PHYSICS

BOOKS - A2Z PHYSICS (HINGLISH)

ATOMIC PHYSICS

Electron And Different Atomic Models

1. The ratio of moment of an electron and an α-particle which are accelerated from rest by a potential difference of $100V$ is

A. 1

B. $\sqrt{\frac{2m_e}{m_\alpha}}$

C. $\sqrt{\frac{m_e}{m_\alpha}}$

D. $\sqrt{\frac{m_e}{2m_\alpha}}$

Answer: D

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2. When subjected to a transverse electric field, cathode rays move

A. down the potential gradient

B. up the potential gradient

C. along a hyperbolic path

D. along a circular path

Answer: B

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3. In Millikan oil drop experiment, a charged drop of mass $1.8 \times 10^{-14} kg$ is stationary between its plates. The distance between its plates is $0.90 cm$ and potential difference is 2.0 kilo volts. The number of electrons on the drop is

A. 500

B. 50

C. 5

D. 0

Answer: C

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4. From the following, what charges can be present on oil drops in Millikan's experiment ?

A. Zero, equal to the magnitude of charge on α-particle

B. Ze, $1.6 \times 10^{-18} C$

C. $1.6 \times 10^{-19} C$, $2.5e$

D. $1.5e$, e

Answer: B

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5. A narrow electron beam passes undeviated through an electric field $E = 3 \times 10^4 \text{volt} / m$ and an overlapping magnetic field $B = 2 \times 10^{-3} Weber / m^2$. If electric field and magnetic field are mutually perpendicular. The speed of the electron is

A. $60 m / s$

B. $10.3 \times 10^7 m / s$

C. $1.5 \times 10^7 m / s$

D. $0.67 \times 10^7 m / s$

Answer: B

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6. Cathode rays enter into a unifrom magnetic field perpendicular to the direction of the field. In the magnetic field their path will be

A. straight line

B. circle

C. parabolic

D. ellipse

Answer: B

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7. The specific charge of an electron is

A. 1.6×10^{-19} coulomb

B. 4.8×10^{-10} statcoulomb

C. 1.76×10^{11} coulomb/kg

D. $|8| \times 10^{-15} Hz$

Answer: C

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8. Cathode rays are similar to visible light rays in that

A. They both can be deflected by electirc and magnetic fields

B. They both have a definite magnitude of wavelength

C. They both ionise a gas through which thay pass

D. They bothe can expose a photographic plate

Answer: D

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9. Gases begin to conduct electricity at low pressure because

A. At low pressure, gass turn to plasma

B. Colliding electrons can acquire higher kinetic energy due to increased mean free path leading to ioinsation of atoms

C. Atom break up into electrons and protons

D. The electron in atoms can move freely at loaw pressure

Answer: B

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10. A beam of electron is moving with constant velocity in a region having electric and magnetic fields of strength $20Vm^{-1}$ and $0.5T$ at right angles to the direction of motion of the electrons. What is the velocity of the electrons?

A. $20ms^{-1}$

B. $40ms^{-1}$

C. $8ms^{-1}$

D. $5.5ms^{-1}$

Answer: B

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11. Kinetic energy of emited cathode rays is dependent on

A. only voltage

B. only work function

C. both (a) and (b)

D. it does not depend upon any physical quantity

Answer: C

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12. The radius of the orbital of electron in the hydrogen atom 0.5Å. The speed of the electron is $2 \times 10^6 m / s$. Then the current in the loop due to the motion of the electron is

A. $1mA$

B. $1.5mA$

C. $2.5mA$

D. $1.5 \times 10^{-2} mA$

Answer: A

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13. In a Millikan's oil drop experiment the charge on an oil drop is calculated to be $16.35 \times 10^{-19} C$. The number of excess electrons on the drop is

A. 3.9

B. 4

C. 4.2

D. 6

Answer: B

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14. A metal plate gets heted, when cathode rays strike against it due to

A. Kinetic energy of cathode rays

B. Potential energy of cathode rays

C. linear velocity of cathode rays

D. angualr velocity of cathode rays

Answer: A

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15. Cathode rays are

A. Positive rays

B. netural rays

C. he rays

D. electron waves

Answer: D

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16. An electron of charge 'e' coulomb passes through a potential difference of V volts. Its energy in 'joules' will be

A. V/e

B. eV

C. e/V

D. V

Answer: B

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17. An electron is accelerated through a potential difference of 200 volts. If e/m for the electron be 1.6×10^{11} coulomb/kg, the velocity acquired by the electron will be

A. $8 \times 10^{6} m/s$

B. $8 \times 10^5 m / s$

C. $5.9 \times 10^6 m / s$

D. $5.9 \times 10^5 m / s$

Answer: A

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18. Which is not true with respect to the cathode rays ?

A. A stream of electrons

B. Charged particles

C. Move with speed same as that of light

D. Can be deflected by magnetic fields

Answer: C

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19. In Millikan's experiment, an oil drop having charge q gets stationary on applying a potential difference V in between two plates separated by a distance 'd'. The weight of the drop is

A. qVd

B. $q\frac{d}{V}$

C. $\frac{q}{Vd}$

D. $q\frac{V}{d}$

Answer: D

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20. In Thomson experiment of finding e/m for electrons, been of electron is replaced by that of muons (particle with same charges as of electrons but mass 208 times that of electrons). No deflection condition in this case satisfied if

A. B is increased 208 times

B. E is increased 208 times

C. B is increased 14.4 times

D. None of these

Answer: C

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21. The colour of the positive column ina gas discharge tube depends on

A. the type of glass used to construct the tube

B. the gas in the tube

C. the applied voltage

D. the meterial of the cathode

Answer: B

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22. The speed of an eletctron having a wavelength of $10^{-10}m$ is

A. $7.25 \times 10^{6}m/s$

B. $6.26 \times 10^{6}m/s$

C. $5.25 \times 10^{6}m/s$

D. $4.24 \times 10^{6}m/s$

Answer: A

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23. Which of the following is not the property of a cathode rays

A. It casts shadow

B. It produces heating effect

C. It produces fluoresence

D. It does not deflect in electric field

Answer: D

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24. An electron is accelerated through a.p.d of 45.5 volt. The velocity acquired by it is (in ms^{-1})

A. 4×10^6

B. 4×10^4

C. 10^6

D. Zero

Answer: A

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25. Order of q/m ratio of proton, α-particle and electron is

A. $e > p > \alpha$

B. $p > \alpha > e$

C. $e > \alpha > p$

D. None of these

Answer: A

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26. A charge of magnitude $3e$ and mass $2m$ is moving electric field $\vec{E}$. The acceleration imparted to the charge is

A. $2Ee/3m$

B. $3Ee/2m$

C. $2m/3Ee$

D. $3m/2Ee$

Answer: B

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27. An electron initially at rest, is accelerated through a potential difference of 200 volt, so that it acquires a velocity $8.4 \times 10^6 m / s$. The value of e / m of elctron

A. $2.76 \times 10^{12} C / kg$

B. $1.76 \times 10^{11} C / kg$

C. $0.76 \times 10^{12} C / kg$

D. None of these

Answer: B

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28. An α-particle is accelerated through a.p.d of 10^{6} volt the $K.E.$ of particle will be

A. $8MeV$

B. $4MeV$

C. $2MeV$

D. $1MeV$

Answer: C

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29. Positive rays consist of

A. electrons

B. neutrons

C. positive ions

D. electromagnetic waves

Answer: C

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30. O^{++}, C^{+}, He^{++} and H^{+} ions are projected on the photographic plate with same velocity in a spectrograph. Which one will strike farthest?

A. O^{++}

B. C^{+}

C. He^{++}

D. H_2^{+}

Answer: B

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31. In an electron gun, the electrons are accelerated by the potential V. If the e is the charge and m is the mass of the electron, then the maximum velocity of these electrons will be

A. $\frac{2eV}{m}$

B. $\sqrt{\frac{2eV}{m}}$

C. $\sqrt{\frac{2m}{eV}}$

D. $\frac{V^2}{2em}$

Answer: B

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32. In Millikan's oil drop experiment, an oil drop mass $60 \times 10^{-6} kg$ is balanced by an electric field of $10^6 V / m$. The charge in coulomb on the drop, assuming $g = 10 m / s^2$ is

A. 6.2×10^{-11}

B. 16×10^{-9}

C. 16×10^{-11}

D. 16×10^{-13}

Answer: C

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33. The Rutherford α-particle experiment shown that most of the α-particles pass through almost unscattered while some are scattered through large angles. What information does it given about the structure of the atom ?

A. Atom is hollow

B. The whole mass of the atom is concentrated in a small centre called nucleus

C. Nucleus is positively charged

D. All the above

Answer: D

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34. According to the Rutherford's atomic model, the electrons inside the atom are

A. Stationary

B. not stationary

C. centralized

D. none of these

Answer: B

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

A. spiral

B. circular

C. parabolic

D. straight line

Answer: A

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36. Rutherford's α- particle experiment showed that the atoms have

A. proton

B. nucleus

C. neutron

D. electrons

Answer: B

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37. In interpreting Rutherford's experiments on the scattering of alpha particles by thin foil, one must examine what were known factors, and what the experiment settle. Which of the following is true in this context?

A. The number of electrons in the target atoms (i.e., Z) was settled by these experiments

B. The validity of Coulomb's law for distance as small as 10^{-13} was knows before these experiments

C. The experiments settled that size of the nucleus could not be larger than a certain value

D. The experiments also settled that size of the nucleus could not be smaller than a certain value

Answer: C

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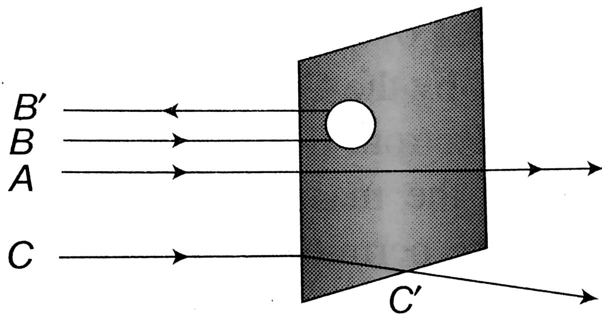
38. A beam of fast moving alpha particles were directed towards a thin film of gold. The parts A', B' and C' of the transmitted and refected beams correcponding ro the incident parts A, B and C of the beam, are shown in the adjoining diagram. The number of alpha particles in



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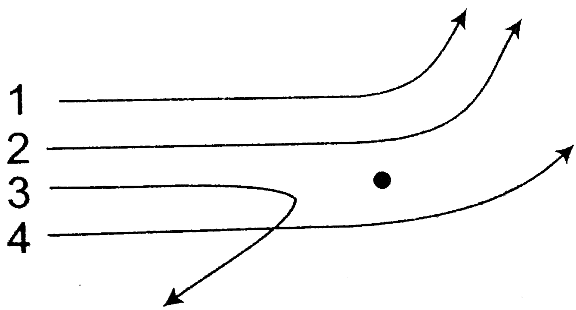
39. The diagram shown the path of four α-particles of the same energy being scattered by the nucleus of an atom simutaneously. Which of these are/is not physically possible ?



A. 3 and 4

B. 2 and 3

C. 1 and 4

D. 4 only

Answer: D

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

A. 90°

B. 270°

C. 0°

D. 180°

Answer: D

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41. 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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42. An α-particle of $5MeV$ energy strikes with a nucleus of uranium at stationary at an scattering angle of 108°. The nearest distance up to which αparticle reaches the nuvles will be of the order of

A. 1Å

B. $10^{-10}cm$

C. $10^{-12}cm$

D. $10^{-15}cm$

Answer: C

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Bohr'S Hydrogen Model

1. Which of the following statement is true regarding Bohr's model of hydrogen atom ?

(I) Orbiting speed of electrons decreases as if falls to discrete orbits away from the nucleus.

(II) Radii of allowed orbits of electrons are proportional to the principle quantum number.

(III) Frequency with which electrons orbit around the nucleus in discrete orbits is inversely proportional to the principle quantum number.

(IV) Binding force with which the electron is bound to the nucleus increases as it shifts to outer orbits.

Selected the correct answer using the codes given below:

A. I and III

B. II and IV

C. I, II and III

D. II, III and IV

Answer: A

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2. In the Bohr model of a hydrogen atom, the centripetal force is furnished by the Coulomb attraction between the proton and the electrons. If a_0 is the radius of the ground state orbit, m is the mass and e I sthe charge on the electron and is the permittivity of vacuum, the speed of the elctron is :

A. 0

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

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

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

Answer: C

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

A. Angular momentum $\propto \frac{1}{n}$

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

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

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

Answer: B

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4. The electron in a hydrogen atom jumps from ground state to the higher energy state where its velcoity is reduced to one-third its initial value. If the radius of the orbit in the ground state is r the radius of new orbit will be

A. $3r$

B. $9r$

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

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

Answer: B

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5. If in nature they may not be an element for which the principle quantum number $n > 4$, then the total possible number of elements will be

A. 60

B. 32

C. 4

D. 64

Answer: A

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6. In the Bohr's hydrogen atom model, the radius of the stationary orbit is directly proportinal to $(n =$ principle quantum number)

A. n^{-1}

B. n

C. n^{-2}

D. n^2

Answer: D

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7. In the nth orbit, the energy of an electron $E_n = -\frac{13.6}{n^2} eV$ for hydrogen atom. The energy required 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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8. The size of an atom is of the order of

A. $10^{-18}m$

B. $10^{-10}m$

C. $10^{-12}m$

D. $10^{-14}m$

Answer: B

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9. The energy required to knock out the electron in the third orbit of a hydrogen atom is equal to

A. $13.6eV$

B. $+\frac{13.6}{9}eV$

C. $-\frac{13.6}{9}eV$

D. $-\frac{3}{13.6}eV$

Answer: B

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10. An electron has a mass of $9.1 \times 10^{-31} kg$. It revolves round the nucleus in a circular orbit of radius 0.529×10^{-10} metre at a speed of $2.2 \times 10^{6} m/s$. The magnitude of its linear momentum in this motion is

A. $1.1 \times 10^{-34} kg - m/s$

B. $2.0 \times 10^{-24} kg - m/s$

C. $4.0 \times 10^{-24} kg - m/s$

D. $4.0 \times 10^{-31} kg - m/s$

Answer: B

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11. In a beryllium atom, if a_0 be the radius of the first orbit, then the radius of the second orbit will be in general

A. na_0

B. a_0

C. $n^2 a_0$

D. $\frac{a_0}{n^2}$

Answer: C

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12. The ionization potential for second He electron is

A. $13.6eV$

B. $27.2eV$

C. $54.4eV$

D. $100eV$

Answer: C

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13. The energy required to remove an electron in a hydrogen atom from $n = 10$ state is

A. $13.6eV$

B. $1.36eV$

C. $0.136eV$

D. $0.0136eV$

Answer: C

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14. The kinetic energy of the electron in an orbit of radius r in hydrogen atom is ($e =$ electronic charge)

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

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

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

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

Answer: B

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15. 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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16. The angular momentum of electron in nth orbit is given by

A. nh

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

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

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

Answer: C

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

A. $1/4$

B. $4/9$

C. $9/4$

D. 4

Answer: C

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18. The ionization potential of hydrogen atom is 13.6 volt. The energy required to remove an electron in the $n=2$ state of the hydrogen atom is

A. $27.2eV$

B. $13.6eV$

C. $6.8eV$

D. $3.4eV$

Answer: D

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19. The ionisation energy of 10 times innised sodium atom is

A. $13.6eV$

B. $13.6 \times 11eV$

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

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

Answer: D

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20. According to Bohr's theory the radius of electron in an orbit described by principle quantum number n and atomic number Z is proportional to

A. $Z^2 n^2$

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

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

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

Answer: D

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21. The radius of electron's second stationary orbit in Bohr's atom is R. The radius of the third orbit will be

A. $3R$

B. $2.25R$

C. $9R$

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

Answer: B

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22. If m is mass of electron, v its velocity, r the radius of stationary circular orbit around a nucleus with charge Ze, then from Bohr's first postulate, the kinetic energy $k = \frac{1}{2}mv^2$ of the electron is

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

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

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

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

Answer: A

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23. Consider an electron in the nth orbit of a hydrogen atom in the Bohr model. The circumference of the orbit can be expressed in terms of the de-Broglie wavelength λ of that electron as

A. $(0.259) n\lambda$

B. $\sqrt{n}\lambda$

C. $(13.6)\lambda$

D. $n\lambda$

Answer: D

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

A. $1/2$

B. 2

C. $-1/2$

D. -2

Answer: C

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25. when a hydrogen atom is raised from the ground state to an excited state

A. $P.E.$ increases and $K.E.$ decreases

B. $P.E.$ decreases and $K.E.$ increases

C. Both kinetic energy and potential eenrgy increase

D. Both $K.E.$ and $P.E.$ Decrease

Answer: A

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

A. infinite energy

B. the maximum energy

C. the minimum energy

D. zero energy

Answer: C

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27. The ratio of the kinetic energy to the total energy of an electron in a Bohr orbit is

A. -1

B. 2

C. $1:1$

D. None of these

Answer: C

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28. An electron in the $n = 1$ orbit of hydrogen atom is bound by $13.6 eV$. If a hydrogen atom I sin the $n = 3$ state, how much energy is required to ionize it

A. $13.6 eV$

B. $4.53 eV$

C. $3.4 eV$

D. $1.51 eV$

Answer: D

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29. Which of the following statements about the Bohr model of the hydrogen atom is false ?

A. Acceleration of electron in $n = 2$ orbit is less than that in $n = 1$ orbit

B. Angular momentum of electron in $n = 2$ orbit is more than that in $n = 1$ orbit

C. Kinetic energy of electron in $n = 2$ orbit is less than that in $n = 1$ orbit

D. Potential energy of electron in $n = 2$ orbit is less than that in $n = 1$ orbit

Answer: D

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30. If an electron jumps from 1st orbital to 3rd orbital, than it will.

A. absorb energy

B. release energy

C. no gain of energy

D. none of these

Answer: A

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31. According to Bohr's theory, the expression for the kinetic and potential energy of an electron revolving in an orbit is given respectively by

A. $+\frac{e^2}{8\pi\varepsilon_0 r}$ and $-\frac{e^2}{4\pi\varepsilon_0 r}$

B. $+\frac{8\pi\varepsilon_0 e^2}{r}$ and $-\frac{4\pi\varepsilon_0 e^2}{r}$

C. $-\frac{e^2}{8\pi\varepsilon_0 r}$ and $-\frac{e^2}{4\pi\varepsilon_0 r}$

D. $+\frac{e^2}{8\pi\varepsilon_0 r}$ and $+\frac{e^2}{4\pi\varepsilon_0 r}$

Answer: A

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32. In the lowest energy level of hydrogen atom, the electron has the angular momentum

A. π / h

B. h / π

C. $h / 2\pi$

D. $2\pi / h$

Answer: C

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33. The Rydberg constant R for hydrogen is

A. $R = -\left(\frac{1}{4\pi\varepsilon_0}\right) \cdot \frac{2\pi^2 me^2}{ch^2}$

B. $R = \left(\frac{1}{4\pi\varepsilon_0}\right) \cdot \frac{2\pi^2 me^4}{ch^2}$

C. $R = \left(\frac{1}{4\pi\varepsilon_0}\right)^2 \cdot \frac{2\pi^2 me^4}{c^2h^2}$

D. $R = \left(\frac{1}{4\pi\varepsilon_0}\right)^2 \cdot \frac{2\pi^2 me^4}{ch^3}$

Answer: D

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

A. $2\pi h$

B. $5.25 \times 10^{6} m / s$

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

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

Answer: D

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35. The velocity of an electron in the second orbit of sodium atom (atomic number $= 11$) is v. The veocity of an electron in its fifth orboit wil be

A. v

B. $\frac{22}{5}v$

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

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

Answer: D

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36. The absorption transitions between the first and the fourth energy states of hydrogen atom are 3. The emission transitions between these states will be

A. 3

B. 4

C. 5

D. 6

Answer: D

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37. In the Bohr model of a hydrogen atom, the centripetal force is furnished by the Coulomb attraction between the proton and the electrons. If a_0 is the radius of the ground state orbit, m is the mass and e is the charge on the electron and e_0 is the vacuum permittivity, the speed of the electron is

A. 0

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

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

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

Answer: C

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38. The electron in a hydrogen atom make a transition $n_1 \rightarrow n_2$ where n_1 and n_2 are the principal quantum number of the two states . Assume the Bohr model to be valid . The time period of the electron in the initial state is eight time that in the final state . The possible values 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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39. 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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40. In Bohr's model of hydrogen atom, let PE represents potential energy and TE the total energy. In going to a higher level

A. PE decreases, TE increases

B. PE increases, TE increases

C. PE decreases, TE decreases

D. PE increases, TE decreases

Answer: B

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41. According to Bohr's model, the radius of the second orbit of helium atom is

A. $0.53 \mathring{A}$

B. $1.06 \mathring{A}$

C. $2.12 \mathring{A}$

D. $0.265 \mathring{A}$

Answer: B

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42. An ionic atom equivalent to hydrogen atom has wavelength equal to $1/4$ of the wavelengths of hydrogen lines. The ion will be

A. He^{+}

B. Li^{++}

C. Ne^{9+}

D. Na^{10+}

Answer: A

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43. An electron in the $n = 1$ orbit of hydrogen atom is bound by $13.6eV$ energy is required to ionize it is

A. $13.6 eV$

B. $6.53 eV$

C. $5.4 eV$

D. $1.51 eV$

Answer: A

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44. Ionization energy of hydrogen is $13.6 eV$. If $h = 6.6 \times 10^{-34} J - s$, the value of R will of the order of

A. $10^{10}m^{-1}$

B. $10^{7}m^{-1}$

C. $10^{4}m^{-1}$

D. $10^{-7}m^{-1}$

Answer: B

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45. To explain his theory, Bohr used

A. Conservation of linear momentum

B. Conservation of angular momentum

C. Conservation of quantum frequency

D. Conservation of energy

Answer: B

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46. The ionisation energy of hydrogen atom is $13.6eV$. Following Bohr's theory, the energy corresponding to a transition between the 3rd and the 4th orbit is

A. $3.40 eV$

B. $1.51 eV$

C. $0.85 eV$

D. $0.66 eV$

Answer: D

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47. Hydrogen atoms are excited from ground state of the principle quantum number 4. Then the number of spectral lines observed will be

A. 3

B. 6

C. 5

D. 2

Answer: B

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48. 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

$21.2 \times 10^{-11} m$. What is the principle quantum number of n of the final state of the atom ?

A. $n = 4$

B. $n = 2$

C. $n = 16$

D. $n = 3$

Answer: B

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49. The energy of a hydrogen atom in its ground state is $-13.6eV$. The energy of the level corresponding to the quantum number $n=2$ (first excited state) in the hydrogen atom is

A. $-2.72eV$

B. $-0.85eV$

C. $-0.54eV$

D. $-3.4eV$

Answer: D

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50. When hydrogen atom is in first excited level, its radius is....its ground state radius

A. Half

B. Same

C. Twice

D. Four times

Answer: B

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51. The wavelength of the energy emitted when electron come from fourth orbit to second orbit in hydrogen is $20.397 cm$. The wavelength of energy for the same transition in He^{+} is

A. $5.099 cm^{-1}$

B. $20.497 cm^{-1}$

C. $40.994 cm^{-1}$

D. $81.988 cm^{-1}$

Answer: A

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

A. $13.6V$

B. $3.4V$

C. $10.2V$

D. $3.6V$

Answer: C

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53. The energy of electron in first excited state of H-atom is $-3.4eV$ its kinetic energy is

A. $-3.4eV$

B. $+3.4eV$

C. $-6.8eV$

D. $6.8eV$

Answer: B

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54. 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. $2.08 \times 10^{-34} J - s$

Answer: C

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55. In a hydrogen atom, the distance between the electron and proton is $2.5 \times 10^{-11} m$. The electricl force of attraction between then will be

A. $2.8 \times 10^{-7} N$

B. $3.7 \times 10^{-7} N$

C. $6.2 \times 10^{-7} N$

D. $9.1 \times 10^{-7} N$

Answer: B

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56. What will be the angular momentum of an electron, if energy of this electron in H-atom is $1.5eV$ (in $J-s$)?

A. 1.05×10^{-34}

B. 2.1×10^{-34}

C. 3.15×10^{-34}

D. -2.1×10^{-34}

Answer: C

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57. The time of revolution of an electron around a nucleus of charge Ze in nth Bohr orbit is directly proportional to

A. n

B. $\frac{n^3}{Z^2}$

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

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

Answer: B

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58. In Bohr's model, if the atomic radius of the first orbit is r_0, then the radius of the fourth orbit is

A. r_0

B. $4r_0$

C. $r_0 / 16$

D. $16r_0$

Answer: D

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59. 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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60. In Bohr model of hyrogen atom, the ratio of periods of revolution of an electon in $n = 2$ and $n = 1$ orbit is

A. $2:1$

B. $4:1$

C. $8:1$

D. $16:1$

Answer: C

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

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

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

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

D. Its kinetic, potential and total energies decrease

Answer: A

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

A. 8Å

B. 4Å

C. 0.5Å

D. 0.25Å

Answer: B

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63. 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. $2\pi hc/e^2$

B. $e^2h/2\pi c$

C. $e^2c/2\pi h$

D. $2\pi e^2/hc$

Answer: D

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64. The energy of hydrogen atom in its ground state is $-13.6eV$. The energy of the level corresponding to the quantum number n is equal 5 is

A. $-5.40eV$

B. $-2.72eV$

C. $-0.85eV$

D. $-0.54eV$

Answer: D

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65. Orbit acceleration of electron is

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

B. $\dfrac{n^2h^2}{2n^2r^3}$

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

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

Answer: A

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66. In the following transitions, which one has higher frequency ?

A. $3 \rightarrow 2$

B. $4 \rightarrow 3$

C. $4 \rightarrow 2$

D. $3 \rightarrow 1$

Answer: D

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67. An electron jumps from $5th$ orbit to $4th$ orbit of hydrogen atom. Taking the Rydberg constant as 10^7 per meter. What will be the frequency of radiation emitted ?

A. $6.75 \times 10^{12} Hz$

B. $6.75 \times 10^{14} Hz$

C. $6.75 \times 10^{13} Hz$

D. None of these

Answer: C

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68. For principle quantum number $n = 3$, the possible values of orbital quantum number 'l' are

A. $1, 2, 3$

B. $0, 1, 2, 3$

C. $0, 1, 2$

D. $-1, 0, +1$

Answer: C

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69. Energy of an electron in an excited hydrogen atom is $-3.4eV$. Its angualr momentum will be: $h = 6.626 \times 10^{-34} J - s$.

A. $1.11 \times 10^{34} J - s$

B. $1.51 \times 10^{-31} J - s$

C. $2.11 \times 10^{-34} J - s$

D. $3.72 \times 10^{-34} J - s$

Answer: C

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70. 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. $4:9:36$

D. $3:2:1$

Answer: C

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71. The wavelength of light emitted from second orbit to first orbits in a hydrogen atom is

A. $1.215 \times 10^{-7} m$

B. $1.215 \times 10^{-5} m$

C. $1.215 \times 10^{-4} m$

D. $1.215 \times 10^{-3} m$

Answer: A

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72. Energy of the electron in nth orbit of hydrogen atom is given by $E_n = -\frac{13.6}{n^2}eV$. The amount of energy needed to transfer electron from first orbit to third orbit is

A. $13.6eV$

B. $3.4eV$

C. $12.09eV$

D. 1.51 eV`

Answer: C

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73. 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 circycumference of the first orbit

C. Equal to twice the circumference of the first orbit

D. Equal to the circulference of the first orbit

Answer: D

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74. In hydrogen atom, when electron jupms from second to first orbit, then enrgy emitted is

A. $-13.6eV$

B. $-27.2eV$

C. $-6.8eV$

D. None of these

Answer: D

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75. Minimum energy required to takeout the only one electron from ground state of He^{+} is

A. $13.6eV$

B. $54.4eV$

C. $27.2eV$

D. $6.8eV$

Answer: B

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76. The frequency of 1st line Balmer series in H_2 atom is v_0. The frequency of line emitted by single ionised He atom is

A. $2v_0$

B. $4v_0$

C. $v_0 / 2$

D. $v_0 / 4$

Answer: B

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77. When the electron in the hydrogen atom jumps from $2nd$ orbit to 1st orbit, the wavelength of radiation emitted is λ. When the electrons jumps from $3rd$ orbit to $1st$ orbit, the wavelength of emitted radiation would be

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

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

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

D. $\frac{3}{2}\lambda$

Answer: A

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78. Which of the following transitions will have highest emission wavelength ?

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

B. $n = 1$ to $n = 2$

C. $n = 2$ to $n = 5$

D. $n = 5$ to $n = 2$

Answer: D

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79. When the wave of hydrogen atom comes from infinity into the first then the value of wave number is

A. $109700cm^{-1}$

B. $1097cm^{-1}$

C. $109cm^{-1}$

D. None of these

Answer: A

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80. With the increase in peinciple quantum number, the energy difference between the two successive energy levels

A. increases

B. decreases

C. remians constant

D. sometimes increases and sometimes decreases

Answer: B

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

A. Single ionized helium

B. Deuterium atom

C. Hydrogen atom

D. Doubly ionized lithium

Answer: D

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

A. $122.4eV$

B. $30.6eV$

C. $13.6eV$

D. $3.4eV$

Answer: B

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83. 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. $1.9 eV$

Answer: D

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84. Which state of triply ionised Beryllium $\left(Be^{+++}\right)$ the same orbital radius as that of the ground state hydrogen ?

A. $n = 4$

B. $n = 3$

C. $n = 2$

D. $n = 1$

Answer: C

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85. The ratio of areas within the electron orbits for the first excited state to the ground state for hydrogen atom is

A. $16:1$

B. $18:1$

C. $4:1$

D. $2:1$

Answer: D

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86. The kinetic energy of electron in the first Bohr orbit of the hydrogen atom is

A. $-6.5eV$

B. $-27.2eV$

C. $13.6eV$

D. $-13.6eV$

Answer: C

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87. If the energy of a hydrogen atom in nth orbit is E_n, then energy in the nth orbit of a singly ionised helium atom will be

A. $4E_n$

B. $E_n / 4$

C. $2E_n$

D. $E_n / 2$

Answer: A

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88. What is the ratio of wavelength of radiations emitted when an electron in hydrogen atom jump from fourth orbit to second ornti and from third orbit to second orbit?

A. $20 : 25$

B. $20 : 27$

C. $20 : 25$

D. $25 : 27$

Answer: B

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

A. $0eV$

B. $-27.2eV$

C. $1eV$

D. $2eV$

Answer: B

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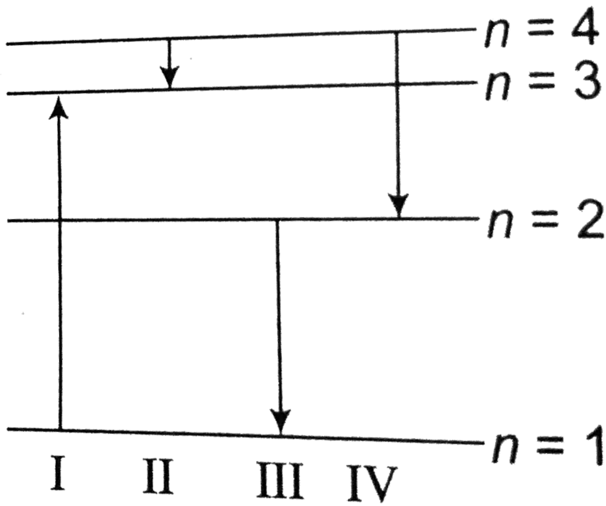
90. The diagram shown the energy levels for an electron in a certain atom. Which transition shown represents emissions of a photon with the most energy ?



A. I

B. II

C. III

D. IV

Answer: C

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Atomic Spectrum

1. If the following atoms and molecylates for the transition from $n = 2$ to $n = 1$, the spectral line of minimum wavelength will be produced by

A. hydrogen atom

B. decterium atom

C. uni-ionized helium

D. di-ionized lithium

Answer: D

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2. The Lyman series of hydrogen spectrum lies in the region :

A. Infrared

B. Visible

C. Ultraviolet

D. Of-X-rays

Answer: C

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

A. Lyman series

B. Balmer series

C. Paschen series

D. Bracket series

Answer: B

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4. The ratio of minimum to maximum wavelength of radiation that en electron in the gorund stsate can cause in a Bohr's hydrgen atom is:

A. $1/2$

B. zero

C. $3/4$

D. $27/32$

Answer: C

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5. 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. $v_2 - v_1 = v_3$

C. $v_3 = \frac{1}{2}(v_1 + v_2)$

D. $v_1 + v_2 = v_3$

Answer: A

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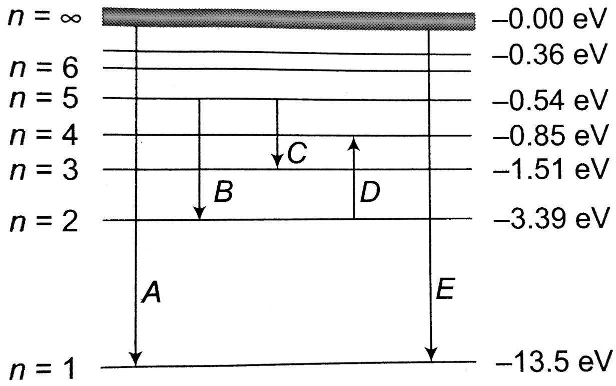
6. The energy levels of the hydrogen spectrum is shown in figure. There are some transitions A, B, C, D and E. Transition A, B, and C

respectively represent



A. First mumber of Lyman series, third spectual line of Balmer series and the second spectral line of Paschen series

B. Ionization potential of hydrogen, second spectral line of Balmer series and third spectral line of Paschen series

C. Series limit of Lyman series, third spectral line of Balmer series and second spectral line of Paschen series

D. Series limit of Lyman series, second spectral line of Balmer series and third spectral line of Paschen series

Answer: C

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7. In the figure of previous problem, D and E respectively represent

A. Absorption line of Balmer series and the ionization potential of hydrogen

B. Absorption line Balmer series and the wavelength lesses than lowest of the Lyamn series

C. Spectral line of Balmer series and the maximum wavelength of Lyman series

D. Spectral line of Lyman series and the absorption of greater wavelength of limiting value of Paschen series

Answer: A

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8. Which of the following is true?

A. Lyman series is a continuous spectrum

B. Paschen series is a line spectrum in the infrared

C. Balmer series is a line spectrum in the ultraviolet

D. The spectral series formula can be derived from the Rutherford model of the hydrogen atom

Answer: B

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9. Every series of hydrogen spectrum has an upper and lower limit in wavelength. The spectral series which has an upper limit of wavelegnth equal to 18752Å is

(Rydberg constant $R = 1.097 \times 10^7$ per metre)

A. Balmer series

B. Lyman series

C. Paschen series

D. Pfund series

Answer: C

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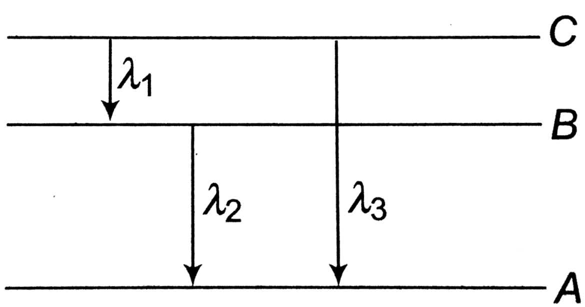
10. Energy levels A, B, C of a certain atom corresponding to increasing values of energy i.e., $E_A < E_B < E_C$. If $\lambda_1, \lambda_2, \lambda_3$ are the wavelengths of radiations corresponding to the transitions C to B, B to A and C to A respectively, which of the following options is correct?



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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11. 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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12. 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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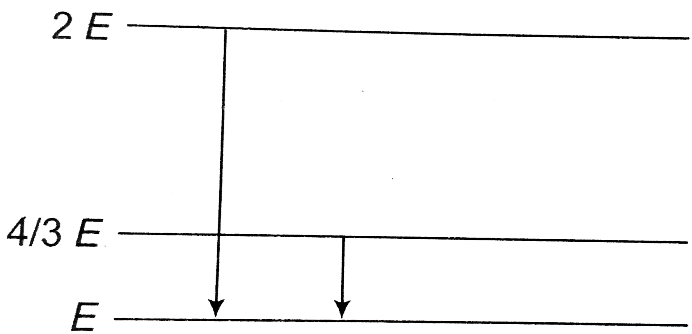
13. The following diagram indicates the energy levels of a certain atom when the system moves from $2E$ level to E, a photon of wavelength λ is emitted. The wavelength of photon produced during its transition from $\frac{4E}{3}$ level to E is



A. $\lambda / 3$

B. $3\lambda/4$

C. $4\lambda/3$

D. 3λ

Answer: D

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

A. Balmer series

B. Pfund series

C. Paschen series

D. Lyman series

Answer: D

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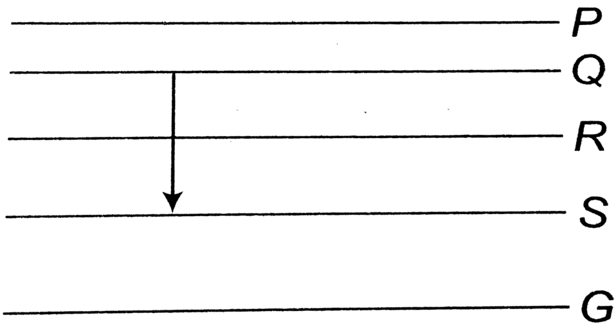
15. Figure shows the enegry levels P, Q, R, S and G of an atom where G is the ground state. A red line in the emission spectrum of the atom can be obtaned by an energy level change from Q so S. A blue line can be obtained by following energy level change



A. P to Q

B. Q to R

C. R to S

D. R to G

Answer: D

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16. A hydrogen atom (ionisation potential $13.6eV$) makes a transition from third excited state to first excied state. The enegry of the photon emitted in the process is

A. $1.89eV$

B. $2.55eV$

C. $12.09eV$

D. $12.75 eV$

Answer: B

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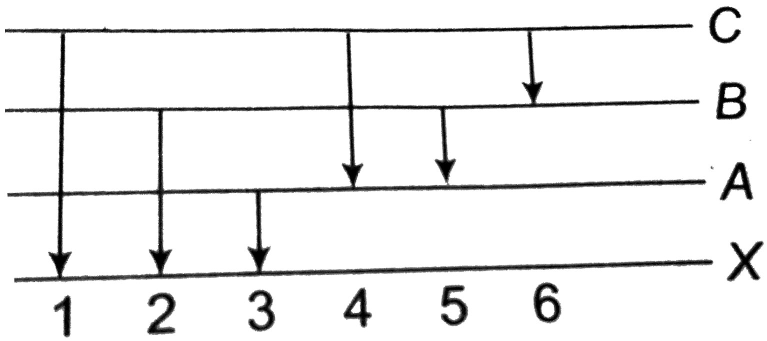
17. The figure indicates the enegry level diagram of an atom and the origin of six spectral lines in emission (e.g. line no.5 series from the transition from level B to A). The following spectral lines will also occur in the absorption spectrum



A. 1, 4, 6

B. 4, 5, 6

C. 1, 2, 3

D. 1, 2, 3, 4, 5, 6

Answer: C

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18. 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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19. The ratio of the frequenices of the long wavelength llmits of Lyman and balman series of hydrogen spectrum is

A. $27 : 5$

B. $5 : 27$

C. $4 : 1$

D. $1 : 4$

Answer: A

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20. Which of the following transitions in a hydrogen atom emits photon of the highest frequency ?

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

B. $n = 2$ to $n = 1$

C. $n = 2$ to $n = 6$

D. $n = 6$ to $n = 2$

Answer: A

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21. In terms of Rydberg's constant R, the wave number of the first Balman line is

A. R

B. $3R$

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

D. $\frac{8R}{9}$

Answer: C

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22. If the ionisation potential of helium atom is 24.6 volt, the energy required to ionise it will be

A. $24.6eV$

B. $24.6eV$

C. $13.6eV$

D. $13.6eV$

Answer: A

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23. 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 $n = 3$

C. $n = 3$ to $n = 1$

D. $n = 4$ to $n = 2$

Answer: B

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24. The minimum enegry required to excite a hydrogen atom from its ground state is

A. $13.6eV$

B. $-13.6eV$

C. $3.4eV$

D. $10.2eV$

Answer: D

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25. Ratio of the wavelength of first line of Lyaman series and first line of Balmer series is

A. $1:3$

B. $27:5$

C. $5:27$

D. $4:9$

Answer: C

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26. The wavelength of the first line of Balmer series is 6563Å. The Rydbergs constant fro hydrogen is about

A. 1.09×10^7 per m

B. 1.09×10^8 per m

C. 1.09×10^9 per m

D. 1.09×10^5 per m

Answer: A

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

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

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

C. 25

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

Answer: D

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28. The extreme wavelength of Paschen series are

A. $0.365\mu m$ and $0.565\mu m$

B. $0.818\mu m$ and $1.89\mu m$

C. $1.45\mu m$ and $4.04\mu m$

D. $2.27\mu m$ and $7.43\mu m$

Answer: B

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29. The third line of Balmer series of an ion equivalent to hydrogen atom has wavelength of $108.5mm$. The ground state energy of an electron of this ion will e

A. $3.4eV$

B. $13.6eV$

C. $54.4eV$

D. $122.4eV$

Answer: C

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30. 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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31. The first line of Balmer series has wvaelength $6563 Å$. What will be the wavelength of the ifrst member of Lyman series?

A. $1215.4 Å$

B. $2500 Å$

C. $7500 Å$

D. 600Å

Answer: A

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32. The wavelength of Lyman series is

A. $\dfrac{4}{3 \times 10967} cm$

B. $\dfrac{3}{4 \times 10967} cm1$

C. $\dfrac{4 \times 10967}{3} cm$

D. $\dfrac{3}{4} \times 109767 cm$

Answer: A

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

A. 4

B. 3

C. 1

D. 2

Answer: B

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34. Number of spectral lines in hydrogen atom is

A. 3

B. 6

C. 15

D. Infinite

Answer: D

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

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

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

Answer: B

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36. If $\lambda_{\max}$ is 6563Å, then wave length of second line of Balmer series will be

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

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

C. $\lambda = \frac{4}{3R}$

D. None of the above

Answer: A

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37. If R is the Rydberg's constant for hydrogen the wave number of the first line in the Lyman series will be

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

B. $\frac{3R}{4}$

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

D. $2R$

Answer: B

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38. The first member of the paschen series in hydrogen spectrum is of wavelength $18,800\text{Å}$. The short wavelength limit of Paschen series is

A. 1215Å

B. 6560Å

C. 8225Å

D. 12850Å

Answer: C

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39. The ratio of the largest to shortest wavelength in Lyman series of hydrogen spectra is

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

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

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

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

Answer: D

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40. The ratio of the longest to shortest wavelength in Brackett series of hydrogen spectra is

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

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

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

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

Answer: A

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41. The ratio of minimum to maximum wavelength in Balmer series is

A. $5:9$

B. $5:36$

C. $1:4$

D. $3:4$

Answer: A

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42. Which of the following is true for number of spectral lines in going from Lyman series to Pfund series ?

A. increases

B. Decreases

C. Unchanged

D. May decrease or increase

Answer: B

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43. The wavelength of yellow line of sodium is 5896Å. Its wave number will be

A. 50883×10^{10} per second

B. 16961 per cm

C. 17581 per cm

D. 50883 per cm

Answer: B

Watch Video Solution

44. The first line in the Lyman series has wavelength λ. The wavelength of the first line in Balmer series is

A. $\frac{2}{9}\lambda$

B. $\frac{9}{2}\lambda$

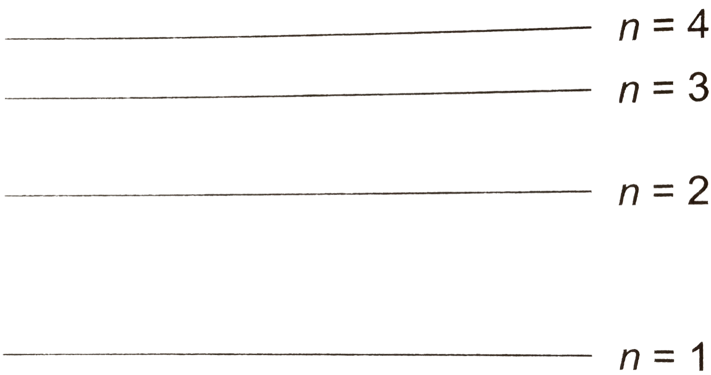
C. $\frac{5}{27}\lambda$

D. $\frac{27}{5}\lambda$

Answer: D

Watch Video Solution

45. Four lowest energy levels of H-atom are shown in the figure. The number of possible emission lines would be



A. 3

B. 4

C. 5

D. 6

Answer: D

46. Whenever a hydrogen atom emits a photon in the Balmer series

A. It need not emit any more photon

B. It may emit another photon in the Paschen series

C. It must emit another photon in the Lyman series

D. It may emit another photon in the Balmer series

Answer: C

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47. The shortest wavelength in the Lyman series of hydrogen spectrum is 912Å correcponding to a photon energy of $13.6eV$. The shortest wavelength in the Balmer series is about

A. 3648Å

B. 8208Å

C. 1228Å

D. 6566Å

Answer: A

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48. Taking Rydberg's constant $R_H = 1.097 \times 10^7 m$ first and second wavelength of Balmer series in hydrogen spectrum is

A. $2000\text{Å}, 3000\text{Å}$

B. $1575\text{Å}, 2960\text{Å}$

C. $6529\text{Å}, 4280\text{Å}$

D. $6552\text{Å}, 4863\text{Å}$

Answer: D

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49. 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. $5/27$

B. $1/93$

C. $4/9$

D. $3/2$

Answer: A

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50. The energy of the highest enegry photon of Blamer series of hydrogen spectrum is close to

A. $13.6eV$

B. $3.4eV$

C. $1.5eV$

D. $0.85eV$

Answer: B

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51. An electron changes its position from orbit $n=4$ to the orbit $n=2$ of an atom. The wavelength of the emitted radiation's is $(R=$ Rydberg's constant)

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

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

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

D. $\frac{16}{7R}$

Answer: B

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52. The energy of electron in the nth orbit of hydrogen atom is expressed as

$E_n = \frac{-13.6}{n^2} eV$. The shortest and longest wavelength of Lyman series will be

A. $910\text{Å}, 1213\text{Å}$

B. $5463\text{Å}, 7858\text{Å}$

C. $1315\text{Å}, 1530\text{Å}$

D. None of these

Answer: A

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53. In an experiment for positive ray analysis with Thomson method, two identical parabola are obtianed when applied electric fields are 3000 and $2000 V/m$. The particles are singly ionised particles assuming same magnetic field :

A. $1:3$

B. $2:4$

C. $3:1$

D. $4:2$

Answer: A

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Problems Based On Mixed Concepts

1. A cathode ray tube contains a pair of parallel metal plates $1.0cm$ apart and $3.0cm$ long. A narrow horizontal beam of electron with a velocity of $3 \times 10^7 ms^{-1}$ is passed down the tube midway between the two plates. When a potential difference of $550V$ is maintained across the plates, it is found that the electron beam is so deflected that it just strikes the end of one of the plates. then the specific change of an electron (that is, the ratio of its charge to mass) in C/kg is :

A. $3.6 \times 10^{-14} C/kg$

B. $1.8 \times 10^{-11} C/kg$

C. $3.6 \times 10^{-12} C/kg$

D. $1.8 \times 10^{-9} C/kg$

Answer: B

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2. In Millikan's oil drop experiment an oil drop of radius r and change Q is held in equilibrium between the plates of a charged parallel plate capacitor when the potential change is V. To keep a drop radius $2r$ and with a change $2Q$ is equilibriu between the plates the potential difference V' required is:

A. V

B. $2V$

C. $4V$

D. $8V$

Answer: C

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3. 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. $2/137$

C. $1/137$

D. $1/237$

Answer: C

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

A. $3.4\times10^{-27}N-\sec$

B. $6.8 \times 10^{-27} N - \text{sec}$

C. $3.4 \times 10^{-24} N - \text{sec}$

D. $6.8 \times 10^{-24} N - \text{sec}$

Answer: B

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5. A sodium atom is in one of the states labelled 'Lowest excited levels'. It remains in that state for an average time of 10^{-8} sec. before it makes a transition back to a ground state. What is the uncertianty in enegry of that excited state ?

A. $6.56 \times 10^{-8} eV$

B. $2 \times 10^{-8} eV$

C. $10^{-8} eV$

D. $8 \times 10^{-8} eV$

Answer: A

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6. An energy of $24.6 eV$ is required to remove one of that electrons from a neutal helium atom. The enegy (in eV)required to remove both the electrons from a netural helium atom is

A. 79.0

B. 51.8

C. 49.2

D. 38.2

Answer: A

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7. A hydrogen atom in its ground state absorbs $10.2eV$ of energy. The orbital angular momentum is increased by

A. $1.05 \times 10^{-34} J - \text{sec}$

B. $3.36 \times 10^{-34} J - \text{sec}$

C. $2.11 \times 10^{-34} J - \text{sec}$

D. $4.22 \times 10^{-34} J - \text{sec}$

Answer: A

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8. Hydrogen (H), deuterium (D), singly ionized helium (He^{+}) and doubly ionized lithium (Li) all have one electron around the nucleus. Consider $n=2$ to $n=1$ transition. The wavelength of emitted radiations are $\lambda_1, \lambda_2, \lambda_3$ and λ_4 respectively. then approximately

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

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

C. $\lambda_1 = 2\lambda_2 = 2\sqrt{2}\lambda_3 = 3\sqrt{2}\lambda_4$

D. $\lambda_1 = \lambda_2 = 2\lambda_3 = 3\sqrt{2}\lambda_4$

Answer: A

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9. The number of revolutions per second made by an electron in the first Bohr orbit of hydrogen atom is of the order of 3:

A. 10^{20}

B. 10^{19}

C. 10^{17}

D. 10^{15}

Answer: D

Watch Video Solution

10. α-particles of enegry $400 KeV$ are boumbardel on nucleus of $._{82} Pb$. In scattering of α-particles, it minimum distance from nucleus will be

A. $0.59 nm$

B. 0.59Å

C. $0.59pm$

D. $0.59pm$

Answer: D

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11. If in Rutherford's experiment, the number of particles scattered at 90° angle are 28 per min, then number of scattered particles at an angle 60° and 120° will be

A. $112/\min, 12.5/\min$

B. $100/\min, 200/\min$

C. $50/\min, 12.5/\min$

D. $117/\min, 25/\min$

Answer: A

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12. An α-particle with a kinetic energy of $2.1eV$ makes a head on collision with a hydrogen atom moving towards it with a kinetic energy of

$8.4eV$. The collision

A. must be perfectly elastic

B. may be perfectly inelastic

C. may be inelastic

D. must be perfectly inelastic

Answer: C

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13. An electron in hydrogen atom after absorbing an energy photon jumps from energy state n_1 to n_2. Then it returns to ground state after emitting six different wavelength in emission spectrum. The energy of emitted photons is either equal to, less than or greater than the absorbed photons. then n_1 and n_2 are

A. $n_1 = 5, n_2 = 3$

B. $n_1 = 5, n_2 = 2$

C. $n_1 = 4, n_2 = 3$

D. $n_1 = 4, n_2 = 2$

Answer: D

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14. One of the lines in the emission spectrum of Li^{2+} has the same wavelength as that of the $2nd$ line of Balmer series in hydrogen spectrum. The electronic transition corresponding to this line is:

A. $n = 4 \rightarrow n = 2$

B. $n = 8 \rightarrow n = 2$

C. $n = 8 \rightarrow n = 4$

D. $n = 12 \rightarrow n = 6$

Answer: D

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15. A double charged lithium atom is equivalent to hydrogen whose atomic number is 3. The wavelength of required radiation for emitted electron from first to third Bohr orbit in Li^{++}

will be (Ionization energy of hydrogen atom is $13.6eV$)

A. 18.51Å

B. 177.17Å

C. 142.25Å

D. 113.74Å

Answer: D

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16. The ionisation potential of H-atom is $13.6eV$. When it is excited from ground state by monochromatic radiations of 970.6Å, the number of emission lines will be (according to Bohr's theory)

A. 10

B. 8

C. 6

D. 4

Answer: C

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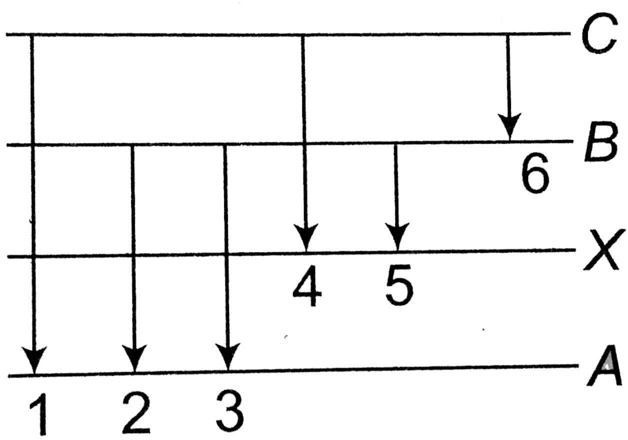
17. In the figure six lines of emission spectrum are shown. Which of them will be absent in the absorption spectrum.



A. $1, 2, 3$

B. $1, 4, 6$

C. $4, 5, 6$

D. $1, 2, 3, 4, 5, 6$

Answer: A

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18. An orbit electron in the ground state of hydrogen has an angular momentum L_1, and an orbital electron in the first orbit in the ground state of lithium (dounle ionised positively) has an angular momentum L_2. Then

:

A. $L_1 = L_2$

B. $L_1 = 3L_2$

C. $L_2 = 3L_1$

D. $L_2 = 9L_1$

Answer: A

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19. Consider atoms H, He^{+}, Li^{++} in their ground states. Suppose E_1, E_2 and E_3 are minimum energies required so that the atoms HHe^{+}, Li^{++} can achieve their first excited states respectively, then

A. $E_1 = E_2 = E_3$

B. $E_1 > E_2 > E_3$

C. $E_1 < E_2 < E_3$

D. $E_1 = E_2 = E_3$

Answer: C

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20. Electrons in a sample of gas containing hydrogen-like atom $(Z = 3)$ are in fourth excited state. When photons emitted only due to transition from third excited state to second excited state are incident on a metal plate photoelectorns are ejected. The stopping potential for these photoelectorns is $3.95eV$. now, if only photons emitted due to transition from fourth excited state to third excited state are incident on the same metal plate, the stopping potential for the emitted photoelectrons will be appoximetely equal to

A. $0.85eV$

B. $0.75eV$

C. $0.65eV$

D. None of these

Answer: B

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21. Consider atoms H, He^{+}, Li^{++} in their ground states. If L_1, L_2 and L_3 are magnitude of angular momentum of their electrons about the nucleus respectively then:

A. $L_1 = L_2 = L_3$

B. $L_1 > L_2 > L_3$

C. $L_1 < L_2 < L_3$

D. $L_1 = L_2 = L_3$

Answer: A

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22. A neutron with velocity V strikes a stationary deuterium atom, its kinetic energy changes by a factor of

A. $\frac{15}{16}$

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

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

D. None of these

Answer: D

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23. Imagine an atom made up of a proton and a hypotnerical 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 hypotnetical photon that will be emitted has wavelength λ (given in terms of the Rydberg constant R for the hydrogen atom) equal to

A. $9/(5R)$

B. $36/(5R)$

C. $18 / (5R)$

D. $4 / R$

Answer: C

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24. If first excitation potential of a hydrogen-like atom is V electron volt, then the ionization energy of this atom will be:

A. V electron-volt

B. $\frac{3V}{4}$ electron-volt

C. $\frac{4V}{2}$ electron-volt

D. cannot be caculated by given information

Answer: C

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25. The energy that should be added to an electron, to reduce its de-Broglie wavelength from $2 \times 10^{-9} m$ to $0.5 \times 10^{-9} m$ will be:

A. $1.1 MeV$

B. $0.56 MeV$

C. $0.56 KeV$

D. $5.67 eV$

Answer: D

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26. If we assume that perptraing power of any radiation/particle is inversely proportional to its de-Broglie wavelength of the particle then:

A. A proton and an α-particle after getting accelerated thorugh same potential difference will have equal penetrating power.

B. Penerating power of $\alpha -$ particle will be greater than hat of proton which have been accelerated by same potential difference.

C. Protons' penetrating power will be less than pentrating power of an electron which has been accelerated by the same potetnial difference.

D. Pentrating powers cannot be compared as all these are partcles having no wavelength or wave nature.

Answer: B

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27. A hydrogen atom in the $4th$ excited state, then:

A. the maximum number of emitted photons will be 10

B. the maximum number of emitted photon will be 6

C. it can emit three photons in ultraviolet region

D. if an infraed photon is generated, then a visible photon may follow this infared photon

Answer: D

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28. Two hydrogen atoms are in excited state with electrons in $n = 2$ state.First one is moving to wards left and emits a photon.' of energy E_1 towards right. Second one is moving towards right with same speed and emits a photon of energy E_2 towards right. Taking recoil of nucleus.into account during_emission process :

A. $E_1 > E_2$

B. $E_1 < E_2$

C. $E_1 = E_2$

D. information insuffcient

Answer: B

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29. 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 to 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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30. Consider a hydrogen-like atom whose energy in nth excited state is given by

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

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

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

$E_{\max} = 1.224 eV$

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

A. 2

B. 5

C. 4

D. None of these

Answer: A

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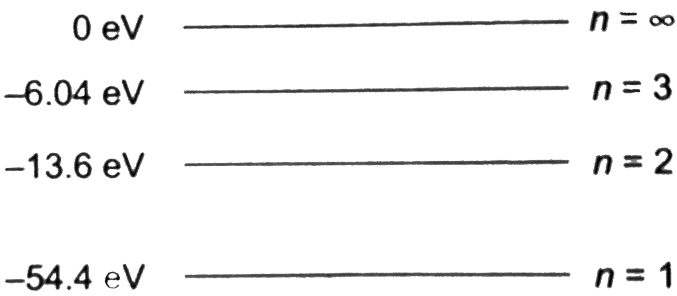
31. The enegry level diagram for an hydrogen-like atom is shown in the figure. The radius of its first Bohr orbit is



A. $0.265 Å$

B. $0.53 Å$

C. $0.132 Å$

D. None of these

Answer: A

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32. How much work must be done to pull apart the electron and the proton that make up the Hydrogen atom, if the atom is initially in the state with $n = 2$?

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

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

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

D. 0

Answer: B

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33. The ratio of ionization energy of Bohr's hydrogen atom and Bohr's hydrogen-like lithium atom is

A. $1:1$

B. $1:3$

C. $1:9$

D. None of these

Answer: C

Watch Video Solution

34. What is the angular momentum of an electron in Bohr's hydrogen atom whose energy is $-0.544eV$?

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

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

C. $\frac{5h}{\pi}$

D. $\frac{7h}{\pi}$

Answer: C

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35. In a sample of hydrogen-like atom all of which are in ground state, a photon beam containing photos of various energies is passed. In absorption spectrum, five dark lines, are observed. The number of bright lines in the emission spectrum will be (assume that all transitions takes place).

A. 5

B. 10

C. 15

D. None of these

Answer: C

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36. A monochromatic radiation of wavelength λ is incident on a sample containing $He+$. As a result the Helium sample stars radiating. A part of this radiation is allowed to pass through a sample of atomic hydrogen gas in ground state. It is noticed that the hydrogen sample has stared emitting electrons whose maximum kinetic energy is $37.4eV$.

$\left(hc = 12400eV\text{Å}\right)$. Then λ is

A. 275Å

B. 243Å

C. 656Å

D. 386Å

Answer: B

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37. An electron of the kinetic energy $10eV$ collides with a hydrogen atom in $1st$ excited state. Assuming loss of kinetic energy in the collision be to quantized which of the following statements is correct?

A. The collision may be perfectly inelastic

B. The collision may be inelastic

C. The collision may be elastic

D. The collision must be inelastic

Answer: D

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

A. $10 ms^{-1}$

B. $2 \times 10^{-2} ms^{-1}$

C. $4 ms^{-1}$

D. $8 \times 10^{2} ms^{-1}$

Answer: C

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39. The ratio between total acceleration of the electron in singly ionized helium atom and hydrogen atom (both in ground state) is

A. 1

B. 8

C. 4

D. 16

Answer: B

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40. If the series limit of Lyman series for Hydrogen atom is equal to the series limit Balmer series for a hydorgen 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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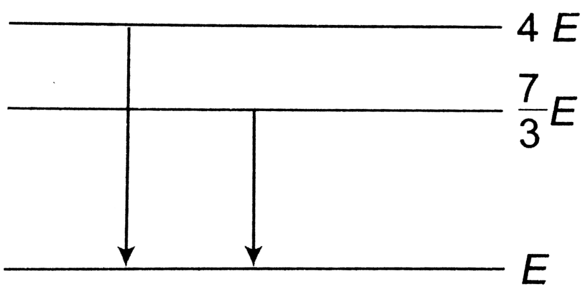
41. The following diagram indicates the energy levels of a certain atom when the system moves from $4E$ level to E. A photon of wavelength λ_1 is emitted. The wavelength of photon produced during its transition from $\frac{7}{3}E$ level to E is λ_2. the ratio $\frac{\lambda_1}{\lambda_2}$ will be



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

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

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

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

Answer: B

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42. An electron beam accelerated from rest through a potential difference of $5000V$ in vacuum is allowed to impinge on a surface normally. The incident current is $50\mu A$ and if the electrons come to rest on striking the surface, the force on it is:

A. $1.1924 \times 10^{-8} N$

B. $2.1 \times 10^{-8} N$

C. $1.6 \times 10^{-8} N$

D. $1.6 \times 10^{-6} N$

Answer: A

Watch Video Solution

43. Imagine an atom made of a proton and a hypothetical particle of double the mass of the electron but having the same change 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. $\frac{9}{5R}$

B. $\frac{36}{5R}$

C. $\frac{18}{5R}$

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

Answer: C

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Section B - Assertion Reasoning

1. 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 assertion is false but reason is true.

Answer: C

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2. Assertion: The electron in the hydrogen atom passes from energy level $n = 4$ to the $n = 1$ level. The maximum and minimum number of photon that can be emitted are six and one respectively.

Reason: The photons are emitted when electron make a transtition from the higher energy state to the lower energy state.

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

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3. 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.

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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 assertion is false but reason is true.

Answer: B

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4. 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 assertion is false but reason is true.

Answer: A

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5. Assertion: A hydrogen atom cannot absorb a photon whose energy is greater than $13.6eV$, its binding energy.

Reason: The extra energy will manifest as KE of the electron.

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 assertion is false but reason is true.

Answer: D

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6. Assertion: The force of repulsion between atomic nucleus and α-particle varies with distance according to inverse square law.

Reason: Rutherford did α-particles scattering experiment.

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 assertion is false but reason is true.

Answer: B

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7. Assertion: The positively changed nucleus of an atom has a radius of almost $10^{-15}m$.

Reason: In α-particle scattering experiment the distance of closest apporach for α-particles is $\approx 10^{-15} m$.

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.

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D. If assertion is false but reason is true.

Answer: A

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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 assertion is false but reason is true.

Answer: B

Watch Video Solution

11. Assertion: α and β particles are accelerated through same potential difference. Finally both particles have sma linear momentum.

Reason: Linear momentum $= \sqrt{KE \times 2 \times mass}$

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 assertion is false but reason is true.

Answer: D

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12. Assertion: According to classical theory, the proposed path of an electron in Rutherford atom model will be parabolic.

Reason: According to electromagnetic theory an accelerated particel continuosly emits radiation.

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 assertion is false but reason is true.

Answer: D

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13. Assertion: In the duration electron jumps from fist excited state to ground state in a stationary isolated hydrogen atom, angular momentum of the electron about the nucleus is conserved.

Reason: As the electron jumps from first excited state to ground state, in a hydrogen atom, the electrostatic force on electron is always directed towards the 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 assertion is false but reason is true.

Answer: D

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AIPMT/NEET Questions

1. The radius of electron's second stationary orbit in Bohr's atom is R. The radius of the third orbit will be

A. $\frac{r_0}{9}$

B. r_0

C. $9r_0$

D. $3r_0$

Answer: C

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2. An electron changes its position from orbit $n = 4$ to the orbit $n = 2$ of an atom. The wavelength of the emitted radiation's is $(R =$ Rydberg's constant)

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

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

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

D. $\frac{16}{7R}$

Answer: B

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3. If the energy of a hydrogen atom in nth orbit is E_n, then energy in the nth orbit of a singly ionised helium atom will be

A. $4E_n$

B. $E_n / 4$

C. $2E_n$

D. $E_n / 2$

Answer: A

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4. Minimum energy required to takeout the only one electron from ground state of He^{+} is

A. $13.6eV$

B. $54.4eV$

C. $27.2eV$

D. $6.8eV$

Answer: B

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5. The frequency of 1st line Balmer series in H_2 atom is v_0. The frequency of line emitted by single ionised He atom is

A. $2v_0$

B. $4v_0$

C. $v_0 / 2$

D. $v_0 / 4$

Answer: B

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

A. Single ionized helium

B. Deuterium atom

C. Hydrogen atom

D. Doubly ionized lithium

Answer: D

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7. The Bohr model of atoms

A. assume that the angular momentum of electrons is quantized

B. uses Einstein's photoelectirc equation

C. predicts continuous emission spectra for atoms

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

Answer: A

Watch Video Solution

8. 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. $1.9 eV$

Answer: D

Watch Video Solution

9. The energy of electron in first excited state of H-atom is $-3.4eV$ its kinetic energy is

A. $-3.4eV$

B. $-6.8eV$

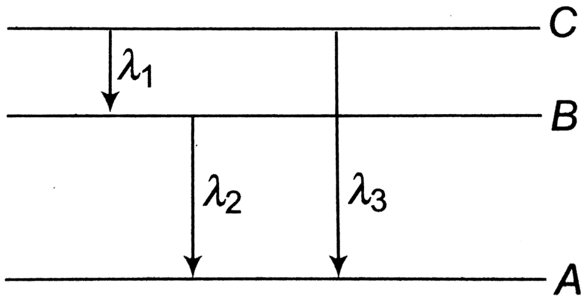
C. $6.8eV$

D. $3.4eV$

Answer: D

Watch Video Solution

10. Energy levels A, B, C of a certain atom corresponding to increasing values of energy i.e., $E_A < E_B < E_C$. If $\lambda_1, \lambda_2, \lambda_3$ are the wavelengths of radiations correspnding to the transitions C to B, B to A and C to A respectively, which o fthe following statements is correct?



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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11. 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. two

B. three

C. four

D. one

Answer: B

Watch Video Solution

12. 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

A. $3.4eV$

B. $6.8eV$

C. $13.6eV$

D. $1.7eV$

Answer: A

Watch Video Solution

13. The groud state energy of hydrogen atom is $-13.6eV$. When its electron is in first excited state, its exciation energy is

A. $3.4eV$

B. $6.8eV$

C. 10.2 eV`

D. zero

Answer: C

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14. 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 proportional to $M_1 \times M_2$

B. directly proportional to $Z_1 Z_2$

C. inversely proportional to Z_1

D. directly proportional to mass M_1

Answer: B

Watch Video Solution

15. 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 $n = 2$ states

B. $n = 3$ to $n = 1$ states

C. $n = 2$ to $n = 1$ states

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

Answer: D

Watch Video Solution

16. The energy of a hydrogen atom in the ground state is $-13.6eV$. The eneergy of a He^{+} ion in the first excited state will be

A. $-13.6eV$

B. $-27.2eV$

C. $-54.4eV$

D. $-6.8eV$

Answer: A

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

B. v^2

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

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

Answer: C

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

A. 3

B. 4

C. 5

D. 2

Answer: A

Watch Video Solution

20. 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. $1.9eV$

B. $11.1eV$

C. $13.6eV$

D. $0.65eV$

Answer: B

Watch Video Solution

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

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

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

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

Answer: B

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22. 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: C

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23. 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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24. 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: C

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25. 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. $2.92 \times 10^{6} m/s$

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

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

D. $3.0 \times 10^{8} m / s$

Answer: B

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26. Two particles of masses m_1, m_2 move with initial velocities u_1 and u_2. On collision, one of the particles get excited to higher level, after absording enegry. If final velocities of particles be v_1 and v_2 then we must have

A. $m_1u_1^2 + m_2u_2^2 - \varepsilon = m_1v_1^2 + m_2v_2^2$

B.

$$\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 - \varepsilon$$

s

C.

$$\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 - \varepsilon = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$$

D.

$$\frac{1}{2}m_1^2u_1^2 + \frac{1}{2}m_2^2u_2^2 + \varepsilon = \frac{1}{2}m_1^2v_1^2 + \frac{1}{2}m_2^2v_2^2$$

Answer: C

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

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

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

Answer: A

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28. 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. $0.025 \times 10^4 m^{-1}$

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

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

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

Answer: C

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

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

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

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

Answer: A

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30. The ratio of wavelength of the lest line of Balmer series and the last line Lyman series is:

A. 1

B. 4

C. 0.5

D. 2

Answer: B

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

A. $1 : -2$

B. $1 : 1$

C. $2 : -1$

D. $1 : -1$

Answer: D

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AIIMS Questions

1. A neutron makes a head-on elastic collision with a stationary deuteron. The fraction energy loss of the neutron in the collision is

A. $16/81$

B. $2/3$

C. $8/27$

D. $8/9$

Answer: D

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

A. Zero

B. $2eV$

C. $1eV$

D. $-27.2eV$

Answer: D

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3. Solid targets of different elements are bombarded by highly energetic electron beam. The frequcny (f) of the characteristic X-rays emitted from different targets varies with atomic number Z as

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

B. $f \propto Z$

C. $f \propto Z^2$

D. $f \propto Z^{1/3}$

Answer: C

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

A. red

B. Yellow

C. green

D. violet

Answer: D

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5. Energy of the electron in nth orbit of hydrogen atom is given by $E_n = -\frac{13.6}{n^2} eV$. The amount of energy needed to transfer electron from first orbit to third orbit is

A. $13.6eV$

B. $3.4eV$

C. $12.09eV$

D. $1.51eV$

Answer: C

Watch Video Solution

6. An electron changes its position from orbit $n = 4$ to the orbit $n = 2$ of an atom. The wavelength of the emitted radiation's is $(R =$ Rydberg's constant)

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

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

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

D. $\frac{16}{7R}$

Answer: B

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

A. K two-fold, Ufour-fold

B. K four-fold, Utwo-fold

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

D. K two-fold, Ualso four-fold

Answer: C

Watch Video Solution

8. Which of the following transitions in a hydrogen atom emits photon of the highest frequency ?

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

B. $n = 2$ to $n = 1$

C. $n = 2$ to $n = 6$

D. $n = 6$ to $n = 2$

Answer: A

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9. How much work must be done to pull apart the electron and the proton that make up the Hydrogen atom, if the atom is initially in the state with $n = 2$?

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

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

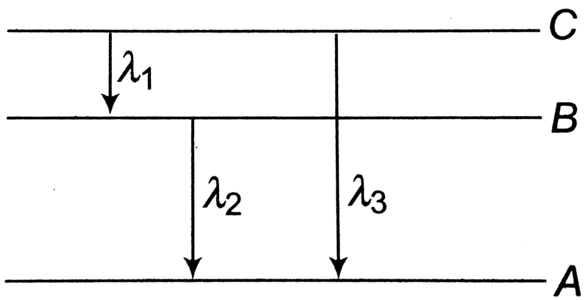
C. $1.51 \times 1.6 \times 10^{-19} J$

D. $0 J$

Answer: B

Watch Video Solution

10. Energy levels A, B, C of a certain atom corresponding to increasing values of energy i.e., $E_A < E_B < E_C$. If $\lambda_1, \lambda_2, \lambda_3$ are the wavelengths of radiations corresponding to the transitions C to B, B to A and C to A respectively, which of the following statements is correct?



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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Assertion Reason

1. 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 assertion is false but reason is true.

Answer: B

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2. Assertion: The electron in the hydrogen atom passes from energy level $n = 4$ to the $n = 1$ level. The maximum and minimum number of photon that can be emitted are six and one respectively.

Reason: The photons are emitted when electron make a transtition from the higher energy state to the lower energy state.

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 assertion is false but reason is true.

Answer: B

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3. 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 assertion is false but reason is true.

Answer: B

Watch Video Solution

4. 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 assertion is false but reason is true.

Answer: B

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5. Assertion: The force of repulsion between atomic nucleus and α-particle varies with distance according to inverse square law.

Reason: Rutherford did α-particles scattering experiment.

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 assertion is false but reason is true.

Answer: B

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Section D - Chapter End Test

1. In hydrogen atom, when electron jupms from second to first orbit, then enrgy emitted is

A. $-13.6eV$

B. $-27.2eV$

C. $-6.8eV$

D. None of these

Answer: D

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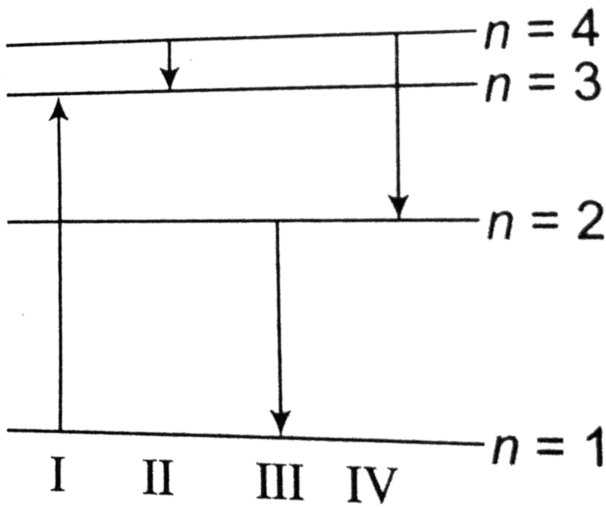
2. The diagram shown the energy levels for an electron in a certain atom. Which transition shown respresents emissions of a photon with the most energy ?



A. I

B. II

C. III

D. IV

Answer: C

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3. An energy of $24.6eV$ is required to remove one of that electrons from a neutal helium atom. The enegy (in eV)required to remove both the electrons from a netural helium atom is

A. 79.0

B. 51.8

C. 49.2

D. 38.2

Answer: A

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

A. $2 \rightarrow 1$

B. $3 \rightarrow 2$

C. $4 \rightarrow 2$

D. $5 \rightarrow 4$

Answer: D

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5. 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: B

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6. The electric potential between a proton and as electron is given by $V = V_0 \frac{\ln(r)}{r_0}$, wherer_0 is a constant . Assuming Bohr's model to be applicable , write variation of r_n with n, n being the principal quantum number ?

A. $r_n \propto n$

B. $r_n \propto 1/n$

C. $r_n \propto n^2$

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

Answer: A

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7. 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

Watch Video Solution

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

A. $2 \rightarrow 1$

B. $3 \rightarrow 2$

C. $4 \rightarrow 2$

D. $5 \rightarrow 2$

Answer: D

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9. 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. $E_0 = -27.2eV, r_0 = a_0/2$

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

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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10. What is the radius of iodine atom (at no. 53, mass number 126)?

A. $2.5 \times 10^{-11} m$

B. $2.5 \times 10^{-9} m$

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

D. $7 \times 10^{-6} m$

Answer: A

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11. An electron passing through a potential difference of $4.9V$ collides with a mercury atom and transfers it to the first excited state. What is the wavelength of a photon corresponding to the transition of the mercury atom to its normal state?

A. 2050Å

B. 2240Å

C. 2525Å

D. 2935Å

Answer: C

Watch Video Solution

12. Which of the following atoms has the lowest ionization potential ?

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

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

C. $._{55}^{133}Cs$

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

Answer: C

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13. The seond line of Balmer series has wavelength 4861Å The wavelength o fthe first line Balmer series is

A. 1216Å

B. 6563Å

C. 4340Å

D. 4101Å

Answer: B

Watch Video Solution

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

A. $\frac{128}{27}\lambda$

B. $\frac{25}{9}\lambda$

C. $\frac{36}{7}\lambda$

D. $\frac{125}{11}\lambda$

Answer: A

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15. 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

A. $912\text{Å}/2$

B. 912Å

C. $912 \times 2\text{Å}$

D. $912 \times 4 \text{Å}$

Answer: D

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16. The first line of Balmer series has wavelength 6563Å. What will be the wavelength of the first member of Lyman series?

A. 1215Å

B. 4861Å

C. 4340Å

D. 4101Å

Answer: A

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17. An atom makes a transition from a state of energy E to one of lower energy E. Which of the following gives the wavelength of the radiation emitted in terms of the Planck's constants h and the speed of light c?

A. $\dfrac{E_2 - E_1}{hc}$

B. $\dfrac{hc}{E_2} - \dfrac{hc}{E_1}$

C. $\dfrac{hc}{E_1} - \dfrac{hc}{E_2}$

D. $\dfrac{hc}{E_2 - E_1}$

Answer: D

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18. 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. $2\pi hc / e^2$

B. $er^2 h / 2\pi c$

C. $e^2 c / 2\pi h$

D. $2\pi e^2 h / hc$

Answer: D

Watch Video Solution

19. An electron in H atom makes a transition from $n = 3$ to $n = 1$. The recoil momentum of the H atom will be

A. $6.45 \times 10^{-27} Ns$

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

C. $6.45 \times 10^{-24} Ns$

D. $6.8 \times 10^{-24} Ns$

Answer: A

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20. If the atom$(_ \; 100)Fm^{257}$ follows the Bohr model the radius of $\_ \; (100)Fm^{257}$ is n time the Bohr radius , then find n .

A. 100

B. 200

C. 4

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

Answer: D

Watch Video Solution

21. The first excited state of hydrogen atom is $10.2eV$ 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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22. The electron in a hydrogen atom makes a transition from an excited state to the ground state. Which of the following statements is true?

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

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

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

D. Its kinetic, potential and total energies decrease

Answer: A

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23. The electron in a hydrogen atom makes a transition $n_1 \rightarrow n_2$, 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. $n_1 = 4, n_2 = 2$

B. $n_1 = 8, n_2 = 2$

C. $n_1 = 8, n_2 = 2$

D. $n_1 = 6, n_2 = 2$

Answer: A

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24. The total energy of an electron in the ground state of hydrogen atom is $-13.6eV$. The potiential energy of an electron in the ground state of Li^{2+} ion will be

A. $122.4eV$

B. $-122.4eV$

C. $244.8eV$

D. $-244.8eV$

Answer: D

Watch Video Solution

25. The orbital velocity of electron in the ground state is v. If the electron is excited to enegry staet $-0.54eV$ its orbital velocity will be

A. v

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

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

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

Answer: C

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26. In hydrogen atom, the transition takes place from $n=3$ to $n=2$. If Rydberg's constant is 1.09×10 per metre, the wavelength of the limit emitted is

A. 6606Å

B. 4861Å

C. 4340Å

D. 4101Å

Answer: A

Watch Video Solution

27. The wavelength of the first line of Balmer series is 6563Å. The Rydberg's constant is

A. $1.09 \times 10^5\ m^{-1}$

B. $1.09 \times 10^6\ m^{-1}$

C. $1.097 \times 10^7\ m^{-1}$

D. $1.09 \times 10^8\ m^{-1}$

Answer: C

Watch Video Solution

28. The electric potential between a proton and an electron is given by $V = V_0 \ln\left(\frac{r}{r_0}\right)$, where r_0 is a constant . Assuming Bohr's model to be applicable, write variation of r_n with n, n being the principal quantum number ?

A. $r_n \propto n$

B. $r_n \propto 1/n$

C. $r_n \propto n^2$

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

Answer: A

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29. Assertion: It is not 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 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 assertion is false but reason is true.

Answer: C

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30. Assertion: In a hydrogen atom energy of emitted photon corresponding to transition from $n = 2$ to $n = 1$ is much greater as compared to transition from $n = \infty$ to $n = 2$.

Reason: Wavelength of photon is directly proportional to the energy of emitted photon.

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 assertion is false but reason is true.

Answer: C

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Others

1. Which of the following statement is true regarding Bohr's model of hydrogen atom ?

(I) Orbiting speed of electrons decreases as if falls to discrete orbits away from the nucleus.

(II) Radii of allowed orbits of electrons are proportional to the principle quantum number.

(III) Frequency with which electrons orbit around the nucleus in discrete orbits is inversely proportional to the principle quantum number.

(IV) Binding force with which the electron is bound to the nucleus increases as it shifts to outer orbits.

Selected the correct answer using the codes given below:

A. I and III

B. II and IV

C. I, II and III

D. II, III and IV

Answer: A

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2. In the Bohr model of a hydrogen atom, the centripetal force is furnished by the Coulomb attraction between the proton and the electrons. If a_0 is the radius of the ground state orbit, m is the mass and e I sthe charge on the electron and is the permittivity of vacuum, the speed of the elctron is :

A. 0

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

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

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

Answer: C

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

A. Angular momentum $\propto \frac{1}{n}$

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

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

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

Answer: B

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4. The electron in a hydrogen atom jumps from ground state to the higher energy state where its velcoity is reduced to one-third its initial value. If the radius of the orbit in the ground state is r the radius of new orbit will be

A. $3r$

B. $9r$

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

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

Answer: B

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5. If in nature they may not be an element for which the principle quantum number $n > 4$, then the total possible number of elements will be

A. 60

B. 32

C. 4

D. 64

Answer: A

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6. In the Bohr's hydrogen atom model, the radius of the stationary orbit is directly proportinal to $(n =$ principle quantum number)

A. n^{-1}

B. n

C. n^{-2}

D. n^2

Answer: D

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7. In the nth orbit, the energy of an electron $E_n = -\frac{13.6}{n^2} eV$ for hydrogen atom. The energy required 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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8. The size of an atom is of the order of

A. $10^{-18}m$

B. $10^{-10}m$

C. $10^{-12}m$

D. $10^{-14}m$

Answer: B

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9. The energy required to knock out the electron in the third orbit of a hydrogen atom is equal to

A. $13.6eV$

B. $+\frac{13.6}{9}eV$

C. $-\frac{13.6}{9}eV$

D. $-\frac{3}{13.6}eV$

Answer: B

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10. An electron has a mass of $9.1 \times 10^{-31} kg$. It revolves round the nucleus in a circular orbit of radius 0.529×10^{-10} metre at a speed of $2.2 \times 10^{6} m/s$. The magnitude of its linear momentum in this motion is

A. $1.1 \times 10^{-34} kg - m/s$

B. $2.0 \times 10^{-24} kg - m/s$

C. $4.0 \times 10^{-24} kg - m/s$

D. $4.0 \times 10^{-31} kg - m/s$

Answer: B

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11. In a beryllium atom, if a_0 be the radius of the first orbit, then the radius of the second orbit will be in general

A. na_0

B. a_0

C. $n^2 a_0$

D. $\frac{a_0}{n^2}$

Answer: C

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12. The ionization potential for second He electron is

A. $13.6eV$

B. $27.2eV$

C. $54.4eV$

D. $100eV$

Answer: C

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13. The energy required to remove an electron in a hydrogen atom from $n = 10$ state is

A. $13.6eV$

B. $1.36eV$

C. $0.136eV$

D. $0.0136eV$

Answer: C

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14. The kinetic energy of the electron in an orbit of radius r in hydrogen atom is ($e =$ electronic charge)

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

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

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

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

Answer: B

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15. 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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16. The angular momentum of electron in nth orbit is given by

A. nh

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

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

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

Answer: C

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

A. $1/4$

B. $4/9$

C. $9/4$

D. 4

Answer: C

Watch Video Solution

18. The ionization potential of hydrogen atom is 13.6 volt. The energy required to remove an electron in the $n = 2$ state of the hydrogen atom is

A. $27.2eV$

B. $13.6eV$

C. $6.8eV$

D. $3.4eV$

Answer: D

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19. The ionisation energy of 10 times innised sodium atom is

A. $13.6eV$

B. $13.6 \times 11eV$

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

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

Answer: D

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20. According to Bohr's theory the radius of electron in an orbit described by principle quantum number n and atomic number Z is proportional to

A. $Z^2 n^2$

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

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

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

Answer: D

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21. The radius of electron's second stationary orbit in Bohr's atom is R. The radius of the third orbit will be

A. $3R$

B. $2.25R$

C. $9R$

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

Answer: B

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22. If m is mass of electron, v its velocity, r the radius of stationary circular orbit around a nucleus with charge Ze, then from Bohr's first postulate, the kinetic energy $k = \frac{1}{2}mv^2$ of the electron is

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

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

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

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

Answer: A

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23. Consider an electron in the nth orbit of a hydrogen atom in the Bohr model. The circumference of the orbit can be expressed in terms of the de-Broglie wavelength λ of that electron as

A. $(0.259)n\lambda$

B. $\sqrt{n}\lambda$

C. $(13.6)\lambda$

D. $n\lambda$

Answer: D

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

A. $1/2$

B. 2

C. $-1/2$

D. -2

Answer: C

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25. when a hydrogen atom is raised from the ground state to an excited state

A. $P. E.$ increases and $K. E.$ decreases

B. $P. E.$ decreases and $K. E.$ increases

C. Both kinetic energy and potential eenrgy increase

D. Both $K. E.$ and $P. E.$ Decrease

Answer: A

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

A. infinite energy

B. the maximum energy

C. the minimum energy

D. zero energy

Answer: C

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27. The ratio of the kinetic energy to the total energy of an electron in a Bohr orbit is

A. -1

B. 2

C. $1:1$

D. None of these

Answer: C

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28. An electron in the $n = 1$ orbit of hydrogen atom is bound by $13.6eV$. If a hydrogen atom I sin the $n = 3$ state, how much energy is required to ionize it

A. $13.6eV$

B. $4.53eV$

C. $3.4eV$

D. $1.51eV$

Answer: D

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29. Which of the following statements about the Bohr model of the hydrogen atom is false ?

A. Acceleration of electron in $n = 2$ orbit is less than that in $n = 1$ orbit

B. Angular momentum of electron in $n = 2$ orbit is more than that in $n = 1$ orbit

C. Kinetic energy of electron in $n = 2$ orbit is less than that in $n = 1$ orbit

D. Potential energy of electron in $n = 2$ orbit is less than that in $n = 1$ orbit

Answer: D

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30. If an electron jumps from 1st orbital to 3rd orbital, than it will.

A. absorb energy

B. release energy

C. no gain of energy

D. none of these

Answer: A

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31. According to Bohr's theory, the expression for the kinetic and potential energy of an electron revolving in an orbit is given respectively by

A. $+\dfrac{e^2}{8\pi\varepsilon_0 r}$ and $-\dfrac{e^2}{4\pi\varepsilon_0 r}$

B. $+\frac{8\pi\varepsilon_0 e^2}{r}$ and $-\frac{4\pi\varepsilon_0 e^2}{r}$

C. $-\frac{e^2}{8\pi\varepsilon_0 r}$ and $-\frac{e^2}{4\pi\varepsilon_0 r}$

D. $+\frac{e^2}{8\pi\varepsilon_0 r}$ and $+\frac{e^2}{4\pi\varepsilon_0 r}$

Answer: A

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32. In the lowest energy level of hydrogen atom, the electron has the angular momentum

A. π / h

B. h / π

C. $h / 2\pi$

D. $2\pi / h$

Answer: C

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33. The Rydberg constant R for hydrogen is

A. $R = -\left(\frac{1}{4\pi\varepsilon_0}\right) \cdot \frac{2\pi^2 me^2}{ch^2}$

B. $R = \left(\frac{1}{4\pi\varepsilon_0}\right) \cdot \frac{2\pi^2 me^4}{ch^2}$

C. $R = \left(\frac{1}{4\pi\varepsilon_0}\right)^2 \cdot \frac{2\pi^2 me^4}{c^2h^2}$

D. $R = \left(\frac{1}{4\pi\varepsilon_0}\right)^2 \cdot \frac{2\pi^2 me^4}{ch^3}$

Answer: D

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

A. $2\pi h$

B. $5.25 \times 10^6 m / s$

C. $\dfrac{h}{\pi}$

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

Answer: D

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35. The velocity of an electron in the second orbit of sodium atom (atomic number $= 11$) is v. The veocity of an electron in its fifth orboit wil be

A. v

B. $\frac{22}{5}v$

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

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

Answer: D

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36. The absorption transitions between the first and the fourth energy states of hydrogen atom are 3. The emission transitions between these states will be

A. 3

B. 4

C. 5

D. 6

Answer: D

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37. In the Bohr model of a hydrogen atom, the centripetal force is furnished by the Coulomb attraction between the proton and the electrons. If a_0 is the radius of the ground state orbit, m is the mass and e is the charge on the electron and e_0 is the vacuum permittivity, the speed of the electron is

A. 0

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

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

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

Answer: C

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38. The electron in a hydrogen atom make a transition $n_1 \rightarrow n_2$ where n_1 and n_2 are the principal quantum number of the two states . Assume the Bohr model to be valid . The time period of the electron in the initial state is eight time that in the final state . The possible values 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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39. 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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40. In Bohr's model of hydrogen atom, let PE represents potential energy and TE the total energy. In going to a higher level

A. PE decreases, TE increases

B. PE increases, TE increases

C. PE decreases, TE decreases

D. PE increases, TE decreases

Answer: B

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41. According to Bohr's model, the radius of the second orbit of helium atom is

A. 0.53Å

B. 1.06Å

C. 2.12Å

D. 0.265Å

Answer: B

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42. An ionic atom equivalent to hydrogen atom has wavelength equal to $1/4$ of the wavelengths of hydrogen lines. The ion will be

A. He^{+}

B. Li^{++}

C. Ne^{9+}

D. Na^{10+}

Answer: A

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43. An electron in the $n = 1$ orbit of hydrogen atom is bound by $13.6eV$ energy is required to ionize it is

A. $13.6eV$

B. $6.53eV$

C. $5.4eV$

D. $1.51eV$

Answer: A

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44. Ionization energy of hydrogen is $13.6eV$. If $h = 6.6 \times 10^{-34} J - s$, the value of R will of the order of

A. $10^{10}m^{-1}$

B. $10^{7}m^{-1}$

C. $10^{4}m^{-1}$

D. $10^{-7}m^{-1}$

Answer: B

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45. To explain his theory, Bohr used

A. Conservation of linear momentum

B. Conservation of angular momentum

C. Conservation of quantum frequency

D. Conservation of energy

Answer: B

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46. The ionisation energy of hydrogen atom is $13.6eV$. Following Bohr's theory, the energy corresponding to a transition between the 3rd and the 4th orbit is

A. $3.40eV$

B. $1.51eV$

C. $0.85eV$

D. $0.66eV$

Answer: D

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47. Hydrogen atoms are excited from ground state of the principle quantum number 4. Then the number of spectral lines observed will be

A. 3

B. 6

C. 5

D. 2

Answer: B

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48. 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

$21.2 \times 10^{-11} m$. What is the principle quantum number of n of the final state of the atom ?

A. $n = 4$

B. $n = 2$

C. $n = 16$

D. $n = 3$

Answer: B

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49. The energy of a hydrogen atom in its ground state is $-13.6eV$. The energy of the level corresponding to the quantum number $n = 2$ (first excited state) in the hydrogen atom is

A. $-2.72eV$

B. $-0.85eV$

C. $-0.54eV$

D. $-3.4eV$

Answer: D

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50. When hydrogen atom is in first excited level, its radius is....its ground state radius

A. Half

B. Same

C. Twice

D. Four times

Answer: B

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51. The wavelength of the energy emitted when electron come from fourth orbit to second orbit in hydrogen is $20.397cm$. The wavelength of energy for the same transition in He^{+} is

A. $5.099cm^{-1}$

B. $20.497cm^{-1}$

C. $40.994cm^{-1}$

D. $81.988cm^{-1}$

Answer: A

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

A. $13.6V$

B. $3.4V$

C. $10.2V$

D. $3.6V$

Answer: C

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53. The energy of electron in first excited state of H-atom is $-3.4eV$ its kinetic energy is

A. $-3.4eV$

B. $+3.4eV$

C. $-6.8eV$

D. $6.8eV$

Answer: B

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54. 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. $2.08 \times 10^{-34} J - s$

Answer: C

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55. In a hydrogen atom, the distance between the electron and proton is $2.5 \times 10^{-11} m$. The electricl force of attraction between then will be

A. $2.8 \times 10^{-7} N$

B. $3.7 \times 10^{-7} N$

C. $6.2 \times 10^{-7} N$

D. $9.1 \times 10^{-7} N$

Answer: B

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56. What will be the angular momentum of an electron, if energy of this electron in H-atom is $1.5eV$ (in $J-s$)?

A. 1.05×10^{-34}

B. 2.1×10^{-34}

C. 3.15×10^{-34}

D. -2.1×10^{-34}

Answer: C

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57. The time of revolution of an electron around a nucleus of charge Ze in nth Bohr orbit is directly proportional to

A. n

B. $\frac{n^3}{Z^2}$

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

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

Answer: B

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58. In Bohr's model, if the atomic radius of the first orbit is r_0, then the radius of the fourth orbit is

A. r_0

B. $4r_0$

C. $r_0 / 16$

D. $16r_0$

Answer: D

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59. 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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60. In Bohr model of hyrogen atom, the ratio of periods of revolution of an electon in $n=2$ and $n=1$ orbit is

A. $2:1$

B. $4:1$

C. $8:1$

D. $16:1$

Answer: C

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

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

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

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

D. Its kinetic, potential and total energies decrease

Answer: A

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

A. 8Å

B. 4Å

C. 0.5Å

D. 0.25Å

Answer: B

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63. 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. $2\pi hc/e^2$

B. $e^2h/2\pi c$

C. $e^2c/2\pi h$

D. $2\pi e^2/hc$

Answer: D

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64. The energy of hydrogen atom in its ground state is $-13.6eV$. The energy of the level corresponding to the quantum number n is equal 5 is

A. $-5.40eV$

B. $-2.72eV$

C. $-0.85eV$

D. $-0.54eV$

Answer: D

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65. Orbit acceleration of electron is

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

B. $\dfrac{n^2h^2}{2n^2r^3}$

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

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

Answer: A

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66. In the following transitions, which one has higher frequency ?

A. $3 \rightarrow 2$

B. $4 \rightarrow 3$

C. $4 \rightarrow 2$

D. $3 \rightarrow 1$

Answer: D

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67. An electron jumps from $5th$ orbit to $4th$ orbit of hydrogen atom. Taking the Rydberg constant as 10^7 per meter. What will be the frequency of radiation emitted ?

A. $6.75 \times 10^{12} Hz$

B. $6.75 \times 10^{14} Hz$

C. $6.75 \times 10^{13} Hz$

D. None of these

Answer: C

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68. For principle quantum number $n = 3$, the possible values of orbital quantum number 'l' are

A. $1, 2, 3$

B. $0, 1, 2, 3$

C. $0, 1, 2$

D. $-1, 0, +1$

Answer: C

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69. Energy of an electron in an excited hydrogen atom is $-3.4eV$. Its angualr momentum will be: $h = 6.626 \times 10^{-34} J - s$.

A. $1.11 \times 10^{34} J - s$

B. $1.51 \times 10^{-31} J - s$

C. $2.11 \times 10^{-34} J - s$

D. $3.72 \times 10^{-34} J - s$

Answer: C

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70. 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. $4:9:36$

D. $3:2:1$

Answer: C

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71. The wavelength of light emitted from second orbit to first orbits in a hydrogen atom is

A. $1.215 \times 10^{-7} m$

B. $1.215 \times 10^{-5} m$

C. $1.215 \times 10^{-4} m$

D. $1.215 \times 10^{-3} m$

Answer: A

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72. Energy of the electron in nth orbit of hydrogen atom is given by $E_n = -\frac{13.6}{n^2}eV$. The amount of energy needed to transfer electron from first orbit to third orbit is

A. $13.6eV$

B. $3.4eV$

C. $12.09eV$

D. 1.51 eV`

Answer: C

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73. 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 circyumference of the first orbit

C. Equal to twice the circumference of the first orbit

D. Equal to the circulference of the first orbit

Answer: D

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74. In hydrogen atom, when electron jupms from second to first orbit, then enrgy emitted is

A. $-13.6eV$

B. $-27.2eV$

C. $-6.8eV$

D. None of these

Answer: D

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75. Minimum energy required to takeout the only one electron from ground state of He^{+} is

A. $13.6eV$

B. $54.4eV$

C. $27.2eV$

D. $6.8eV$

Answer: B

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76. The frequency of 1st line Balmer series in H_2 atom is v_0. The frequency of line emitted by single ionised He atom is

A. $2v_0$

B. $4v_0$

C. $v_0 / 2$

D. $v_0 / 4$

Answer: B

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77. When the electron in the hydrogen atom jumps from $2nd$ orbit to 1st orbit, the wavelength of radiation emitted is λ. When the electrons jumps from $3rd$ orbit to $1st$ orbit, the wavelength of emitted radiation would be

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

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

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

D. $\frac{3}{2}\lambda$

Answer: A

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78. Which of the following transitions will have highest emission wavelength ?

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

B. $n = 1$ to $n = 2$

C. $n = 2$ to $n = 5$

D. $n = 5$ to $n = 2$

Answer: D

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79. When the wave of hydrogen atom comes from infinity into the first then the value of wave number is

A. $109700cm^{-1}$

B. $1097cm^{-1}$

C. $109cm^{-1}$

D. None of these

Answer: A

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80. With the increase in peinciple quantum number, the energy difference between the two successive energy levels

A. increases

B. decreases

C. remians constant

D. sometimes increases and sometimes decreases

Answer: B

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

A. Single ionized helium

B. Deuterium atom

C. Hydrogen atom

D. Doubly ionized lithium

Answer: D

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

A. $122.4eV$

B. $30.6eV$

C. $13.6eV$

D. $3.4eV$

Answer: B

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83. 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. $1.9 eV$

Answer: D

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84. Which state of triply ionised Beryllium (Be^{+++}) the same orbital radius as that of the ground state hydrogen ?

A. $n = 4$

B. $n = 3$

C. $n = 2$

D. $n = 1$

Answer: C

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85. The ratio of areas within the electron orbits for the first excited state to the ground state for hydrogen atom is

A. $16:1$

B. $18:1$

C. $4:1$

D. $2:1$

Answer: D

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86. The kinetic energy of electron in the first Bohr orbit of the hydrogen atom is

A. $-6.5eV$

B. $-27.2eV$

C. $13.6eV$

D. $-13.6eV$

Answer: C

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87. If the energy of a hydrogen atom in nth orbit is E_n, then energy in the nth orbit of a singly ionised helium atom will be

A. $4E_n$

B. $E_n/4$

C. $2E_n$

D. $E_n/2$

Answer: A

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88. What is the ratio of wavelength of radiations emitted when an electron in hydrogen atom jump from fourth orbit to second ornti and from third orbit to second orbit?

A. $20 : 25$

B. $20 : 27$

C. $20 : 25$

D. $25 : 27$

Answer: B

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

A. $0eV$

B. $-27.2eV$

C. $1eV$

D. $2eV$

Answer: B

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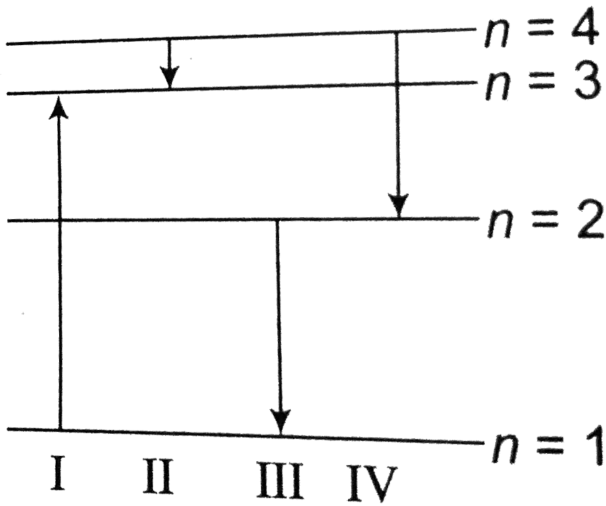
90. The diagram shown the energy levels for an electron in a certain atom. Which transition shown represents emissions of a photon with the most energy ?



A. I

B. II

C. III

D. IV

Answer: C

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