PHYSICS

BOOKS - MTG PHYSICS (ENGLISH)

ATOMS

Alpha Particle Scattering

1. The first model of atom in 1998 was proposed by

A. Ernst Ruterford

B. Albort einstein

C. j.j thomson

D. neiels bohr

Answer: C

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2. In geiger-marsden scattering experiment , the trajectory traced by α- particle depends on

A. number of collision

B. number of scattered α-particles

C. impact parameter

D. none of these

Answer: C

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3. 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

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4. 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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5. 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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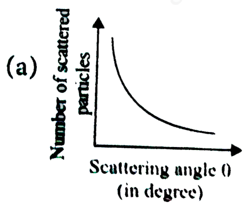
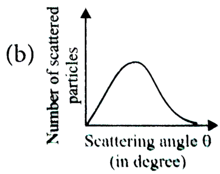
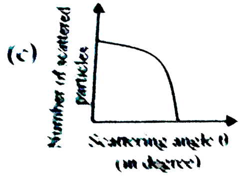
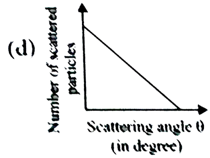
6. The graph of the total number of α-particles scattered at different angles in a given interval of time for α- particles scattering in the geiger- marsden experiment is given by

A. 

B. 

C. 

D. 

Answer: A

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

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

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

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

D. 10^{-15m} to $10^{-12}m$

Answer: C

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8. In an atom the ratio of radius of orbit of electron to the radius of nucleus is

A. 10^3

B. 10^4

C. 10^5

D. 10^6

Answer: C

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9. The relation between the orbit radius and the electron velocity for a dynamically stable orbit in a hydrogen atom is (where, all notations have their usual meanings)

A. $v=\sqrt{\frac{4\pi\varepsilon_0}{me^2r}}$

B. $r=\sqrt{\frac{e^2}{4\pi\varepsilon_0 v}}$

C. $v=\sqrt{\frac{e^2}{4\pi\varepsilon_0 mr}}$

D. $r=\sqrt{\frac{ve^2}{4\pi\varepsilon_0 m}}$

Answer: C

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10. The relationship between kinetic energy (K) and potential energy (U) of electron moving in a orbit around the nucleus is

A. $U = -K$

B. $U = -2K$

C. $U = -3K$

D. $U = -\frac{1}{2}K$

Answer: B

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

A. 10^1

B. 10^5

C. 10^{10}

D. 10^{15}

Answer: D

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12. Consider aimimg a beam of free electrons to wards free atoms . When they scatter, an electron and a protons cannot combine be produced a H-atom,

A. energy conservation

B. simultaneously releasing energy in the from of radiation

C. momentum conservation

D. angular momentum conservation

Answer: A

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13. In an experiment on α- particle scattering, α-particles are directed towards a gold foil and detectors are placed in postition P,Q and R . What is the distribution of α-paritcles as recored at P,Q and R?

A. $\begin{array}{lll} P & Q & R \\ \text{all} & \text{none} & \text{none} \end{array}$

B. P none, Q none, R all

P	Q	R
none	none	all

C.

P	Q	R
a few	some	most

D.

P	Q	R
most	some	a few

Answer: C

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14. The first spectral series was discovered by

A. balmer

B. lyman

C. paschen

D. Pfund

Answer: A

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15. Which of the following spectral series falls within the visible range of electromagnetic radiation ?

A. Lyman series

B. Balmer series

C. Paschen series

D. Pfund series

Answer: B

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

A. 720 nm

B. 790 nm

C. 800 nm

D. 820 nm

Answer: D

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17. The shortest wavelength in the balmer series is $(R = 1.097 \times 10^7 m^{-1})$

A. 200 nm

B. 256.8 nm

C. 300 nm

D. 364.6 nm

Answer: D

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18. the wavelength limit present in the pfund series is $\left(R = 1.097 \times 10^{7} m^{-1}\right)$

A. 1572 nm

B. 1898 nm

C. 2278 nm

D. 2535 nm

Answer: C

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

A. second line of paschen series

B. second line of balmer serie

C. first line pfund series

D. second line of lyman series

Answer: B

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20. The balmer series for the H-atom can be ob-served

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 light emitted due to transitions between excited states and the first excited state

C. in any transition in a H-atom

D. none of these

Answer: B

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21. when an atomic gas or vapour is excited at low pressure, by passing an electric current through it then

A. emission spectrum is observed

B. absorption spectrum is observed

C. band spectrum is observed

D. both a and c

Answer: A

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22. In balmer series of emission spectrum of hydrogen, first four lines with different wavelength H_α, H_β, H_γ and H_δ are obtained. Which line has maximum frequency out of these ?

A. 1. H_α

B. 2. H_β

C. 3. H_γ

D. 4. H_δ

Answer: D

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23. hydrogen atom emits light when it changes from $n=5$ energy level to $n=2$ energy level. Which colour of light would the atom emit ?

A. red

B. yellow

C. green

D. voilet.

Answer: D

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24. the wavelength of the first line of lyman series is 1215Å, the wavelength of first line of balmer series will be

A. 4545Å

B. 5295Å

C. 6561Å

D. 6750Å

Answer: C

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25. the wavelength of radiation emitted is λ_0 when an electron jumps. From the third to second orbit of hydrogen atom. For the electron jumping from the fourth to the second orbit of the hydrogen atom, the wavelength of radiation emitted will be

A. $(16/25)\lambda_0$

B. $(20/27)\lambda_0$

C. $(27/20)\lambda_0$

D. $(25/16)\lambda_0$

Answer: B

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26. 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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27. According to bohr's theory, the wave number of last line of balmer series is $(R = 1.1 \times 10^7 m^{-1})$

A. $5.5 \times 10^5 m^{-1}$

B. $4.4 \times 10^7 m^{-1}$

C. $2.75 \times 10^6 m^{-1}$

D. $2.75 \times 10^8 m^{-1}$

Answer: C

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28. The first line of the lyman series in a hydrogen spectrum has a wavelength of 1210 Å. The corresponding line of a hydrogen like atom of $Z = 11$ is equal to

A. 4000Å

B. 100Å

C. 40Å

D. 10Å

Answer: D

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29. What is the ratio of the shortest wavelength of the balmer to the shoretst of the lyman series ?

A. $4:1$

B. $4:3$

C. $4:9$

D. $5:9$

Answer: A

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30. If the wavelength of the first line of the Balmer series of hydrogen is 6561Å, the wavelngth of the second line of the series should be

A. 13122Å

B. 3280Å

C. 4860Å

D. 2187Å

Answer: C

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Emission series		Make transitions from higher levels to following levels	
A	Lyman series	P	$n = 1$
B	Paschen series	Q	$n = 2$
C	Balmer series	R	$n = 3$
D	Brackett series	S	$n = 4$
		T	$n = 5$

31.

A. A-P,B-R,C-Q,D-S

B. A-P,B-Q,C-R,D-T

C. A-Q,B-R,C-S,D-T

D. A-T,B-S,C-R,D-Q

Answer: A

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32. If v_1 is the frequency of the series limit of lyman seies, v_2 is the freqency of the first line of lyman series and v_3 is the fequecny of the series limit of the balmer series, then

A. $v_1 - v_2 = v_3$

B. $v_1 = v_2 - v_3$

C. $\frac{1}{v_2} = \frac{1}{v_1} + \frac{1}{v_3}$

D. $\frac{1}{v_1} = \frac{1}{v_2} + \frac{1}{v_3}$

Answer: A

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33. which of the following postulates of the Bohr model led to the quantization of energy of the hydrogen atom ?

A. the electron goes around the nucleus in circular orbits.

B. the angular momentum of the electron can only be an intergral multiple of $h / 2\pi$.

C. the magnitude of the linear momentum of the electron is qunatized.

D. Quantization of energy is itself a postulate of the bohr model.

Answer: B

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34. The Bohr model of atoms

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

B. uses Einstein's photoelectirc equation.

C. predicts continous emission spectra for atoms.

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

Answer: A

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

A. directly proportional to n

B. inversely proportional to $\sqrt{n}$

C. inversely proportional to n^2

D. inversely proportional to n^3

Answer: D

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36. The electric current I created by the electron in the ground state of H atom bohr model in terms of bohr radius (a_0) and velocity of electron in first orbit v_0 is

A. $\dfrac{ev_0}{2\pi a_0}$

B. $\dfrac{2\pi a}{ev_0}$

C. $\dfrac{2\pi a}{v_0}$

D. $\frac{v_0}{2\pi a}$

Answer: A

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37. Total energy of electron in nth stationary orbit of hydrogen atom 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: C

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38. According to Bohr's theory the moment of momentum of an electron revolving in second orbit of hydrogen atom will be

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

B. $2\pi h$

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

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

Answer: A

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39. According to second postulate of bohr model, the agnular momentum (L_n) of n^{th} possible orbit of hydrogen atom is given by

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

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

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

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

Answer: B

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40. Which of the following statements is true of hydrogen atom ?

A. Angualr moment $\propto \frac{1}{n}$

B. Linear moment $\propto \frac{1}{n}$

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

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

Answer: B

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41. Total energy of electron in nth stationary orbit of hydrogen atom is

A. $\frac{-13.6}{n}eV$

B. $\frac{-13.6}{n^2}eV$

C. $\frac{-136}{n}eV$

D. $\frac{-136}{n^2}eV$

Answer: B

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42. The radius of n^th orbit r_n in the terms of Bohr radius (a_0) for a hydrogen atom is given by the relation

A. na_0

B. $\sqrt{na_0}$

C. n^2a_0

D. n^3a_0

Answer: C

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43. In Bohr model of the hydrogen atom, the lowest orbit corresponds to

A. infinite energy

B. maximum energy

C. minimum energy

D. zero energy

Answer: C

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44. Define ionisation energy. What is the value for a hydrogen atom?

A. $3.4eV$

B. $10.4eV$

C. $12.09eV$

D. $13.6eV$

Answer: D

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45. energy is absorbed in the hydrogen atom giving absorption spectra when transition takes place from

A. $n = 1 \to n$'where ' n' > 1

B. $n = 2 \to 1$

C. $n' \to n$

D. $n \to n$' $= \propto$

Answer: A

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46. If n is the orbit number of the electron in a hydrogen atom, the correct statement among the following is

A. electron energy increases as n increases.

B. hydrogen emits infrared rays for the electron tranition from $n = \propto$ to $n = 1$.

C. electron energy is zero for $n = 1$.

D. electron energy varies as n^2.

Answer: A

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

A. 1. An electron in an atom could revolve in certain stable orbits without the emission of radiant energy.

B. 2. Electron revolves around the nulceus only in those orbits for which angular momentum $L_n = \frac{nh}{2\pi}$.

C. 3. when electron make a transition from one of its stable orbit to lower orbit then a photon emitted with energy $h\upsilon = E_f - E_i$.

D. 4. Bohr model is applicable to all atoms.

Answer: D

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48. In which of the following systems will 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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49. 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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50. Let $E=\frac{-1me^4}{8\varepsilon_0^2 n^2 h^2}$ be the energy of the n^{th} level of H-atom 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. all atoms will make a transition to the $n = 3$ state

Answer: B

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51. 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. the electron would not move in circular orbits

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

C. the molecule will soon decay in to a proton and a H-atom

D. none of these

Answer: A

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52. 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 of 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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53. 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. millikan

C. joule

D. franck and hertz

Answer: D

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54. Suppose an electron is attracted toward 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. $T_n \propto \frac{1}{n^2}$

B. T_n is independent of n, $r_n \propto n$

C. $T_n \propto \frac{1}{n}$ and r_n

D. $T_n \propto \frac{1}{n}$ and $r_n \propto n^2$

Answer: B

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55. 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. VR

B. RE

C. R/E

D. none of these

Answer: A

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56. suppose an electron is attracted towards the origin by a force k/r, where k is a constant and r is the distance of the electron form the origin. By applying bohr model to this system, the radius of n^{th} orbit of the electron is found to be r_n and

A. E

B. 2E

C. 3E

D. 4E

Answer: D

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57. Which of the transitions in hydrogen atom emits a photon of lowest frequecny $(n =$ quantum number)?

A. $n = 2$ to $n = 1$

B. $n = 4$ to $n = 2$

C. $n = 4$ to $n = 1$

D. $n = 4$ to $n = 3$

Answer: D

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58. The transition form the state $n = 3$ to $n = 1$ in a hydrogen-like atom results in ultraviolet radiation. Infared radiation will be obtained in the transition from

A. $2 \rightarrow 1$

B. $3 \rightarrow 2$

C. $4 \rightarrow 2$

D. $4 \rightarrow 3$

Answer: D

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59. If $13.6eV$ energy is required to separate a hydrogen atom into a proton and an electron, then the orbital radius of electron in a hydrogen atom is

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

B. $4.3 \times 10^{-11}m$

C. $6.3 \times 10^{-11}m$

D. $7.3 \times 10^{-11}m$

Answer: A

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60. In the question number 59, the value of velocity of the revolving electron is (radius r is $5.3 \times 10^{-11} m)$

A. $1.2 \times 10^{6} ms^{-1}$

B. $2.2 \times 10^{6} ms^{-1}$

C. $3.2 \times 10^{6} ms^{-1}$

D. $4.2 \times 10^{6} ms^{-1}$

Answer: B

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61. A $10kg$ satellite circles earth once every $2hr$ in an orbit having a radius of $8000km$. 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^{40}

B. 5.3×10^{45}

C. 7.8×10^{48}

D. 7.8×10^{50}

Answer: B

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62. if an electron is revolving in its bohr orbit having bohr radius of 0.529Å, then the radius of third orbit is

A. 4234Å

B. 4496Å

C. 4.761Å

D. $5125nm$

Answer: C

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

A. $8.5eV$

B. $10.2eV$

C. $12.7 eV$

D. $13.6 eV$

Answer: B

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64. in the question number 63, the frequency of emitted photon due to the given transition is

$\left(h = 6.64 \times 10^{-34} Js, 1 eV = 1.6 \times 10^{-19} J\right)$

A. $2.46 \times 10^{10} Hz$

B. $2.46 \times 10^{12} Hz$

C. $2.46 \times 10^{15} Hz$

D. $2.46 \times 10^{18} Hz$

Answer: C

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65. Which state of the triply ionized Beryllium (Be^{3+}) has the same orbit radius as that of the ground state of hydrogen atom?

A. $n = 1$

B. $n = 2$

C. $n = 3$

D. $n = 4$

Answer: B

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66. A difference of 2.3 eV separates two energy levels in an atom. What is the frequency of radiation emitted when the atom transits form the upper level to the lower level.

A. $5.5 \times 10^{13} Hz$

B. $5.5 \times 10^{14} Hz$

C. $5.5 \times 10^{18} Hz$

D. $5.5 \times 10^{19} Hz$

Answer: B

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67. The ground state energy of hydrogen atom is -13.6eV. What is the K.E. of electron in this state?

A. $2.18 \times 10^{-14} J$

B. $2.18 \times 10^{-16} J$

C. $2.18 \times 10^{-18} J$

D. $2.18 \times 10^{-19} J$

Answer: C

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68. In the ground state energy of hydrogen atom is -13.6, find the potential energy of electron (in joule) in the given state.

A. $-4.36 \times 10^{-14} J$

B. $-4.36 \times 10^{-16} J$

C. $-4.36 \times 10^{-17} J$

D. $-4.36 \times 10^{-18} J$

Answer: D

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69. If the radius of inner most electronic orbit of a hydrogen atom is 5.3×10^{-11} m, then the radii of $n = 2$ orbit is

A. 1.12Å

B. 2.12Å

C. 3.22Å

D. 4.54Å

Answer: B

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70. 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. 790Å

B. 870Å

C. 970Å

D. 1070Å

Answer: C

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71. If $\lambda = 9.7 \times 10^{-8} m$, what is frequency of photon ?

A. $3.1 \times 10^{15} Hz$

B. $3.1 \times 10^{18} Hz$

C. $9.1 \times 10^{15} Hz$

D. $9.1 \times 10^{18} Hz$

Answer: A

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72. The radius of electron orbit and the speed of electron in the ground state of hydrogen atom is $5.30 \times 10^{-11} m$ and $22 \times 10^{6} ms^{-1}$ respectively, then the orbital period of this electron in second excited state will be

A. $1.21 \times 10^{-14} s$

B. $1.21 \times 10^{-12} s$

C. $1.21 \times 10^{-10} s$

D. $1.21 \times 10^{-15} s$

Answer: D

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73. In accordance with the Bohr's model, find the quantum number that characterizes the earth's revolution around the sun in an orbit of radius $1.5 \times 10^{11} m$ with orbital speed $3 \times 10^4 m/s$. (Mass of earth=$6.0 \times 10^{24} kg$)

A. 5.98×10^{86}

B. 2.57×10^{38}

C. 8.57×10^{64}

D. 2.57×10^{74}

Answer: D

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74. if speed of electron is ground state energy level is $2.2 \times 10^6 ms^{-1}$, then its speed in fourth excited state will be

A. $6.8 \times 10^6 ms^{-1}$

B. $8.8 \times 10^5 ms^{-1}$

C. $5.5 \times 10^5 ms^{-1}$

D. $5.5 \times 10^6 ms^{-1}$

Answer: C

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75. if muonic hydrogen atom is an atom in which a negatively charged muon (μ) of mass about $207m_e$ revolves around a proton, then first bohr radius of this atom is $(r_e = 0.53 \times 10^{-10} m)$

A. $2.56 \times 10^{-10} m$

B. $2.56 \times 10^{-11} m$

C. $2.56 \times 10^{-12} m$

D. $2.56 \times 10^{-13} m$

Answer: D

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76. In the question number 75, if ground state energy of electron is $-13.6 eV$ then what is the ground state energy of muonic hydrogen atom?

A. $1.8keV$

B. $-2.8keV$

C. $-3.8keV$

D. $4.8keV$

Answer: B

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77. An electron is revolving in the n^{th} orbit of radius 4.2Å, then the value of n is $(r1 = 0.529\text{Å})$

A. 4

B. 5

C. 6

D. 3

Answer: D

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

A. $3.4 eV$

B. $-5.2 eV$

C. $-6.8 eV$

D. $-10.2 eV$

Answer: C

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79. The minimum energy that must be given to a H atom in ground state so that it can emit an H, line in balmer series is

A. $12.4eV$

B. $10.2eV$

C. $13.06eV$

D. $13.6eV$

Answer: C

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80. In the question number 79, what would be the angular momentum of H_γ photon if the angular momentum of the system is conserved

A. ħ

B. 2ħ

C. 3ħ

D. 4ħ

Answer: C

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81. Energy E of a hydrogen atom with principle quantum number n is given 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. $1.5 eV$

B. $0.85 eV$

C. $3.4 eV$

D. $1.9eV$

Answer: D

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82. 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. 0.65eV

B. 1.9eV

C. 11.1eV

D. 13.6eV

Answer: C

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83. The ratio of the speed of the electrons in the ground state of hydrogen to the speed of light in vacuum is

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

B. $\frac{2}{237}$

C. $\frac{1}{137}$

D. $\frac{1}{237}$

Answer: C

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84. In an excited state of hydrogen like atom an electron has total energy of $-3.4eV$. If the kinetic energy of the electron is E and its de-Broglie wavelength is λ, then

A. $E = 6.8 eV, \lambda = 6.6 \times 10^{-10} m$

B. $E = 3.4 eV, \lambda = 6.6 \times 10^{-10} m$

C. $E = 3.4 eV, \lambda = 6.6 \times 10^{-11} m$

D. $E = 6.8 eV, \lambda = 6.6 \times 10^{-11} m$

Answer: B

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85. The binding energy of the electron in the ground state of He atom is equal to $E_0 = 24.6eV$. Find the energy required to remove both the electrons from the atom.

A. 49.2eV

B. 54.4eV

C. 79eV

D. 108.8eV

Answer: C

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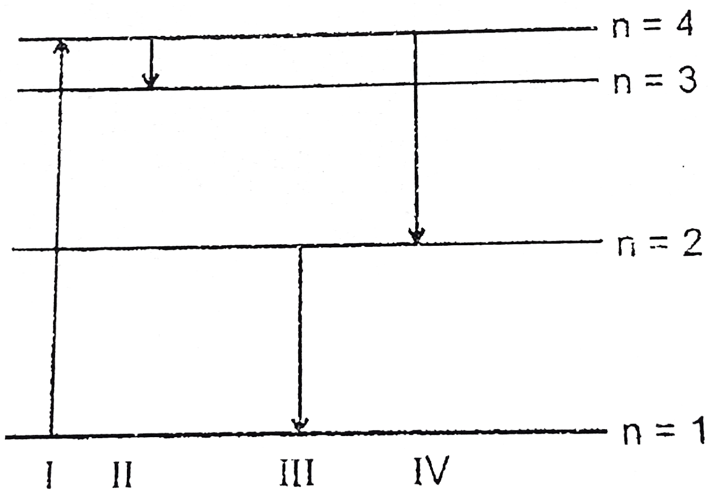
86. The diagram shows the energy levels for an electron in a certain atom. Which transition shown represents the emission of photon with the most enegy ?



A. I

B. II

C. III

D. IV

Answer: C

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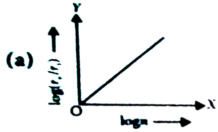
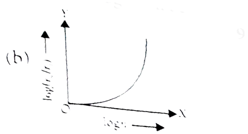
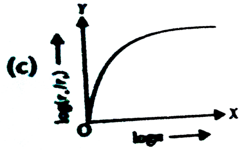
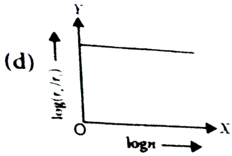
87. In a hydrogen atom, the radius of n^{th} bohr orbit is r_n. The graph between log (r_n / r_1) and logn will be

A. 

B. 

C. 

D. 

Answer: A

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88. 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. $\dfrac{eh}{4\pi m}$

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

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

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

Answer: A

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89. The electron in hydrogen atom makes a transition $n_1 \to n_2$ where n_1 and n_2 are the principal quantum number of two states. Assuming 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 value of n_1 and n_2 are:

A. $n_1 = 4, n_2 = 2$

B. $n_1 = 8, n_2 = 2$

C. $n_1 = 8, n_2 = 1$

D. $n_1 = 6, n_2 = 2$

Answer: A

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90. the ionization energy of Li ^(++)` is equal to

A. 9hcR

B. 6 hcR

C. 2hcR

D. hcR

Answer: A

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91. A hydrogen atom and a Li^{2+} ion are both in the second excited state. If l_H and l_{Li} are their respective electronic angular momenta, and E_H and E_{Li} their respective energies, then

(a) $l_H > l_{Li}$ and $|E_H| > |E_{Li}|$

(b) $l_H = l_{Li}$ and $|E_H| < |E_{Li}|$

(C) $l_H = l_{Li}$ and $|E_H| > |E_{Li}|$

(d) $l_H < l_{Li}$ and $|E_H| < |E_{Li}|$

A. $l_H > l_{Li}$ and $|E_H| > |E_{Li}|$

B. $l_H = l_{Li}$ and $|E_H| > |E_{Li}|$

C. $l_H = l_{Li}$ and $|E_H| < |E_{Li}|$

D. $l_H < l_{Li}$ and $|E_H| < |E_{Li}|$

Answer: C

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92. 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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93. the wavelength of spectral line in the lyman series of a H-atom is 1028Å. If instead of hydrogen, we consider deuterium then shift in the wavelength of this line be $(m_p = 1860m_e)$

A. 1027.7Å

B. 1036Å

C. 1028Å

D. 1021Å

Answer: A

Watch Video Solution

94. The rydberg formula, for the spectrum of the hydorgen aotm where all terms have their usual menaning is

A. $h\upsilon_{\text{if}} = \frac{me^4}{8\varepsilon_0^2 h^2}\left(\frac{1}{n_f} - \frac{1}{n_i}\right)$

B. $h\upsilon_{\text{if}} = \frac{me^4}{8\varepsilon_0^2 h^2}\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$

C. $h\upsilon_{\text{if}} = \frac{8\varepsilon_0^2 h^2}{me^4}\left(\frac{1}{n_f} - \frac{1}{n_i}\right)$

D. $h\upsilon_{\text{if}} = \frac{8\varepsilon_0^2 h^2}{me^4}\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$

Answer: B

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95. Hydrogen atom from excited state comes to the ground state by emitting a photon of wavelength λ. If R is the Rydberg constant, then the principal quatum number n of the excited state is

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

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

C. $\sqrt{\frac{\lambda R^2}{\lambda R - 1}}$

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

Answer: A

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

A. one

B. two

C. three

D. four

Answer: C

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97. the excitation energy of lyman last lines is

A. the same as ionisation energy

B. the same as the last absorption line in lyman series

C. both (a) and (b)

D. different from (a) and (b)

Answer: C

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98. the number of de broglie wavelength contained in the second bohr orbit of hydrogen atom is

A. 1

B. 2

C. 3

D. 4

Answer: B

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99. if three are N atoms in a source of laser light and each atom is emitting light with intensity I, then the total intensity produced by it is

A. NI

B. N^2I

C. N^3I

D. $N^4 I$

Answer: B

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100. What does the word LASER stand for ?

A. Light amplification by stimulated emission of radiation

B. light amplitude by stimulated emission of radiation

C. light amplification by strong emission of radiation

D. light amplification by stimulated emission of radiowave

Answer: A

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Higher Order Thinking Skills

1. Deutrium was discovered in 1932 by Harold Urey by measuring the small change in wavelength for a particular transition in $.^1 H$ and $.^2 H$. 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 μ, 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 $.^1 H$ and $.^2 H$. (mass of $.^1 H$ nucleus is 1.6725×10^{-27} kg, mass of $.^2 H$ nucleus is 3.3374×10^{-27} kg, Mass of electron $= 9.109 \times 10^{-31} kg.$)

A. $2.7 \times 10^{-1}\%$.

B. $2.7 \times 10^{-2}\%$.

C. $3.5 \times 10^{-2}\%$.

D. $3.5 \times 10^{-1}\%$.

Answer: B

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2. The inverse sequare law in electrostatic is $|F| = \frac{e^2}{(4\pi\varepsilon_0)r^2}$ for the force between an electron and a proton. The $\left(\frac{1}{r}\right)$ dependence of $|F|$ can be understood in quantum theo ry as being due to the fact that the particle of light (photon) is massless. If photons had a mass m_p, force would be modified to

$$|F| = \frac{e^2}{(4\pi\varepsilon_0)\pi^2}\left[\frac{1}{r^2}+\frac{\lambda}{r}\right] .\exp(-\lambda r)$$

where $\lambda = \frac{m_p c}{h}$ and $h = \frac{h}{2\pi}$. Estimate the change in the gound state energy of a H-atom if m_p were 10^{-6} times the mass of the electron.

A. $18.6\lambda r_B$

B. -27.2

C. $27.2\lambda r_B$

D. $-\lambda r_b$

Answer: C

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3. The Bohr model for the H-atom relies on the Coulomb's law of electrostatics . Coulomb's law has not directly been varified for very short distances of the order of angstroms. Suppos-ing Coulomb's law between two oppsite charge $+q_1, -q_2$ is modified to

$$\left|\overrightarrow{F}\right| = \frac{q_1 q_2}{(4\pi\varepsilon_0)r^2}\frac{1}{r^2}, r \geq R_0$$

$$= \frac{q_1 q_2}{(4\pi\varepsilon_0)r^2}\frac{1}{R_0^2}\left(\frac{R_0}{r}\right)^{\varepsilon}, r \leq R_0$$

Calculate in such a case , the ground state enenergy of H-atom , if $\varepsilon = 0.1, R_0 = 1\text{Å}$

A. -11.4

B. -17.3

C. 5.9

D. -23.2

Answer: A

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4. In the Auger process as 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 .

A. 4.6

B. 7.5

C. 5.38

D. 3.36

Answer: C

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5. If a proton had a radius R and the charge was uniformly distributed, the ground state energy (in eV) of a H -atom for $R = 0.1 \text{Å}$ is

A. -13.6

B. -27.2

C. -3.4

D. -30.8

Answer: A

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6. The ground state energy of an atom is $-13.6eV$. The photon emitted during the transition of electron from $n = 3$ to $n = 1$ state, is incidenet on a photosensitive material of unknown work function. The photoelectrons are emitted from the materials with a maximum kinetic energy of 9 eV. the threshold wavelength of the material used is

A. $0.9 \times 10^{-7} m$

B. $4 \times 10^{-7} m$

C. $0.47 \times 10^{-7} m$

D. $9 \times 10^{-7} m$

Answer: A

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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, the scattering angle for $b = 0$ is

A. 180°

B. 90°

C. 45°

D. 120°

Answer: A

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8. The impact parameter at which the scattering angle is $90^0, z = 79$ and initial energy $10MeV$ is

A. 1.137*10^-14

B. 1.137*10^-16

C. 2.24*10^-17

D. zero

Answer: C

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Ncert Examplar Problems

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

A. 53pm

B. 27pm

C. 18pm

D. 13pm

Answer: C

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2. The binding to energy of a H-atom, considering and electron moving around a fixed nuclei (proton) , is

$$B = -\frac{me^4}{8n^2\varepsilon_0^2 h^2} \text{ (m=electron mass)}$$

In one decides to work in a frame of reference where the electon is at rest, teh 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)

The last expression is not, correct, because

A. n 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 ap-plied to calculate the energy level of an 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 an 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 H-atom has an angular momentum $= h,$ according to the simple Bohr model. Angular momentum is a vector ans hence there will be infinitely many orbits with the vector pointing in all possible direction . In actuality, this is not true.

A. a) because bohr model gives incorrect values of angular momentum .

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

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

D. d) because electrons go around only in horizontal orbits

Answer: A

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5. O_2molecules consists of two oxygen atoms. In the molecules , 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 has 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. 10.2eV

B. 20.4eV

C. 13.6eV

D. 27.2eV

Answer: A

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7. A set of atom 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 togather simultaneously into a lower state

D. to emit photons only when they collide

Answer: A

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Assertion Reason Corner

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

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

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

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

assertion.

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: B

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2. (A) atom as a whole is electrically neutral.

(R)atom contains equal amount of positive and negative charges.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: A

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3. (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. if both assertion and reason are true and reason is the correct explanation of assertion.

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: C

Watch Video Solution

4. (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. if both assertion and reason are true and reason is the correct explanation of assertion.

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

assertion.

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: B

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5. (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. if both assertion and reason are true and reason is the correct explanation of assertion.

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: C

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6. (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. if both assertion and reason are true and reason is the correct explanation of assertion.

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: B

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

(R)gold is a ductile material.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: B

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

(R) energy can have positive or negative values.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: B

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9. Statement -1 : Large angle scattering of alpha particles led to the discovery of atomic nucleus.

Statement -2 : Entire positive charge of atom is concentrated in the central core.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: A

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10. Assertion: For the scattering of α-particles at a large angles, only the nucleus of the atom is responsible.

Reason: Nucleus is very heavy in comparison to electrons.

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

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

assertion.

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: A

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11. Assertion: Hydrogen atom consists of anly one electron but its emission spectrum has may lines.

Reason: Only Lyman series is found in the absorption spectrum of hydrogen atom whereas in the emission spectrum, all the series are found.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: B

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12. (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. if both assertion and reason are true and reason is the correct explanation of assertion.

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: A

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13. Assertion: Bohr had to postulate that the electrons in stationary orbits around the nucleus do not radiate.

Reason: According to classical physical all moving electrons radiate.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: C

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14. (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. if both assertion and reason are true and reason is the correct explanation of assertion.

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: D

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15. Assertion: Electrons in the atom are held due to coulomb forces.

Reason: The atom is stable only because the centripetal force due to Coulomb's law is balanced by the centrifugal force.

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

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

assertion.

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: C

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Alpha Particle Scattering And Rutherford Model

1. The first model of atom in 1998 was proposed by

A. Ernst Ruterford

B. Albort einstein

C. j.j thomson

D. neiels bohr

Answer: C

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2. In geiger-marsden scattering experiment , the trajectory traced by α- particle depends on

A. number of collision

B. number of scattered α-particles

C. impact parameter

D. none of these

Answer: C

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3. 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

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4. 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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Watch Video Solution

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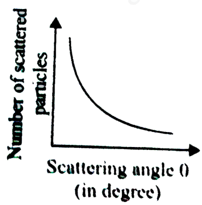
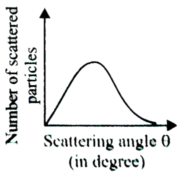
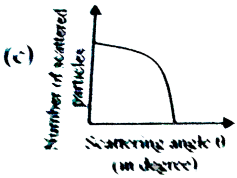
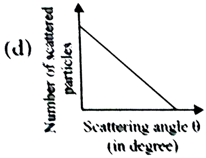
6. The graph of the total number of α-particles scattered at different angles in a given interval of time for α- particles scattering in the geiger- marsden experiment is given by

A. (a) 

B. (b) 

C. 

D. 

Answer: A

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

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

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

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

D. 10^{-15m} to $10^{-12}m$

Answer: C

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8. In an atom the ratio of radius of orbit of electron to the radius of nucleus is

A. 10^{3}

B. 10^4

C. 10^5

D. 10^6

Answer: C

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9. The relation between the orbit radius and the electron velocity for a dynamically stable orbit in a hydrogen atom is (where, all notations have their usual meanings)

A. $v=\sqrt{\frac{4\pi\varepsilon_0}{me^2r}}$

B. $r=\sqrt{\frac{e^2}{4\pi\varepsilon_0 v}}$

C. $v=\sqrt{\frac{e^2}{4\pi\varepsilon_0 mr}}$

D. $r=\sqrt{\frac{ve^2}{4\pi\varepsilon_0 m}}$

Answer: C

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10. The relationship between kinetic energy (K) and potential energy (U) of electron moving in a orbit around the nucleus is

A. $U = -K$

B. $U = -2K$

C. $U = -3K$

D. $U = -\frac{1}{2}K$

Answer: B

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

A. 10^{1}

B. 10^{5}

C. 10^{10}

D. 10^{15}

Answer: D

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12. Consider aimimg a beam of free electrons to wards free atoms . When they scatter, an electron and a protons cannot combine be produced a H-atom,

A. energy conservation

B. simultaneously releasing energy in the from of radiation

C. momentum conservation

D. angular momentum conservation

Answer: A

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13. In an experiment on α- particle scattering, α-particles are directed towards a gold foil and detectors are placed in postition P,Q and R . What is the distribution of α-paritcles as recored at P,Q and R?

A. $\begin{array}{ccc} P & Q & R \\ \text{all} & \text{none} & \text{none} \end{array}$

B. $\begin{matrix} P & Q & R \\ \text{none} & \text{none} & \text{all} \end{matrix}$

C. $\begin{matrix} P & Q & R \\ \text{a few} & \text{some} & \text{most} \end{matrix}$

D. $\begin{matrix} P & Q & R \\ \text{most} & \text{some} & \text{a few} \end{matrix}$

Answer: C

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Atomic Spectra

1. The first spectral series was discovered by

A. balmer

B. lyman

C. paschen

D. Pfund

Answer: A

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2. Which of the following spectral series falls within the visible range of electromagnetic radiation ?

A. Lyman series

B. Balmer series

C. Paschen series

D. Pfund series

Answer: B

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

A. 720 nm

B. 790 nm

C. 800 nm

D. 820 nm

Answer: D

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4. The shortest wavelength in the balmer series is $\left(R = 1.097 \times 10^7 m^{-1}\right)$

A. 200 nm

B. 256.8 nm

C. 300 nm

D. 364.6 nm

Answer: D

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5. the wavelength limit present in the pfund series is $\left(R = 1.097 \times 10^7 m^{-1}\right)$

A. 1572 nm

B. 1898 nm

C. 2278 nm

D. 2535 nm

Answer: C

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

A. second line of paschen series

B. second line of balmer serie

C. first line pfund series

D. second line of lyman series

Answer: B

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7. 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 light emitted due to transitions between excited states and the first excited state

C. in any transition in a H-atom

D. none of these

Answer: B

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8. when an atomic gas or vapour is excited at low pressure, by passing an electric current through it then

A. emission spectrum is observed

B. absorption spectrum is observed

C. band spectrum is observed

D. both a and c

Answer: A

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9. In balmer series of emission spectrum of hydrogen, first four lines with different wavelength H_{α}, H_{β}, H_{γ} and H_{δ} are obtained. Which line has maximum frequency out of these ?

A. 1. H_{α}

B. 2. H_{β}

C. 3. H_{γ}

D. 4. H_{δ}

Answer: D

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10. hydrogen atom emits light when it changes from $n = 5$ energy level to $n = 2$ energy level. Which colour of light would the atom emit ?

A. red

B. yellow

C. green

D. voilet.

Answer: D

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11. the wavelength of the first line of lyman series is 1215Å, the wavelength of first line of balmer series will be

A. 4545Å

B. 5295Å

C. 6561Å

D. 6750Å

Answer: C

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12. the wavelength of radiation emitted is λ_0 when an electron jumps. From the third to second orbit of hydrogen atom. For the electron jumping from the fourth to the second orbit of the hydrogen atom, the wavelength of radiation emitted will be

A. $(16/25)\lambda_0$

B. $(20/27)\lambda_0$

C. $(27/20)\lambda_0$

D. $(25/16)\lambda_0$

Answer: B

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13. 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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14. According to bohr's theory, the wave number of last line of balmer series is $(R = 1.1 \times 10^7 m^{-1})$

A. $5.5 \times 10^5 m^{-1}$

B. $4.4 \times 10^7 m^{-1}$

C. $2.75 \times 10^6 m^{-1}$

D. $2.75 \times 10^8 m^{-1}$

Answer: C

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15. The first line of the lyman series in a hydrogen spectrum has a wavelength of 1210 Å. The corresponding line of a hydrogen like atom of $Z = 11$ is equal to

A. 4000Å

B. 100Å

C. 40Å

D. 10Å

Answer: D

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16. What is the ratio of the shortest wavelength of the balmer to the shoretst of the lyman series ?

A. $4:1$

B. $4:3$

C. $4:9$

D. $5:9$

Answer: A

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17. If the wavelength of the first line of the Balmer series of hydrogen is 6561Å, the wavelngth of the second line of the series should be

A. 13122Å

B. 3280Å

C. 4860Å

D. 2187Å

Answer: C

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18.

Emission series		Make transitions from higher levels to following levels	
A	Lyman series	P	$n = 1$
B	Paschen series	Q	$n = 2$
C	Balmer series	R	$n = 3$
D	Brackett series	S	$n = 4$
		T	$n = 5$

A. A-P,B-R,C-Q,D-S

B. A-P,B-Q,C-R,D-T

C. A-Q,B-R,C-S,D-T

D. A-T,B-S,C-R,D-Q

Answer: A

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19. If v_1 is the frequency of the series limit of lyman seies, v_2 is the freqency of the first line of lyman series and v_3 is the fequecny of the series limit of the balmer series, then

A. $v_1 - v_2 = v_3$

B. $v_1 = v_2 - v_3$

C. $\dfrac{1}{v_2} = \dfrac{1}{v_1} + \dfrac{1}{v_3}$

D. $\dfrac{1}{v_1} = \dfrac{1}{v_2} + \dfrac{1}{v_3}$

Answer: A

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Bohr Model Of Hydrogen Atom

1. which of the following postulates of the Bohr model led to the quantization of energy of the hydrogen atom ?

A. the electron goes around the nucleus in circular orbits.

B. the angular momentum of the electron can only be an intergral multiple of $h / 2\pi$.

C. the magnitude of the linear momentum of the electron is qunatized.

D. Quantization of energy is itself a postulate of the bohr model.

Answer: B

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2. The Bohr model of atoms

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

B. uses Einstein's photoelectirc equation.

C. predicts continous emission spectra for atoms.

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

Answer: A

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

A. directly proportional to n

B. inversely proportional to $\sqrt{n}$

C. inversely proportional to n^2

D. inversely proportional to n^3

Answer: D

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4. The electric current I created by the electron in the ground state of H atom bohr model in terms of bohr radius (a_0) and velocity of electron in first orbit v_0 is

A. $\frac{ev_0}{2\pi a_0}$

B. $\frac{2\pi a}{ev_0}$

C. $\frac{2\pi a}{v_0}$

D. $\frac{v_0}{2\pi a}$

Answer: A

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5. Total energy of electron in nth stationary orbit of hydrogen atom is

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

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

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

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

Answer: C

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6. According to Bohr's theory the moment of momentum of an electron revolving in second orbit of hydrogen atom will be

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

B. $2\pi h$

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

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

Answer: A

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7. According to second postulate of bohr model, the agnular momentum (L_n) of n^{th} possible orbit of hydrogen atom is given by

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

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

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

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

Answer: B

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8. Which of the following statements is true of hydrogen atom ?

A. Angualr moment $\propto \frac{1}{n}$

B. Linear moment $\propto \frac{1}{n}$

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

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

Answer: B

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9. Total energy of electron in nth stationary orbit of hydrogen atom is

A. $\frac{-13.6}{n}eV$

B. $\frac{-13.6}{n^2}eV$

C. $\frac{-136}{n}eV$

D. $\frac{-136}{n^2}eV$

Answer: B

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10. The radius of n^th orbit r_n in the terms of Bohr radius (a_0) for a hydrogen atom is given by the relation

A. na_0

B. $\sqrt{na_0}$

C. $n^2 a_0$

D. $n^3 a_0$

Answer: C

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11. In Bohr model of the hydrogen atom, the lowest orbit corresponds to

A. infinite energy

B. maximum energy

C. minimum energy

D. zero energy

Answer: C

Watch Video Solution

12. Define ionisation energy. What is the value for a hydrogen atom?

A. $3.4 eV$

B. $10.4 eV$

C. $12.09 eV$

D. $13.6 eV$

Answer: D

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13. energy is absorbed in the hydrogen atom giving absorption spectra when transition takes place from

A. $n = 1 \rightarrow n$'where ' n' > 1

B. $n = 2 \rightarrow 1$

C. $n' \rightarrow n$

D. $n \rightarrow n' = \propto$

Answer: A

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14. If n is the orbit number of the electron in a hydrogen atom, the correct statement among the following is

A. electron energy increases as n increases.

B. hydrogen emits infrared rays for the electron tranition from $n = \propto$ to $n = 1$.

C. electron energy is zero for $n = 1$.

D. electron energy varies as n^2.

Answer: A

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

A. 1. An electron in an atom could revolve in certain stable orbits without the emission of radiant energy.

B. 2. Electron revolves around the nulceus only in those orbits for which angular momentum $L_n = \frac{nh}{2\pi}$.

C. 3. when electron make a transition from one of its stable orbit to lower orbit then a photon emitted with energy $hv = E_f - E_i$.

D. 4. Bohr model is applicable to all atoms.

Answer: D

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16. In which of the following systems will 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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17. 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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18. Let $E = \frac{-1me^4}{8\varepsilon_0^2 n^2 h^2}$ be the energy of the n^{th} level of H-atom 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. all atoms will make a transition to the $n = 3$ state

Answer: B

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19. 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. the electron would not move in circular orbits

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

C. the molecule will soon decay in to a proton and a H-atom

D. none of these

Answer: A

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20. 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 of 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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21. 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. millikan

C. joule

D. franck and hertz

Answer: D

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22. Suppose an electron is attracted toward 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. $T_n \propto \frac{1}{n^2}$

B. T_n is independent of n, $r_n \propto n$

C. $T_n \propto \frac{1}{n}$ and r_n

D. $T_n \propto \frac{1}{n}$ and $r_n \propto n^2$

Answer: B

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23. 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. VR

B. RE

C. R/E

D. none of these

Answer: A

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24. suppose an electron is attracted towards the origin by a force k/r, where k is a constant and r is the distance of the electron form the origin. By applying bohr model to this system, the radius of n^{th} orbit of the electron is found to be r_n and

A. E

B. 2E

C. 3E

D. 4E

Answer: D

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25. Which of the transitions in hydrogen atom emits a photon of lowest frequecny $(n =$ quantum number)?

A. $n = 2$ to $n = 1$

B. $n = 4$ to $n = 2$

C. $n = 4$ to $n = 1$

D. $n = 4$ to $n = 3$

Answer: D

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26. The transition form the state $n = 3$ to $n = 1$ in a hydrogen-like atom results in ultraviolet radiation. Infared radiation will be obtained in the transition from

A. $2 \rightarrow 1$

B. $3 \rightarrow 2$

C. $4 \rightarrow 2$

D. $4 \rightarrow 3$

Answer: D

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27. If $13.6eV$ energy is required to separate a hydrogen atom into a proton and an electron, then the orbital radius of electron in a hydrogen atom is

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

B. $4.3 \times 10^{-11} m$

C. $6.3 \times 10^{-11} m$

D. $7.3 \times 10^{-11} m$

Answer: A

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28. In the question number 59, the value of velocity of the revolving electron is (radius r is $5.3 \times 10^{-11} m$)

A. $1.2 \times 10^{6} ms^{-1}$

B. $2.2 \times 10^{6} ms^{-1}$

C. $3.2 \times 10^{6} ms^{-1}$

D. $4.2 \times 10^{6} ms^{-1}$

Answer: B

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29. A $10kg$ satellite circles earth once every $2hr$ in an orbit having a radius of $8000km$. 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^{40}

B. 5.3×10^{45}

C. 7.8×10^{48}

D. 7.8×10^{50}

Answer: B

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30. if an electron is revolving in its bohr orbit having bohr radius of 0.529Å, then the radius of third orbit is

A. 4234Å

B. 4496Å

C. 4.761Å

D. $5125nm$

Answer: C

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

A. $8.5eV$

B. $10.2eV$

C. $12.7eV$

D. $13.6eV$

Answer: B

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32. in the question number 63, the frequency of emitted photon due to the given transition is

$(h = 6.64 \times 10^{-34} Js, 1eV = 1.6 \times 10^{-19} J)$

A. $2.46 \times 10^{10} Hz$

B. $2.46 \times 10^{12} Hz$

C. $2.46 \times 10^{15} Hz$

D. $2.46 \times 10^{18} Hz$

Answer: C

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33. Which state of the triply ionized Beryllium (Be^{3+}) has the same orbit radius as that of the ground state of hydrogen atom?

A. $n = 1$

B. $n = 2$

C. $n = 3$

D. $n = 4$

Answer: B

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34. A difference of 2.3 eV separates two energy levels in an atom. What is the frequency of radiation emitted when the atom transits form the upper level to the lower level.

A. $5.5 \times 10^{13} Hz$

B. $5.5 \times 10^{14} Hz$

C. $5.5 \times 10^{18} Hz$

D. $5.5 \times 10^{19} Hz$

Answer: B

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35. The ground state energy of hydrogen atom is -13.6eV. What is the K.E. of electron in this state?

A. $2.18 \times 10^{-14} J$

B. $2.18 \times 10^{-16} J$

C. $2.18 \times 10^{-18} J$

D. $2.18 \times 10^{-19} J$

Answer: C

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36. In the ground state energy of hydrogen atom is -13.6, find the potential energy of electron (in joule) in the given state.

A. $-4.36 \times 10^{-14} J$

B. $-4.36 \times 10^{-16} J$

C. $-4.36 \times 10^{-17} J$

D. $-4.36 \times 10^{-18} J$

Answer: D

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37. If the radius of inner most electronic orbit of a hydrogen atom is 5.3×10^{-11} m, then the radii of $n = 2$ orbit is

A. 1.12Å

B. 2.12Å

C. 3.22Å

D. 4.54Å

Answer: B

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38. 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. 790Å

B. 870Å

C. 970Å

D. 1070Å

Answer: C

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39. If $\lambda = 9.7 \times 10^{-8} m$, what is frequency of photon ?

A. $3.1 \times 10^{15} Hz$

B. $3.1 \times 10^{18} Hz$

C. $9.1 \times 10^{15} Hz$

D. $9.1 \times 10^{18} Hz$

Answer: A

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40. The radius of electron orbit and the speed of electron in the ground state of hydrogen atom is $5.30 \times 10^{-11} m$ and $22 \times 10^{6} ms^{-1}$ respectively, then the orbital period of this electron in second excited state will be

A. $1.21 \times 10^{-14} s$

B. $1.21 \times 10^{-12} s$

C. $1.21 \times 10^{-10} s$

D. $1.21 \times 10^{-15} s$

Answer: D

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41. In accordance with the Bohr's model, find the quantum number that characterizes the earth's revolution around the sun in an orbit of radius $1.5 \times 10^{11} m$ with orbital speed $3 \times 10^{4} m / s$. (Mass of earth=$6.0 \times 10^{24} kg$)

A. 5.98×10^{86}

B. 2.57×10^{38}

C. 8.57×10^{64}

D. 2.57×10^{74}

Answer: D

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42. if speed of electron is ground state energy level is $2.2 \times 10^6 ms^{-1}$, then its speed in fourth excited state will be

A. $6.8 \times 10^6 ms^{-1}$

B. $8.8 \times 10^5 ms^{-1}$

C. $5.5 \times 10^5 ms^{-1}$

D. $5.5 \times 10^6 ms^{-1}$

Answer: C

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43. if muonic hydrogen atom is an atom in which a negatively charged muon (μ) of mass about $207m_e$ revolves around a proton, then first bohr radius of this atom is $\left(r_e = 0.53 \times 10^{-10} m\right)$

A. $2.56 \times 10^{-10} m$

B. $2.56 \times 10^{-11} m$

C. $2.56 \times 10^{-12} m$

D. $2.56 \times 10^{-13} m$

Answer: D

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44. In the question number 75, if ground state energy of electron is $-13.6 eV$ then what is the ground state energy of muonic hydrogen atom?

A. $1.8keV$

B. $-2.8keV$

C. $-3.8keV$

D. $4.8keV$

Answer: B

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45. An electron is revolving in the n^{th} orbit of radius 4.2Å, then the value of n is $(r1 = 0.529\text{Å})$

A. 4

B. 5

C. 6

D. 3

Answer: D

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

A. $3.4eV$

B. $-5.2eV$

C. $-6.8eV$

D. $-10.2eV$

Answer: C

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47. The minimum energy that must be given to a H atom in ground state so that it can emit an H, line in balmer series is

A. $12.4eV$

B. $10.2eV$

C. $13.06eV$

D. $13.6eV$

Answer: C

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48. In the question number 79, what would be the angular momentum of H_γ photon if the angular momentum of the system is conserved

A. ħ

B. 2ħ

C. 3ħ

D. 4ħ

Answer: C

View Text Solution

49. Energy E of a hydrogen atom with principle quantum number n is given 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. $1.5 eV$

B. $0.85 eV$

C. $3.4 eV$

D. $1.9eV$

Answer: D

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50. 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. 0.65eV

B. 1.9eV

C. 11.1eV

D. 13.6eV

Answer: C

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51. The ratio of the speed of the electrons in the ground state of hydrogen to the speed of light in vacuum is

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

B. $\frac{2}{237}$

C. $\frac{1}{137}$

D. $\frac{1}{237}$

Answer: C

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52. In an excited state of hydrogen like atom an electron has total energy of $-3.4eV$. If the kinetic energy of the electron is E and its de-Broglie wavelength is λ, then

A. $E = 6.8 eV, \lambda = 6.6 \times 10^{-10} m$

B. $E = 3.4 eV, \lambda = 6.6 \times 10^{-10} m$

C. $E = 3.4 eV, \lambda = 6.6 \times 10^{-11} m$

D. $E = 6.8 eV, \lambda = 6.6 \times 10^{-11} m$

Answer: B

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53. The binding energy of the electron in the ground state of He atom is equal to $E_0 = 24.6eV$. Find the energy required to remove both the electrons from the atom.

A. 49.2eV

B. 54.4eV

C. 79eV

D. 108.8eV

Answer: C

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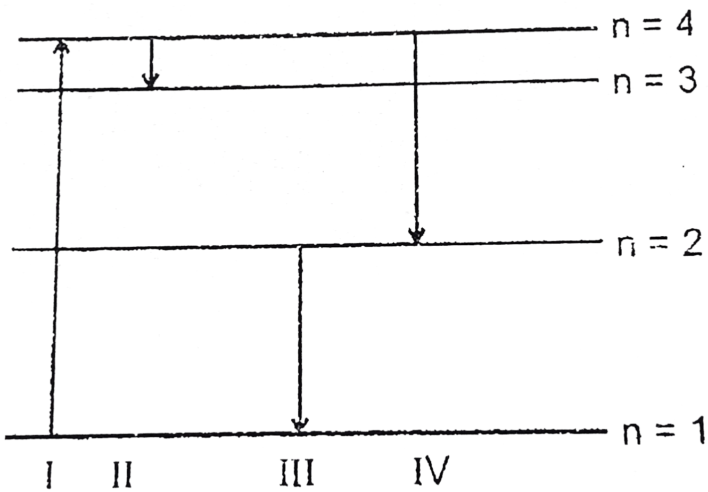
54. The diagram shows the energy levels for an electron in a certain atom. Which transition shown represents the emission of photon with the most enegy ?



A. I

B. II

C. III

D. IV

Answer: C

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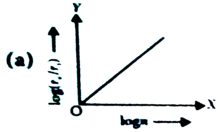
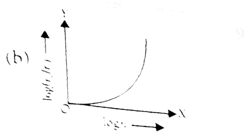
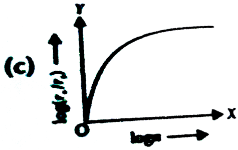
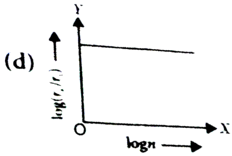
55. In a hydrogen atom, the radius of n^{th} bohr orbit is r_n. The graph between log (r_n / r_1) and logn will be

A. 

B. 

C. 

D. 

Answer: A

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

Answer: A

Watch Video Solution

57. The electron in hydrogen atom makes a transition $n_1 \rightarrow n_2$ where n_1 and n_2 are the principal quantum number of two states. Assuming 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 value of n_1 and n_2 are:

A. $n_1 = 4, n_2 = 2$

B. $n_1 = 8, n_2 = 2$

C. $n_1 = 8, n_2 = 1$

D. $n_1 = 6, n_2 = 2$

Answer: A

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58. the ionization energy of Li ^(++)` is equal to

A. 9hcR

B. 6 hcR

C. 2hcR

D. hcR

Answer: A

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59. A hydrogen atom and a Li^{2+} ion are both in the second excited state. If l_H and l_{Li} are their respective electronic angular momenta, and E_H and E_{Li} their respective energies, then

(a) $l_H > l_{Li}$ and $|E_H| > |E_{Li}|$

(b) $l_H = l_{Li}$ and $|E_H| < |E_{Li}|$

(C) $l_H = l_{Li}$ and $|E_H| > |E_{Li}|$

(d) $l_H < l_{Li}$ and $|E_H| < |E_{Li}|$

A. $l_H > l_{Li}$ and $|E_H| > |E_{Li}|$

B. $l_H = l_{Li}$ and $|E_H| > |E_{Li}|$

C. $l_H = l_{Li}$ and $|E_H| < |E_{Li}|$

D. $l_H < l_{Li}$ and $|E_H| < |E_{Li}|$

Answer: C

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The Line Spectra Of Hydrogen Atom

1. 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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2. the wavelength of spectral line in the lyman series of a H-atom is 1028Å. If instead of hydrogen, we consider deuterium then shift in the wavelength of this line be $(m_p = 1860 m_e)$

A. 1027.7Å

B. 1036Å

C. 1028Å

D. 1021Å

Answer: A

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3. The rydberg formula, for the spectrum of the hydorgen aotm where all terms have their usual menaning is

A. $h\upsilon_{\text{ if }}=\frac{me^4}{8\varepsilon_0^2h^2}\left(\frac{1}{n_f}-\frac{1}{n_i}\right)$

B. $h\upsilon_{\text{ if }}=\frac{me^4}{8\varepsilon_0^2h^2}\left(\frac{1}{n_f^2}-\frac{1}{n_i^2}\right)$

C. $h\upsilon_{\text{ if }}=\frac{8\varepsilon_0^2h^2}{me^4}\left(\frac{1}{n_f}-\frac{1}{n_i}\right)$

D. $h\upsilon_{\text{ if }}=\frac{8\varepsilon_0^2h^2}{me^4}\left(\frac{1}{n_f^2}-\frac{1}{n_i^2}\right)$

Answer: B

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4. Hydrogen atom from excited state comes to the ground state by emitting a photon of wavelength λ. If R is the Rydberg constant, then the principal quatum number n of the excited state is

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

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

C. $\sqrt{\frac{\lambda R^2}{\lambda R - 1}}$

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

Answer: A

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

A. one

B. two

C. three

D. four

Answer: C

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6. the excitation energy of lyman last lines is

A. the same as ionisation energy

B. the same as the last absorption line in lyman series

C. both (a) and (b)

D. different from (a) and (b)

Answer: C

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De Broglie Explanation Of Bohr Model

1. the number of de broglie wavelength contained in the second bohr orbit of hydrogen atom is

A. 1

B. 2

C. 3

D. 4

Answer: B

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2. if three are N atoms in a source of laser light and each atom is emitting light with intensity I, then the total intensity produced by it is

A. NI

B. N^2I

C. N^3I

D. N^4I

Answer: B

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3. What does the word LASER stand for ?

A. Light amplification by stimulated emission of radiation

B. light amplitude by stimulated emission of radiation

C. light amplification by strong emission of radiation

D. light amplification by stimulated emission of radiowave

Answer: A

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Ncert Exemplar

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

A. 53pm

B. 27pm

C. 18pm

D. 13pm

Answer: C

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2. The binding to energy of a H-atom, considering and electron moving around a fixed nuclei (proton) , is

$B = -\frac{me^4}{8n^2\varepsilon_0^2h^2}$ (m=electron mass)

In one decides to work in a frame of reference where the electon is at rest, teh 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)

The last expression is not, correct, because

A. n 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 ap-plied to calculate the energy level of an 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 an 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 H-atom has an angular momentum $= h$, according to the simple Bohr model. Angular momentum is a vector ans hence there will be infinitely many orbits with the vector pointing in all possible direction . In actuality, this is not true.

A. a) because bohr model gives incorrect values of angular momentum .

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

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

D. d) because electrons go around only in horizontal orbits

Answer: A

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5. O_2molecules consists of two oxygen atoms. In the molecules , 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 has 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. 10.2eV

B. 20.4eV

C. 13.6eV

D. 27.2eV

Answer: A

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7. A set of atom 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 togather simultaneously into a lower state

D. to emit photons only when they collide

Answer: A

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Assertion And Reason

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

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

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: B

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2. (A) atom as a whole is electrically neutral.

(R)atom contains equal amount of positive and negative charges.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: A

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3. (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. if both assertion and reason are true and reason is the correct explanation of assertion.

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: C

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4. (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. if both assertion and reason are true and reason is the correct explanation of

assertion.

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: B

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5. (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. if both assertion and reason are true and reason is the correct explanation of assertion.

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: C

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6. (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. if both assertion and reason are true and reason is the correct explanation of assertion.

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: B

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

(R)gold is a ductile material.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: B

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

(R) energy can have positive or negative values.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: B

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9. Statement -1 : Large angle scattering of alpha particles led to the discovery of atomic nucleus.

Statement -2 : Entire positive charge of atom is concentrated in the central core.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: A

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10. Assertion: For the scattering of α-particles at a large angles, only the nucleus of the atom is responsible.

Reason: Nucleus is very heavy in comparison to electrons.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: A

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11. Assertion: Hydrogen atom consists of anly one electron but its emission spectrum has may lines.

Reason: Only Lyman series is found in the absorption spectrum of hydrogen atom whereas in the emission spectrum, all the series are found.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: B

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12. (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. if both assertion and reason are true and reason is the correct explanation of assertion.

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

assertion.

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: A

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13. Assertion: Bohr had to postulate that the electrons in stationary orbits around the nucleus do not radiate.

Reason: According to classical physical all moving electrons radiate.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: C

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14. (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. if both assertion and reason are true and reason is the correct explanation of assertion.

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: D

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15. Assertion: Electrons in the atom are held due to coulomb forces.

Reason: The atom is stable only because the centripetal force due to Coulomb's law is balanced by the centrifugal force.

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

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

C. if assertion is true but reason is false.

D. if both assertion and reason are false.

Answer: C

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