

C. $0.73 \times 10^6 m/s$

D. $3.0 \times 10^6 m/s$

Answer: B

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44. Given the value of Rydberg constant is $10^7 m^{-1}$ the wave number of the last line of the Balmer series in hydrogen spectrum will be

A. $0.5 \times 10^7 m^{-1}$

B. $0.25 \times 10^7 m^{-1}$

C. $2.5 \times 10^7 m^{-1}$

D. $0.025 \times 10^7 m^{-1}$

Answer: B

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45. When an o-particle of mass m moving with velocity v bombards on a heavy nucleus of charge 'Ze', its distance of closest approach from the nucleus depends on m as

A. $\frac{1}{\sqrt{m}}$

B. $\frac{1}{m_e}$

C. m

D. $\frac{1}{m}$

Answer: D

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46. If an electron in a hydrogen atom jumps from the 3rd orbit to the 2nd 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

A. $\frac{20}{7}\lambda$

B. $\frac{20}{13}\lambda$

C. $\frac{16}{25}\lambda$

D. $\frac{9}{16}\lambda$

Answer: A

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47. If the longest wavelength of the ultraviolet region of hydrogen spectrum is λ_0 then the shortest wavelength of its infrared region is ......

A. $\frac{46}{7}\lambda_0$

B. $\frac{20}{3}\lambda_0$

C. $\frac{36}{5}\lambda_0$

D. $\frac{27}{4}\lambda_0$

Answer: A

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48. The ratio of wavelength of the last line of Balmer series and the last line of Lyman series is ....

A. $1:1$

B. $4:1$

C. $1:2$

D. 2

Answer: B

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49. The ratio of kinetic energy of the total energy of an electron of a Bohr orbit of the hydrogen atom is ......

A. $1: -2$

B. $1:1$

C. $2: -1$

D. $1: -1$

Answer: D

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50. The total energy of an electron in an atom in an orbit is -3.4 eV. Its kinetic and potential energies are, respectively:

A. $3.4eV, 3.4eV$

B. $-3.4eV - 3.4eV$

C. $-3.4eV, -6.8eV$

D. $3.4eV, -6.8eV$

Answer: C

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Section D Mcqs Asked In Aiims

1. Characteristic X-rays are produced due to ....

A. transfer of momentum in collision of electron with target atoms

B. transition of electron from higher to lower electrons orbits in an atom

C. heating of target

D. transfer of energy in collision of electrons with atoms in the target.

Answer: B

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

A. 0eV

B. $-27.2eV$

C. $1eV$

D. $2eV$

Answer: B

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3. Solid targets of different elements are bombarded by highly energetic electron beams. The frequency of the characteristic X-rays emitted from different target varies with atomic number Z as ......

A. $f \propto \sqrt{Z}$

B. $f \propto Z^2$

C. $f \propto Z^{-2}$

D. $f \propto Z^{\frac{3}{2}}$

Answer: B

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4. Hard X-rays for the study of fractures in bones should have a minimum wavelength of 10^{-11}m. The accelerating voltage for electron in X-ray machine should be .....

A. $< 124.2kV$

B. $> 124.2kV$

C. between 60 kv and 70 kv

D. $= 100kV$

Answer: B

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5. What is the energy of He electron in first orbit?

A. $40.8eV$

B. $-27.2eV$

C. $-54.4eV$

D. $-13.6eV$

Answer: C

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6. What is ratio of Bohr magneton and nuclear magneton ?

A. $\frac{m_p}{m_e}$

B. $\frac{m_p^2}{m_e^2}$

C. 1

D. $\frac{m_e}{m_p}$

Answer: A

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7. The wavelength of K_α X-rays for lead isotopes P_b^{208}, P_b^{206} and P_b^{204} are $\lambda_1, \lambda_2,$ and λ_3, respectively. Then ...

A. $\lambda_2 = \sqrt{\lambda_1 \lambda_3}$

B. $\lambda_3 = \lambda_1 + \lambda_3$

C. $\lambda_2 = \lambda_1 \lambda_3$

D. $\lambda_2 = \frac{\lambda_1}{\lambda_3}$

Answer: A

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8. When a stream of electrons collides with a stream of photons in this collision which of the following is not conserved ?

A. Linear momentum

B. Total energy

C. No. of photons

D. No. of electrons

Answer: C

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9. What would be maximum wavelength for Brackett series of hydrogen spectrum ?

A. 74583 Å

B. 22790 Å

C. 40519 Å

D. 18753 Å

Answer: C

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10. The maximum wavelength of Lyman series is ....

A. $\frac{4 \times 1.097 \times 10^7}{3} m$

B. $\frac{3}{4 \times 1.097 \times 10^7} m$

C. $\frac{4}{4 \times 1.097 \times 10^7} m$

D. $\frac{3}{4} \times 1.097 \times 10^7 m$

Answer: C

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11. The series corresponding to minimum wavelength transition in H atom ......

A. Balmer

B. Lyman

C. Paschen

D. Brackett

Answer: B

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12. A: Bohr had to postulate that the electrons in stationary orbit around the nucleus do not radiate.

R: According to classical physics all moving electrons radiate.

A. Both assertion and reason are true and the reason is correct explanation of the assertion.

B. Both assertion and reason are true but reason is not correct explanation of the assertion.

C. Assertion is true but the reason is false.

D. Both assertion and reason are false

Answer: B

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13. A: X-rays can penetrate through the flesh but not through the bones.

R: The penetrating power of X-ray depends on voltage.

A. Both assertion and reason are true and the reason is correct explanation of the assertion.

B. Both assertion and reason are true but reason is not correct explanation of the assertion.

C. Assertion is true but the reason is false.

D. Both assertion and reason are false

Answer: B

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14. A: a-particles with a large angle scattered leads to the discovery of the nucleus of the atom. R: The central part of the atom is almost concentrated by positive electric charges

A. Both assertion and reason are true and the reason is correct explanation of the assertion.

B. Both assertion and reason are true but reason is not correct explanation of the assertion.

C. Assertion is true but the reason is false.

D. Both assertion and reason are false

Answer: A

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15. A: l amu = 931.48 MeV

R: The statement follows the $E = mc^2$ equation.

A. Both assertion and reason are true and the reason is correct explanation of the assertion.

B. Both assertion and reason are true but reason is not correct explanation of the assertion.

C. Assertion is true but the reason is false.

D. Both assertion and reason are false

Answer: B

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16. A: Electric force is the reason for electron to remain in a atom.

R : According to Coulomb's law, the electron in a atom can remain stable in nucleus only if the centripetal force is equal to its centrifugal force.

A. Both assertion and reason are true and the reason is correct explanation of the assertion.

B. Both assertion and reason are true but reason is not correct explanation of the assertion.

C. Assertion is true but the reason is false.

D. Both assertion and reason are false

Answer: C

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17. A: Electromagnetic spectrum has a Balmer series in the visible region.

R: $\frac{1}{\lambda} = R\left[\frac{1}{2^2} - \frac{1}{n^2}\right]$ where $n = 3, 4, 5, \ldots$

A. Both assertion and reason are true and the reason is correct explanation of the assertion.

B. Both assertion and reason are true but reason is not correct explanation of the assertion.

C. Assertion is true but the reason is false.

D. Both assertion and reason are false

Answer: A

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Section D Mcqs Asked In Gujcet Board Exam

1. The ratio of longest wavelength and the shortest wavelength observed in the 5 spectral series of emission spectrum of hydrogen is ....

A. $\frac{4}{3}$

B. $\frac{525}{376}$

C. 25

D. $\frac{900}{11}$

Answer: D

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2. Which line of the Balmer series has the maximum wavelength ?

A. H_α line

B. H_β line

C. H_r line

D. Last line of the series

Answer: A

View Text Solution

3. As the quantum number increases, the difference of energy between consecutive energy levels ....

A. decreases

B. increases

C. first decreases and then increases

D. remain same

Answer: A

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4. In Rutherford's α-scattering experiment, what will be the correct angle of scattering for impact parameter

A. 90°

B. 270°

C. 0°

D. 180°

Answer: D

View Text Solution

5. The potential energy of the orbital electron in the ground state of hydrogen atom is -E What is its kinetic energy ?-

A. $\frac{E}{4}$

B. $\frac{E}{2}$

C. 2E

D. 4E

Answer: B

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6. What will the angular momentum in fourth orbit, if L is the angular momentum of the electron in the second orbit of hydrogen atom?

A. 2L

B. $\frac{3}{2}L$

C. $\frac{2}{3}L$

D. $\frac{L}{2}$

Answer: A

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7. The ratio of areas of the electron orbits for the first excited state and the ground state for the hydrogen atom is .....

A. $16:1$

B. $2:1$

C. $4:1$

D. $8:1$

Answer: A

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8. What is the difference of angular momenta of an electron between two consecutive orbits in hydrogen atom?

A. $\frac{h}{\pi}$

B. $\frac{h}{2\pi}$

C. $\frac{h}{2}$

D. $\frac{2\pi}{h}$

Answer: B

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9. The ratio of kinetic energy of the total energy of an electron of a Bohr orbit of the hydrogen atom is ......

A. -1

B. $+1$

C. -2

D. $+2$

Answer: A

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10. The potential difference applied to an X-ray tube is 5 kV and the current through it is 3.2 mA. The number of electrons stricking the target per second is ...... (Take $e = 1.6 \times 10^{-19} C$)

A. 4×10^{16}

B. 2×10^{16}

C. 1.6×10^{16}

D. 2×10^{-6}

Answer: B

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11. For an electron in the second orbit of Bohr's hydrogen atom, the moment of linear momentum is ......

A. $\frac{2h}{\pi}$

B. $\frac{h}{\pi}$

C. $n\pi$

D. $2\pi h$

Answer: B

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12. of the following transitions in the hydrogen atom, the one which gives an emission line of the highest frequency?

A. n = 3 to n = 10

B. n = 10 to n = 3

C. n = 1 to n = 2

D. n = 2 to n = 1

Answer: D

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13. The relation between principle quantum number (n) and orbital radius (r) in Bohr atomic model is .....

A. $r \propto n^2$

B. $r \propto \frac{1}{n^2}$

C. $r \propto \frac{1}{n}$

D. $r \propto n$

Answer: A

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14. The total energy of an electron in second excited state is - 2E. What is potential energy with proper sign in this state?

A. $-2E$

B. $-4E$

C. 4E

D. $-E$

Answer: B

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15. The atom of hydrogen absorbs 12.75 eV of energy in ground state. Then what will be the change in orbital angular momentum of the electron in it.

A. $\frac{h}{2\pi}$

B. $\frac{h}{\pi}$

C. $\frac{2h}{\pi}$

D. $\frac{3h}{2\pi}$

Answer: D

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16. Find out the atomic number of the element which gives X-ray of minimum wavelength 0.252 nm of K series $(R = 1.09737 \times 10^7 m^{-1})$

A. 2

B. 200

C. 20

D. 2000

Answer: C

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17. The minimum wavelength of the X-rays produced by electrons accelerated through a potential difference of V volt is directly proportional to ......

A. $\frac{1}{V}$

B. $\sqrt{V}$

C. $\frac{1}{\sqrt{V}}$

D. V^2

Answer: A

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18. Write range of wave length of X - rays.

A. 0.001 nm to 1 nm

B. 0.001μ to $1\mu m$

C. 0.001Å to 1Å

D. $0.001cm$ to 1 cm

Answer: A

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19. If , λ_1 and λ_2 are the wavelength of the numbers of the Lyman and Paschen seri respectively. Then $\lambda_1 : \lambda_2 =$ .....

A. $1:3$

B. $7:50$

C. $1:30$

D. $7 : 108$

Answer: D

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20. Number of spectral line of hydrogen atom is

A. 6

B. 15

C. 8

D. ∞

Answer: D

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21. The distance of the closest approach of an α- particle fired at a nucleus with kinetic energy K is r_0. The distance of the closest approach when the α-particle is fire at the same nucleus with kinetic energy 2K will be

A. $\frac{r_0}{2}$

B. $\frac{r_0}{4}$

C. $4r_0$

D. $2r_0$

Answer: A

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22. An α-particle of energy 5 MeV is moving forward for a head on collision. The distance of closest approach from the nucleus of atomic numbe Z=50 is ... $\times 10^{-14} m \left(k = 9 \times 10^9 SI, c = 1.6 \times 10^{-19} C\right)$,

A. 0.72

B. 2.88

C. 1.44

D. 5.76

Answer: B

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23. Hydrogen atom is excited from ground state to another state with principle quantum number equal to 4. Then the number of spectral lines in the emission spectra will be ......

A. 5

B. 6

C. 3

D. 2

Answer: B

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24. The total energy of an electron in the first excited state of H atom is -3.4 eV, then its potential energy in this state is ...eV.

A. $+3.4$

B. -3.4

C. -6.8

D. $+6.8$

Answer: C

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25. The ionization potential of hydrogenic ions P and Q are V_P and V_Q respectively. If $V_Q < V_P$ then radii ......

A. $r_P > r_Q$

B. $r_P < r_Q$

C. $r_P = r_Q$

D. none of these

Answer: B

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26. Wavelength of characteristic X-ray depends on which property of target ...

A. A

B. Z

C. melting point

D. all of these

Answer: B

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27. The energy of the fast neutron released in the nuclear fission process is almost?

A. 2MeV

B. 2 KeV

C. 10 MeV

D. 20 MeV

Answer: A

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28. In X-ray tube the potential difference between the anode and the cathode is 20 kV and the current flowing is 1.6 mA. The number of electrons striking the anode in 1s is ..... (Take $e = 1.6 \times 10^{-19} C$)

A. 10^{14}

B. 1.25×10^{16}

C. 10^{16}

D. 6.25×10^{18}

Answer: C

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29. If the kinetic energy of an electron in a hydrogen is $\frac{e^2}{8\pi\varepsilon_0 r}$ then its potential energy is.....

A. $\frac{e^2}{4\pi\varepsilon_0 r}$

B. $-\frac{e^2}{4\pi\varepsilon_0 r}$

C. $\frac{e^2}{8\pi\varepsilon_0 r}$

D. $-\frac{e^2}{8\pi\varepsilon_0 r}$

Answer: B

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30. The wavelength of the first spectral line of the Lyman series is λ then the wavelength of the first spectral line of the Paschen series is ....λ

A. $\frac{108}{7}$

B. $\frac{27}{5}$

C. $\frac{7}{108}$

D. $\frac{5}{7}$

Answer: A

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31. 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.

A. $10.6 \times 10^{-11} m$

B. $5.3 \times 10^{-11} m$

C. $2.65 \times 10^{-11} m$

D. $1.33 \times 10^{-11} m$

Answer: B

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32. To excite the hydrogen atom from its ground state to second excited state.... eV energy is required.

A. 3.4

B. 12.09

C. 1.51

D. 13.6

Answer: B

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33. What is the shortest wavelength present in the Paschen series of spectral lines?

A. 6563 Å

B. 820 nm

C. 911 nm

D. 656 nm

Answer: B

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34. In case of head on collision, when the impact parameter is minimum θ =............. Rad

A. $\frac{\pi}{2}$

B. 0

C. $\frac{\pi}{4}$

D. π

Answer: D

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