PHYSICS

BOOKS - BITSAT GUIDE

ATOMIC STRUCTURE

Practice Exercise

1. Alpha-particles are projectied towards the nuclei of the following metals with the same

kinetic energy. Towards which metal, the distance of closest approach is minimum?

A. $Cu(Z = 29)$

B. $Ag(Z = 47)$

C. $Au(Z = 79)$

D. $Pd(Z = 46)$

Answer: A

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2. An alpha-particle accelerated through V volt is fired towards a nucleus . Lts distance of closest approach is r.lf a proton accelerated through the same potential is fired towards the same nucleus, then distance of closest approach of proton will be

A. r

B. $2r$

C. $r/2$

D. $r/4$

Answer: A

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

A. $2r$

B. $4r$

C. $r/2$

D. $r/4$

Answer: D

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4. Which of the following is incorrect regarding Rutherford's atomic model?

A. Atom contains nucleus

B. Size of nucleus is very small in comparison to that of atom

C. Nucleus contains about 90° mass of the atom

D. Electrons revolve around the nucleus with a uniform speed

Answer: C

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5. In rutherford's experiment, the mumber of alpha-particles scattered through an angle of 90° is 28 per minute. Then,the number of particles scattered through an angle of 60° per minute by the same nucleus is

A. 28 per minute

B. 112 per minute

C. 12.5 per minute

D. 7 per minute

Answer: B

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6. Find the equivalent current due to motion of electron in first orbit of H-atom.

A. $0.7 \times 10^{-3} A$

B. $9 \times 10^{-3} A$

C. $10^{-3} A$

D. None of these

Answer: A

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

A. $2\pi x$

B. $6\pi x$

C. $9x$

D. $x/3$

Answer: B

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8. How many times larger is the spacing between the energy levels with n=3 and n=4,then the spacing between the energy levels with n=8 and n=9 for a hydrogen like atom or ion?

A. 0.71

B. 0.41

C. 2.43

D. 14.82

Answer: B

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9. The circumference of the second orbit of an atom or ion having single electron, 4×10^{-9} m. The de-Broglie wavelength of electron revolving in this orbit should be

A. $2 \times 10^{-9} m$

B. $4 \times 10^{-9} m$

C. $8 \times 10^{-9} m$

D. $1 \times 10^{-9} m$

Answer: A

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10. In each of the following atoms or ions, electronic transition form $n = 4 \rightarrow n = 1$ take place. Frequency of the radiation emitted out will be minimum for

A. hydrogen atom

B. deuterium atom

C. $He^{+}ion$

D. $Li^{2+}ion$

Answer: A

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

A. $2.188 \times 10^6 m/s$

B. $1.094 \times 10^6 m/s$

C. $4.376 \times 10^6 m/s$

D. $1.59 \times 10^6 m/s$

Answer: D

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12. The angular speed of an electron revolving around the H-nucleus is proportional to

A. $1/r$

B. $1/r^{3/2}$

C. $1/r^2$

D. $r^{3/2}$

Answer: B

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13. calculate the angular momentum of the electron in third orbit of hydrogen atom,if the

angular momentum in the second orbit of hydrogen atom is L.

A. L

B. $3L$

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

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

Answer: C

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14. If an electron is moving around a nucleus of charge 3θin a circular orbit of radius 10^{-10} m,then calculate the initial frequency of light emitted by the electron.

A. $4.2 \times 10^{15} Hz$

B. $0.36 \times 10^{15} Hz$

C. $3.6 \times 10^{15} Hz$

D. $4.2 \times 10^{15} Hz$

Answer: C

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15. An electron of hydrogen atom is revolving in third bohr's orbit $(n = 3)$.How many revolutions will it undergo before making a transition to the second orbit $(n = 2)$.Assume the average life time of an excited state of the hydrogen atom is of the order of 10^{-8}s. (Given,Bohr radius=$5.3 \times 10^{-12} m$)

A. 2.5×10^{6}revolutions

B. 3.5×10^{6}revolutions

C. 4.5×10^6 revolutions

D. 1.5×10^6 revolutions

Answer: A

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16. If $\left(\frac{0.51 \times 10^{-10}}{4}\right)$ meter is the radius of smallest electron orbit in hydrogen like atom,then this atom is

A. hydrogen atom

B. He^+

C. Li^{2+}

D. Be^{3+}

Answer: D

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17. How many different wavelengths may be observed in the spectrum form a hydrogen sample, if the atoms are excited to third excited state?

A. 3

B. 4

C. 5

D. 6

Answer: D

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18. Find the maximum number of photons number of photons emitted by an H-atom, if

atom is excited to atates with principal quantum number four.

A. 4

B. 3

C. 2

D. 1

Answer: B

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19. In (Q.18)problem, the minimum number of photons emitted by the H-atom is

A. 1

B. 2

C. 3

D. 4

Answer: A

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20. The kinetic energy of an electron in hydrogen atom is $3.40eV$.The minimum energy required to ionise the hydrogen atom is

A. $-3.40eV$

B. $6.40eV$

C. $-6.80eV$

D. $3.40eV$

Answer: D

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

A. $10.20eV$

B. $20.40eV$

C. $13.6eV$

D. $27.2eV$

Answer: A

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22. Calculate the ratio of the frequencies of the long wavelength limits of the Balmer and Lyman series of hydrogen.

A. $27:5$

B. $5:27$

C. $4:1$

D. $1:4$

Answer: A

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

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

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

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

D. $3\lambda_2 = \lambda_3 + 2\lambda_2$

Answer: B

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24. Calculate the energy required to excite an electron in hydrogen atom from the ground state to the next higher state, if the ionsation energy for the hydrogen atom is $13.6eV$.

A. $3.4eV$

B. $10.2eV$

C. $12.1eV$

D. $1.3eV$

Answer: B

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25. Find the wavelength of the emitted radiation,if electron in hydrogen atom jumps from third orbit to second orbit.

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

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

C. $\lambda = \frac{5}{R}$

D. $\lambda = \frac{R}{6}$

Answer: A

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26. Any radiation in the ultraviolet region of hydrogen spectrum is able to eject photoelectrons from a metal. What should be

the maximum value of threshold frequency for the metal?

A. $3.288 \times 10^{15} Hz$

B. $2.466 \times 10^{15} Hz$

C. $4.594 \times 10^{14} Hz$

D. $8.220 \times 10^{14} Hz$

Answer: B

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27. Balmer given an equation for wavelength of visible radiation of H-spectrum as $\lambda = \frac{kn^2}{n^2 - 4}$.The value of k in terms of Rydbrum constant R is

A. R

B. $4R$

C. $R/4$

D. $4/R$

Answer: D

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

A. ultraviolet region

B. visible region

C. infrared region

D. X-ray region

Answer: B

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29. Deuterum atoms in the ground state are radiated by photons of energy $12.8eV$ What will be the energy of induced radiation of longest wavelength? Lonisation energy of deuterium is $14.4eV$.

A. $12.8eV$

B. $10.8eV$

C. $1.6eV$

D. $2.00eV$

Answer: D

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30. Calculate the ionisation energy of Li^{2+} atom in ground state.

A. $13.6 \times 9eV$

B. $13.6J$

C. $13.6erg$

D. 13.6×10^{-19}

Answer: A

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31. The first excitation potential of a given atom is $10.2V$,then the ionisation potential is

A. $10.2V$

B. $13.6V$

C. $30.6V$

D. $20.4V$

Answer: B

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32. For a single ionised helium atom, the longest wavelength in ground state will absorb

A. 912 Å

B. 304 Å

C. 606 Å

D. 1216 Å

Answer: B

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33. If an electron drops from 4th orbit to 2nd orbit in an H-atom, then

A. it gains $2.55eV$ of potential energy

B. it gains $2.55eV$ of total energy

C. it emits a $2.55eV$ electron

D. it emits a $2,55eV$ photon

Answer: D

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34. 29 electrons are removed from Zn-atom (Z=30)by certain means. The minimum energy needed to remove the 30th electron, will be

A. $12.24keV$

B. $408eV$

C. $0.45eV$

D. None of these

Answer: A

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35. An electron of kinetic energy E_0 is scattered by an atomic hydrogen sample in ground state. Find the minimum value of E_0 ,so that a photon of wavelength 656.3nm may be emitted by H-atom.

A. $12.09eV$

B. 13.6 eV`

C. $14.6eV$

D. None of these

Answer: A

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

A. $6.25 \times 10^4 m/s$

B. $8 \times 10^4 m/s$

C. $7.25 \times 10^4 m/s$

D. $13.6 \times 10^4 m/s$

Answer: A

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37. A photon of energy $15eV$ collision , H-atom gets ionised. The maximum kinetic energy of emitted electron is

A. $1.4eV$

B. $5eV$

C. $15eV$

D. $13.6eV$

Answer: A

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38. Find the minimum frequency of light which can ionise a hydrogen atom.

A. $3.28 \times 10^{15} Hz$

B. $5 \times 10^{15} Hz$

C. $91.1 Hz$

D. None of these

Answer: A

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39. In the case of Compton effect, which of the following is applicabel?

A. energy conservation

B. Momentum conservation

C. Charge conservation

D. All of these

Answer: B

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40. The number of orbitals in 3rd orbit are

A. 3

B. 10

C. 18

D. None of these

Answer: D

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1. In hydrogen atom, an electron jumps from bigger orbit to smaller orbit, so that radius of

smaller orbit is one-fourth of radius of bigger orbit. If speed of electron in bigger orbit was v,then speed in smaller orbit is

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

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

C. v

D. $2v$

Answer: D

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2. In hydrogen atom, if $\lambda_1, \lambda_2, \lambda_3$ are shortest wavelengths in Lyman, Balmer and Paschen series respectively, then $\lambda_1 : \lambda_2 : \lambda_3$ equals

A. $1:4:9$

B. $9:4:1$

C. $1:2:3$

D. $3:2:1$

Answer: A

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3. If lambda is the wavelength of hydrogen atom from the transition $n = 3 \rightarrow n = 1$,then what is the wavelength for doubly ionised lithium ion for same transition?

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

B. 3λ

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

D. 9λ

Answer: C

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4. In Bohr's atom model,

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

B. electrons in a quantised orbit will not radiate energy

C. mass of electron remains constant

D. All of the above

Answer: D

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