PHYSICS

BOOKS - AAKASH SERIES

ATOMS

Problem Solution

1. Calculate distance of closet approach by an α-particle of $KE = 2.5 MeV$ being scattered by gold nucleus $(Z = 79)$.

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2. A particle of mass m, charge $q > 0$ and initial kinetic energy K is projected from infinity towards a heavy nucleus of charge Q assumed to have a fixed position.

If the aim is perfect, how close to the center of the nucleus is the particle when it comes instantaneously to rest ?

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3. For scattering by an inverse-square field (such as that produced by a charged nucleus in Rutherford's model) the relation between impact parameter b and the scattering angle θ is given by, the scattering angle for $b = 0$ is

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4. An electron in a hydrogen atom makes a transition $n_1 \to n_2$ where n_1 and n_2 are principle quantum numbers of the states . Assume the Bohr's model to be valid , the frequency of revolution in initial state is eight times that of final state. The ratio n$\frac{n_1}{n_2}$ is

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5. Find the kinetic energy, potential energy and total energy in

first and second orbit of hydrogen atom if potential energy in first orbit is taken

to be zero.

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6. A small particle of mass m moves in such a way that the potential energy $U = ar^2$, where a is constant and r is the distance of the particle from the origin. Assuming Bhor model of quantization of angular momentum and circular orbits, find the radius of nth allowed orbit.

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7. Consider a hydrogen-like atom whose energy in nth excited state is given by

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

When this excited makes a transition from excited state to ground state , most energetic photons have energy

$E_{\max} = 52.224eV$. and least energetic photons have energy

$E_{\min} = 1.224eV$

Find the atomic number of atom and the initial state or excitation.

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8. A doubly ionized lithium atom is hydrogen like with atomic number 3. Find the wavelength of the radiation required to excite the electron in Li^{++} from the first to the third Bohr orbit (ionization energy of the hydrogen atom equals 13.6 eV).

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9. A hydrogen like atom (atomic number Z) is in a higher excited state of quantum number n. The excited atom can make a transition to the first excited state by successively emitting two photons of energy 10.2 eV and 17.0 eV, respectively. Alternatively, the atom from the same excited state can make a transition to the second excited state by successively emitting two photons of energies 4.25 eV and 5.95 eV, respectively Determine the values of n and Z. (Ionization energy of H-atom = 13.6 eV)

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10. The wavelength of light from the spectral emission line of sodium is 589 nm. Find the kinetic energy at which

(i) an electron, and

(ii) a neutron, would have the same de-Broglie wavelength .

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11. A hydrogen atom in a state of binding energy 0.85 eV makes a transition to a state of excitation energy of 10.2 eV . Find the energy and wavelength of photon emitted.

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12. 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 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 1.5×10^{11} m. The radius of sun is taken as 7×10^{8} m.

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13. In a geiger - marsden experiment. Find the distance of closest approach to the nucleus of a 7.7 me v α- particle before it comes momentarily to rest and reverses its direction. (z for gold nucleus = 79) .

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14. It 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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15. 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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16. A 10 kg satellite circles earth once every 2h in an orbit having a radius of 8000km. Assuming that Bohr's angular momentum postulate applies to a satellite just as it does to an electron in the hydrogen atom, then the quantum number of the orbit of satellite is

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Exercise Ia

1. Rutherford experiment suggested that the size of the nucleus is about

A. 10^{-14} m to 10^{-12} m

B. 10^{-15} m to 10^{-13} m

C. 10^{-15} m to 10^{-14} m

D. 10^{-15} m to 10^{-16} m

Answer: C

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2. In the geiger -marsden scattering experiment, in case of head- on collision the impact parameter should be

A. Maximum

B. minimum

C. infinite

D. zero

Answer: B

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3. In the geiger -marsden scattering experiment the number of scattered detected are maximum and minimum at the scattering angles respectively at

A. 0° and 180°

B. 180° and 0°

C. 90° and 180°

D. 45° and 90°

Answer: A

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4. The volume occupied by an atom is greater than the volume of the nucleus by a factor of about

A. 10^1

B. 10^5

C. 10^{10}

D. 10^{15}

Answer: D

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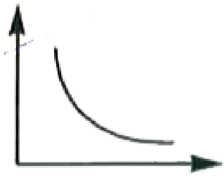
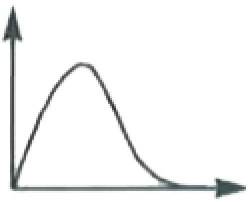
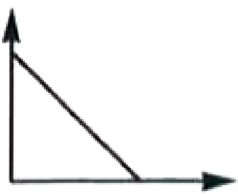
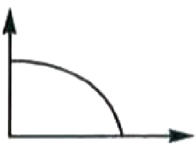
5. The graph of the total number of α-particles scattered at different angles in a given interval of time for α- particles scattering in the geiger- marsden experiment is given by

A. 

B. 

C. 

D. 

Answer: A

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6. According to Bohr's principle , the relation between principle quantum number (n) and radius of orbit is

A. r $\alpha \frac{1}{n}$

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

C. rαn^2

D. rα n

Answer: C

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7. Find the longest and shortest wavelengths in the Lyman series for hydrogen. In what region of the electromagnetic spectrum does each series lie?

A. Ultraviolet

B. Infrared

C. Visible

D. X-ray

Answer: A

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8. In a p-n junction, depletion region contains

A. Lyman lines

B. Balmer lines

C. Paschan lines

D. All of the above

Answer: B

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9. An electron in Bohr's hydrogen atom has an energy of $-3.4eV$. The angular momentum of the electron is

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

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

C. $\frac{4h}{2\pi}$

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

Answer: B

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10. If radius of second stationary orbit (in Bohr's atom) is R then radius of third orbit will be :

A. 3R

B. 9R

C. $\frac{5}{4}$R

D. $\frac{9}{4}$R

Answer: D

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11. Find angular momentum of an electron when it is in the second Bohr orbit of hydrogen atom.

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

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

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

D. zero

Answer: A

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12. the energy required to excite an electron in hydrogen atom to its first excited state is

A. 13.6ev

B. 12.1 ev

C. 10.2 ev

D. 5.1 ev

Answer: C

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13. When electron jumps from n = 4 to n = 1 orbit, we get

A. hydrogen atom

B. deuterium atom

C. singly ionized helium

D. doubly ionized lithium

Answer: D

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14. When an electrons jumps from higher orbit to the second orbit in He^{+} ion, the radiation emitted out will be in $\left(R = 1.09 \times 10^{-7} m^{-1}\right)$

A. Balmer series

B. Pacshen series

C. Bracket series

D. Pfund series

Answer: B

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15. The total energy of electron in the ground state of hydrogen atom is $-13.6eV$. Find the kinetic energy of and electron in the first excited state.

A. 3.4 ev

B. 0.85 ev

C. 1.7 ev

D. 0.425 ev

Answer: B

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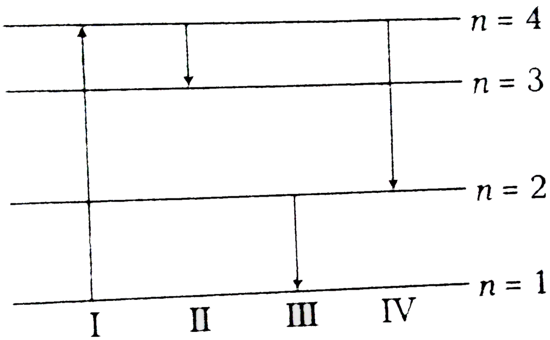
16. The diagram shows the energy levels for an electron in a certain atom. Which transition shown represents the emission of a photon with the most energy



A. III

B. IV

C. I

D. II

Answer: A

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17. The wavelengths 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 nuclei are different

B. the nuclear forces are different in two cases

C. the masses of the two nuclei are different

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

Answer: C

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18. When a hydorgen atom is excited from ground state to first excited state then :

A. $\frac{n(n+1)}{2}$

B. $\frac{n(n-1)}{2}$

C. $\frac{(n-1)^2}{2}$

D. $\frac{(n+1)^2}{2}$

Answer: B

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19. Which of the following is not correct about bohr model of the hydrogen atom ?

A. The radius of nth orbit is proportional to n^2

B. The total energy of electron in nth orbit is proportional to n

C. The angular momentum of an electron in an orbit is an integral multiple of $h / 2\pi$

D. The magnitude of the potential energy of an electron in any orbit is greater than its kinetic

Answer: B

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20. In the Bohr's model of a hydrogen atom, the centripetal force is furnished by the Coulomb attraction between the proton and the electron. If a_o is the radius of he ground state orbit, m is the mass $\imath$, is the charge non electron and ε_0 is the permittivity of free space the speed of the electron is

A. Zero

B. $\frac{e}{\sqrt{\varepsilon_0 a_0 m}}$

C. $\frac{e}{\sqrt{4\pi\varepsilon_0 a_0 m}}$

D. $\frac{\sqrt{4\varepsilon_0 a_0 m}}{e}$

Answer: C

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21. The Bohr model of atoms

A. assumed that the angular momentum of electrons is quantized

B. uses Einstein's photoelectric equation

C. predicts continuous emission spectra for atoms

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

Answer: A

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22. Bohr's model of hydrogen atom.

A. accelerating electrons

B. decelerating electrons

C. electrons going to higher kinetic energy levels

D. trons going to lower momentum levels

Answer: D

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23. Three photons coming from excited atomic-hydrogen sample are picked up. Their energies are $12.1eV, 10.2eV. And 1.9eV$. The photons must come from

A. a single atom

B. two atoms

C. three atoms

D. either two atoms or three atoms

Answer: D

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24. Whenever a hydrogen atom emitsa photon in the Balmer series .

A. it need not emit any more photon

B. it may emit another photon in the Paschen senes

C. it must emit another photon in the Lyman series

D. it may emit another photon in the Balmer senes

Answer: C

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25. If wavelength of photon emitted due to transition of an electron from the third orbit to the first orbit in a hydrogen atom is λ then the wavelength of photon emitted due to transition of an electron from the forth orbit to the second orbit will be

A. $v \propto \frac{1}{n}$

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

C. $v \propto \frac{1}{n^3}$

D. $v \propto \frac{1}{n}$

Answer: C

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26. When a hydrogen atom is raised from the ground state to an excited state

A. Both KE and PE increase

B. Both KE and PE decrease

C. PE increase and KE decrease

D. PE decrease and KE increase

Answer: C

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27. Consider a spectral line resulting $n = 5$ to $n = 1$, in the atom and loss given below. The shortest wavelength is produced by

A. helium atom

B. deuterium atom

C. singly ionized helium

D. ten times ionized sodium atom

Answer: D

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28. In which of the following systems will be the radius of the first orbit $(n = 1)$ be minimum ?

A. Doubly ionized lithium

B. Singly ionized helium

C. Deuterium atom

D. Hydrogen atom

Answer: A

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29. If the radius of an orbit is r and the velocity of electron in it is v , then the frequency of electron in the orbit will be

A. $2\pi rv$

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

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

D. $\frac{v}{2\pi r}$

Answer: D

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30. As the n (number of orbit) increases, the difference of energy between the consecutive energy levels

A. decreases

B. increases

C. first decreases and then increases

D. remains the same

Answer: A

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31. In which of the following transitions will the wavelength be minimum ?

A. n=5 to n-4

B. $n = 4$ to $n = 3$

C. $n = 3$ to $n = 2$

D. $n = 2$ to $n = 1$

Answer: D

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32. Which of the following parameters are the same for all hydrogen like atoms and ions in their ground state?

A. Radius of the orbit

B. Speed of the electron

C. Energy of the atom

D. Orbital angular momentum of the electron

Answer: D

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33. The angular momentum of an electron in a hydrogen atom is proportional to (when n is principle quantum number)

A. $1/\sqrt{r}$

B. $1/r$

C. $\sqrt{r}$

D. r^2

Answer: C

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34. The electron in a hydrogen atom makes a transition from an excited state to the ground state. Which of the following satatement is true?

A. Its kinetic energy increases and its potential and total energies decrease.

B. Its kinetic energy decreases, potential energy increases, and its total energy remain the same.

C. Its kinetic and total energies decrease and its potential energy increases

D. Its kinetic, potential and total energies decrease

Answer: A

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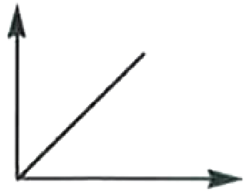
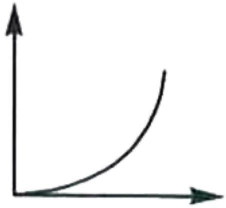
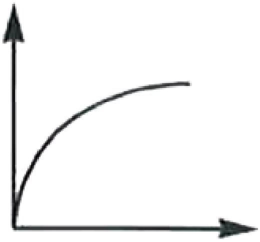
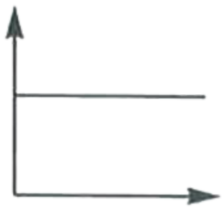
35. In a hydrogen atom, the radius of n^{th} bohr orbit is r_n. The graph between log (r_n / r_1) and logn will be

A. 

B. 

C. 

D. 

Answer: A

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36. How many waves will be made by an electron in the hydrogen atom if it is present in the 5th Bohr Orbit?

A. infinite

B. 3

C. 6

D. 15

Answer: A

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37. An electron in the ground state of hydrogen atom is revolving in anticlockwise direction in circular orbit of radius R. The orbital magnetic dipole moment of the electron will be

A. $\frac{eh}{4\pi m}$

B. $\frac{eh}{2\pi m}$

C. $\frac{eh^2}{4\pi m}$

D. $\frac{e^2 h}{4\pi m}$

Answer: A

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38. when an electron falls from a higher energy to a lower energy level the difference in the energies appears in the form of

A. Electromagnetic radiation only

B. Thermal radiation only

C. Both Electromagnetic and Thermal radiations

D. None of these

Answer: A

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39. The de- broglie wavelength of an electron in the first bohr orbit is

A. equal to one-fourth the circumference of the first orbit

B. equal to half the circumference of first orbit

C. equal to twice the circumference of first orbit

D. equal to the circumference of the first orbit

Answer: D

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40. Bohr's basic idea of discrete energy levels in atoms and the process of emission of photons from the higher levels to lower levels was experimentally confirmed by experiments performed by

A. Michelson-Morley

B. Milikan

C. Joule

D. Frank and Hertz

Answer: D

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41. From quantisation of angular momentum one gets for hydrogen atom, the radius of the n^th orbit as $r_n = \left(\frac{n^2}{m_e}\right)\left(\frac{h}{2\pi}\right)^2\left(\frac{4\pi\varepsilon_0}{e^2}\right)$

For a hydrogen like atom of atomic number Z,

A. the radius the first orbit will be the same

B. r_n will be greater for larger 'Z' values

C. $r_n$will be smaller for larger 'Z' values

D. None of these

Answer: C

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42. the excitation energy of lyman last lines is

A. The same as ionization energy

B. The same as the last absorption line is Lyman series

C. Both 1 and 2

D. Different from 1 and 2

Answer: C

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43. The change in orbital angular momentum corresponding to an electron transition inside a hydrogen atom can be-

(a). $\frac{h}{4\pi}$

(b). $\frac{h}{\pi}$

(c). $\frac{h}{2\pi}$

(d). $\frac{h}{8\pi}$

A. Balmer series

B. Lyman series

C. Paschen series

D. Brackett series

Answer: B

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44. The minimum magnetic dipole moment of electron in hydrogen atom is

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

B. $\frac{eh}{4\pi m}$

C. $\frac{eh}{\pi m}$

D. 0

Answer: B

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45. Total energy of the electron in hydrogen atom above 0 eV leads to

A. Continuation of energy states

B. Large number of discrete ionised states

C. Balmer series

D. Paschen series

Answer: A

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46. An ionized 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. b' and 'd' are true

B. a' and 'b' are true

C. a' and 'c' are true

D. b' and 'c' are true

Answer: C

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

A. Both 'a' and 'c' are true

B. Both 'a' and 'b' are true

C. Both 'c' and 'd' are true

D. Both 'b' and 'd' are true

Answer: B

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

A. both 'a' and 'b' are true

B. both 'b' and 'c' are true

C. Both 'c' and 'd' are true

D. both 'a' and 'd' are true

Answer: A

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49. When a hydrogen atom is raised from the ground state to an excited state

A. Both a&b are true

B. Both b&c are true

C. Both c&d are true

D. Both b&d are true

Answer: D

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

A. Both a&b are true

B. Both c&d are true

C. Both a&c are true

D. Both b&d are true

Answer: B

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51. Check the corretness of the following statement about the Bohr model of hydrogen atom:

(i) The acceleration of the electron in $n = 2$ orbit is more than that in $n = 1$ orbit.

(ii) The angular momentum of the electron in $n = 2$ orbit is more than that in $n = 1$ orbit.

(iii) The KE of the electron in $n = 2$ orbit is more than that in $n = 1$ orbit.

A. All the statements are correct

B. Only (i) and (ii) are correct

C. Only (ii) and (iii) are correct

D. Only (iii) and (i) are correct

Answer: C

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Exercise Ib

1. Thickness of the foil of gold used in α-particle scattering experiment is

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

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2. Statement-I : In Rutherford's gold foil experiment, very few α-particles are deflected back.

Because

Statement-II : Nucleus present inside the atom is heavy.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

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3. In scattering experiment, find the distance of closest approach, if a $6MeV\alpha - partic \leq$ is used

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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4. Rutherford experiment suggested that the size of the nucleus is about

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

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5. When an electron of the hydrogen atom jumps from a higher to lower energy state then which is not true ?

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

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6. According the classical theory of Rutherford's model, the path of elelctron will be

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

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7. (A) hydrogen atom consists of only one electron but its emission spectrum has many lines.

(R) only lyman series is found in the absorption spectrum of hydrogen atom whereas in the emission spectrum, all the series are found.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

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8. Assertion : It is essential that all the lines available in the emission sprectrum will also be available in the absorption spectrum .

Reason : The spectrum of hydrogen atom is only absorption sprectrum .

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: C

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9. Name the material used for heating element of a room heater.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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10. (A) for the scattering of α- particles at large angles, only the necleus of the atom is responsible.

nucleus is very heavy in comparison to electrons.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

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11. Statement-1 : Between any two given energy levels, the number of abosrption transitionsis always less than the number of emission transitions.

and

Statement-2 : Absorption transitions starts from the lowest energy level only and may end at any higher energy level. But emission transitions may start from any higher energy level and end at any energy level below it.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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12. Balmer series lies in which region of electromagnetic spectrum

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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13. (A) bohr's postulate states that the electrons, in stationary orbits around the nucleus do not radiate :

(R) according to classical physics, all moving electron radiate.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: C

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14. (A) electrons int the atom are held due to coulomb forces.

(R) the atom is stable only because the centripetal force due to coulomb's law is balanced by the centrifugal force .

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: C

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15. In Bohr model of the hydrogen atom, let R,v and E represent the radius of the orbit, speed of the electron and the total energy respectively. Which of the following quantities are directly proportional to the quantum number n?

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

Watch Video Solution

16. The lines in Balmer series have their wavelengths lying between

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

Watch Video Solution

17. Assertion: Magnetic force between two short magnets, when they are co-axial follows inverse square law of distance.

Reason: The magnetic forces between two poles do not follow inverse square law of distance.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: D

Watch Video Solution

18. The energy of a photon of wavelength λ is

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

Watch Video Solution

19. (A) bohr model can not be extended to two or more electron atoms.

(R) each electron in the atom interacts not only with the positively charged nueleus but also with all other electrons.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

Watch Video Solution

20. (A) large angle of scattering of alpha particles led to the discovery of atomic nucleus.

(R) entire positive charge of atom is concentrated in the central core.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

Watch Video Solution

21. (A) the trajetory traced by an incident particle depends on the impact parameter of collision.

(R) the impact parameter is the perpendicular distance of the initial velocity vector of the incident particle from the centre of the target nucleus.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

Watch Video Solution

22. Thickness of the foil of gold used in α-particle scattering experiment is

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

Watch Video Solution

23. In scattering experiment, find the distance of closest approach, if a $6MeV\alpha - partic \le$ is used

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

Watch Video Solution

24. According the classical theory of Rutherford's model, the path of elelctron will be

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

Watch Video Solution

25. When an electron of the hydrogen atom jumps from a higher to lower energy state then which is not true ?

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

Watch Video Solution

26. (A) hydrogen atom consists of only one electron but its emission spectrum has many lines.

(R) only lyman series is found in the absorption spectrum of hydrogen atom whereas in the emission spectrum, all the series are found.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

Watch Video Solution

27. (A) for the scattering of α- particles at large angles, only the necleus of the atom is responsible.

nucleus is very heavy in comparison to electrons.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

Watch Video Solution

28. Statement-1 : Between any two given energy levels, the number of abosrption transitionsis always less than the number of emission transitions.

and

Statement-2 : Absorption transitions starts from the lowest energy level only and may end at any higher energy level. But emission transitions may start from any higher energy level and end at any energy level below it.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

Watch Video Solution

29. (A) atoms of each element are stable and emit characteristic spectrum.

(R) the spectrum provides useful information about the atomic structure.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

Watch Video Solution

30. (A) most of the mass of the atom is concentrated in its nucleus.

(R) all alpha particles striking a gold sheet are scattered in different directions.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: C

Watch Video Solution

31. (A) bohr's third postulaate states that the stationary orbits are those for which the angular momentum is some integral multiple of $\frac{h}{2\pi}$.

(R) linear momentum of the electron in the atom is quantised.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: C

Watch Video Solution

32. (A) the total energy of an electron revolving in any stationary orbit is negative.

(R) energy can have positive or negative values.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

Watch Video Solution

33. (A) in the experiment of alpha particle scattering, extremely thin gold foils are preferred over other metals.

(R)gold is a ductile material.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

Watch Video Solution

34. (A) in alpha particle scattering number of alpha paritcle undergoing head on collision is small.

(R) small fraction of the number of incident particles rebound back.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

Watch Video Solution

35. (A) electrons int the atom are held due to coulomb forces.

(R) the atom is stable only because the centripetal force due to coulomb's law is balanced by the centrifugal force .

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: C

Watch Video Solution

36. (A) according to classical electromagnetic theory an accelerated particle continuously emits radiation.

(R) according to classical theory, the proposed path of an electron in Rutherford atom model will be parabolic.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: C

Watch Video Solution

37. Assertion : A laser beam of 0.2 watt power can drill holes through a metal sheet whereas a 1000 watt torch light cannot

Reason The frequency of laser light

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: C

Watch Video Solution

38. Assertion (A) : LASER is used to measure distant object as moon.

Reason (R) : They are highly coherent source of light.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

Watch Video Solution

39. Assertion In He-Nelaser, population inversion takes place between energy levels of neon atoms.

Reason Helium atoms have a metastable energy level.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

Watch Video Solution

40. Assertion : Crystalline solids can cause Xrays to diffract.

Reason : Interatomic distance in crystalline solids is of the order of 0.1 nm.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

Watch Video Solution

41. A: In β-decay an electron is emitted by the nucleus

R: Electrons are not present inside the nucleus.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: C

Watch Video Solution

42. Assertion : X-ray astronomy is possible only from satellites orbiting the carth.

: Eliciency of X-rays tclescope is large as compared to any other telescope. Reason

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: C

Watch Video Solution

43. According to Bohr's atomic model

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

Watch Video Solution

44. Assertion : Total energy of electron in an hydrogen atom is negative.

Reason : It is bourided to the nucleus.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

Watch Video Solution

Exercise Ii

1. In a geiger - marsden experiment. Find the distance of closest approach to the nucleus of a 7.7 me v α- particle before it comes momentarily to rest and reverses its direction. (z for gold nucleus = 79) .

A. 10 fm

B. 20 fm

C. 30 fm

D. 40 fm

Answer: C

Watch Video Solution

2. Thickness of the foil of gold used in α-particle scattering experiment is

A. 15

B. 30

C. 10

D. 20

Answer: A

Watch Video Solution

3. In Rutherford's experiment, number of particles scattered at 90° angel are x per second. Number particles scattered per second at angle 60° is

A. 56

B. 112

C. 60

D. 120

Answer: B

Watch Video Solution

4. If an electron in hydrogen atom jumps from third orbit to second orbit, the Wavelength of the emitted radiation is given by (c is speed of light)

A. $\lambda = \dfrac{R}{6}$

B. $\lambda = \dfrac{36}{5R}$

C. $\lambda = \dfrac{6}{R}$

D. $\lambda = \dfrac{5R}{36}$

Answer: B

Watch Video Solution

Watch Video Solution

5. An alpha nucleus of energy $\frac{1}{2}mv^2$ bomobards a heavy nuclear target of charge Ze. Then the distance of closest approach for the alpha nucleus will be proportional to

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

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

C. ϑ^2

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

Answer: D

Watch Video Solution

6. In Rutherford's α particle cexperiment with thin gold faill, 8100 scattered α-particles per unit ara per unit area per minute were observed at an anle of 60° . Find the number of scattered αparticles pr unit area per minute at and angle of 120°

A. 100

B. 2025

C. 32400

D. 900

Answer: D

Watch Video Solution

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

A. $1A^{\circ}$

B. 10^{-15} cm

C. 10^{-12} cm

D. 10^{-10} cm

Answer: C

Watch Video Solution

8. If the electron in an hydrogen atom jumps from an orbit with level $n_f = 3$ to an orbit with level $n_f = 2$, the emitted rediation has a wavelength given by

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

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

C. $\frac{27}{32}\lambda$

D. $\frac{32}{27}\lambda$

Answer: C

Watch Video Solution

9. The ratio of the largest to shortest wavelength in Balmer series of hydrogen spectra is

A. 25/9

B. 17/6

C. 9/5

D. 5/4

Answer: C

Watch Video Solution

10. An electron in a hydrogen atom makes a trsnsition $n_1 \to n_2$ where n_1 and n_2 are principal quantum numbers of the two states. Assume the Bohr model to be valid. The time period of the electron in the initial state is eight times that in the final state. The possible values of n_1 and n_2 are

A. $8:1$

B. $4:1$

C. $2:1$

D. $1:2$

Answer: C

Watch Video Solution

11. Light from balmer series of hydrogen is able to eject photoelectron from a metal. What can be the maximum work function of the metal?

A. 3.3×10^{15} HZ

B. 2.5×10^{15} HZ

C. 4.6×10^{14} Hz

D. 8.2×10^{14} HZ

Answer: A

Watch Video Solution

12. A hydrogen atom emits a photon corresponding to an electron transition from n=5 to n=1. The recoil speed of hydrogen atom is almost (mass of proton $= 1.6 \times 10^{-27}$ kg).

A. 10^4 m/s

B. 2×10^{-2} m/s

C. 4 m/s

D. 8×10^{-2} m/s

Answer: C

Watch Video Solution

13. when an electron jumps from the fourth orbit to the second orbit, one gets the

A. 5,099 cm^{-1}

B. 20,497 cm^{-1}

C. $40, 994cm^{-1}$

D. 81,988 cm^{-1}

Answer: D

Watch Video Solution

14. If the radius of the first Bohr orbit of the H atom is r then for the Li^{2+} ion it will be:

A. $150a_0$

B. $\sqrt{150}a_0$

C. $\frac{a_0}{\sqrt{150}}$

D. $\frac{a_0}{150}$

Answer: D

Watch Video Solution

15. The wavelength of first member of Balmer series in hydrogen spectrum is λ. Calculate the wavelength of first member of Lyman series in the same spectrum

A. 1215 Å

B. 4862 Å

C. 6050

D. data given is insufficient to calculate the value

Answer: B

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16. A hydrogen like atom (atomic number Z) is in a higher excited state of quantum number n. The excited atom can make a transition to the first excited state by successively emitting two photons of energy 10.2 eV and 17.0 eV, respectively. Alternatively, the atom from the same excited state can make a transition to the second excited state by successively emitting two photons of energies 4.25 eV and 5.95 eV, respectively Determine the values of n and Z. (Ionization energy of H-atom = 13.6 eV)

A. $n = 6$ and $z = 3$

B. $n = 3$ and $z = 6$

C. $n = 8$ and $z = 4$

D. $n = 4$ and $z = 8$

Answer: A

Watch Video Solution

17. Electrons from $n = 2$ to $n = 1$ in hydrogen atom is made to fall on a metal surface with work function 1.2ev. The maximum velocity of photo electrons emitted is nearly equal to

A. 6×10^5 m/s

B. 3×10^5 m/s

C. 2×10^5 m/s

D. 18×10^5 m/s

Answer: D

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18. Let v_1 be the frequency of the series limit of the Lyman series, v_2 be the frequency of the first line of the Lyman series, and v_3 be the frequency of the series limit of the Balmer series. Then

A. $\vartheta_1\vartheta_2 = \vartheta_3$

B. $\vartheta_2 - \vartheta_1 = \vartheta_3$

C. $2\vartheta_3 = \vartheta_1 + \vartheta_2$

D. $\vartheta_1 + \vartheta_2 = \vartheta_3$

Answer: A

Watch Video Solution

19. The transition 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. $3 \rightarrow 2$

B. $4 \rightarrow 2$

C. $5 \rightarrow 4$

D. $2 \rightarrow 1$

Answer: C

Watch Video Solution

20. Energy required for the electron excitation in Li^{++} from the first to the third Bohr orbit is:

A. 36.3 eV

B. 108.8 eV

C. 122.4 eV

D. 12.1 eV

Answer: B

Watch Video Solution

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

A. $74583A^{\circ}$

B. $22790A^{\circ}$

C. $40519A^{\circ}$

D. $18753A^{\circ}$

Answer: C

Watch Video Solution

22. What would be the radius of second orbit of He^{+} ion?

A. $1.058A^{\circ}$

B. $3.023A^{\circ}$

C. $2.068A^{\circ}$

D. $4.458A^{\circ}$

Answer: A

Watch Video Solution

23. The wavelength of Lymen series for first number is

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

B. $\dfrac{3}{4 \times 1.09 \times 10^{7}}$ m

C. $\dfrac{4}{3 \times 1.097 \times 10^7}$ m

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

Answer: C

Watch Video Solution

24. The principal quantum number, n describes

A. $\mu \propto n$

B. $\mu \propto \dfrac{1}{n}$

C. $\mu \propto n^2$

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

Answer: A

Watch Video Solution

25. What is ratio of Bohr magneton to the 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

Watch Video Solution

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

A. 0.65e V

B. 1.9eV

C. 11.1 eV

D. 13.6 eV

Answer: C

Watch Video Solution

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

A. One

B. Two

C. Three

D. Four

Answer: C

Watch Video Solution

28. A hydrogen atom initially in the ground level absorbs a photon and is excited to $n = 4$ level then the wavelength of photon is

A. 970 A°

B. $1210A^{\circ}$

C. $3644A^{\circ}$

D. $4560A^{\circ}$

Answer: A

Watch Video Solution

29. The speed of the electron in a hydrogen atom in the n = 3 level is

A. $6.2 \times 10^5 ms^{-1}$

B. $3.7 \times 10^5 ms^{-1}$

C. $7.3 \times 10^5 m^{-1}$

D. $1.6 \times 10^5 ms^{-1}$

Answer: C

Watch Video Solution

30. Hydrogen atom in ground state is excited by a monochromatic radiation of $\lambda = 975\text{Å}$. Number of spectral lines in the results spectrum emitted will be

A. 3

B. 2

C. 6

D. 10

Answer: C

Watch Video Solution

31. In the spectrum of hydrogen atom, the ratio of the longest wavelength in Lyman series to the longest wavelength in the Balmer series is:

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

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

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

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

Answer: B

Watch Video Solution

32. 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. $0.25 \times 10^7 m^{-1}$

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

C. $0.025 \times 10^4 m^{-1}$

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

Answer: A

Watch Video Solution

33. When an α- particle of mass m moving with velocity bombards on a heavy nucleus of charge Ze its distance of closest approach from the nucleus depends on m as

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

B. m

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

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

Answer: C

Watch Video Solution

34. The ratio of wavelengths of the last line of Balmer series and the last line of Lyman series is

A. 0.5

B. 2

C. 1

D. 4

Answer: D

Watch Video Solution

35. The ratio of kinetic energy to the total energy of an electron in a Bohr orbit of the hydrogen atom, is

A. $1:1$

B. $1 : -1$

C. $1 : -2$

D. $2 : -1$

Answer: B

Watch Video Solution

Exercise Iii

1. An α-particle of energy 4 Me V is scattered by gold foil (Z = 79) .Calculate the maximum volume in which positive charge of the atom is likely to be concentrated.

A. $3.3 \times 10^{-40} m^3$

B. $7.7 \times 10^{-40} m^3$

C. $5.5 \times 10^{-40} m^3$

D. $11 \times 10^{-40} m^3$

Answer: B

Watch Video Solution

2. Calculate the impact parameter of a 5 MeV particle scattered by 90° when it approaches a gold nucleus.

A. $15.27x10^{-14}$ m

B. 23.23×10^{-14} m

C. 2.27×10^{-14}m

D. 77.2×10^{-14}m

Answer: C

Watch Video Solution

3. Two electrons are revolving around a nucleus at distances 'r' and '4r' ratio of their periods is

A. $1:4$

B. $4:1$

C. $8:1$

D. $1:8$

Answer: D

Watch Video Solution

4. When an electron jumps from a level $n = 4$ to $n = 1$, the momentum of the recoiled hydrogen atom will be

A. $6.5 \times 10^{-27} \text{Kgms}^{-1}$

B. $12.75 \times 10^{-19} \text{kgms}^{-1}$

C. $13.6 \times 10^{-27} \text{kgms}^{-1}$

D. Zero

Answer: A

Watch Video Solution

5. The energy change is greatest for a hydrogen atom when its state changes from

A. n = 2 to n = 1

B. n = 3 to n =2

C. n = 4 to n = 3

D. n = 5 to n = 4

Answer: A

Watch Video Solution

6. As the electron in the Bohr orbit is hydrogen atom passes from state $n=2$ to $n=1$, the $KE(K)$ and $PE(U)$ change as

A. K two-fold, U also two-fold

B. K four-fold, U also four-fold

C. K four-fold, U two-fold

D. K two-fold, U four-fold

Answer: B

Watch Video Solution

7. The energy of an electron in excited hydrogen atom is -3.4 eV . Then, according to Bohr's therory, the angular momentum of the electron of the electron is

A. 2.1×10^{-34}

B. 3×10^{-34}

C. 2×10^{-34}

D. 0.5×10^{-34}

Answer: A

Watch Video Solution

8. The wavelength of first line of lyman series for hydrogen is 1216 A the wavelength of the first line of this series for a ten times ionized sodium atom will be

A. $0.1A^{\circ}$

B. $1000A^{\circ}$

C. $100A^{\circ}$

D. $10A^{\circ}$

Answer: D

Watch Video Solution

9. The ionisation potential of hydrogen atom is $13.6eV$. The energy required to remove an electron in the $n=2$ state of the hydrogen atom is

A. 1.9 eV

B. 2.3 eV

C. 3.4 eV

D. 6.8 eV

Answer: A

Watch Video Solution

10. The radius of the Bohr orbit in the ground state of hydrogen atom is 0.5Å. The radius of the orbit of the electron in the third exicted state of He^{+} will be

A. 8 A°

B. $4A^{\circ}$

C. $0.5A^{\circ}$

D. $0.25A^{\circ}$

Answer: B

Watch Video Solution

11. The potential energy of an electron in the fifth orbit of hydrogen atom is

A. 0.54 eV

B. -0.54 eV

C. 1.08 eV

D. -1.08 eV

Answer: D

Watch Video Solution

12. If R is the Rydberg constant for hydrogen, then the wave number of the first line in the Lyman series is

A. R/2

B. 2R

C. R/4

D. 3R/4

Answer: D

Watch Video Solution

13. If λ_1 and λ_2 are the wavelengths of the first members of the Lyman and Paschen series respectively , then $\lambda_1 : \lambda_2$ is

A. $1:3$

B. $1:30$

C. $7:50$

D. $7:108$

Answer: D

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14. The ratio of maximum to minimum possible radiation energy Bohr's hypothetical hydrogen atom is equal to

A. 2

B. 4

C. $4/3$

D. $3/2$

Answer: C

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15. The shortest wavelength of Balmer series of H-atom is

A. RC

B. 4RC

C. 4/RC

D. RC/4

Answer: D

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16. Given mass number of gold $= 197$, Density of gold $= 19.7 gcm^{-3}$. The radius of the gold atom is approximately:

A. 1.5×10^{-8} m

B. 1.5×10^{-9} m

C. 1.5×10^{-10}m

D. 1.5×10^{-12} m

Answer: C

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17. Transition between three energy energy levels in a particular atom give rise to three Spectral line of wevelength , in increasing magnitudes. λ_1, λ_2 and λ_3. Which one of the following equations correctly ralates λ_1, λ_2 and λ_3?

$\lambda_1 = \lambda_2 - \lambda_3$

$\lambda_1 = \lambda_3 - \lambda_2$

$\frac{1}{\lambda_1} = \frac{1}{\lambda_2} + \frac{1}{\lambda_3}$

$\frac{1}{\lambda_2} = \frac{1}{\lambda_3} + \frac{1}{\lambda_1}$

A. $\lambda_1 = \lambda_2 - \lambda_3$

B. $\lambda_1 = \lambda_3 - \lambda_2$

C. $\frac{1}{\lambda_1} = \frac{1}{\lambda_2} + \frac{1}{\lambda_3}$

D. $\frac{1}{\lambda_1} = \frac{1}{\lambda_3} + \frac{1}{\lambda_2}$

Answer: C

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18. An electron in a hydrogen atom makes a transition from $n_1 \to n_2$. If the time period of electron in the initial state is eight times that in the final state then Find the ratio $\frac{n_1}{n_2}$

A. $n_1 = 4, n_2 = 2$

B. $n_1 = 8, n_2 = 2$

C. $n_1 = 8, n_2 = 2$

D. $n_1 = 6, n_2 = 2$

Answer: A

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19. An electron revolving in an orbit of radius 0.5Å in a hydrogen atom executes per secon. The magnetic momentum of electron due to its orbital motion will be

A. $1.256 \times 10^{-23} \text{ A } m^2$

B. 653×10^{-26} A m^2

C. 10^{-3} A m^2

D. 256×10^{-26} A m^2

Answer: A

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20. The radius of second Bohr's orbit of Hydrogen atom is:

A. 6.62×10^{15}

B. 100

C. 1000

D. 1

Answer: A

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21. If one were to apply Bohr model to a particle of mass $'m'$ and charge $'q'$ moving in a plane under the influence of a mgentic filed $'B'$, the energy of the cahrged particle in the n^{th} level will be :-

A. n $\left(\frac{\text{hqB}}{\pi m}\right)$

B. $n\left(\frac{hqB}{8\pi m}\right)$

C. $\left(\frac{hqB}{2\pi m}\right)$

D. n $\left(\frac{hqB}{4\pi m}\right)$

Answer: D

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22. In hydrogen spectrum, the shortest wavelength in Balmer series is the λ. The shortest wavelength in the Brackett series will be

A. 2λ

B. 4λ

C. 9λ

D. 16λ

Answer: B

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23. If a charged particle is moving in a plane perpendicular to a uniform magnetic field with a time period T Then

A. n^2

B. n

C. $n^{3/2}$

D. $n^{1/2}$

Answer: D

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24. Condiser 3rd orbit of He^{+} (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)=$6.6 \times 10^{-34} J - s$)

A. 0.73×10^{6} m/s

B. 3.0×10^{8} m/s

C. 2.92×10^{6} m/s

D. 1.46×10^{6} m/s

Answer: D

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25. Identify A and B:

A. B' will be minimum and in C' maximum

B. A' will be maximum and in B' minimum

C. A' will be minimum and in B' maximum

D. C' will be minimum and in B' maximum

Answer: B

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Problem

1. Calculate the impact parameter of 5.0 MeV α -particle scattered by 10° when it approaches a gold nuclcus (Z = 79).

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2. A projectile of mass m, charge Z., initial speed v and impact parameter b is scattered by a heavy nucleus of charge Z. Use angular momentum and energy conservation to obtain a formula connecting the minimum distance (s) of the projectile form the nucleus to these parameters. Show that for b = 0, s reduces to the closest distance of approach r_0.

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3. For scattering by an inverse-square field (such as that produced by a charged nucleus in Rutherford's model) the relation between impact parameter b and the scattering angle θ is given by, the scattering angle for $b = 0$ is

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4. For scattering by an .inverse square. field (such as that produced by a charged nucleus in Rutherford.s model), the relation between

impact parameter b and the scattering angle θ is given by,

$$b = \frac{Ze^2 \cot \theta / 2}{4\pi\varepsilon_0 \left(\frac{1}{2}mv^2\right)}$$

For a given imapct parameter b, does the angle of deflection increase or decrease with increase in energy ?

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5. For scattering by an inverse square field (such as that produced by a charged nucleus in Rutherford's model), the relation between

impact parameter b and the scattering angle θ is given by,

$$b = \frac{Ze^2 \cot \theta / 2}{4\pi\varepsilon_0 \left(\frac{1}{2}mv^2\right)}$$

What is the impact parameter at which the scattering angle is 90° for Z = 79 and initial energy equal to 10MeV ?

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6. For scattering by an .inverse square. field (such as that produced by a charged nucleus in Rutherford.s model), the relation between

impact parameter b and the scattering angle θ is given by,

$$b = \frac{Ze^2 \cot \theta / 2}{4\pi\varepsilon_0 \left(\frac{1}{2}mv^2\right)}$$

Why is it that the mass of the nucleus does not enter the formula above but its charge does ?

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7. For scattering by an .inverse square. field (such as that produced by a charged nucleus in Rutherford.s model), the relation between

impact parameter b and the scattering angle θ is given by,

$$b = \frac{Ze^2 \cot \theta / 2}{4\pi\varepsilon_0 \left(\frac{1}{2}mv^2\right)}$$

For a given energy of the projectile, does the scattering angle increase or decrease with dec rease in impact parameter ?

Watch Video Solution

8. An electron in a hydrogen atom makes a transition $n_1 \rightarrow n_2$ where n_1 and n_2 are principle quantum numbers of the states .

Assume the Bohr's model to be valid , the frequency of revolution in initial state is eight times that of final state. The ratio n$\frac{n_1}{n_2}$ is

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9. Find the kinetic energy, potential energy and total energy in

first and second orbit of hydrogen atom if potential energy in first orbit is taken

to be zero.

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10. A small particle of mass m moves in such a way that the potential energy $U = ar^2$, where a is constant and r is the distance of the particle from the origin. Assuming Bhor model of quantization of angular momentum and circular orbits, find the radius of nth allowed orbit.

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11. Consider a hydrogen-like atom whose energy in nth excited state is given by

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

When this excited makes a transition from excited state to ground state , most energetic photons have energy

$E_{\max} = 52.224eV$. and least energetic photons have energy

$E_{\min} = 1.224eV$

Find the atomic number of atom and the initial state or excitation.

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12. A hydrogen like atom (atomic number Z) is in a higher excited state of quantum number n. This excited atom can make a transition to the first excited state by successively emitting two photons of energies 10.20 and $17.00 eV$ respectively. Alternatively, the atom from the same axcited state can make a transition to the second excited state by successively emitting two photons of energy $4.25 eV$ and $5.95 eV$ respectively. Determine the values of n and Z

(ionisation energy of hydrogen atom $= 13.6 eV$)

. Given answer $= n + Z$.

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13. A doubly ionized lithium atom is hydrogen like with atomic number 3. Find the wavelength of the radiation required to excite the electron in Li^{++} from the first to the third Bohr orbit (ionization energy of the hydrogen atom equals 13.6 eV).

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14. A hydrogen atom in a state of binding energy 0.85 eV makes a transition to a state of excitation energy of 10.2 eV . Find the energy and wavelength of photon emitted.

Watch Video Solution

15. A hydrogen atom in a state of binding energy 0.85 eV makes a transition to a state of excitation energy of 10.2 eV . Find the energy and wavelength of photon emitted.

Watch Video Solution

16. A hydrogen atom in a state of binding energy 0.85 eV makes a transition to a state of excitation energy of 10.2 eV . Find the energy and wavelength of photon emitted.

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17. The wavelength of light from the spectral emission line of sodium is 589 nm. Find the

kinetic energy at which

(i) an electron, and

(ii) a neutron, would have the same de-Broglie wavelength .

Watch Video Solution

18. The wavelength of light from the spectral emission line of sodium is 589 nm. Find the kinetic energy at which

(i) an electron, and

(ii) a neutron, would have the same de-Broglie wavelength .

Watch Video Solution

19. 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 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 1.5×10^{11} m. The radius of sun is taken as 7×10^{8} m.

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20. In a geiger - marsden experiment. Find the distance of closest approach to the nucleus of a 7.7 me v α- particle before it comes momentarily to rest and reverses its direction. (z for gold nucleus = 79) .

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21. It 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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22. 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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23. A 10 kg satellite circles earth once every 2h in an orbit having a radius of 8000km. Assuming that Bohr's angular momentum postulate applies to a satellite just as it does to an electron in the hydrogen atom, then the quantum number of the orbit of satellite is

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24. 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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Exercise I

1. According to Bohr's principle , the relation between principle quantum number (n) and radius of orbit is

A. $r\alpha\frac{1}{n}$

B. $r\alpha n$

C. $r\alpha n^2$

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

Answer: C

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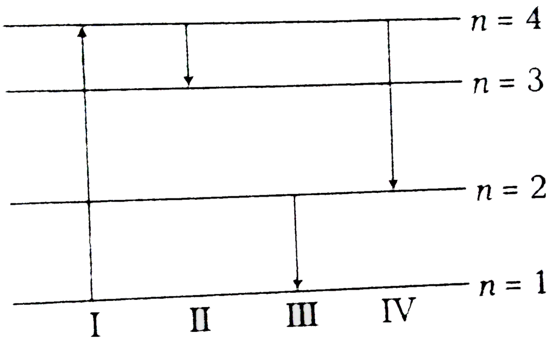
2. The diagram shows the energy levels for an electron in a certain atom. Which transition shown represents the emission of a photon with the most energy



A. III

B. IV

C. I

D. II

Answer: A

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3. The wavelengths 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 nuclei are different

B. the nuclear forces are different in two cases

C. the masses of the two nuclei are different

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

Answer: C

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4. Hydrogen atom does not emit X-rays because

A. its energy levels are too close to each other

B. its energy levels are too far apart

C. it has a very small mass

D. it has a single electron

Answer: A

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5. Atomic hydrogen is excited from the grounds state to the n^{th} state. The number of lines in the emission spectrum will be:

A. $\frac{n(n+1)}{2}$

B. $\frac{n(n-1)}{2}$

C. $\frac{(n-1)^2}{2}$

D. $\frac{(n+1)^2}{2}$

Answer: B

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6. Which of the following is not correct about bohr model of the hydrogen atom ?

A. The radius of nth orbit is proportional to n^2

B. The total energy of electron in nth orbit is proportional to n

C. The angular momentum of an electron in an orbit is an integral multiple of $h / 2\pi$

D. The magnitude of the potential energy of an electron in any orbit is greater than its kinetic energy

Answer: B

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7. Which of the following transitions gives photon of maximum energy

A. n=1 to n=2

B. n=2 to n=1

C. n=2 to n=6

D. n=6 to n=2

Answer: B

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8. The Bohr model of atoms

A. assumes that the angular momentum of electrons is quantized

B. uses Einstein.s photoelectric equation

C. predicts continuous emission spectra for atoms

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

Answer: A

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9. Bohr's model of hydrogen atom.

A. accelerating electrons

B. decelerating electrons

C. electrons going to higher kinetic energy levels

D. electrons going to lower momentum levels

Answer: D

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10. Three photons coming from excited atomic-hydrogen sample are picked up. Their energies are $12.1eV, 10.2eV. And 1.9eV.$ The photons must come from

A. a single atom

B. two atoms

C. three atoms

D. either two atoms or three atoms

Answer: D

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11. Whenever a hydrogen atom emitsa photon in the Balmer series .

A. it need not emit any more photon

B. it may emit another photon in the Paschen series

C. it must emit another photon in the Lyman series

D. it may emit another photon in the Balmer series

Answer: C

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12. When a hydrogen atom is raised from the ground state to an excited state

A. both KE and PE increase

B. both KE and PE decrease

C. PE increase and KE decrease

D. PE decrease and KE increase

Answer: C

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13. Consider a spectral line resulting from the transition n = 5 to n = 1, in the atoms and ions given below. The shortest wavelength is produced by

A. helium atom

B. deuterium atom

C. singly ionized helium

D. ten times ionized sodium atom

Answer: D

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14. In which of the following systems will be the radius of the first orbit $(n = 1)$ be minimum ?

A. Doubly ionized lithium

B. Singly ionized helium

C. Deuterium atom

D. Hydrogen atom

Answer: A

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15. If the radius of an orbit is r and the velocity of electron in it is v , then the frequency of electron in the orbit will be

A. 2π rv

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

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

D. $\frac{v}{2\pi r}$

Answer: D

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16. As the n (number of orbit) increases, the difference of energy between the consecutive energy levels

A. decreases

B. increases

C. first decreases and then increases

D. remains the same

Answer: A

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17. Which of the following parameters are the same for all hydrogen like atoms and ions in their ground state?

A. Radians of the orbit

B. Speed of the electron

C. Energy of the atom

D. Orbital angular momentum of the electron

Answer: D

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18. The electron in a hydrogen atom makes a transition from an excited state to the ground state. Which of the following satatement is true?

A. Its kinetic energy increases and its potential and total energies decrease.

B. Its kinetic energy decreases, potential energy increases, and its total energy remain the same.

C. Its kinetic and total energies decrease and its potential energy increases

D. Its kinetic, potential and total energies decrease

Answer: A

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19. The angular momentum of an electron in a hydrogen atom is proportional to (when n is principle quantum number)

A. $1\sqrt{r}$

B. $1/r$

C. $\sqrt{r}$

D. r^2

Answer: C

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20. The equation corresponding to the wave number of spectral lines in Pfund series is

A. infinite

B. 3

C. 6

D. 15

Answer: A

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Exercise Ii

1. When the electron in hydrogen atom jumps from the second orbit to the first orbit, the wavelength of the radiation emitted is λ. When the electron jumps from the third to the first orbit . The wavelenth of the radiation emitted is

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

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

C. $\frac{27}{32}\lambda$

D. $\frac{32}{27}\lambda$

Answer: C

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2. The ratio of the largest to shortest wavelength in Balmer series of hydrogen spectra is

A. $\frac{25}{9}$

B. $\frac{17}{6}$

C. $\frac{9}{5}$

D. $\frac{5}{4}$

Answer: C

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3. An electron in a hydrogen atom makes a transition $n_1 \to n_2$, where n_1 and n_2 are principal quantum numbers of the states. Assume the Bohr's model to be valid. The time period of the electron in the initial state is eight times to that of final state. What is ratio of n_2 / n_1

A. $8:1$

B. $4:1$

C. $2:1$

D. $1:2$

Answer: C

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4. Any radiation in the ultra violet region of Hydrogen spectrum is able to eject photo-electrons from a metal. Then the maximum value of threshold wave length is $\lambda = \frac{1}{R} = 911\text{Å}$ then the frequency of the metal is, nearly

A. 3.3×10^{15} HZ

B. 2.5×10^{15} HZ

C. 4.6×10^{14} HZ

D. 8.2×10^{14} HZ

Answer: A

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5. A hydrogen atom emits a photon corresponding to an electron transition from n=5 to n=1. The recoil speed of hydrogen atom is almost (mass of proton $= 1.6 \times 10^{-27}$ kg).

A. 10^{-4} m/s

B. 2×10^{-2} m/s

C. 4 m/s

D. 8×10^{-2} m/s

Answer: C

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6. The wave number of energy emitted when electron jumbs from fourth orbit to second orbit in hydrogen in 20,497 cm^{-1}. The wave number of energy for the same transition in He^{+} is

A. $5, 099cm^{-1}$

B. $20, 497cm^{-1}$

C. $40, 994cm^{-1}$

D. $81, 988cm^{-1}$

Answer: D

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7. In a Bohr atom the electron is replaced by a particle of mass 150 times the mass of the electron and the same charge . If a_0 is the radius of the first Bohr orbit of the orbital atom, then that of the new atom will be

A. $150a_0$

B. $\sqrt{150}a_0$

C. $\frac{a_0}{\sqrt{150}}$

D. $\frac{a_0}{150}$

Answer: D

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8. If the wavelength of first member of Balmer series of hydrogen spectrum is $6564A^{\circ}$. The wavelength of second member of Balmer series will be :

A. 1215Å

B. 4862Å

C. 6050

D. data given is insufficient to calculate the value

Answer: B

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9. A hydrogen like atom (atomic number Z) is in a higher excited state of quantum number n. This excited atom can make a transition to the first excited state by successively emitting two photons of energies 10.20 and $17.00 eV$ respectively. Alternatively, the atom from the same axcited state can make a transition to the second excited state by successively emitting two photons of energy $4.25 eV$ and $5.95 eV$ respectively. Determine the values of n and Z

(ionisation energy of hydrogen atom $= 13.6 eV$)

. Given answer $= n + Z$.

A. n=6 and z=3

B. n=3 and z=6

C. n=8 and z=4

D. n=4 and z=8

Answer: A

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10. Electrons from n = 2 to n= 1 in hydrogen atom is made to fall on a metal surface with work function 1.2ev. The maximum velocity of photo electrons emitted is nearly equal to

A. 6×10^5 m/s

B. 3×10^5 m/s

C. 2×10^5 m/s

D. 18×10^5 m/s

Answer: D

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11. Let v_1 be the frequency of the series limit of the Lyman series, v_2 be the frequency of the first line of the Lyman series, and v_3 be the frequency of the series limit of the Balmer series. Then

A. $\vartheta_1 - \vartheta_2 = \vartheta_3$

B. $\vartheta_2 - \vartheta_1 = \vartheta_3$

C. $2\vartheta_3 = \vartheta_1 + \vartheta_2$

D. $\vartheta_1 + \vartheta_2 = \vartheta_3$

Answer: A

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12. When a silver foil (Z = 47) was used in an α ray scattering experiment , the number of α-particles scattered at 30° was found to be 200 per minute. If the silver foil is replaced by alumninium (z = 13) foil of same thickness, the number of α-particles scattered per minute at 30° is nearly equal to

A. 15

B. 30

C. 10

D. 20

Answer: A

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13. In Rutherford experiments on α-ray scattering the number of particles scattered at 90^0angle be 28 per minute. Then the number of particles scattered per minute by the same foil, but at 60^0 is

A. 56

B. 112

C. 60

D. 120

Answer: B

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14. An alpha nucleus of energy $\frac{1}{2}mv^2$ bomobards a heavy nuclear target of charge Ze. Then the distance of closest approach for the alpha nucleus will be proportional to

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

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

C. ϑ^2

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

Answer: D

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15. In Rutherford's α particle scattering experiment with their gold foil 8100 scintillations per minute are observed at an angle of 60° . The number of seintillations per minute at 120° will be

A. 100

B. 2025

C. 32400

D. 900

Answer: D

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16. 240 coulombs of electricity is passed through a soluton of dilute suplhuric acid for 20 minutes the amperes of current produced is

A. $1A^0$

B. $10^{-15}cm$

C. $10^{-12}cm$

D. $10^{-10} cm$

Answer: C

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17. The transition 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. $3 \rightarrow 2$

B. $4 \rightarrow 2$

C. $5 \rightarrow 4$

D. $2 \rightarrow 1$

Answer: C

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18. Energy required for the electron excitation in Li^{++} from the first to the third Bohr orbit is:

A. 36.3eV

B. 108.8eV

C. 122.4eV

D. 12.1eV

Answer: B

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19. Hydrogen $\left(._1 H^1\right)$, Deuterium $\left(._1 H^2\right)$, singly ionised Helium $\left(._2 H^4\right)^+$ and doubly ionised lithium $\left(._3 Li^6\right)^{++}$ all have one electron around the nucleus. Consider an electron transition from n = 2 to n = 1. If the wave lengths of emitted radiation are $\lambda_1, \lambda_2, \lambda_3$ and λ_4 respectively then approximately which one of the following is correct?

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

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

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

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

Answer: D

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Practice Exercise

1. The energy of the electron in the ground state of hydrogen atom is $-13.6eV$. Find the kinetic energy of electron in this state.

A. 1.85eV

B. 13.6 V

C. 6.8eV

D. 3.4eV

Answer: B

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2. Hydrogen atom emits blue light when it jumps from n=4 energy level to the n=2 level. Which colour of light would the atom emit when it changes from the n=5 level ot the n=2 level?

A. Red

B. Yellow

C. Green

D. Violet

Answer: D

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3. The separation energy of the electron presetn in the shell n =3 is 1.51 eV what is the energy in the first exicted state ?

A. $-52.4eV$

B. $-27.2eV$

C. $-68eV$

D. $-3.4eV$

Answer: D

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4. Radius of first orbit of hydrogen is 0.53Å.

The radius in fourth orbit is:

A. 8.48Å

B. 2.12Å

C. 4.24Å

D. 0.193Å

Answer: A

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5. The electrons in hydrogen atoms are raised from ground state to third excited state. The number of emission lines will be

A. 10

B. 6

C. 4

D. 3

Answer: B

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6. For H^+ and Na^+ the values of λ° are 349.8 and 50.11 respectively calculate the mobilites of these ions and their velocites if they are in a cel in which electrode are 4 cm apart and to which a ptential of 3BV is appied

A. $27:5$

B. $5:27$

C. $4:1$

D. $1:4$

Answer: B

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7. Calculated the energy required to excite one litre of hydrogen gas at $1atm$ and $298K$ to the first excited state of atomic hydorgen. The enegry for the dissociation of $H - H$ bond is $436kJmol^{-1}$.

A. 10.2 ev

B. 0 ev

C. 3.4 ev

D. 6.8 ev

Answer: C

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8. The ratio of the energies of the hydrogen atom in its first excited state to second excited state is

A. $4 : 1$

B. $1 : 4$

C. $4 : 9$

D. $9 : 4$

Answer: A

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9. Find the ratio of wavelengths of first line of Lyman series and second line of Balmer series.

Hint : Use Rydberg formula

A. $1:4$

B. $5:27$

C. $27:20$

D. $20:27$

Answer: B

Watch Video Solution

10. Calculated the energy required to excite one litre of hydrogen gas at $1atm$ and $298K$ to the first excited state of atomic hydorgen. The enegry for the dissociation of $H-H$ bond is $436kJmol^{-1}$.

A. $L_1 = L_2$

B. $L_1 = 4L_1$

C. $L_1 = L2/2$

D. $L_1 = 2L_2$

Answer: C

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11. In Bohr's model of the hydrogen atom, the ratio between the period of revolution of an electron in the orbit of $n = 1$ to the period of revolution of the electron in the orbit $n = 2$ is

A. $1 : 2$

B. $2:1$

C. $1:4$

D. $1:8$

Answer: D

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12. The radius of the first orbit of hydrogen in $0.528\overset{0}{A}$. The radius of second orbit of hydrogen is

A. 4.752Å

B. 2.112Å

C. 0.071Å

D. 0.142Å

Answer: B

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13. The ovary is half inferior in flowers of

A. 13.6eV

B. 27.2eV

C. 6.8eV

D. 8.6eV

Answer: A

Watch Video Solution

14. The circumference of first orbit of hydrogen atom is .S.. Then the Broglie wavelength of electron in that orbit is

A. $S/2$

B. 2S

C. S

D. 3S

Answer: C

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15. In hydrogen spectrum L_{α} line arises due to transition of electron from the orbit n=3 to the orbit n=2. In the spectrum of singly ionized helium there is a line having the same wavelength as that of the L_α line. This is due to the transition of electron from the orbit:

A. n = 3 to n = 2

B. n = 4 to n = 2

C. n = 5 to n = 3

D. n = 6 to n = 4

Answer: D

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16. If a hydrogen atom emit a photon of energy $12.1eV$, its orbital angular momentum changes by Δ L. then Δ L equals

A. 1.05×10^{-34} Js

B. 2.11×10^{-34} Js

C. 3.16×10^{-34} Js

D. 4.22×10^{-34} Js

Answer: B

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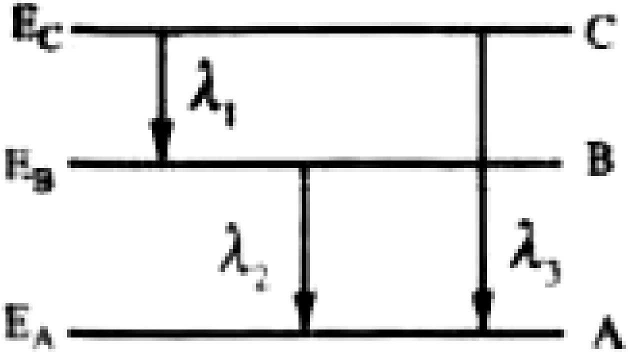
17. Energy levels A,B,C of an atom are shown below



If $E_A < E_B < E_C$, then correct statements of the following is

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

B. $\lambda_3 = \dfrac{\lambda_1 \times \lambda_2}{\lambda_2 + \lambda_1}$

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

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

Answer: B

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18. An electron, in a hydrogen like atom , is in excited state. It has a total energy of -3.4 eV, find the de-Broglie wavelength of the electron.

A. 6.6×10^{-10} m

B. 6.6×10^{11}m

C. 7.6×10^{-11}m

D. 7.6×10^{-10} m

Answer: A

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19. What is the energy of state in a triply ionized beryllium (Be^{+++}) whose radius is equal to that of ground state of hydrogen ?

A. 27.2eV

B. 54.4eV

C. 13.6eV

D. 40.8eV

Answer: B

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20. A stationary hydrogen atom emits photon corresponding to the first line of Lyman series. If R is the Rydberg constant and M is the mass of the atom, then the velocity acquired by the atom is

A. 7.29m/s

B. 2.79m/s

C. 3.2m/s

D. 5.32m/s

Answer: C

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21. The radius of the first orbit of hydrogen is r_H and the energy in the ground state is $-13.6 eV$.considering aμ - particle with the mass 207m_e revolving round a porton as in hydrogen atom, the energy and radius of proton and μ-combination respectively in the first orbit are(assume nucleus to be stationary)

A. $-13.6 \times 207 eV, \frac{r_H}{207}$

B. $-207 \times 13.6 eV, 207 r_H$

C. $\frac{-13.6}{207} eV, \frac{r_H}{207}$

D. $\frac{-13.6}{207}eV, 207r_H$

Answer: A

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