PHYSICS

BOOKS - DC PANDEY PHYSICS (HINGLISH)

ATOMS

Example

1. 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°

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2. An alpha particle of energy $5MeV$ is scattered through 180° by a found uramiam nucleus . The distance of closest approach is of the order of

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3. Atomicn number of of silver metal is 47. calculate the speed at which a beam of protons has to be fired at a sheet of silver foil if the protons were able to approach to whithin 2.5×10^{-14} m of the silver nucleus?

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4. In Rutherford scattering experiment, what will b ethe correct angle for α scattering for an impact parameter $b = 0$?

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5. It is found experimentally that $13.6eV$ energy is required to separated a hydrogen atom into a proton and an electron. Compute the orbital radius and velocity of electron in a hydrogen atom.

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6. Compute the angular momentum in 4th orbit, if L is the angular momentum of he electron in the 2nd orbit of hydrogen atom.

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7. Using known volues for hydrogen atom, calculate radius of third orbit for Li^{+}

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8. Using known values for hydrogen atom, calculate speed of electron in fourth orbit of He^{+}

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9. Find the ratio of product of velocity and time period of electron orbiting in 2nd and 3nd stable orbits.

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10. In the Bohr model of hydrogen atom, the electron is pictured to rotate in a circular orbit of radius $5 \times 10^{-11} m$, at a speed 2.2×10^{6} m/ s. What is the current associated with electron motion?

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11. In hydrogen atom, the electron is making $6.6 \times 10^{15} rev / \sec$ around the nucleus in an orbit of radius $0.528 A$. The magnetic moment `(A-m^(2)) will be

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

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13. The total energy of eletcron in the ground state of hydrogen atom is $-13.6eV$. The

kinetic enegry of an electron in the first excited state is

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14. 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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15. 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.

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16. Determine the wavelength of the radiation required to excite the electron in Li^{++} from the first to the third Bohr orbit.

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17. Determine the wavelength of the radiation required to excite the electron in Li^{++} from the first to the third Bohr orbit.

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18. A hydrogen like atom with atomic number Z is in an excited state of quantum number 2n. It can emit a maximum energy photon of 204 eV. If it makes a transition ot quantum state n, a photon of energy 40.8 eV is emitted. Find n, Z and the ground state energy (in eV) of this atom. Also calculate the minimum energy (in eV) that can be emitted by this atom during de-excitation. Ground state energy of hydrogen atom is – 13. 6 eV.

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19. A moving hydrogen atom makes a head on collision with a stationary hydrogen atom. Before collision both atoms are in in ground state and after collision they move together.

What is the minimum value of the kinetic energy of the moving hydrogen atom, such that one of the atoms reaches one of the excited state?

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20. A hydrogen like atom (atomic number Z) is in a higher excited sate of quantum number n .This excited atom can make a transition to the first excited state by successively emitting two photon of energies $10.20 eV$ and $17.00 eV$

.Alternatively, the atom from the same excited state can make a transition to the second excited state by successively emitting two photon of energy $4.25 ev$ and $5.95 eV$ Determine the followings:

The value of atomic number (Z) is

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21. 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 to the third Bohr orbit (ionization energy of the hydrogen atom equals 13.6 eV).

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22. Monochromatic radiation of wavelength λ are incident on a hydrogen sample in ground state. Hydrogen atoms absorb the light and subsequently emit radiations of 10 different wavelength . The value of λ is nearly :

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23. 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

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24. An electron is moving in an orbit of a hydrogen atom from which there can be a maximum of six transition. An which there can be a maximum of three transition. Find ratio of the velocities of the electron in these two orbits.

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25. A $12.5eV$ electron beam is used to bombard gaseous hydrogen at room temperature. What serious of wavelength will be emitted?

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26. In a hydrogen atom, a transition takes place from n = 3 to n = 2 orbit. Calculate the wavelength of the emitted photon. Will the photon be visible ? To which spectral series will this photon belong? Given $R = 1.097 \times 10^7 m^{-1}$

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

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

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29. If the series limit wavelength of the Lyman series for hydrogen atom is 912Å, then the series limit wavelength for the Balmer series for the hydrogen atom is

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30. Caclulate (I) is the wavelength and (ii) the frequecny of the H_{β} line of the second line of Bolmer series for some hydrogen.

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31. The wavelength of the first line of Lyman series for hydrogen is idetical to that of the second line of Balmer series for some hydrogen like ion Y. Calculate energies of the first three levels of Y.

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32. Hydrogen atom in its ground state is excited by means of monochromatic radiation of wavelength 970.6Å. How many lines are possible in the resulting emission spectrum ? Calculate the longest wavelength amongst them. You may assume that the ionisation energy for hydrogen atom is 13.6 eV. Given Planck's constant

$= 6.6 \times 10^{-34} Js, \quad c = 3 \times 10(8) ms^{-1}$

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33. An electron of a hydrogen like atom is in excited, state. If total energy of the electron is -4.6 eV, then evaluate

(i) the kinetic energy and

(ii) the de-Brogli wavelength of the electron .

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34. 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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35. Let us assume that the de-Broglie wave asssociated with an electron froms a standing wave between the atoms arranged in a one-dimensional array with nodes at each of the atomic sites. If is found that one such standing wave is formed, if the distacne between theatoms of the array is $3.X36\text{Å}$ similar standing waave is again fromed, if d is increased to 3.5Å but not for any intermediate value of d. Find the energy of the electrons in electron volts and the least value of d for which the standing wave of the type described above can from.

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36. Hydrogen gas in the atomic state is excited to an energy level such that the electrostatic polential energy becomes $-3.02eV$

Now, the photoelectric plate hoving W=4.6 eV is exposed to the emission spectra of this gas. Assuming all the transition of be possible, find the minimum de-Broglie wavelength of ejected photoelectrons.

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37. Find the cut off wavelength for the continuous X - rays coming

from an X-ray tube operating at 40 kV.

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38. An X-ray tube is operated at 30 eV. If a particular electron loses 10% of its kinetic energy to emit an X-ray photon during the collision. Find the wavelength and maximum frequency assoicated with this photon.

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39. The operating voltage in an -X-ray tube is increased to 3 times the original value of when the short wavelength limits shifs by 25 nm.

Find the original value or the opreating voltage.

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40. The current flowing through the X-ray tube which is operating at 25 kV is 1 mA. Calculate the number of electrons hitting target per second . Also, find the energy falling on the target per second.

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41. The wavelength of K_α X-ray for an element is 21.3 pm. It takes 12.5 ke V to knock out an electron out an electron from the L-shell of the atom of the element. What should be the minimum accelerating voltage across on X-ray tube having the element as target which allows production of K_α X-ray?

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42. The wavelength of K_α line in copper is 1.54Å. The ionisation energy of K electron in copper in Joule is

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43. The wavelength of K_α X-ray line for an element is 0.42Å . Find the wavelength of K_β line emitted by the same element.

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44. The energy of an element with a vacancy in K-shell is 35.2 V, in L-shell is 5.25 keV and in M-shell is 0.55 keV higher than the energy of the atom of with no vacancy. Find the frequency of K_{α}, K_{β} and L_{α} X-rays of that element.

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45. Use Moseley's law with b = 1 to find the frequency of the K_{α} X-ray of $La(Z = 57)$ if the frequency of the K_{α} X-ray of $Cu(Z = 29)$ is known to be $1 \cdot 88 \times 10^{18}$ Hz.

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46. The k_{α} X-rays of aluminium (Z = 13) and zinc (Z = 30) have wavelengths 887 pm and 146 pm respectively. Use Moseley\'s law $\sqrt{v} = a(Z - b)$ to find the wavelength of the K_{α} X-ray of iron (Z = 26).

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Check Point 12 1

1. The radius of the atom is of the order of

A. $10^{-8}m$

B. $10^{-9}m$

C. $10^{-11}m$

D. $10^{-10}m$

Answer: D

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2. According to classical theory, the circular path of an electron in Rutherford atom is

A. parabolic

B. hyperboic

C. cicular

D. elliiptical

Answer: B

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3. An alpha nucleus of energy $\frac{1}{2}m\nu^2$ bombards a heavy nucleus of charge Ze. Then the distance of closed approach for the alpha nucleus will be proportional to

A. v^2

B. 1/m

C. $1/v^4$

D. 1/Ze

Answer: B

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4. The number of α-particless scattered per unit area N (θ) at scattering angle θ varies inversely as

A. $\cos^4\left(\frac{\theta}{2}\right)$

B. $\sin^4\left(\frac{\theta}{2}\right)$

C. $\tan^4\left(\frac{\theta}{2}\right)$

D. $\cot^4\left(\frac{\theta}{2}\right)$

Answer: B

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5. in Rutherford scattering experiment for scattering angle of 180° , what be the value of impact parameter?

A. 0

B. ∞

C. 1

D. Data is insufficient

Answer: A

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6. The concept of stationary orbits was proposed by

A. Neil Bohr

B. J J Thomson

C. Rutherford

D. I Newton

Answer: A

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7. In Bohr's atom model,

A. the nucleuss is of infinite mass and is at rest

B. electrons in a quanitsed orbit will not radiate energy

C. mass of electron remains constant

D. All the above conditions

Answer: B

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8. The angular momentum (L) of an electron moving in a stable orbit around nucleus is

A. half intergal multiple of $\frac{h}{2\pi}$

B. integral multiple of h

C. integral multiple of $\frac{h}{2\pi}$

D. half integral multiple of h

Answer: C

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9. In Bohr's mode, the atomic radius of the first orbit is r_0 then the radius of the third orbit is

A. $r_0 / 9$

B. r_0

C. $9r_0$

D. $3r_0$

Answer: C

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

A. Hydrogen atom

B. Deutrium atom

C. Singly ionised helium

D. Doubly ionised lithium

Answer: D

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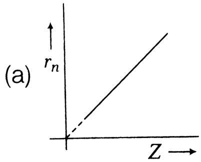
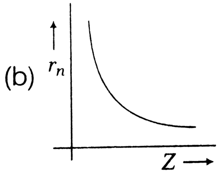
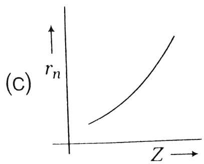
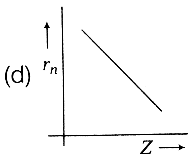
11. Radius (r_n) of electron in nth orbit versus atomic number (Z) graph is

A. 

B. 

C. 

D. 

Answer: B

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

A. $1/2$

B. $\frac{2}{137}$

C. $1/137$

D. $1/237$

Answer: C

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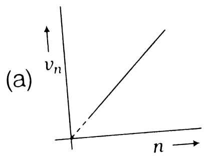
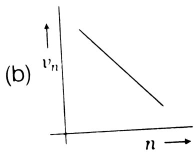
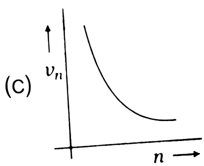
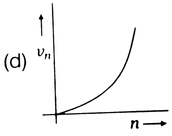
13. Speed (V_n) of electron in nth orbit versus principal quantum number (n) graphs is

A. 

B. 

C. 

D. 

Answer: B

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14. The orbital frequency of an electron in the hydrogen atom is proportional to

A. n^3

B. n^{-3}

C. n

D. n^0

Answer: D

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Check Point 12 2

1. Product of velocity and time period of electron orbiting in nth stable orbit is proportional to

A. n^3

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

C. n

D. n^2

Answer: D

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2. Kinetic energy of electron in nth orbit is given by

A. $\frac{Rhc}{2n^2}$

B. $\frac{2Rhc}{n}$

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

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

Answer: D

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

A. 1.85 eV

B. 13.6 eV

C. 6.8 eV

D. 3.4 eV

Answer: B

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4. Potential energy (PE_n) and kinetic energy (KE_n) of electron in nth orbit are related as

A. $PE_n = KE_n$

B. $PE_n = -2KE_n$

C. $PE_n = 2KE_n$

D. $PE_n = KE_n$

Answer: B

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5. The ground state energy of hydrogen atom is $-13.6eV$. What is the potential energy of the electron in this state

A. 0 eV

B. $-27.2 eV$

C. 1 eV

D. 2 eV

Answer: B

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6. In the nth orbit, the energy of an electron $E_n = -\frac{13.6}{n^2} eV$ for hydrogen atom. The energy rquired to take the electron from first orbit to second orbit will be

A. $10.\ 2eV$

B. $12.1eV$

C. $13.6eV$

D. $3.4eV$

Answer: A

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7. In hydrogen atom, if the difference in the energy of the electron in $n = 2$ and $n = 3$ orbits is E, the ionization energy of hydrogen atom is

A. $13.2E$

B. $7.2E$

C. $5.6E$

D. $3.2E$

Answer: B

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8. Ionisation potential (IP) and ionisation (IE) are related a

A. $IP = (IE)e$

B. $IP = \frac{IE}{e}$

C. $IE = \frac{IP}{e^2}$

D. $IP = \frac{IE}{e^2}$

Answer: B

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9. Atomic hydrogen is excited to the n^{th} energy level . The maximum number of spectral lines which it can emit while returning to ground state, is:

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

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

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

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

Answer: B

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10. Which one of the series of hydrogen spectrum is in the visible region ?

A. Lyman series

B. Balmer series

C. Paschen series

D. Brackett series

Answer: B

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11. In which of the following system will the wavelength corresponding to $n = 2 \rightarrow n = 1$ be minimum ?

A. Hydrogen atom

B. Deutrium atom

C. Singly ionised helium

D. Doubly ionised lithium

Answer: D

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12. 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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13. In which of the following transition 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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14. Wavelength corresponding to series limit is

A. $\frac{1}{\lambda}=\frac{2R}{n}$

B. $\frac{1}{\lambda}=\frac{R^2}{n^2}$

C. $\frac{1}{\lambda}=\frac{R^2}{n^2}$

D. $\frac{1}{\lambda}=\frac{R}{n}$

Answer: C

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15. For the Bohr's first orbit of circumference $2\pi r$, the de - Broglie wavelength of revolving electron will be

A. $2\pi r$

B. πr

C. $\frac{1}{2\pi r}$

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

Answer: A

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16. Which of the following is incorrect regarding limitations of Borhr's model?

A. This model is applicable only to single electron lines

B. It does not explain fine structure of spectral lines

C. It's assumption regarding staionary orbits supports Heisenberg uncertainty principle

D. None of the above

Answer: C

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Check Point 12 3

1. X-rays were discovered by

A. Becqueral

B. Roentgen

C. Marrie Curie

D. Von Laue

Answer: B

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2. Which of the following wavelength falls in X - ray region

A. 10000Å

B. 1000Å

C. 1Å

D. 10^{-2}Å

Answer: C

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3. X-rays are in nature similar to

A. beta rays

B. gamma rays

C. de-Broglie

D. cathode rays

Answer: B

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4. The nature of X-rays spectrum is

A. continuous

B. line

C. continuous and line

D. None of these

Answer: C

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5. The kinetic energy of electrons that strike the target is increased , then the cut-off wavelength of continuous X-rays spectrum

A. increases

B. decreases

C. no change

D. cannot be said

Answer: B

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6. If V be the accelerating voltage, then the maximum frequency of continuous X-rays is given by

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

B. $\frac{hV}{e}$

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

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

Answer: C

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7. An X-ray tube is operated at 50 kV. The minimum wavelength produced is

A. 0.5Å

B. 0.5Å

C. 0.25Å

D. 1Å

Answer: C

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8. X-rays are being produced in a tube operating at $10^5 V$. The velocity of X-rays produced is

A. $3 \times 10^8 ms^{-1}$

B. $2.8 \times 10^8 ms^{-1}$

C. $3.1 \times 10^8 ms^{-1}$

D. $3 \times 10^{10} ms^{-1}$

Answer: A

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9. The energy of a photon of characteristic X-ray from a Coolidge tube comes from

A. the kinetic energy of the striking electron

B. the kinetic energy of the free electrons of the target

C. the kinetic energy of the ions of the target

D. an atomic transition in the target

Answer: D

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10. In X-rays spectrum, transition of an electron from an outer shell to an inner shell gives a characteristics X-rays spectral line. If we consider the spectrum line

$K_{\beta}, L_{\beta}n$ and M_{α} , them

A. K_{β} and L_{β} have a common inner shell

B. K_{β} and L_{β} have a common outer shell

C. L_{β} and M_{α} have a common outer shell

D. L_{β} and M_{α} have a common inner shell

Answer: C

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11. In X-ray spectrum wavelength λ of line K_{α} depends on atomic number Z as

A. $\lambda \propto Z^2$

B. $\lambda \propto (Z-1)^2$

C. $\lambda \propto \dfrac{1}{(Z-1)}$

D. $\lambda \propto \dfrac{1}{(Z-1)^2}$

Answer: D

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12. For characteristic X - ray of some material

A. $E(K_{\gamma}) < E(K_{\beta}) < E(K_{\alpha})$

B. $E(K_{\alpha}) < E(L_{\alpha}) < E(M_{\alpha})$

C. $\lambda(K_{\gamma}) < \lambda(K_{\beta}) < \lambda(K_{\alpha})$

D. $\lambda(M_{\alpha}) < \lambda(L_{\alpha}) < \lambda(K_{\alpha})$

Answer: C

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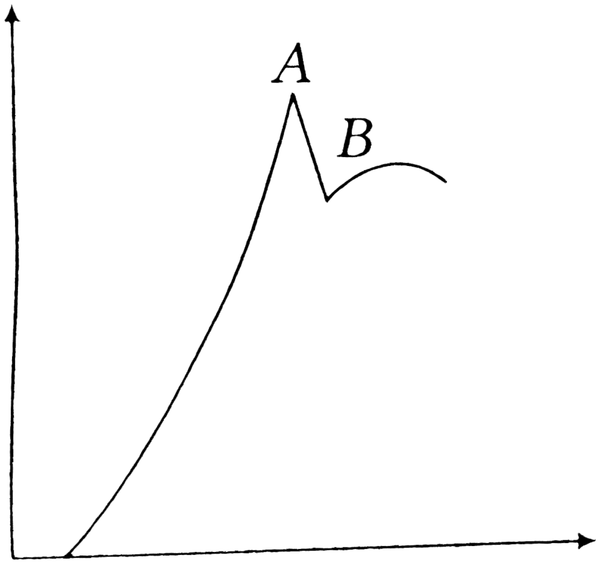
13. Sharp peak point A represents



A. characteristic X-rays

B. continuous X-rays

C. Bremesstrahlung

D. discontinuous sepectrum

Answer: A

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14. Mosley's law relates the frequencies of line X-rays with the following characteristics of the target element

A. its density

B. its atomic weight

C. its atomic number

D. interplaner spacing of the atomic planes

Answer: C

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15. Bragg's law for X-rays is

A. $d \sin \theta = 2n\lambda$

B. $2d \sin \theta = n\lambda$

C. $n \sin \theta = 2\lambda d$

D. None of these

Answer: B

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Taking It Together

1. Increase in which of the following increases the penetrating power of the X-rays ?

A. velocity

B. intensity

C. frequency

D. wavelength

Answer: C

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2. X-rays are not used for radar purooses, because they are not,

A. they are not relfected by the target

B. they are not electromagnetic waves

C. they are completely absorbed by the air

D. they sometimes damage the target

Answer: A

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3. The X- rays beam coming from an X- rays tube will be

A. monochromatic

B. having all wavelength larger than a certain minimum wavelength

C. having alll wavelengths smaller than a certain maximum wavelenth

D. having all wavelength between a minimum and a maximum wavelength

Answer: D

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4. Consider a photon of continuous X-ray coming from a Coolidge tube. Its energy comes from

A. the kinetic energy of the striking electron

B. the kinetic energy of the free electrons of the target

C. the kinetic energy of the ions of the target

D. an atomic transition in the target

Answer: A

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5. Hydrogen atom does not emit X-rays because

A. its energy levels are too close to each other

B. its energy levels ar too far apart

C. it has a very small mass

D. it has a single electron

Answer: A

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6. Moseley's law for characteristic X-rays is $\sqrt{v} = a(Z - b)$. In this,

A. Both a and b are independent of the material

B. a is independent but b depends on the material

C. b is independent but a depends on the material

D. Both a and b depends on the meterial

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 lowe energy

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

C. all together simultaneously into a lower state

D. to emit phtons only when they collide

Answer: A

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8. X-ray beam can be deflected

A. magnetic field

B. electric field

C. Both (a) and (b)

D. None of these

Answer: D

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9. In an X - rays tube , the intensity of the emitted X - rays beam is increased by

A. increasing the filment current

B. decreasing the filment current

C. increasing the target potential

D. decreasing the target potential

Answer: A

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10. If the current in the circuit for heating the filament is increased, the cutoff wavelength

A. will increase

B. will decrease

C. will remain unchanged

D. may increase of decrease

Answer: C

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11. X-rays are produced by jumping of:

A. electrons from lower to higher energy orbit of atom

B. electrons from higher to lower energy orbit of atom

C. protons from lower to higher energy orbit of nucleus

D. protons from higher to lower energy orbit of nucleus

Answer: B

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12. The difference in angular momentum associated with electron in two successive orbits of hydrogen atom is:

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

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

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

D. $(n-1)\frac{h}{2\pi}$

Answer: B

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13. In the Bohr model of the hydrogen atgom

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 intergal 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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14. 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 electrons

C. Energy of the atom

D. Orbital angular momentum of the electron

Answer: D

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15. The second line in Paschen series is obtained when the electron makes transition from

A. fourth orbit to third orbit

B. seventh orbit to third orbit

C. six orbit to third orbit

D. fifth orbit to third orbit

Answer: D

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16. An electron moves in a circular orbit at a distance from a proton with kinetic energy E to escape to infinity, the minimum energy which must be supplied to the electron is

A. E

B. 2E

C. 0.5E

D. $E\sqrt{2}$

Answer: A

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17. Molybdenum is used as a target element for production of X - rays because it is

A. light and can easily deflect electrons

B. light can absorb electrons

C. a heavy element with a high melting point

D. an element having high thermal conductivity

Answer: D

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18. An X-ray has a wavelength of 0.010 Å. Its momentum is

A. $2.126 \times 10^{-23} kgms^{-1}$

B. $6.626 \times 10^{-22} kgms^{-1}$

C. $3.456 \times 10^{-25} kgms^{-1}$

D. $3.313 \times 10^{-22} kgms^{-1}$

Answer: B

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19. X-rays of $\lambda = 1\text{Å}$ have frequency

A. $3 \times 10^8 Hz$

B. $3 \times 10^{18} Hz$

C. $3 \times 10^{10} Hz$

D. $3 \times 10^{15} Hz$

Answer: B

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20. 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 collidng 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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21. The velocity of an electron in the first orbit of H-atom is v. The velocity of an electron in the 2nd orbit

A. 2 v

B. v

C. v/2

D. v/4

Answer: C

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22. A X-ray tube operates at an accelerating potntial of 20 kV. Which of the following wavelength will be absent in the continuous spectrum of X-rays ?

A. 12 pm

B. 75 pm

C. 65 pm

D. 95 pm

Answer: A

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23. A metal block is exposed to beams of X-rays of different wavelength. X-rays of which wavelength penetrate most

A. 2Å

B. 4 Å

C. 6 Å

D. 8 Å

Answer: A

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24. 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 imortant as electrostatic force for binding the two atoms

C. cancels the repulsive electrostatic force between the nuclei

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

Answer: A

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25. The patient is asked to drink $BaSO_4$ for examining the stomach by X-rays because X-rays are-

A. reflected by heavy atoms

B. refracted by heavy atoms

C. less abosrbed by heavy atoms

D. more absorbed by heavy atoms

Answer: D

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26. The orbital angular momentum of electron in the $n_1 th$ shell of element of atomic number $Z_1 is L_1$ an the same in the $n_2 th$ shell of element of atomic number $Z_2 is L_2$ If $L_2 > L_1$

then

A. $n_2 > n_1$

B. $Z_2 > Z_1$

C. $n_2 Z_2 > n_1 Z_1$

D. Both (a) and (b)

Answer: A

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27. For production of characteristic $K_{\beta}X-rays$, the electron transition is

A. n=2 to n=1

B. n=3 to n=2

C. n=3 to n=1

D. n=4 to n=2

Answer: C

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28. Hydrogen atom is exited from ground state to another state with principal quantum number equal to 4 Then the number of spectral line in the emission spectra will be

A. 2

B. 3

C. 5

D. 6

Answer: D

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29. Consider the following two statements A and B and identify the correct choice in the given answer

A : The characteristic X-ray spectrum depends on the nature of the material of the target

B : The short wavelength limit of continuous X-ray spectrum varies inversely with the potential difference applied to the X-rays tube

A. A is true and B is false

B. A is false and B are true

C. Both A and B are true

D. Both A and B are false

Answer: C

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30. In a hypothetical Bohr hydrogen, the mass of the electron is doubled. The energy E_0 and the radius r_0 of the first orbit will be (a_0 is the Bohr radius)

A. $E_0 = -27.eV, r_0 = a_0/2$

B. $E_0 = -27.2eV, r_0 = a_0 = a_0$

C. $E_0 = -13.6eV, r_0 = a_0/2$

D. $E_0 = -13.6eV r_0 = a_0$

Answer: A

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31. Ionization energy of a hydrogen-like ion A is greater than that of another hydrogen like ion B . Let r, u, E and L represent the radius of the orbit , speed of the electron , total energy of the electron and angular momentum of the electron respectively (for the same n). In ground state :

A. $r_A > r_B$

B. $u_A > u_B$

C. $E_A < E_B$

D. $L_A > L_B$

Answer: B

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32. If ω the speed of electron in the nth orbit hydrogen atom, then

A. $\omega \propto n^{1/2}$

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

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

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

Answer: D

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

A. Red

B. Yellow

C. Green

D. Violet

Answer: D

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34. The potential difference between the cathode. And the target electrod in a coolidge tube is 24.75 kV. The minimum wavelength of the emitted X-rays is

A. 0.1Å

B. 0.5Å

C. 1Å

D. 5Å

Answer: B

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35. In Rutherford scattering experiment, wha will be the ratio of impact parameter for scattering angles $\theta_1 = 90^\circ$ and $\theta_2 = 120^\circ$

A. 1

B. $\sqrt{2}$

C. 2

D. $\sqrt{3}$

Answer: D

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

A. 53pm

B. 27 pm

C. 18 pm

D. 13 pm

Answer: C

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37. An electron jumps from the $4th$ orbit to the $2nd$ orbit of hydrogen atom. Given the Rydberg's constant $R = 10^5 cm^{-1}$. The frequency in Hz of the emitted radiation will be

A. $\frac{3}{16} \times 10^5$

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

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

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

Answer: C

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38. When an electron in hydrogen atom is excited, from its 4th to $5$the stationary orbit, the change in angular momentum of electron is (Planck's constant: $h = 6.6 \times 10^{-34} J - s$)

A. $4.16 \times 10^{-34} J - s$

B. $3.32 \times 10^{-34} J - s$

C. $1.05 \times 10^{-34} J - s$

D. None of these

Answer: C

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39. The magntic moment (μ) of a revolving electron around the mucleaus varies with principle quantum number n as

A. $\mu \propto n$

B. $\mu \propto 1/n$

C. $\mu \propto n^2$

D. $\mu \propto 1/n^2$

Answer: A

Watch Video Solution

40. The electron in a hydrogen atom makes a transition from $n = n_1$ to $n = n_2$ state. The time period of the electron in the initial state

(n_1) is eigh times that in the final state (n_2).

The possible values of n_1 and n_2 are

A. $n_1 = 8, n_2 = 1$

B. $n_1 = 4, n_2 = 2$

C. $n_1 = 2, n_2 = 4$

D. $n_1 1, n_2 = 8$

Answer: B

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41. Two elements A and B with atomic numbers Z_A and Z_B are used to produce charateristic X-rays with frequencies v_A and v_B respectively. If $Z_A : Z_B = 1 : 2,$ then $v_A : v_B$ will be

A. $1 : \sqrt{2}$

B. $1 : 8$

C. $4 : 1$

D. $1 : 4$

Answer: B

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42. An electron revolves round a nucleus of charge Ze. In order to excite the electron from the $n=20$ to $n=3$, the energy required is $47.2eV$. Z is equal to

A. 3

B. 4

C. 5

D. 2

Answer: C

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43. As par Bohr model, the minimum energy (in eV) required to remove an electron from the ground state of doubly ionized Li atom $(Z = 3)$ is

A. 1.51

B. 13.6

C. 40.8

D. 122.4

Answer: D

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44. Excitation energy of a hydrogen like ion in its first excitation state is 40.8 eV. Energy needed to remove the electron from the ion in gruond state is

A. 54.4 eV

B. 13.6 eV

C. 40.8 eV

D. 27.2 eV

Answer: A

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45. 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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46. An electron makes a transition from orbit $n = 4$ to the orbit $n = 2$ of a hydrogen atom. The wave number of the emitted radiations $(R =$ Rydberg's constant) will be

A. $\frac{16}{3R}$

B. $\frac{2R}{16}$

C. $\frac{3R}{16}$

D. $\frac{4R}{16}$

Answer: C

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47. The K_{α} and K_{β} lines of charateristic X-ray spectrum of molybdenum are $0.76\overset{\circ}{A}$ and $0.64\overset{\circ}{A}$, respectively. The wavelength of L_{α} line is

A. $1.4\overset{\circ}{A}$

B. $2.4\overset{\circ}{A}$

C. $4.1\overset{\circ}{A}$

D. $3.6\overset{\circ}{A}$

Answer: C

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48. The longest wavelength that can be analysed by a sodium chloride crystal of spacing $d = 2.82 \text{Å}$ in the second order is -

A. $2.82\overset{\circ}{A}$

B. $5.64\overset{\circ}{A}$

C. $8.46\overset{\circ}{A}$

D. $11.28\overset{\circ}{A}$

Answer: A

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49. The wavelength of K_a , X-rays for lead isotopes $Pb^{208}, Pb^{206}, Pb^{204}$ areλ_1, λ_2 andλ_3, resperctively. Then

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

B. $\lambda_1 > \lambda_2 > \lambda_3$

C. $\lambda_1 < \lambda_2 < \lambda_3$

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

Answer: D

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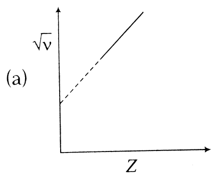
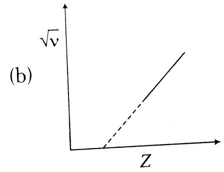
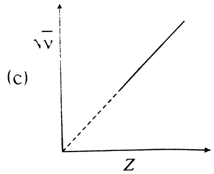
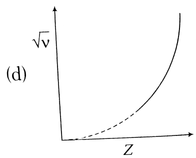
50. The graph between the square root of the frequency of a specific line of characteristic spectrum of X - rays and the atomic number of the target will be

A. 

B. 

C. 

D. 

Answer: B

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

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

B. $\frac{27}{8}$

C. $\frac{8}{27}$

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

Answer: C

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52. Magnetic moment of an electron in nth orbit of hydrogen atom is

A. $\frac{neh}{\pi m}$

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

C. $\frac{meh}{2\pi m}$

D. $\frac{neh}{4\pi n}$

Answer: B

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53. A sphere of work function $\phi = 4.6eV$ is suspended in a vacuum number by an insulating thread. Radiation of wavelength $\lambda = 0.2\mu m$ stricke on the sphere. The maximum electric pontential of the sphere will be

A. 4.6 V

B. 6.2 V

C. 1.6 V

D. 3.2 V

Answer: A

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

A. $\frac{16}{25}\lambda_0$

B. $\frac{27}{20}\lambda_0$

C. $\frac{20}{27}\lambda_0$

D. $\frac{25}{16}\lambda_0$

Answer: B

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

A. $< 124.2kV$

B. $> 124.2kV$

C. Between 60 kV and 70 kV

D. equal to 100 kVs

Answer: A

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56. An electron with kinetic energy $5eV$ is incident on a hydrogen atom in its ground state.The collision

A. must be elastic

B. may be partially elastici

C. must be completely inelastic

D. may be completely inelastic

Answer: A

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57. An electron makes a transition from orbit $n = 4$ to the orbit $n = 2$ of a hydrogen atom.

The wave number of the emitted radiations

$(R =$ Rydberg's constant) will be

A. $\frac{16}{3R}$

B. $\frac{16}{5R}$

C. $\frac{5R}{16}$

D. $\frac{3R}{16}$

Answer: A

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58. The minimum energy to ionize an atom is the energy required to

A. add on electron to the gaseous state of atom

B. excite the atom form its ground state to its first excited state

C. remove one outermst electron from the gaseous state of atom

D. remove one innermost electron from the

gaseous state of atom

Answer: C

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59. Let v_1 be the frequency of series limit of Lyman series, v_2 the frequency of the first line of Lyman series and v_3 the frequency of series limit of Balmer series. Then which of the following is correct ?

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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60. The shortest wavelength of the Brackett series of a hydrogen-like atom (atomic number of Z) is the same as the shortest wavelength of the Balmer series of hydrogen atom. The value of z is

A. 3

B. 4

C. 5

D. 2

Answer: D

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61. If and α-paricle of mass m, charged q and velocity v is incident on a nucleus charge Q and mass m, then the distance of closest approach is

A. $\dfrac{Qq}{4\pi\varepsilon_0 m^2}$

B. $\dfrac{Qq}{2\pi\varepsilon_0 mv^2}$

C. $\dfrac{Qqmv^2}{2}$

D. $\dfrac{Qq}{mv^2}$

Answer: B

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62. 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. $2.1 \times 10^{-34} J - s$

B. $3 \times 10^{-34} J - s$

C. $2 \times 10^{-34} J - s$

D. $0.5 \times 10^{-34} J - s$

Answer: A

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63. The shortest wavelength which can be obtained in hydrogen spectrum $(R = 10^7 m^{-1})$

A. 1000 Å

B. 8000 Å

C. 1300 Å

D. 2100 Å

Answer: A

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64. The wavelength of th first spectral line of sodium 5896 Å . The fisrt excitation potential of sodium atomm will be (Planck's constant $h = 6.63 \times 10^{-34} J - s$)

A. $4.2V$

B. $3.5V$

C. $2.1V$

D. None of these

Answer: C

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65. The shoretest wavelength in Lyman series is 91.2 nm. The longest wavelength of the series is

A. 121.6 nm

B. 182.4 nm

C. 243. 4nm

D. 364.8 nm

Answer: A

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66. Energy of 24. eV is required to remove one of the electron from a neutral helium atom. The energy (in e V) reauired to remove both the electorns from a netural helium aotm is

A. 38.2

B. 49.2

C. 51.8

D. 78.6

Answer: D

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67. If the radius of first Bohr's orbit is x,then de-broglie wavelength of electron in 3rd orbit is nearly

A. $2\pi r$

B. $6\pi r$

C. 9x

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

Answer: B

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68. An excited hydrogen atom emits a photon of wavelength λ in returning to the ground state. If 'R' is the Rydberg's constant, then the quantum number 'n' of the excited state is:

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

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

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

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

Answer: B

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69. An alpha nucleus of energy $\frac{1}{2}m\nu^2$ bombards a heavy nucleus of charge Ze . Then the distance of closed approach for the alpha nucleus will be proportional to

A. 1/m

B. $1/v^2$

C. 1/ze

D. v^2

Answer: A

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70. if the frequency of K_a X-ray emitted from the element with atomic number 31 is f, then the frequency of K_a x-ray emitted from the element with atomic number 51 would be

A. $\frac{5f}{3}$

B. $\frac{41f}{31}$

C. $\frac{9f}{25}$

D. $\frac{25f}{9}$

Answer: D

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71. According to Moseley's law, the ratio of the slope of graph between $\sqrt{f}$ and Z for K_β and K_α is

A. $\sqrt{\frac{32}{27}}$

B. $\sqrt{\frac{27}{32}}$

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

D. $\sqrt{\frac{36}{5}}$

Answer: A

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72. The ratio of the speed of the electron in the first Bohr orbit of hydrogen and the speed of light is equal to (where e, h and c have their usual meanings)

A. $\frac{2\pi hc}{e^2}$

B. $\frac{e^2 c}{2\pi h}$

C. $\frac{e^2 h}{2\pi hc}$

D. $\frac{e^2}{2\varepsilon_0 hc}$

Answer: D

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73. If scattering particles are 56 for 90° angle than this will be at 60° angle

A. 224

B. 256

C. 98

D. 108

Answer: A

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74. de-Broglie wavelength of an electron in the nth Bohr orbit is λ_n and the angular momentum is J_n then

A. $J_n \propto \lambda_n$

B. $\lambda_n \propto \frac{1}{J_n}$

C. $\lambda_n \propto J_n^2$

D. None of these

Answer: A

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75. In hydrogen atom, electron makes transition from $n = 4$ to $n = 1$ level. Recoil momentum of the H atom will be

A. $13.6 \times 10^{-19} kgms^{-1}$

B. $6.8 \times 10^{-27} kgms^{-1}$

C. $12.75 \times 10^{-24} kgms^{-1}$

D. None of these

Answer: B

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

$21.2 \times 10^{-11} m.$ The principal quantum number of the final state of the atom is.

A. n=4

B. n=2

C. n=16

D. n=3

Answer: B

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77. The acceleration of electron in the first orbits of hydrogen atom is

A. $\frac{4\pi^2 m}{h^3}$

B. $\frac{h^2}{4\pi^2 mr}$

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

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

Answer: C

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78. An α- particle accelerated through V volt is fired towards a nucleus. It distance of closest approach is r. If a proton accelerated through the same potential is fired towards the same nucleus, the distance of closest approach of the proton will be :

A. r

B. 2r

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

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

Answer: A

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79. In a Rutherford scattering experiment when a projectile of change Z_1 and mass M_1 approaches s target nucleus of change Z_2 and mass M_2, te distance of closed approach is r_0. The energy of the projectile is

A. directly proportianla to $M_1 \times M_2$

B. directly proportianla to $Z_1 Z_2$

C. directly proportianla to Z_1

D. directly proportianla to mass M_1

Answer: B

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80. In the Bohr model of a hydrogen atom, the centripetal force is furnished by the coulomb attraction between the proton and the electron. If a_0 is the radius of the ground state orbit, m is the mass and e is the chargeon the electron and ε_0 is the vacuum permittivity,the speed of the electron is

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

B. zero

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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81. For the first member of Balmer series of hydrogen spectrum, the wavelength is λ. What is the wavelength of the second member?

A. $\frac{27}{20}\lambda$

B. $\frac{20}{27}\lambda$

C. $\frac{27}{10}\lambda$

D. None of these

Answer: B

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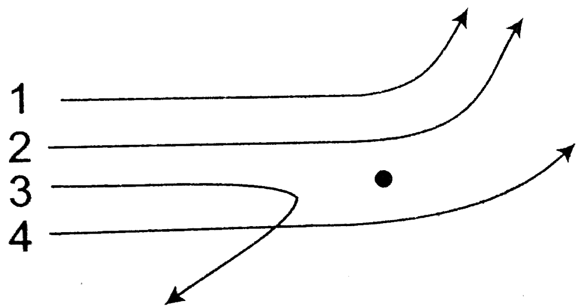
82. The diagram shown the path of four α-particles of the same energy being scattered by the nucleus of an atom simutaneously. Which of these are/is not physically possible ?



A. Both 3 and 4

B. Both 2 and 3

C. Both 1 and 4

D. Only 4

Answer: D

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83. In a hydrogen atom, the binding energyo of the electron in the gound state is E_1. Then the frequecny of revolution of the electron in the nth orbit is

A. $\frac{2E_1}{n^3 h}$

B. $\frac{2E_1n^3}{h}$

C. $\sqrt{\frac{2mE_1}{n^3h}}$

D. $\frac{E_1n^2}{h}$

Answer: A

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84. The ratio of the wavelengths for $2 \rightarrow 1$ transition in Li^{++}, He^{+} and H is

A. $1 : 2 : 3$

B. $1 : 4 : 9$

C. $2 : 9 : 36$

D. $3 : 2 : 1$

Answer: C

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85. The electron in a hydrogen atom makes a transition from M shell to L-shell. The ratio of magnitude of initial to final acceleration of the electron is

A. $9:4$

B. $81:16$

C. $4:9$

D. $16:81$

Answer: D

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

A. 13122Å

B. 3280Å

C. 4860Å

D. 2187Å

Answer: C

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87. If the wavelength of the first member of Blmer series of hydrogen spectrum is 6563Å A, then the wavelength of second member of Blamer series will be

A. 1215Å

B. 4861Å

C. 6050Å

D. data given is insufficient to calculate the value

Answer: B

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88. The wavelength of K_{α} line for an element of atomic number $43 is \lambda$. Then the wavelength of K_{α} line for an element of atomic number 29 is

A. $\frac{43}{29}\lambda$

B. $\frac{42}{28}\lambda$

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

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

Answer: C

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89. For he ground state , the electron int eh H-atom has an angular momentum $= h$, according to the simple Bohr model. Angular momentum is a vector ans hence there will be infi-nitely many orbits with the vector pointing in alll possible direction . In actuality , this is not true,

A. because Bohr model gives incorrect values of angular momentum

B. because only one of these would hav a minimum

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

D. because electrons go ground only in horizontal orbits

Answer: A

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90. If λ_{Cu} is the wavelength of K_{α} X-ray line of copper (atomic number 29) and λ_{Mo} is the wavelength of the K_{α}X-ray line of molybdenum (atomic number 42),then the ratio $\lambda_{Cu} / \lambda_{Mo}$ is close to

A. 1.99

B. 2.14

C. 0.5

D. 0.48

Answer: B

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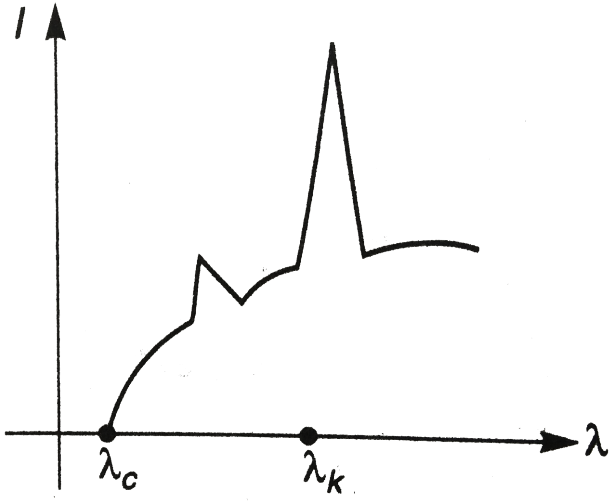
91. The intensity of X-rays form a Coolidge tube is plotted against wavelength λ as shown in the figure. The minimum wavelength found is λ_c and the wavelength of the K_α line is λ_k. As the accelerating voltage is increased



(a) $\lambda_k - \lambda_c$ increases (b) $\lambda_k - \lambda_c$ decreases

(c) λ_k increases (d) λ_k decreases

A. $(\lambda_k - \lambda_c)$ increases

B. $(\lambda_k - \lambda_c)$ decreases

C. λ_k increases

D. λ_k decreases

Answer: A

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92. Which element has a K_{α} line of wavlength 1.785Å ?

A. Copper

B. cobalt

C. Sodium

D. Aluminium

Answer: B

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93. A H-atom moving with speed v makes a head on collision with a H-atom in rest. Both atoms are in ground state. Find the minimum value of velocity v for which one of atom may excite.

A. $6.25 \times 10^4 ms^{-1}$

B. $8 \times 10^4 ms^{-1}$

C. $7.25 \times 10^4 ms^{-1}$

D. $13.6 \times 10^4 ms^{-1}$

Answer: A

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94. 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. 4

B. 1

C. 2

D. 3

Answer: C

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95. In an inelastic collision an electron excites a hydrogen atom from its ground state to a M-Shell state. A second electron collides instantaneously with the excited hydrogen atom in the m-Shell state and ionizes it. At leas how much energy the second electron transfors to the atom is the M-shell state?

A. $+3.4eV$

B. $+1.51eV$

C. $-3.4eV$

D. $-1.51eV$

Answer: D

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96. A hydrogen-like atom emits rediationof frequency 2.7×10^{15} Hz $when$ if $makesatransitionomn$ = 2 to n = 1 $. Theeqquencyemied \in atransitionomn$ = 3 to n = 1` will be

A. 1.8×10^{15} Hz

B. 3.2×10^{15} Hz

C. 4.7×10^{15} Hz

D. 6.9×10^{15} Hz

Answer: B

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

A. 10.20 eV

B. 20.40 eV

C. 13.6 eV

D. 27.2 eV

Answer: A

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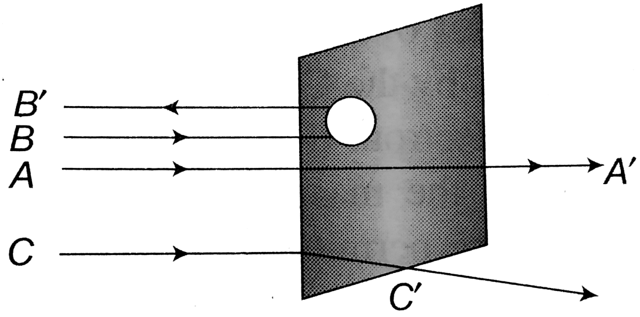
98. A beam of fast moving alpha particles were directed towards a thin film of gold. The parts A', B' and C' of the transmitted and refected beams correcponding ro the incident parts A, B and C of the beam, are shown in the adjoining diagram. The number of alpha particles in



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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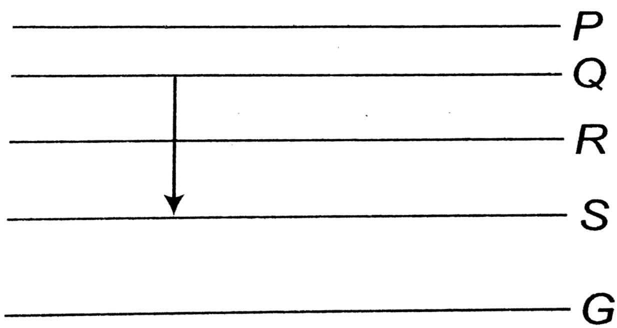
99. Figure shows the enegry levels P, Q, R, S and G of an atom where G is the ground state. A red line in the emission spectrum of the atom can be obtaned by an energy level change from Q so S. A blue line can be obtained by following energy level change



A. P to Q

B. Q to P

C. R to S

D. R to G

Answer: D

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

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

If one decides to work in a frame of reference where the electron is at rest, the proton would be moving around it. By similar arguments, the binding energy would be :

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

This last expression is not correct, because

A. n would not be integral

B. Bohr-quantisation applies only two electron

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

D. the motion of the proton would not bein

circular orbits, even approximately.

Answer: C

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101. If the intensity of an X-ray becomes $\frac{I_0}{2}$ from I_0 after travelling 2.0 cm inside a target, then its intesity after travelling a distance of 4 cm will be

A. $\frac{I_0}{2}$

B. $\frac{I_0}{4}$

C. $2I_0$

D. I_0

Answer: B

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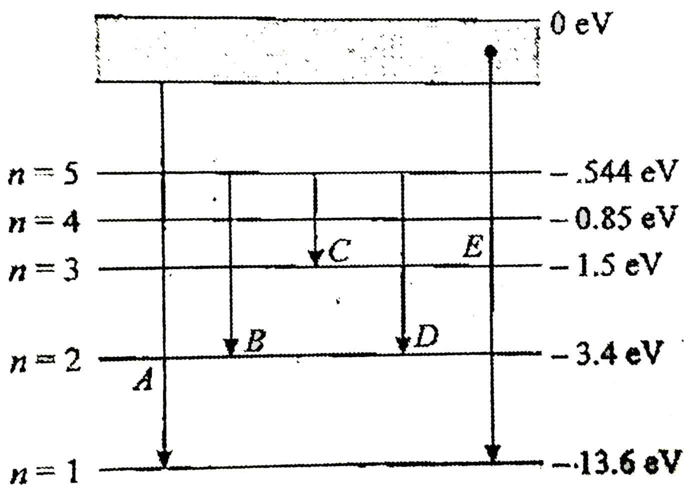
102. In the following figure the energy levels of hydrogen atom have been shown along with some transitions marked A, B,C,D and E. The transitions A,B and C respectively represent:



A. the first member of the Lyman series,

third member of Balmer series and

second member of Paschen series

B. the ionisation potential of H, second

member of Blamer series and third

member of Pachend sereis

C. the series limit of Lyman series, second member of Balmer series and second member of Paschen series

D. the series limit of Lyman series, third member of Balmer series and second member of Paschen series

Answer: D

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103. The ionization energy of the electron in the hydrogen atom in its ground state is $13.6 ev$. The atoms are excited to higher energy levels to emit radiations of 6 wavelengths. Maximum wavelength of emitted radiation corresponds to the transition between

A. n=3 and n=2 states

B. n=3 and n=1 state

C. n=2 and n=1 state

D. n=4 and n=3 states

Answer: D

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104. If an electron is revolving around the hydrogen nucleus at a distance of 0.1 nm,what should be its speed?

A. $2.188 \times 10^6 ms^{-1}$

B. $1.094 \times 10^6 ms^{-1}$

C. $4.376 \times 10^6 ms^{-1}$

D. $1.60 \times 10^6 ms^{-1}$

Answer: D

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105. Imagine an atom made of a proton and a hypothetical particle of double the mass of the electron but having the same charge as the electron. Apply the Bohr atom model and consider all possible transitions of this hypothetical particle of the first excited level. the longest wavelength photon that will be emitted has wavelength [given in terms of the

Rydberg constant R for the hydrogen atom]

equal to

A. $\dfrac{9}{(5R)}$

B. $\dfrac{36}{(5R)}$

C. $\dfrac{18}{(5R)}$

D. $\dfrac{4}{(5R)}$

Answer: C

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106. For a certain atom, there are energy levels A,B,C corresponds to energy values $E_A < E_B < E_C$. Choose the correct option if $\lambda_1, \lambda_2, \lambda_3$ are the wavelength of radiations corresponding to the transition from C to B,B to A and C to A respectively.

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

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

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

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

Answer: B

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107. The electron in a hydrogen atom makes a transition $n_1 \to n_2$, where n_1 and n_2 are the principle 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. $n_1 \Delta n_2 = 2$

B. $n_1 8, n_2 = 2$

C. $n_1 \Delta, n_2 = 1$

D. $n_1 = 6, n_2 = 2$

Answer: A

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108. If elements with principal quantum number $n > 4$ were not allowed in nature, the number of possible elements would be:

A. 32

B. 60

C. 18

D. 4

Answer: B

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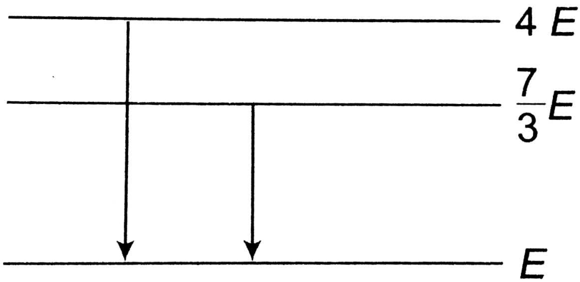
109. The following diagram indicates the energy levels of a certain atom when the system moves from $4E$ level to E. A photon of wavelength λ_1 is emitted. The wavelength of photon produced during its transition from $\frac{7}{3}E$ level to E is λ_2. the ratio $\frac{\lambda_1}{\lambda_2}$ will be



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

B. $\frac{4}{8}$

C. $\frac{3}{8}$

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

Answer: A

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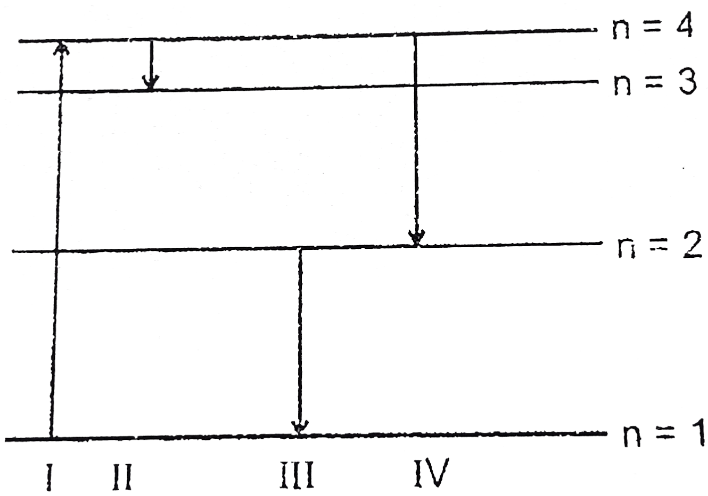
110. The diagram shows the energy levels for an electron in a certain atom. Which transition shown represents the emission of photon with the most enegy ?



A. III

B. IV

C. I

D. II

Answer: A

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111. When the voltage applied to and X-ray tube is increases from $V_1 = 10KV \text{to} V_2 = 20kV$, the wavelength difference between the K_α line and short wavelength limit of the continuous X-ray spectrum increases by a factor 3. The atomic number of the element of which the tube anticathode is made will be

A. 62

B. 56

C. 45

D. 29

Answer: D

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112. The ionisation potential of hydrogen atom is -13.6 eV. An electron in the ground state of a hydrogen atom absorbs a photon of energy 12.75 eV. How many diggerent spectral lines can one expect when the electron make a downward transition

A. 1

B. 4

C. 2

D. 6

Answer: D

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113. The distance of closest approach of an alpha-particle fired towards a nucleus with momentum p is r. What will be the distance of closest approach when the momentum of alpha-particle is $2p$?

A. r/2

B. 2r

C. 4r

D. r/4

Answer: D

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114. The first excited state of hydrogen atom is $10.2 eV$ above its ground state. The temperature is needed to excite hydrogen atoms to first excited level is

A. $7.9 \times 10^4 K$

B. $3.5 \times 10^4 K$

C. $5.8 \times 10^4 K$

D. $14 \times 10^4 K$

Answer: A

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115. Hydrogen $(1H^1)$ Deuterium $(1H^2)$ singly ionized helium $(2He)^+$ and doubly ionized lithium $(3Li^6)^{++}$ all have one electron around the nucleus Consider an electron transition from $n = 2 \rightarrow n = 1$ if the wavelength of emitted radiation are $\lambda_1, \lambda_2, \lambda_3,$ and $\lambda_4,$ respectively then approximately which one of the following is correct ?

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

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

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

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

Answer: C

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116. 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 indepnednt of $n, r_n \propto n$

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

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

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

Answer: A

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117. A hydrogen like atom with atomic number Z is in an excited state of quantum number 2n. It can emit a maximum energy photon of 204 eV. If it makes a transition ot quantum state n, a photon of energy 40.8 eV is emitted. Find n, Z and the ground state energy (in eV) of this atom. Also calculate the minimum energy (in eV) that can be emitted by this atom during de-excitation. Ground state energy of hydrogen atom is – 13. 6 eV.

A. 1

B. 2

C. 3

D. 4

Answer: B

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Assertion And Reason

1. Assertion Angular momentum of single electron in any orbit or hydrogen type atom is independent of the atomic number of the element.

Reason In ground state angular momentum is minimum

A. If both Assertion and Reason ar true and Reason is the correct explanation of

Assertion.

B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion

C. If Assertion is true by Reason is false.

D. If Assertion is false but Reason is true.

Answer: B

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2. Assertion The radius of second orbit of hydrogen atom is 2.1Å

Reason Radius of nth orbit of hydrogen atom $r_n \propto n^2$

A. If both Assertion and Reason ar true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion

C. If Assertion is true by Reason is false.

D. If Assertion is false but Reason is true.

Answer: B

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3. Assertion Energy E_1 is required to remove first electron from helium atom and energy E_2 is to required to remove the second electron . Them $E_1 < E_2$.

Reason Ionisation energy of single electron of He^{+} is 54.4 eV.

A. If both Assertion and Reason ar true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion

C. If Assertion is true by Reason is false.

D. If Assertion is false but Reason is true.

Answer: B

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4. Assertion The spectral series 'Blamer' of the of the hydrogen atom lies in the visible region of the electromagnetic spetrum

Reason Wavelength of light in the visible region lies in the range of 400 nm to 700 nm

A. If both Assertion and Reason ar true and Reason is the correct explanation of

Assertion.

B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion

C. If Assertion is true by Reason is false.

D. If Assertion is false but Reason is true.

Answer: B

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

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

A. If both Assertion and Reason ar true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not correct explanation of

Assertion

C. If Assertion is true by Reason is false.

D. If both Assertion and Reason are false.

Answer:

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6. Assertion Second orbit circumference of hydrogen atom is two times the de-Broglie wavelength of electrons in that orbit

Reason de-Broglie wavelength of electron in ground state is minimum.

A. If both Assertion and Reason ar true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion

C. If Assertion is true by Reason is false.

D. If Assertion is false but Reason is true.

Answer: B

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7. Assertion By increasing the accelerationg voltage in coolidge tube wavelength of characteristic X-rays does not change.

Reason Cut-off wavelength is inversely proportional to the acceleration voltage

A. If both Assertion and Reason ar true and Reason is the correct explanation of

Assertion.

B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion

C. If Assertion is true by Reason is false.

D. If Assertion is false but Reason is true.

Answer: B

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8. Assertion Energy of characteristic X-rays in more than the energy of continuous X-rays

Reason Charactersitic X-rays are produced due to transition of electrons from higher energy states to lower energy states.

A. If both Assertion and Reason ar true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not correct explanation of

Assertion

C. If Assertion is true by Reason is false.

D. If Assertion is false but Reason is true.

Answer: D

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9. Assertion Wavelength of characteristic X-rays is given by

$$\frac{1}{\lambda} \propto \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

in the transition from $n_2 \rightarrow n_2$. In the above relation propotionally constant does not deped upon the traget material.

Reason Continuous X-rays are target independent.

A. If both Assertion and Reason ar true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion

C. If Assertion is true by Reason is false.

D. If Assertion is false but Reason is true.

Answer: B

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10. Assertio Wavelength of charachteristic X-rays is given by

$$\frac{1}{\lambda} \propto \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

in trasnition from $n_2 \to n_1$. In the abvoe relation proportionality constant is series dependent. For different series (K-series, L-series, etc.) value of this constant will be different.

Reason For L-series value of this constant is less than the value for K-series

A. If both Assertion and Reason ar true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion

C. If Assertion is true by Reason is false.

D. If Assertion is false but Reason is true.

Answer: C

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Match The Columns

1. In Column I physical quantities corresponding to hydrogen and hydrogen like atom are given. In column II, powers of principal quantum number n are givem on which thosee physical quantities depend. Match the two columns.

Column I		Column II
A. Angular velocity of circular motion of electron	(p)	– 4
B. Centripetal acceleration in circular motion of electron	(q)	1
C. Angular momentum of electron	(r)	– 3
D. Moment of inertia of electron about centroidal axis	(s)	4

Ground state energy of hydrogen atom is E_0. Match the following two columns.

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2. Ground state energy of hydrogen atom is E_0 . Match the following two columns.

Column I		Column II
A. Electrostatic potential energy in ground state of hydrogen atom	(p)	E_0
B. Total energy in first excited state of He^+ ion	(q)	$-E_0$
C. Kinetic energy of electron in first excited state of He^+ ion	(r)	$2E_0$
D. Kinetic energy of electron in ground state of hydrogen atom	(s)	$-2E_0$

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3. Wavelength of X-ray photon is a and momentum of X-ray photon is b.

Now, match the following two columns

Column I		Column II
A. Wavelength of γ-ray photon	(p)	$> a$
B. Momentum of γ-ray photon	(q)	$< a$
C. Wavelength of UV ray photon	(r)	$> b$
D. Momentum of UV ray photon	(s)	$< b$

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4. Match the Column :

	Column I		Column II
A.	$\frac{Z^3}{n^5}$	(p)	Angular speed
B.	$\frac{Z^2}{n^2}$	(q)	Magnetic field at the centre due to revolution of electron
C.	$\frac{Z^2}{n^3}$	(r)	Potential energy of an electron in nth orbit
D.	$\frac{Z}{n}$	(s)	Speed of electron in nth orbit

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1. Given the value of Rydberg constant is $10^7 m^{-1}$, the waves number of the lest line of the Balmer series in hydrogen spectrum will be:

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

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

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

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

Answer: B

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2. When an α particle of mass m moving with velocity v bombards on a heavy nucleus of charge Ze, its distance of closest approach form the nucleus depends on m as

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

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

C. m

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

Answer: D

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3. Electrons with de- Broglie wavelength λ fall on the target in an X- rays tube . The cut off wavelength of the emitted X- rays is

A. $\lambda_0 = \frac{2mc\lambda^2}{h}$

B. $\lambda_0 = \frac{2h}{mc}$

C. $\lambda_0 = \frac{2m^2c^2\lambda^3}{h^2}$

D. $\lambda_0 = \lambda$

Answer: A

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4. If an electron in a hydrogen atom jumps from the $3rd$ orbit to the $2nd$ orbit, it emits a photon of wavelength λ. When it jumps form the $4th$ orbit to the $3dr$ orbit, the corresponding wavelength of the photon will be

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

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

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

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

Answer: C

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5. Number of spectral lines in hydrogen atom is

A. 8

B. 6

C. 15

D. ∞

Answer: D

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

A. 13.6 V

B. $-13.6V$

C. 10.2 V

D. $-10V$

Answer: C

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7. If the frequency of K_{α}, K_{β} and L_{α} , X-ray lines of a substance are $v_{K_{\alpha}}, v_{K_{\beta}}$, and $v_{L_{\beta}}$

A. $v_{K_{\beta}} = v_{K_{\alpha}} + v_{L_{\alpha}}$

B. $v_{K_{\beta}} = v_{K_{\alpha}} - v_{L_{\alpha}}$

C. $v_{K_{\beta}} = \dfrac{v_{K_{\alpha}}}{v_{L_{\alpha}}}$

D. $v_{K_\beta}^2 = \frac{v_{K_\alpha} \cdot v_{L_\alpha}}{2}$

Answer: A

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8. The magntic moment (μ) of a revolving electron around the mucleaus varies with principle quantum number n as

A. $\mu \propto 1/n$

B. $\mu \propto 1/n^2$

C. $\mu \propto n$

D. $\mu \propto n^2$

Answer: C

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9. The ionization enegry of the electron in the hydrogen atom in its ground state is $13.6ev$. The atoms are excited to higher energy levels to emit radiations of 6 wavelengths. Maximum wavelength of emitted radiation corresponds to the transition between

A. n=3 to n=1 states

B. n=4 to n=3 states

C. n=3 to n=2 states

D. n=2 to n=1 states

Answer: B

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10. A photon of wavelength 300nm interacts with a stationary hydrogen atom in ground state. During the interaction, whole energy of the photon is transferred to the electron of the atom. State which possibility is correct, (consider, Plank's constant $= 4 \times 10^{-15}$ eVs, velocity of light $= 3 \times 10^{8} ms^{-1}$ ionization energy of hydrogen =13.6 eV)

A. Electron will be knocked out of the atom

B. Electron will go to any excited state of the atom

C. Electron will go only to first excited state of the atom

D. Electron will keep orbiting in the ground state of the atom

Answer: D

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11. Consider $3rd$ orbit of He^{+} (Helium) using nonrelativistic approach the speed of electron in this orbit will be (given $K = 9 \times 10^{9}$

constant $Z = 2$ and h (Planck's constant) $= 6.6 \times 10^{-34} Js.$)

A. $2.29 \times 10^6 ms^{-1}$

B. $1.46 \times 10^6 ms^{-1}$

C. $0.73 \times 10^6 ms^{-1}$

D. $3 \times 10^8 ms^{-1}$

Answer: B

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12. What is the wavelength of ligth for the least energetic photon emitted in the Lyman series of the hydrogen spectrum. (Take , hc =1240 eV -nm)

A. 122nm

B. 82nm

C. 150nm

D. 120nm

Answer: A

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13. The wavelength of k_{α} X- rays produced by an X - rays tube is 0.76Å . The atomic number of the anode material of the tube is ....

A. 20

B. 60

C. 41

D. 80

Answer: C

14. The de-Broglie wavelength of an electron in 4th orbit is (where, r=radius of 1st orbit)

A. $2\pi r$

B. $4\pi r$

C. $8\pi r$

D. $16\pi r$

Answer: C

15. The de-Broglie wavelength of an electron is the same as that of a 50 ke X-ray photon. The ratio of the energy of the photon to the kinetic energy of the electron is (the energy equivalent of electron mass of 0.5 MeV)

A. $1:50$

B. $1:20$

C. $20:1$

D. $50:1$

Answer: C

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16. The ionisation energy of hydrogen is 13.6 eV . The energy of the photon released when an electron jumps from the first excited state (n=2) to the ground state of hydrogen atom is

A. 3.4 eV

B. 4.53 eV

C. 10.2 eV

D. 13.6eV

Answer: C

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

A. 3

B. 2

C. 6

D. 10

Answer: A

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18. If, an electron in hydrogen atom jumps from an orbit of lelvel n=3 to an orbit of level n=2, emitted radiation has a freqwuency (R= Rydbertg's contant ,c = velocity of light)

A. $\frac{3Rc}{27}$

B. $\frac{3Rc}{25}$

C. $\frac{8Rc}{9}$

D. $\frac{5Rc}{36}$

Answer: D

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

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

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

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

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

Answer: A

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20. The Rutherford charge experiment proves than an atom consists of

A. a sphere of positive charge in which electrons are embedded like seeds of water-melon

B. a sphere of negagtive charge in which protons are emebedded like seeds of water -melon

C. a shpere of electrons cloud in which the positive charge is placed at the centre of the sphere

D. a shpere of meutral charge

Answer: C

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21. According to Bohrr model of hydrogen atom, only those orbit are permissible which satisfy the condition

A. mv=nh

B. $\frac{mv^2}{r} = n\left(\frac{h}{2\pi}\right)$

C. $mvr = n\left(\frac{h}{2\pi}\right)$

D. $mvr^2 = n\left(\frac{h}{2\pi}\right)$

Answer: C

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22. In Moseley's law $\sqrt{v} = a(z - b)$, the volue of the screening constant for K-series and L-series of X-rays are respectively

A. 1, 6.4

B. 1,4

C. 4,6

D. 2,4

Answer: A

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23. The K_{α} X-rays of moylydenum has a wavelength of $71 \times 10^{-12} m$. If the energy of molybdenum atom with molybdenum atom when an L-electron removed is

$\left(hc = 12.42 \times 10^{-7} eV\right)$

A. 17.5 keV

B. 40.82 keV

C. 23.32 keV

D. 5.28 keV

Answer: D

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24. Pick out the correct statement from the following

A. Mercury vapour lam produces lines emission spectrum

B. Oil flame produces line emission spectrum

C. Band spectrum helps us to study molecular structure

D. Sunlight spectrum is an example for line absroption spectrum

Answer: A::C::D

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25. Ligth emitted during the de excitation of electrons from n=3 to n=2, when incident on metal, photoelectrons following de excitations photoelectrons are just emitted from that metal. In which of the following de excitations photoelectric effect, is not possible ?

A. From n=2 to n=1

B. From n=3 to n=1

C. From n=5 to n=2

D. From n= to n=1

Answer: D

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26. The energy required in ionise a helium atom is equal to $24.6 eV$ The energy required to remove both the electron from the helium atom would be

A. 51.8 eV

B. 79 eV

C. 38.2 eV

D. 49.2 eV

Answer: B

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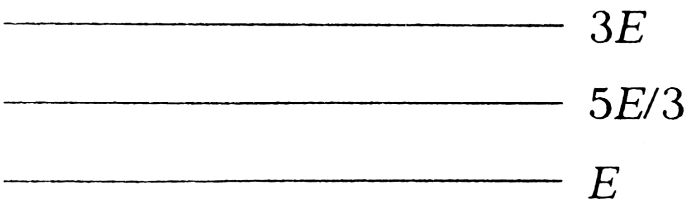
27. The figure shows the energy level of certain atom. When the electron de excites from 3E to E, an electromagentic wave of wavelelngth λ is emitted. What is the wavelelngth of the electromagnetic wave emitted when the electron de excites from $\frac{5E}{3}$ to E?

______3E

______5E/3

______E ?



A. 3λ

B. 2λ

C. 5λ

D. $\frac{3\lambda}{5}$

Answer: A

28. Spectrum of X-rays is

A. continuous

B. linear

C. continuous and linear

D. band

Answer: A

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29. The spectral series of the hydrogen spectrum that lies in the ultraviolet region is the

A. Balmer series

B. Brackett series

C. Paschen series

D. Lyman series

Answer: D

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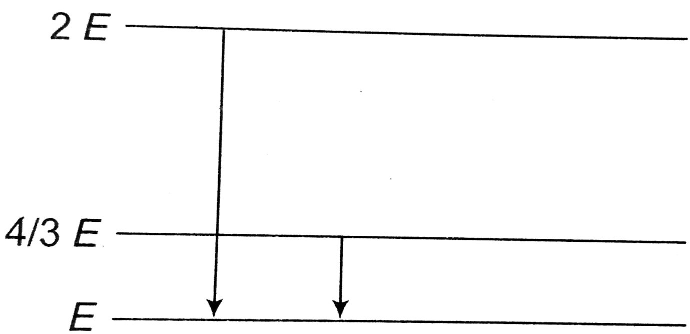
30. The following diagram indicates the energy levels of a certain atom when the system moves from $2E$ level to E, a photon of wavelength λ is emitted. The wavelength of photon produced during its transition from $\frac{4E}{3}$ level to E is



A. 3λ

B. $\lambda/3$

C. $3\lambda/3$

D. $4\lambda/3$

Answer: A

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31. As par Bohr model, the minimum energy (in eV) required to remove an electron from the ground state of doubly ionized Li atom $(Z = 3)$ is

A. 1.51

B. 28.7

C. 53.9

D. 122.4

Answer: D

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32. If the series limit of Lyman series for Hydrogen atom is equal to the series limit Balmer series for a hydrogen like atom, then atomic number of this hydrogen-like atom will be

A. 1

B. 2

C. 3

D. 4

Answer: B

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33. Electron in hydrogen atom first jumps from third excited state to second excited state and then form second excited state to first excited state. The ratio of wavelength $\lambda_1 : \lambda_2$ emitted in two cases is

A. $7 / 5$

B. $27 / 20$

C. $27 / 5$

D. $20 / 7$

Answer: D

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34. An electrons of a stationary hydrogen aton passes form the fifth enegry level to the ground level. The velocity that the atom acquired as a result of photon emission will be (m is the mass of the electron, R, Rydberg constanrt and h, Planck's constant)

A. $\frac{24hR}{25m}$

B. $\frac{25hR}{24m}$

C. $\frac{25m}{24hR}$

D. $\frac{24m}{25hR}$

Answer: A

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35. Assertion Bamer series lies in the visble region of electromagnetic spectrum.

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

A. If both Assertion and Reason are true and Reason is the correct explanation of Assetion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assetion is true but Reason is false.

D. If both Assertion and Reason are false.

Answer: A

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36. Assertion A beam of charged particles is employed in the treatment of cancer.

Reason Charged particles on passing through a material medium loss their energy by causing ionisation of the atoms along their path.

A. If both Assertion and Reason are true and Reason is the correct explanation of Assetion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assetion is true but Reason is false.

D. If both Assertion and Reason are false.

Answer: B

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37. In Bohr model of hydrogen atom, the force on the electron depends on the principal quantum number (n) as

A. independent of n

B. $F \propto \dfrac{1}{n^5}$

C. $F \propto \dfrac{1}{n^4}$

D. $F \propto \dfrac{1}{n^3}$

Answer: C

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38. The wavelength of K_a line copper is $1.5Å$. The ionisation energy of K electron in copper is

A. $11.2 \times 10^{-17} J$

B. $12.9 \times 10^{-16} J$

C. $1.7 \times 10^{-15} J$

D. $10 \times 10^{-16} J$

Answer: B

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39. The wavelength of first line of Balmer series is 6563Å. The wavelength of first line of Lyman series will be

A. 1215.4Å

B. 2500Å

C. 7500Å

D. 600Å

Answer: A

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

A. e^2

B. e^3

C. e^5

D. e^6

Answer: C

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41. If 10000 V is applied across an X-ray tube, what will be the ratio of de-Broglie wavelength of the incident electrons to the shortest wavelength X-ray produced?

$\left(\frac{e}{m}\text{for electron} = 1.8 \times 10^{11} Ckg^{-1}\right)$

A. 0.1

B. 0.2

C. 0.3

D. 1.0

Answer: A

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42. 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

$E_{\max} = 1.224eV$

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

A. 2

B. 4

C. 5

D. None of these

Answer: A

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