CHEMISTRY

BOOKS - BRILLIANT PUBLICATION

STRUCTURE OF ATOMS

Level I Homework

1. Which of the following is wrong?

A. Cathode rays have constant e/m ratio

B. e/m ratio of anode rays is not constant

C. e/m ratio of proton is not constant

D. e/m ratio of β particle is constant

Answer:

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2. The heaviest subatomic particle is

A. Proton

B. Neutron

C. Electron

D. Positron

Answer:

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3. Thomson suggested that the amount of deviation of the particle from their path in the presence of electrical or magnetic field depends upon

I) The magnitude of the negative charge on the particle

II) The mass of particle

III) The strength of the electrical or magnetical field

Choose the correct set of statements

A. I and II

B. II and III

C. I and III

D. I, II and III

Answer:

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4. In which of the following, the number of protons is greater than the number of neutrons, but the number of protons is less than the number of electrons

A. D_3O^+

B. SO_2

C. H_2O

D. OH^-

Answer:

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5. Isotone (s) of $_{32}Ge^{76}$ is/are

A. $^{78}_{34}Se$

B. $^{77}_{33}As$

C. $^{77}_{34}Se$

D. Both 1 and 2

Answer:

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6. Canal rays is name for beam of

A. electrons

B. protons

C. neutrons

D. positively charged ions

Answer:

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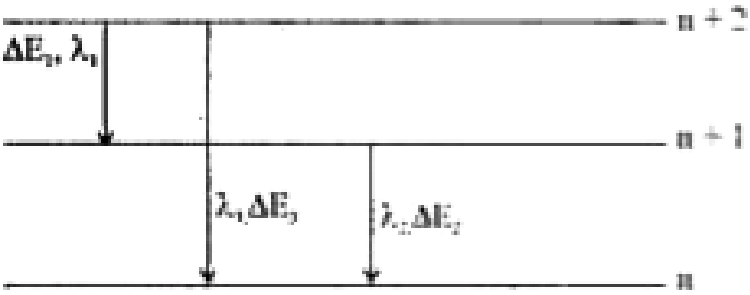
7. Which of the following relations is correct for the facts shown in the given figure ?



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

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

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

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

Answer:

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8. In hydrogen spectrum which of the following lies in the wavelength range 400nm - 700nm ?

A. Balmer series

B. Lyman series

C. Brackett series

D. Paschen series

Answer:

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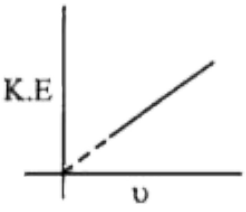
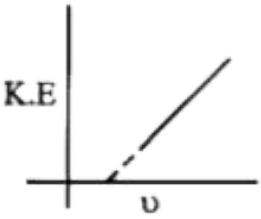
9. Which among the following graph photoelectric effect correct regarding

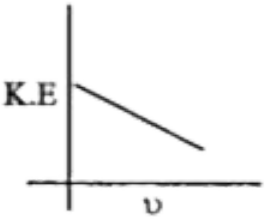
A. A)



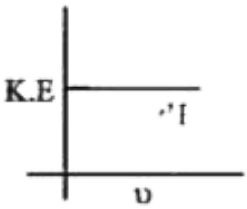
B. B)



C. C)



D. D)



Answer:

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10. Longest wavelengths in Balmer series of He^{+1} is

A. $\frac{5}{9}R_H$

B. $\frac{9}{5}R_H$

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

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

Answer:

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11. In photoelectric effect, at which frequency electron will be ejected with certain kinetic energy (γ_o = threshold frequency)

A. $\gamma = \gamma_o$

B. $\gamma > \gamma$

C. $\gamma_o \geq \gamma$

D. $\gamma > \gamma_o$

Answer:

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12. The threshold wavelength for photoelectric effect on sodium is $5000A^\circ$. Its work function is

A. 4×10^{-19}J

B. 1 J

C. 2×10^{-19}J

D. 3×10^{-10}J

Answer:

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13. According to Bohr's atomic theory, angular momentum of an electron in the orbit is quantised. Which among the following cannot be the value of angular momentum in a Bohr orbit.

A. $\frac{5h}{2\pi}$

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

C. $\frac{2.5h}{\pi}$

D. $\frac{1.5h}{2\pi}$

Answer:

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14. The dimensions of plank constant are the same as that of .....

A. energy

B. angular momentum

C. work

D. power

Answer:

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15. Hydrogen like species produce spectrum by absorbing photons. The level which allows them to absorb but not to emit is

A. 1s

B. 2s

C. 2p

D. 3d

Answer:

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16. What is the maximum number of emission lines when the excited electron of a hydrogen atom in n = 6 drops to the ground state?

A. 20

B. 16

C. 15

D. 5

Answer:

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17. An electron in hydrogen atom jumps from one orbit to another orbit in such a way that its kinetic energy X changes one fourth of its initial. The change in its potential energy is

A. $\frac{3}{2}x$

B. $\frac{-3}{8}x$

C. $\frac{3}{4}x$

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

Answer:

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18. The number of spectral lines that can be possible when electrons in 7^{th} shell in different hydrogen atoms return to the 2^{nd} shell

A. 12

B. 15

C. 14

D. 10

Answer:

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19. Radiation of certain frequency is emitted when electronic transition occurs from n = 4 to n = 2 in He^+ which transition in H atom gives radiation of the same frequency?

A. n = 4 to n = 2

B. n = 3 to n = 2

C. n = 3 to n = 1

D. n = 2 to n = 1

Answer:

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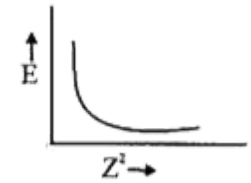
20. The energy of an electron moving in n^{th} Bohr's orbit of an element is given by

$$E_n = \frac{-13.6}{n^2} Z^2 eV / \text{atom}$$

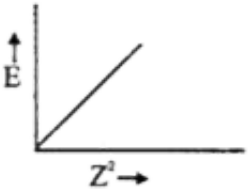
Here Z = atomic number

The graph of E vs Z^2 will be

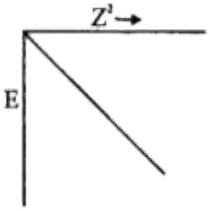
A.



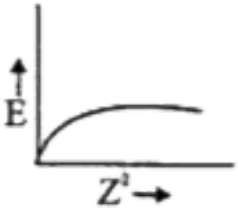
B.



C.



D.



Answer:

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21. Which of the following statements in relation to the hydrogen atom is correct? $3s$ orbital is lower in energy than $3p$ orbital, $3p$ orbital is lower in energy than $3d$ orbital, $3s$ and $3p$ orbitals are lower in energy than $3d$ orbital, $3s$ and $3p$ orbital all have the same energy

A. 3s, 3p, 3d orbitals, all have the same energy

B. 3s and 3p orbitals are of lower energy than 4d orbital

C. 3p orbital is lower in energy than 3d orbital

D. 3s orbital is lower in energy than 3p orbital

Answer:

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22. In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which of the following inner orbit jumps of the electron for Bohr orbits in an atom of hydrogen?

A. $3 \rightarrow 2$

B. $5 \rightarrow 2$

C. $4 \rightarrow 1$

D. $2 \rightarrow 5$

Answer:

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23. The radius of the first Bohr orbit of hydrogen is $0.529A^{\circ}$. The radius of the 3^{rd} orbit of He^{+} will be

A. $8.46A^{\circ}$

B. $0.705A^{\circ}$

C. $1.59A^{\circ}$

D. $2.38A^{\circ}$

Answer:

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24. What is wrong about atomic emission spectrum of hydrogen?

A. It is discontinues spectrum

B. It is dark line spectrum

C. It is bright line spectrum

D. It is obtained by passing heat or electricity through hydrogen gas

Answer:

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25. If the speed of electron in the Bohr's first orbit of hydrogen atom be x, then the speed of electron in second orbit of He^{+1} is

A. x/9

B. x/3

C. 3x

D. x

Answer:

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26. The wavelength associated with a golf ball weighing 200g and moving at a speed of 5 m/h is of the order of

A. 10^{-10}m

B. 10^{-20}m

C. 10^{-30}m

D. 10^{-40}m

Answer:

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27. De broglie wavelength of particle B is double of particle A and mass of particle A is thrice of mass of particle B. The ratio of velocity of particle A to B is

A. $2:3$

B. $3:2$

C. $4:3$

D. $3:4$

Answer:

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28. According to Heisenburg's uncertainty principle in determinancy originate due to

A. the limitations of our instrument

B. human imagination coupled with limited observation

C. inherent properties of the system itself resulting from wave particle dualisms

D. designing of experiment with in certain frame of reference which contradicts with Einstein's relativity

Answer:

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29. Electrons are identified by quantum numbers n and l. Define them.

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30. Spin angular momentum of electron can be calculated by the relation is

A. $\sqrt{l(l+1)}h/2\pi$

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

C. $\sqrt{s(s+1)}\frac{h}{2\pi}$

D. $\sqrt{s(s+2)}\frac{h}{2\pi}$

Answer:

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31. Which of the following ions have a spin magnetic moment of 5.93 BM?

A. Fe^{2+}

B. Mn^{2+}

C. Cr^{2+}

D. V^{3+}

Answer:

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32. The nodes present in 3p-orbitals are

A. one spherical, one planar

B. two spherical

C. Two planar

D. One planar

Answer:

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33. For a particular value of azimuthal quantum number '(l)' the fotal number of magnetić quantum number (m) is givne by:

A. $l = \frac{m+1}{2}$

B. $l = \frac{2m+1}{2}$

C. $l = \frac{m-1}{2}$

D. $m = \frac{2l-1}{2}$

Answer:

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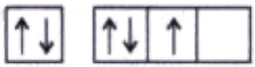
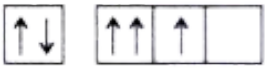
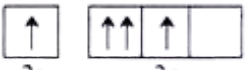
34. The orbital diagram in which both the Pauli's exclusion priciple and Hund's rule are violated, is:

A. 

B. 

C. 

D. 

Answer:

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35. Number of electron exchanges present in d^5 and d^{10} configuration are

A. $10, 0$

B. 20, 10

C. 10, 20

D. 15, 20

Answer:

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Level Ii

1. Consider the following statements, which of the following is/are true?

i) Charge to mass ratio of canal rays are found to depend on the gas from which these originate

ii) Cathode rays produce fluorescence and phosphorescence when it hit on the corresponding materials

iii) J.J. Thomson's model of an atom could clearly explain "atom is electrically neutral"

iv) Behaviour of canal rays in the electrical or magnetic field is opposite to that observed for cathode rays

v) Charge to mass ratio of cathode rays are found to depend on the gas from which these originate

A. i, iv

B. i, ii, iii

C. iii, iv, v

D. all except v

Answer:

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2. Which one is a wrong statement?

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3. Two nuclei have their mass number in the ratio 1 : 3. The ratio of their nuclear densities would be

A. $1:1$

B. $1:3$

C. $3:1$

D. $3^{1/3}:1$

Answer:

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4. Mark the incorrect statement regarding the photoelectric effect

A. There is no time lag between the striking of light beam and the ejection of electrons from the metal surface

B. The number of electrons ejected in inversily proportional to the intensity of light

C. Photo electric effect is not observed below threshold energy

D. K.E of the electrons increases with increase in frequency of light used

Answer:

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5. One mole photons having energy 400 kJ/mol will always break x mole bonds of molecule A_2 where A-A bond dissociation energy is 100 kJ/mol. The value of x is

A. 4 mole

B. 2 mole

C. 1 mole

D. 6 mole

Answer:

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6. A certain metal when irradiated by light $\left(v = 3.2 \times 10^{16} Hz\right)$ emits photoelectrons with twice KE as did photoelectrons when the same metal is irradiated by light $\left(v = 2 \times 10^{16} Hz\right)$. The v_0 of the metal is

A. $1.2 \times 10^{14} Hz$

B. $8 \times 10^{15} Hz$

C. $1.2 \times 10^{16} Hz$

D. $4 \times 10^{12} Hz$

Answer:

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7. The ratio of slope of two graphs, which are plotted with K.E. v/s v and stopping potential V v/s v is

A. h

B. hv_0

C. e (electronic charge)

D. h/e

Answer:

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8. What is the ratio of $\lambda_{\max}$ and $\lambda_{\min}$ for Balmer series of hydrogen spectrum ?

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

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

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

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

Answer:

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9. In a sample of hydrogen atoms, electrons jump from 10^{th} excited state to ground state. If X are the number of different ultraviolet radiations Y are the number of different visible radiations and Z are the possible number of different infrared radiations from 10^{th} excited state to third level. The value Z-(x + y) is (Assuming all the Balmer lines lie with in visible region)

A. 17

B. 18

C. 19

D. 36

Answer:

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10. The transition from the state n = 3 to n = 1 in a hydrogen like atom results in ultraviolet radiation. Infrared 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:

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11. 4^{th} Bohr orbit of a hydrogen like one electron species X coincide with first Bohr orbit of H atom. The number of positive charges in the nucleus of the species X is

A. 3

B. 4

C. 16

D. 25

Answer:

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12. Which one of the following statement is/are correct?

A. Rydberg constant and wave number have same units

B. Lyman series of hydrogen spectrum occurs in the u v region

C. The angular momentum of the electron in one of the energy level of hydrogen atom is equal to 2.5 $\frac{h}{\pi}$

D. All of these

Answer:

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13. If H-atom is supplied with 12.1 eV energy and electron returns to the ground state after excitation. The number of spectral lines in Balmer series would be

A. 1

B. 2

C. 3

D. 4

Answer:

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14. If in Bohr's model, for unielectronic atom, time period of revolution is represented as T_{nz} where n represents shell number and z represents atomic number then the value of $T_{12} : T_{21}$ will be

A. $8:1$

B. $1:8$

C. $1:1$

D. $1:32$

Answer:

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15. Difference between n^{th} and $(n+1)^{th}$ Bohr radius of H atom is equal to its $(n-1)^{th}$ Bohr's radius. The value of n is

A. 2

B. 3

C. 4

D. 5

Answer:

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16. He^+ ions are in an excited state from where maximum 6 types of photons can be emitted. If E is the separation of energy of He^+ from this excited state, then how many times of energy E is required to ionise hydrogen atom

A. 2

B. 3

C. 4

D. 6

Answer:

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17. The velocity of electron in the n^{th} Bohr orbit of hydrogen atom is $1.09 \times 10^6 ms^{-1}$. Velocity of electron in the same Bohr orbit of He^+ is

A. $2.18 \times 10^6 m/s$

B. $4.18 \times 10^6 m/s$

C. $3.6 \times 10^6 m/s$

D. $5.2 \times 10^6 m/s$

Answer:

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18. The hydrogen line spectra provides evidence for the

A. Heisenberg uncertainty principle

B. Wave like property of light

C. Diatomic nature of hydrogen

D. Quantised nature of atomic energy state

Answer:

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19. The de Broglie wavelength (λ) associated with photoelectron varies with frequency (ν) of the incident raidation as [ν_0 = threshold frequency]

A. $\lambda\alpha\frac{1}{(\nu-\nu_0)^2}$

B. $\lambda\alpha\frac{1}{(\nu-\nu_0)^{1/4}}$

C. $\lambda\alpha\frac{1}{(\nu-\nu_0)}$

D. $\lambda\alpha\frac{1}{(\nu-\nu_0)^{1/2}}$

Answer:

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20. The uncertainty in position of an electron is equal to its de-Broglie wavelength. The minimum percentage error in its measurement of velocity under this circumstances will be approximately

A. 4

B. 8

C. 22

D. 18

Answer:

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21. If the uncertainly in position and momentum of a particle like electrons are equal then uncertainty in velocity is .....

A. $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$

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

C. $\frac{1}{m}\sqrt{\frac{h}{\pi}}$

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

Answer:

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22. The atomic masses of He and Ne are 4 and 20amu respectively. The value of the de-Broglie wavelength of He gas at $-73^{\circ}C$ is 'M' times that of the de Broglie wave length of Ne at 727° the value of 'M' is

A. 2

B. 3

C. 4

D. 5

Answer:

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23. The significance of Ψ_{420}

A. n = 4, l = 1, m = 0, (4pz)

B. n = 4, l = 2, m = 0, $\left(4dx^2 - y^2\right)$

C. n = 4, l = 2, m = 0, (4dxy)

D. n = 4,l = 2, m = 0, $\left(4dz^2\right)$

Answer:

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24. Consider the following sets of quantum numbers

n	l	m	s
(i) 3	0	0	+½
(ii) 2	2	1	+½
(iii) 4	3	–2	–½
(iv) 1	0	–1	–½
(v) 3	2	3	+½

Which of the following sets of quantum numbers is/are not possible ?

A. (i) (ii) (iii) and (iv)

B. (ii) (iv) and (v)

C. (i) and (iii)

D. (ii), (iii) and (iv)

Answer:

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25. What is the maximum possible number of electrons in an atom that can have the quantum numbers n = 4 and $m_l = +1$?

A. 4

B. 15

C. 3

D. 6

Answer:

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26. The number of electron in d-subshell of Cr^{+2} (z = 24) is not equal to

A. s-electron in Ne (z = 10)

B. unpaired electron in Fe (z = 26)

C. p electron in O (z = 8)

D. d electron in Fe^{3+} (z = 26)

Answer:

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27. Total number of electrons present in an orbital having (n + l) = 3 in sodium atom

A. 4

B. 5

C. 6

D. 7

Answer:

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28. A compound of vanadium has a magnetic moment (μ) of 1.73 BM. If the vanadium ion in the compound is present as V^{x+}, then the value of x is :

A. 1

B. 2

C. 3

D. 4

Answer:

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29. The values of orbital angular momentum of the electrons in 1s, 2s, 3d and 2p are

A. $0, 0, \sqrt{6}h, \sqrt{2}h$

B. $h, h, 2h, \sqrt{2}h$

C. $0, h, \sqrt{6}h, \sqrt{3}h$

D. $0, 0, \sqrt{2}h, \sqrt{6}h$

Answer:

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30. The maximum number of electrons in n = 4, l = 3, $m_s = -1/2$ is

A. 4

B. 5

C. 7

D. 14

Answer:

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31. What is the lowest value of 'n' that allows 'g' orbitals to exist?

A. 6

B. 7

C. 4

D. 5

Answer:

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32. Number of maxima and minima present in a '3s' orbital, in radial probability curve which is plotted with radial probability function in Y axis and radius in the X-axis

A. 4, 2

B. 4, 3

C. 3, 2

D. 2, 1

Answer:

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33. From the following select the wrong statement

A. Radial probability distribution function $\left(4\pi r^2\Psi^2\right)$ gives the probability at a particular distance along one direction

B. xz plane act as a nodal plane for $3P_y$ orbital

C. For S orbital wave function is independent of θ and ϕ

D. 2p orbital with quantum numbers n = 2, l = 1, m = 0 also shows the angular dependence.

Answer:

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34. If the numbers of orbitals of a particular type were (3l+1), but spin quantum numbers were only $+1/2$ and $-1/2$, then d-type orbitals will contain a maximum of _____ electrons.

A. 10

B. 14

C. 7

D. 5

Answer:

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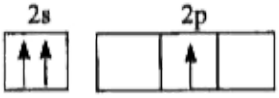
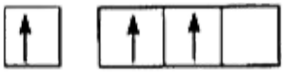
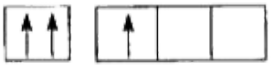
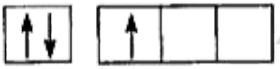
35. Which among the following is correct for ${}_5B$ in normal state?

A. A) 

Against Hund's rule

B. B)  Against Aufbau principle as well as Hund's rule

C. C)  Violation of Pauli's exclusion principle and not Hund's rule

D. D)  Against Aufbau principle

Answer:

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36. If the subsidiary quantum number of sub energy level is 4, the maximum and minimum values of the spin multiplicities are

A. 9, 1

B. 10, 1

C. 10, 2

D. 4, 4

Answer:

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37. The correct order of relative stability of half filled and completely filled shell is

A. $d^5 < p^3 < d^{10} < p^6$

B. $p^3 < d^5 < d^{10} < p^6$

C. $d^5 > p^3 > d^{10} > p^6$

D. $d^{10} > d^5 > p^3 > p^6$

Answer:

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38. Which point does not pertain to electron in Bohr's model of atom? : Angular momentum is an integral multiple of $h/(2\pi)$, The path of the electron within an atom is circular, Force of attraction of electron towards nucleus is balanced by centrifugal force, For a moving electron, energy changes continuously.

A. Angular momentum is an integral multiple of $h/(-2\pi)$

B. The path of the electron within an atom is circular

C. Force of attraction of electron towards nucleus is balanced by centrifugal force

D. For a moving electron, energy changes continuously.

Answer: D

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39. Which of the following electron transitions in hydrogen atom will require largest amount of energy?From n=1 to n=2 From =2 to n=3 From

n=2 to n=0 From n=3 to n=5

A. From n=1 to n=2

B. From =2 to n=3

C. From n=2 to n=0

D. From n=3 to n=5

Answer: A

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40. The speed of the electron in the Ist orbit of the hydrogen atom in the ground state is (c is the velocity of light):c 1/1.37 c/ 1370 c/ 13.7 c/ 137

A. $\frac{c}{1.37}$

B. $\frac{c}{1370}$

C. $\frac{c}{13.7}$

D. $\frac{c}{137}$

Answer: D

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41. The longest wavelength of He^+ when its electron return to third Bohr orbit is 'm' then shortest wavelength of Be^{3+} in the corresponding transition series in terms of 'm' is

A. $\frac{7}{64}$m

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

C. $\frac{64}{7}$ m

D. $\frac{53}{8}m$

Answer: A

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42. For the energy levels in an atom which one of the following statements is correct?

A. The 4s sub-energy level is at a higher energy than the 3d sub-energy level

B. The M-energy level can have maximum of 32 electrons

C. The second principal energy level can have four orbitals and contain a maximum of 8 electrons

D. The 5^{th} main energy level can Have maximum of 72 electrons

Answer: C

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43. The ionization enthalpy of hydrogen atoms is $1.312 \times 10^6 J \ \ \text{mol}^{-1}$ The energy required to excite the electron the atom from n =1 to n=2 is :

A. $9.84 \times 10^5 J \ \ \text{mol}^{-1}$

B. $8.51 \times 10^6 J \ \ \text{mol}^{-1}$

C. $6.56 \times 10^5 J \ \ \text{mol}^{-1}$

D. $7.56 \times 10^5 J \ \ \text{mol}^{-1}$

Answer: A

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44. Ionization energy of He^+ is 19.6×10^{-18} J atom^{-1} The energy of the first stationary state (n=1) of Li^{2+} is :

A. -2.2×10^{-15} J atom^{-1}

B. 8.82×10^{-17} J atom^{-1}

C. 4.41×10^{-16} J atom^{-1}

D. -4.41×10^{-17} J atom^{-1}

Answer: D

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45. A metal is irradiated with light of wavelength 600 nm. Given that the work function of the metal is 1.0 eV, the de Broglie wavelength of the ejected electron is close to:

A. $6.6 \times 10^{-7} m$

B. $8.9 \times 10^{-11} m$

C. $1.19 \times 10^{-9} m$

D. $6.6 \times 10^{-13} m$

Answer: C

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46. Ionization energy of gaseous Na atoms is $495.5 \text{ kJ mol}^{-1}$. The lowest possible frequency of light that ionizes sodium atom is $\left(h = 6.626 \times 10^{-34} Js, N_A = 6.022 \times 10^{23} \text{ mol}^{-1}\right)$

A. $7.50 \times 10^{-4} s^{-1}$

B. $4.76 \times 10^{14} s^{-1}$

C. $3.15 \times 10^{15} s^{-1}$

D. $1.24 \times 10^{15} s^{-1}$

Answer: D

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47. The energy required to break one mole of Cl - Cl bonds in Cl_2, is $242\ \text{kJ mol}^{-1}$. The longest wavelength of lig capable of breaking Cl-Cl bonds is $\left(c = 3 \times 10^8\ \text{ms}^{-1} \text{ and } N_A = 6.02 \times 10^{23}\ \text{mol}^{-1}\right)$

A. 494 nm

B. 594 nm

C. 640 nm

D. 700 nm

Answer: A

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48. A 1kW radio transmitter operates at a frequency of 880 Hz. How many photons per second does it emit?

A. 1.71×10^{-21}

B. 1.71×10^{33}

C. 6.02×10^{23}

D. 2.85×10^{28}

Answer: B

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49. Calculate the energy of radiation emitted for the electronic transition from infinity to ground state for hydrogen atom. Given

$c = 3 \times 10^8 \ \ \mathrm{ms}^{-1}, R_H = 1.09678 \times 10^7 m^{-1}, h = 6.6256 \times 10^{-34} \ \ \mathrm{J\,s}^{-1}$

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

B. $3.25 \times 10^{-18} J$

C. $4.05 \times 10^{-18} J$

D. $2.39 \times 10^{-18} J$

Answer: A

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50. Wavelength of high energy transition of hydrogen atoms is 91.2 nm. Calculate the corresponding wavelength of He atoms.

A. 22.8 nm

B. 20.5 nm

C. 14.6 nm

D. 17.9 nm

Answer: A

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51. The de Broglie wavelength of a tennis ball of mass 60g moving with a velocity of $10ms^{-1}$ is approximate [Planck's constant $= 6.63 \times 10^{-34} Js$]

A. $10^{-33}m$

B. $10^{-31}m$

C. $10^{-16}m$

D. $10^{-25}m$

Answer: A

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52. In an atom, an electron is moving with a speed of $600ms^{-1}$ with an accuracy of 0.005%. Certainty with while the position of the electron can be located is $\left(h = 6.6 \times 10^{-34}kgm^2s^{-1}\right)$, mass of electron $m_e = 9.1 \times 10^{-31}k$

A. $1.52 \times 10^{-4}m$

B. $5.10 \times 10^{-3}m$

C. $1.92 \times 10^{-3}m$

D. $3.84 \times 10^{-3}m$

Answer: C

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53. Which of following pairs of d-orbitals will have electron density along the axis?

A. $dz^2, dx^2 - y^2$

B. $dxy, dx^2 - y^2$

C. dz^2, dxz

D. dxz, dyz

Answer: A

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54. In hydrogen atomic spectrum, a series limit found at $12186.3cm^{-1}$. Then it belongs to.

A. Lyman series

B. Balmer series

C. Paschen series

D. Brackett series

Answer: C

Watch Video Solution

55. The maximum kinetic energy of the photoelectrons is formed to be $6.63 \times 10^{-19} J$, when the metal is irradiated with a radiation of requency $2 \times 10^{15} Hz$. The threshold frequency, of the metal is about?

A. $1 \times 10^{15} s^{-1}$

B. $2 \times 10^{19} s^{-1}$

C. $3 \times 10^{15} s^{-1}$

D. $1.5 \times 10^{15} s^{-1}$

Answer: A

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56. Energy of an electron is given by, $E = -2.178 \times 10^{-18} 4\left(\frac{Z^2}{n^2}\right) J.$ Wavelength of light required to excite an electron in hydrogen atom from level n = 1 to n = 2 will be: $\left(h = 6.62 \times 10^{-34} Js \text{ and } c = 3 \times 10^{8} ms^{-1}\right)$

A. $6.500 \times 10^{-7} m$

B. $8.500 \times 10^{-7} m$

C. $1.214 \times 10^{-7} m$

D. $2.816 \times 10^{-7} m$

Answer: C

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57. A photon with initial frequency 10^{11} Hz scatters off electron at rest. Its final frequency is 0.9×10^{11} Hz. The speed of scattered electron is close to: $\left(h = 6.63 \times 10^{-34} Js.\ M_e = 9.1 \times 10^{-31} kg\right)$

A. $4 \times 10^{3} ms^{-1}$

B. $3 \times 10^{2} ms^{-1}$

C. $2 \times 10^{6} ms^{-1}$

D. $30 ms^{-1}$

Answer: A

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58. Calculate the uncertainty in velocity of an oxygen molecule $\left(5.3 \times 10^{-26} kg\right)$, trapped within a sac of average diameter 5×10^{-10} m.

A. 3.11 m/sec

B. 2.65 m/sec

C. 4.31 m/sec

D. 1.99 m/sec

Answer: D

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59. The orbital angular momentum of an electron in a d-orbital is :

A. $\sqrt{6}\frac{h}{2\pi}$

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

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

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

Answer: A

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60. The work function of carsium metal is 2.14eV. When light of frequency 6×10^{14} Hz is incident on the metal surface, photoemission of electrons occurs.$\left(h = 6.6 \times 10^{-34} js\right)$:-Calculate the maximum kinetic energy of the emitted electrons.

A. $2.49eV$

B. $4.49eV$

C. $0.49eV$

D. $5.49eV$

Answer: C

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61. Increasing order (lowest first) for the values of e/m (charge/mass) for electron (e), proton (p), neutron (n) and $\alpha -$ particle (α) is :

A. e, p, n, α

B. n, p, e, α

C. n, p, α, c

D. n, α, p, e

Answer: D

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62. The triad of nuclei that is isotonic is

A. ${}_{6}^{14}C, {}_{7}^{14}N, {}_{9}^{19}F$

B. ${}_{6}^{12}C, {}_{7}^{14}N, {}_{9}^{19}F$

C. ${}_{6}^{14}C, {}_{7}^{14}N, {}_{9}^{17}F$

D. ${}_{6}^{14}C, {}_{7}^{15}N, {}_{9}^{17}F$

Answer: D

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63. Which of the following statements is incorrect ?

A. The frequency of radiation is inversely proportional to its wavelength

B. Energy of radiation increases with increase in wavelength.

C. Energy of radiation decreases with increase in wavelength.

D. The frequency of radiaction is directly proportional to its wavelength.

Answer: D

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64. A 600 W mercury lamp emits monochromatic radiation of wavelength 331.3 nm. How many photons are emitted from the lamp per second ? ($h = 6.626 \times 10^{-34}$ Js, velocity of light $= 3 \times 10^{8} ms^{-1}$)

A. 8.35×10^{19}

B. 8.35×10^{21}

C. 8.35×10^{20}

D. 8.35×10^{23}

Answer: C

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65. Which one of the following is not the characteristic of Planok's quantum theory of radiation ?

A. The energy is not absorbed or emitted in whole number multiple of quantum.

B. Radiation is associated with energy.

C. Radiation energy is not emitted or absorbed continuously but in the form of small packet called quanta.

D. The magnitude of energy associated with a quantum is proportional to the frquency.

Answer: A

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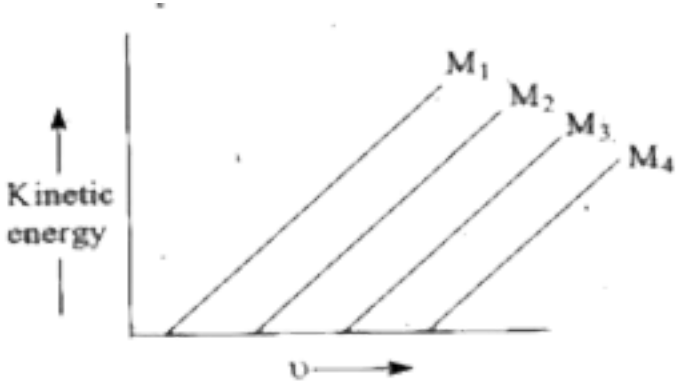
66. A plot of the kinetic energy $\left(\frac{1}{2}mv^2\right)$ of ejected electrons as a function of the frequency (v) of inciden radiation for four alkali metals

(M_1, M_2, M_3, M_4) is given below:



The alkali metals (M_1, M_2, M_3, M_4) are respectively. : Li, Na, K and Rb; Rb, K, Na and Li; Na, K, Li and Rb; Rb, Li, Na and K

A. Li, Na, K and Rb

B. Rb, K, Na and Li

C. Na, K, Li and Rb

D. Rb, Li, Na and K

Answer: B

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67. The highest energy in Balmer series, in the emission spectra of hydrogen is represented by: $\left(R_H = 109737 \mathrm{cm}^{-1}\right)$

A. $4389.48 cm^{-1}$

B. $219474 cm^{-1}$

C. $5486.85 cm^{-1}$

D. $27434.25 cm^{-1}$

Answer: D

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68. If the electronic configuration of nitrogen had $1s^7$, it would have energy lower than that of the normal ground 'state configuration $1s^2 2s^2 2p^3$ because the electrons would be closer to the nucleus. Yet $1s^7$ is not observe because it violates:

A. Heisenberg uncertainty principle

B. Hund's rule

C. Paul's exclusion priciple

D. Bohr postulates of stationary orbits

Answer: C

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69. An excited He^+ ion emits photon of wavelength λ in returning to ground state from n^{th} orbit. If 'R' is Rydberg constant, then

A. $n = \sqrt{\frac{4\lambda R}{4\lambda R - 1}}$

B. $n = \sqrt{\frac{4\lambda R}{4\lambda R + 1}}$

C. $n = \sqrt{\frac{4\lambda R - 1}{4\lambda R}}$

D. $n = \sqrt{\frac{4\lambda R + 1}{4\lambda R}}$

Answer: A

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70. If the energy of H-atom in the ground state is-E, the velocity of photo-electron emitted when a photon having energy E_ρ strikes a stationary Li^{2+} ion in ground state, is given by: $v = \sqrt{\frac{2(E_\rho - E)}{m}}$, $v = \sqrt{\frac{2(E_\rho + 9E)}{m}}, v = \sqrt{\frac{2(E_\rho - 9E)}{m}}, v = \sqrt{\frac{2(E_\rho - 3E)}{m}}$

A. $v = \sqrt{\frac{2(E_\rho - E)}{m}}$

B. $v = \sqrt{\frac{2(E_\rho + 9E)}{m}}$

C. $v = \sqrt{\frac{2(E_\rho - 9E)}{m}}$

D. $v = \sqrt{\frac{2(E_\rho - 3E)}{m}}$

Answer: C

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71. The energy of I, II and III energy levels of a certain atom are E, $\frac{4E}{3}$ and $2E$ respectively. A photon wavelength λ is emitted during a

transition from III to I. What will be the wavelength of emission for transition II to I?

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

B. λ

C. 2λ

D. 3λ

Answer: D

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72. An electron in a hydrogen atom in its ground state absorbs 1.5 times as much energy as the minimum require for it to escape from the atom. What is the velocity of the emitted electron?

A. $1.54 \times 10^6 m/s$

B. $1.54 \times 10^8 m/s$

C. $1.54 \times 10^3 m/s$

D. $1.54 \times 10^4 m/s$

Answer: A

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73. An α-particle having kinetic energy 5 MeV falls on a Cu-foil. The shortest distance from the nucleus of Cu to which α-particle reaches is (Atomic no. of $Cu = 29, K = 9 \times 10^9 \ \ \mathrm{Nm}^2/C^2$)

A. $2.35 \times 10^{-13} m$

B. $1.67 \times 10^{-14} m$

C. $5.98 \times 10^{-15} m$

D. $6.32 \times 10^{-15} m$

Answer: B

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74. The energy of separation of an electron in a Hydrogen like atom in excited state is 3.4 eV. The de-Broglie wave length (in $\mathring{A}$) associated with the electron is: (Given radius of I orbit of hydrogen atom is $0.53\mathring{A}$)

A. 3.33

B. 6.66

C. 13.31

D. 31.31

Answer: B

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75. Photons of frequency, v, fall on metal surface for which the threshold frequency is v_0. Then

A. All ejected electrons have the same kinetic energy, $h(v - v_0)$:

B. The ejected electrons have a distribution of kinetic energy from zero to $h(v = v_0)$

C. The most energetic electron has kinetic energy hv.

D. The average kinetic energy of ejected electrons is $h(v - v_0)$.

Answer: B

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76. When electron jumps from the fourth orbit to the second orbit in Het ion, the radiation emitted out will fall inultraviolet region visible region infrared region radio wave region

A. ultraviolet region

B. visible region

C. infrared region

D. radio wave region

Answer: B

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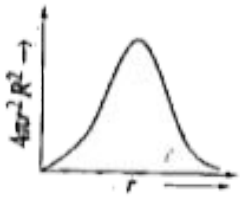
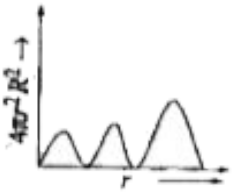
77. Which of the following graph represents the radial probability function of 3d electron?

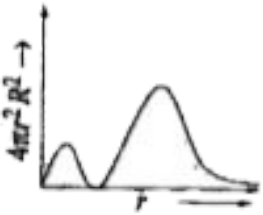
A.

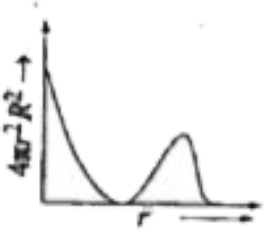


B.



C.





D.

Answer: A

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78. For an atom or ion having single electron, compare the energies of the following orbitals:

$S_1 =$ a spherically symmetrical orbital having two spherical nodes.

S_2= an orbital which is double dumb-bell and has no radial node.

S_3= an orbital with orbital angular momentum zero and three radial nodes.

S_4 = an orbital having one planar and one radial node.

A. $S_1 = S_2 = S_3 = S_4$

B. $S_1 = S_2 = S_4 < S_3$

C. $S_1 > S_2 > S_3 > S_4$

D. $S_1 < S_4 < S_3 < S_2$

Answer: B

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79. Excited hydrogen atom emits light in the ultra violet region at 2.47×10^{15} Hz. With this frequency, the energy of a single photon is (Given: $h = 6.63 \times 10^{-34} Js$)

A. $8.041 \times 10^{-40} J$

B. $2.680 \times 10^{-19} J$

C. $1.640 \times 10^{18} J$

D. $6.111 \times 10^{-17} J$

Answer: C

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80. Which of the following statements on quantum numbers is not correct?

A. Quantum numbers n, l, m and s are needed to describe an electron in an atom completely.

B. Quantum numbers n, l, m and s are obtained by solving the Schrodinger wave equation.

C. A subshell in an atom can be designated with two quantum numbers n and l.

D. The maximum value of l is equal to n-1

Answer: B

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81. The electrons, identified by quantum numbers 'n' and (i) 'n=4, l=1' (ii) 'n=4, l=0' (iii) 'n=3, l=2' (iv) 'n=3, l=1' can be placed in order of increasing

energy, from the lowest to the highest as

A. $(i) < (iii) < (ii) < (iv)$

B. $(iii) < (iv) < (ii) < (i)$

C. $(iv) < (ii) < (iii) < (i)$

D. $(ii) < (iv) < (i) < (iii)$

Answer: C

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82. The kinetic and potential energy (in eV) of an electron present in 3^{rd} Bohr's orbit of hydrogen atom are respectively?

A. $-1, 51, \ -3, 02$

B. $1, 51, \ -3.02$

C. $-3.02, 1.51$

D. $1.51, \ -1.51$

Answer: B

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83. The stopping potential of the electrons emitted in a photoelectric experiment is V. The de-Broglie wavelength of the electron when it is emitted from the metal surface will be

A. $h^2 / \sqrt{2emV}$

B. $h / \sqrt{2emV}$

C. $h^2 / 2emV$

D. $h / 2emV$

Answer: B

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84. If the uncertainity in locating the position of a proton $\left(m = 1.67 \times 10^{-27kg}\right)$ is $5\mu m$, the uncertainitiy in its speed will be

A. $\geq 9.3 \times 10^{-3} ms^{-1}$

B. $\geq 6.3 \times 10^{-3} ms^{-1}$

C. $\geq 6.3 \times 10^{-2} ms^{-1}$

D. $\leq 6.3 \times 10^{-2} ms^{-1}$

Answer: B

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85. Consider the ground state of Cu atom (Z = 29). The number of electrons with the azimuthal quantum numbers l=1 and 2 are, respectively,12,5 12,10 16,6 14,8

A. 12,5

B. 12,10

C. 16,6

D. 14,8

Answer: B

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86. For which of the following hydrogen-like species, the wavelength of radiation emitted due to electron shifts from n = 2 to n= 1, has a maximum value?H H e + L i 2 + B e 3 +

A. H

B. He^+

C. Li^{2+}

D. Be^{3+}

Answer: A

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87. The correct Schrodinger's wave equation for an election with total energy E and potential energy V is given by

A. $\frac{\partial^2\psi}{\partial x^2}+\frac{\partial^2\psi}{\partial y^2}+\frac{\partial^2\psi}{\partial z^2}+\frac{8\pi^2}{mh^2}(E-V)\psi=0$

B. $\frac{\partial^2\psi}{\partial x^2}+\frac{\partial^2\psi}{\partial y^2}+\frac{\partial^2\psi}{\partial z^2}+\frac{8\pi m}{h^2}(E-V)\psi=0$

C. $\frac{\partial^2\psi}{\partial x^2}+\frac{\partial^2\psi}{\partial y^2}+\frac{\partial^2\psi}{\partial z^2}+\frac{8\pi^2 m}{h^2}(E-V)\psi=0$

D. $\frac{\partial^2\psi}{\partial x^2}+\frac{\partial^2\psi}{\partial y^2}+\frac{\partial^2\psi}{\partial z^2}+\frac{8\pi^2 h}{m^2}(E-V)\psi=0$

Answer: C

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Level Ii Assertion Reason

1. Assertion : Energy of orbitals in hydrogen atom is $1s<2s=2p<3s=3p=3d<4s=4p=4d=4f$

Reason : The energy of orbitals in hydrogen atom is determined by using principal quantum number.

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

B. Both assertion and reason are correct but reason is not the correct explanation of assertion

C. If assertion is correct and reason is not correct

D. Assertion is wrong and reason is correct

Answer:

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2. Assertion : Orbital having XZ plane as node may be 3dxy

Reason : 3dxy has zero radial node

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

B. Both assertion and reason are correct but reason is not the correct explanation of assertion

C. If assertion is correct and reason is not correct

D. Assertion is wrong and reason is correct

Answer:

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3. Assertion : As the distance of the shell increases from the nucleus its energy level increases

Reason : The energy of a shell is $E_n \alpha \frac{-1}{n^2}$

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

B. Both assertion and reason are correct but reason is not the correct explanation of assertion

C. If assertion is correct and reason is not correct

D. Assertion is wrong and reason is correct

Answer:

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4. Assertion : Energy is released in the form of light, when electron drops from a higher energy level to lower energy level

Reason : A spectral lines can be seen for $3d_z^2 \text{ to } 3dx^2 - y^2$ transition

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

B. Both assertion and reason are correct but reason is not the correct explanation of assertion

C. If assertion is correct and reason is not correct

D. Assertion is wrong and reason is correct

Answer:

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5. Assertion : It is impossible to determine the exact position, and exact momentum of an electron simultaneously

Reason : The path of an electron in an atom is clearly defined

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

B. Both assertion and reason are correct but reason is not the correct explanation of assertion

C. If assertion is correct and reason is not correct

D. Assertion is wrong and reason is correct

Answer:

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Level I

1. A radiostation broadcasts on a frequency of 1550 kHz. Calculate the wavelength.

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2. Calculate the time taken by light to travel 1 astronomical unit (au $= 1.5 \times 10^{11}$ m)

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3. Calculate the frequency of visible light of wavelength 650 nm.

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4. Calculate the wave rumber of yellow light of wavelength 585 nm.

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5. Calculate the energy of an electron moving with a wavelength of 525 nm.

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6. Calculate the frequency and energy of a photon of wavelength 589 nm.

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7. How many photons having wavelength 4557Å are needed to provide 1 Joule of energy ?

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8. A photon of wavelength 250 nm, absorbed by a substance was subsequently emitted as two photons. The first photon had a wavelength of 600 nm. What was the wavelength of the second photon?

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9. Calculate energy in terms of blue light of wavelength 450 nm.

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10. Calculate the mass of a photon of light of wavelength 580 nm.

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11. A 150 W hollow-cathode lamp of an atomic absorption spectrophotometer emits monochromatic light of wavelength 553.5 nm. Calculate the number of photons emitted in one minute (150 watts $150 Js^{-1}$).

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12. A photon of wavelength 450 nm strikes a metal surface whose work function is 2.5 eV. Calculate

the energy of the photon

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13. A photon of wavelength 450 nm strikes a metal surface whose work function is 2.5 eV. Calculate

the kinetic energy

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14. A photon of wavelength 450 nm strikes a metal surface whose work function is 2.5 eV. Calculate

the velocity of the photelectron.

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15. In a photoelectric effect experiment the threshold wavelength of the light is 380nm. If the wavelength of incident light is 260nm, the maximum kinetic energy electrons will be: Given E(ineV)= 1237/λ(innm)

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16. Calculate the energy of 1 mole of photons whose frequency is 6.0×10^{14} Hz.

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17. Calculate the wavelength of the second line in Balmer series.

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18. Calculate the wavelength of the limiting line in Balmer series.

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19. Why is the negative sign for energy of the electron in hydrogen atom for all possible orbits?

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20. What is a free electron at rest?

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21. Calculate the radius of the second orbit of Li^{2+}

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22. Calculate the radius of the I^{st} Bohr orbit of He^{+}

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23. Calculate the velocity of an electron placed in the 3^{rd} orbit of He^{2+} ion.

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24. Find out the quantum number 'n' coresponding to the exited state of He^{+} ion if on de-exitation to the ground state that ion emits two photons in sucession with wavelengths $1023.7 \text{ and } 304\text{Å}\left(R_H = 1.097 \times 10^7 m^{-1}\right)$.

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25. Calculate the wavelengths of the first line and the series limit for the Lyman series for hydrogen $\left(R_H = 109678 cm^{-1}\right)$.

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26. Calculate the de Broglie wavelength of a ball of mass 0.05 kg moving with a velocity of $50ms^{-1}$.

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27. Calculate the mass of a photon of wavelength1 nm

Watch Video Solution

28. Calculate the wavelength of an electron moving with a velocity of $2.05 \times 10^{7}ms^{-1}$.

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29. Find the de Broglie wavelength of an electron with kinetic energy $9.6 \times 10^{-19}J$.

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30. With what velocity must an electron travel so that its momentum is equal to that of a photon of wavelength of $\lambda = 5000\text{Å}$?

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31. The wavelength of an electron moving in the second orbit of H-atom is an integral multiple of its circumference. Calculate

speed of electron in the second orbit

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32. The wavelength of an electron moving in the second orbit of H-atom is an integral multiple of its circumference. Calculate

speed of electron in the second orbit

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33. The wavelength of an electron moving in the second orbit of H-atom is an integral multiple of its circumference. Calculate potential that must be applied to an electron so that it becomes stationary at a point?

View Text Solution

34. What is the uncertainty in the position of electron, if uncertainty in its velocity is 0.006 m/s ?

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35. Calculate the uncertainty in velocity of a cricket ball of mass 150g, if the uncertainty in its position is of the order of 1Å.

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36. What is the uncertainty in position of a golfball of mass 40 g and speed 45 m/s if the speed can be measured within an accuracy of 2% ?

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37. What is the orbital angular momentum of an electron 3d orbital ?

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38. Given below are the sets of quantum number for given orbitals. Name the orbital.

$n = 2, l = 1, m_1 = -1$

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39. Given below are the sets of quantum number for given orbitals. Name these orbitals.

n=4, l =3

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40. Given below are the sets of quantum number for given orbitals. Name these orbitals.

$n = 3, l = 1$

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41. Given below are the sets of quantum number for given orbitals. Name these orbitals.

$n = 4, l = 2$

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42. For n=5, suggest

Total number of electrons that it can have

Watch Video Solution

43. For n=5, suggest

total number of sub-shells which can exist

Watch Video Solution

44. For n=5, suggest

total number of sub sub-shells (orbitals) which can exist.

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45. Find the number of nodes in 3p orbital

Watch Video Solution

46. Find the number of nodes in 3d.

Watch Video Solution

47. Predict total spin for each configuration :

$1s^2, 2s^2, 2p^5$

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48. Predict total spin for each configuration :

$1s^2, 2s^2, 2p^3$

Watch Video Solution

49. Predict total spin for each configuration :

$1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^5, 4s^2$

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50. Predict total spin for each configuration :

$1s^2, 2s^2$

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51. A compound of vanadium has magnetic moment of 1.73 BM. What is the electronic configuration of the vanadium ion in the compound ?

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52. An α-particle having kinetic energy of 7.5 MeV is scattered by gold (Z=79) mucleus through 180°. Calculate the distance of closest approach.

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53. The Schrodinger wave equation for hydrogen atom is

$$\psi_{2r}^2 = 0 = \left[\frac{1}{4\sqrt{2\pi}}\right]^2 \left(2 - \frac{r_0}{a_0}\right) e^{-r_n/a_0}$$

where a_0 is Bohr's radius. Let the radial node be at r_0 then find r in terms of a_0.

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54. For an orbital in B^{+4}, radial function is $R_{(r)} = \frac{1}{9\sqrt{6}}\left(\frac{Z}{a_0}\right)^{3/4}(4-\sigma)\sigma e^{-\sigma/2}$ where $\sigma = \frac{Zr}{a_0}$, $a_0 = 0.529\text{Å}$, $Z =$ atomic number, and r is the radial distance from the nucleus. Find the distance of the rdial node from the nucleus.

A. 0.529

B. 2.12

C. 1.06

D. 0.423

Answer:

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55. The Schrodinger wave equation for hydrogen atom is

$$\psi_{2r}^2 = 0 = \left[\frac{1}{4\sqrt{2\pi}}\right]^2 \left(2 - \frac{r_0}{a_0}\right) e^{-r_n/a_0}$$

where a_0 is Bohr's radius. Let the radial node be at r_0 then find r in terms of a_0.

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56. For an electron in a hydrogen atom, the wave function ψ is proportional to exp $-r/a_0$, where a_0 is the Bohr radius. Find the ratio of probability of finding the electron at the nucleus to the probability of finding it at a_0.

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57. The wave function of atomic orbital of H-like atom is

$$R_{2,0} \text{ or } R_{2s} = \frac{1}{4\sqrt{2\pi}} Z^{3/2}(2 - Zr)e^{Zr/2}$$

Given that the radius is in $\mathring{A}$, then what is the radiusfor nodal surface for He^{+} ion.

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58. The absolute value of charge on the electron was determined by:

A. J.J. Thomson

B. R.A. Millikan

C. Rutherford

D. Chadwick

Answer: B

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59. Rutherford's experiment on scattering of α- particles showed for the first time that the atom has:

A. electrons

B. protons

C. neutrons

D. nucleus

Answer: D

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60. Which of the following conditions is incorrect for a well behaved wave function (ψ)?

A. ψ must be finite

B. ψ must be single valued

C. ψ must be infinite

D. ψ must be continuous

Answer: C

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61. Neutrino has:

A. charge+1, mass 1

B. charge 0, mass 0

C. charge-1, mass 1

D. charge 0, mass-1

Answer: B

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62. Which of the following does not characterise X-rays?

A. The radiations can ionise gases

B. It causes ZnS to fluorescence

C. Deflected by electric and magnetic fields

D. Have wavelengths shorter than ultraviolet ray

Answer: C

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63. The ratio of the volume of the atom and the volume of the nucleus is:

A. 10^{10}

B. 10^{12}

C. 10^{15}

D. 10^{20}

Answer: C

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64. The spectral lines corresponding to the radiation emitted by an electron jumping from higher orbits to first or belong to:

A. Paschen series

B. Balmer series

C. Lyman series

D. Brackett series

Answer: C

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65. The quantum number not obtained from the Schrodinger's wave equation is:

A. n

B. l

C. m

D. s

Answer: D

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66. An electron has a spin quantum number+1/2 and a magnetic quantum number-1. It cannot be present in:

A. d-orbital

B. f-orbital

C. s-orbital

D. p-orbital

Answer: C

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67. The correct set of four quantum numbers for the valence electrons of rubidium atom (Z=37) is :

A. $5, 1, 1, +\frac{1}{2}$

B. $5, 0, 1, +\frac{1}{2}$

C. $5, 0, 0, +\frac{1}{2}$

D. $5, 1, 0, +\frac{1}{2}$

Answer: C

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68. Maximum number of electrons in a subshell with l=3 and n=4 is

A. 14

B. 16

C. 10

D. 12

Answer: A

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69. Two electrons occupying the same orbital are distinguished by

A. Principal quantum number

B. Magnetic quantum number

C. Azimuthal quantum number

D. Spin quantum number

Answer: D

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70. Ratio of energy of photon of wavelength 3000Å and 6000Å is

A. $3:1$

B. $2:1$

C. $1:2$

D. $1:3$

Answer: B

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71. Which one of the following sets of quantum numbers is possible ?

A. $n=3, l=3, m, \ = \ -3, m_s = \ +\frac{1}{2}$

B. $n=2, l=1, m_t=2, m_s = \ -\frac{1}{2}$

C. $n=2, l=0, m_i=0, m_s = \ +\frac{1}{2}$

D. $n=1, l=0, m_i=0, m_s=0$

Answer: C

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72. 'Heisenberg's uncertainty principle can be expressed as

A. $\Delta x \geq \frac{\Delta p \times h}{4\pi}$

B. $\Delta x \times \Delta p \geq \frac{h}{4\pi}$

C. $\Delta x \times \Delta p \geq \frac{h}{x}$

D. $\Delta p \geq \frac{\pi h}{\Delta x}$

Answer: B

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73. Calculate the wavelength (in nanometer) associated with a proton moving at $1.0 \times 10^3 ms^{-1} s$ (mass of proton $= 1.67 \times 10^{-27} kg$ and $h = 6.63 \times 10^{-34} Js$)

A. 0.032 nm

B. 0.40 nm.

C. 2.5 nm

D. 14.0 nm

Answer: B

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74. The total spin resulting from a d^7 configuration is

A. $3/2$

B. $1/2$

C. 2

D. 1

Answer: A

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75. An ion that has 18 electrons in the outermost shell is

A. cu^{+}

B. Th^{4+}

C. Cs^{+}

D. K^{+}

Answer: A

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76. The wavelength associated with a golf ball weighing 300 g and moving at a speed of $5mh^{-1}$ is of the order

A. $10^{-10}m$

B. $10^{-20}m$

C. $10^{-30}m$

D. $10^{-40}m$

Answer: C

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77. Which of the following pairs is isodiaphers?

A. ${}_{6}^{14}C$ and ${}_{11}^{23}Na$

B. ${}_{12}^{24}Mg$ and ${}_{11}^{23}Na$

C. ${}_{90}^{234}Th$ and ${}_{92}^{238}U$

D. ${}_{6}^{12}C$ and ${}_{7}^{15}N$

Answer: C

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78. In Bohr's stationary orbits

A. Electrons do not move

B. Electrons move emitting radiations

C. Energy of the electron remains constant

D. Angular momentum of the electron is $h/2\pi$

Answer: C

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79. The distance between 4^{th} and 3^{rd} Bohr orbits of He^{+} is :

A. $2.645 \times 10^{-10} m$

B. $1.322 \times 10^{-10} m$

C. $1.851 \times 10^{-10} m$

D. $2.33 \times 10^{-10} m$

Answer: C

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80. Line spectra is characteristic of:

A. molecules

B. atoms

C. radicals

D. both A and B

Answer: B

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81. With increasing principal quantum number, the energy difference between adjacent energy levels in H-atom:

A. decreases

B. increases

C. remains constant

D. decreases for low value of Z and increases for higher value of Z.

Answer: A

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82. The total number of orbitals in M shell of an atom is

A. 1

B. 4

C. 9

D. None of these

Answer: C

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83. Which of the following statements is correct?

A. The 3d orbitals remain degenerate in the presence of magnetic field

B. he electron densities in the xy and yz planes are zero in $3d_{xz}$ orbital.

C. The electron density in the xy plane in $3d_{z^2}$ orbital is zero

D. The electron density in the xy plane in $3d_{xy}$ orbital zero.

Answer: B

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84. The number of unpaired electrons in $_{27}Co$ is

A. 2

B. 3

C. 4

D. None of these

Answer: B

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85. The numbers of spherical and angular nodes in 4f orbitals, respectively, are

A. 1,3

B. 1,4

C. 2,3

D. None of these

Answer: D

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86. Which of the following sets represents isoelectronic species?

A. K^+, Ca^{2+}, Sc^{3+}

B. Na^+, F^-, V^{3+}

C. K^+, Cl^-, Mg^{2+}

D. None of these

Answer: A

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87. The electronic configuration of $_{24}Cr$ is

A. $[Ar]3d^5 4s^1$

B. $[Ar]3d^4 4s^2$

C. $[Ar]3d^6 4s^0$

D. None of these

Answer: A

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88. The number of possible orientations of d orbitals in space is

A. 2

B. 3

C. 4

D. 5

Answer: D

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89. Which electronic configuration does not follow the Aufbau rule? : $1s^2 2s^2 2p^6$; $1s^2 2s^2 2p^4 3s^2$; $1s^2$; None of these

A. $1s^2 2s^2 2p^6$

B. $1s^2 2s^2 2p^4 3s^2$

C. $1s^2$

D. None of these

Answer: B

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90. The subshells which are filled just before and just after the filling of 5p subshell are respectively: 5s, 5d; 4d, 6s; 4d, 4f; None of these

A. 5s, 5d

B. 4d, 6s

C. 4d, 4f

D. None of these

Answer: B

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91. The magnetic moment and nature for isolated gaseous ion Au^{3+} is. : zero and diamagnetic, 2.82 BM and diamagnetic, 2.82 BM and paramagnetic, None of these

A. zero and diamagnetic

B. 2.82 BM and diamagnetic

C. 2.82 BM and paramagnetic

D. None of these

Answer: C

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92. The correct set of quantum numbers for the last electron of Na^+ is3 , 0 , 0 , – 1/ 2 3 , 1 , 0 , + 1/ 2 3 , 1 , 1 , + 1/ 2 None of these

A. $3, 0, 0, -\frac{1}{2}$

B. $3, 1, 0, +\frac{1}{2}$

C. $3, 1, 1, +\frac{1}{2}$

D. None of these

Answer: D

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93. Select the correct statement for Ne.

A. It is not isoelectronic with H_2O

B. Its last electron enters in s orbital

C. The value of m must be zero for the last electron

D. The value of l must be 1 for the last electron

Answer: D

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94. Which of the following may have same set of quantum numbers? :

A. Last electron of Sc and last electron of Fe.

B. An unpaired electron of C and an unpaired electron in Si.

C. Last electron of Sc and last electron of Y.

D. An unpaired electron in 2p orbital of N and unpaired electron in 2p orbital of B.

Answer: D

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95. Choose the correct statement among the following:

A. Number of orbitals in n^{th} shell are n^2

B. Number of orbitals in a subshell are (2l-1).

C. Number of subshell in nt^{th} shell are (n-1).

D. Number of electrons in an orbital of a subshell are 2 (2l+1).

Answer: A

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96. In boron atom, shielding of the last electron is due to

A. electrons of K shell only.

B. all the electrons of K and L shells.

C. two electrons each of 1s and 2s.

D. all the electrons of L shell only.

Answer: C

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97. Which of the following statements is correct?

A. Total number of electrons in a subshell is 2l + 1.

B. p_z, $d_{x^2-y^2}$ and d_{x^2} orbitals are non-axial.

C. Only s orbital has directional orientation while P_z d and f orbitals have non directional properties.

D. Spin multiplicity of nitrogen atom is 4.

Answer: D

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98. Which of the following species has the magnetic moment value of 3.87 B.M.?

A. Fe^{3+}

B. Cr^{2+}

C. Co^{2+}

D. Au^{3+}

Answer: C

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99. The first emission line in the atomic spectrum of hydrogen in the Balmer series appear at.

A. $\frac{9R}{400}cm^{-1}$

B. $\frac{7R}{144}cm^{-1}$

C. $\frac{3R}{4}cm^{-1}$

D. $\frac{5R}{36}cm^{-1}$

Answer: D

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100. Which of the following orbit of He^{+} ion will have the same energy as that of second orbit of hydrogen atom?

A. n=1

B. n=2

C. n=3

D. n=4

Answer: D

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101. The ratio of potential energy and total.energy of an electron in Bohr orbits of hydrogen atom is

A. 2

B. $1/2$

C. 1

D. $-1/2$

Answer: A

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102. The number of possible spectral lines emitted when electron in n=4 Bohr orbit reaches to n=1 Bohr orbit is.

A. 1

B. 2

C. 4

D. 6

Answer: D

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103. The correct order of penetrating power of 3s, 3p, 3d electrons is:

A. $3d > 3p > 3s$

B. $3s > 3p > 3d$

C. $3s > 3d > 3p$

D. $3d > 3s > 3p$

Answer: B

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104. Which of the following rules could explain the presence of three unpaired electrons in N-atom?

A. Hund's rule

B. Aufbau's principle

C. Heisenberg's uncertainty principle

D. Pauli's exclusion principle

Answer: A

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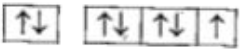
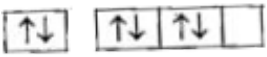
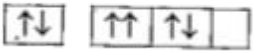
105. The orbital diagram in which both the Pauli's exclusion priciple and Hund's rule are violated, is: 

A. 

B. 

C. 

D. 

Answer: D

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106. The correct order of screening effects of s, p, d, f sub-shells is:

A. $s > p > d > f$

B. $s < p < d < f$

C. $d > p > s > f$

D. $s > f > d > p$

Answer: A

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107. Which of the following subshells can accommodate as many as 10 electrons?

A. 2d

B. 3d

C. 4f

D. 5g

Answer: B

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Level Iii Single Correct Answer Type

1. Iodine molecule dissociates into atoms after absorbing light of 4500Å. If one quantum of radiation is absorbed by each molecule, calculate the kinetic energy of iodine atoms. (Bond energy of $I_2 = 240kJ \ \ \text{mol}^{-1}$)

A. $0.789 \times 10^{-19} J$

B. $0.216 \times 10^{-19} J$

C. $1.632 \times 10^{-19} J$

D. $0.789 \times 10^{-21} J$

Answer: B

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2. Energy required for excitation of electron in 1 mole H atom from ground state to 3^{rd} excited state is 2.67 times (lesser than) dissociation energy per mole of $H_{2(g)}$. Calculate the amount of energy needed to excite each H atom of $H_{2(g)}$ confined in 1 L at $27^\circ C$ and 1 bar pressure. (R=0.083 bar litre $K^{-1} \ \ \text{mol}^{-1}$, $R_B = 1.1 \times 10^{-7} m^{-1}$).

A. $21.87 \times 10^4 J$

B. $18.21 \times 10^6 J$

C. $16.32 \times 10^4 J$

D. $7.789 \times 10^6 J$

Answer: A

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3. K.E. of a subatomic particle is $6.626 \times 10^{-19} J$. Calculate its frequency. 2 × 10 − 15 H z 2 × 10 15 H z 2 × 10 − 13 H z 2 × 10 13 H z

A. $2 \times 10^{-15} Hz$

B. $2 \times 10^{15} Hz$

C. $2 \times 10^{-13} Hz$

D. $2 \times 10^{13} Hz$

Answer: B

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4. The mass of an electron is 9.1×10^{-31} kg. If its K.E.is 3.0×10^{-25} J,then calculate it's wavelength

A. $857.6nm$

B. $896.7nm$

C. $845.5nm$

D. $860nm$

Answer: B

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5. Calculate the uncertainity in the position (Δx) of an electron if Δv is 0.1%. Take the velocity of electron $= 2.2 \times 10^{6} ms^{-1}$ and mass of electron as $9.108 \times 10^{-31} kg$.

A. $263.47 \times 10^{-10} m$

B. $240.46 \times 10^{10} m$

C. $254.45 \times 10^{-10} m$

D. $235.33 \times 10^{-10} m$

Answer: A

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6. Calculate the wavelength of electron in an second orbit of Be^{3+} ion having radius equal to the Bohr's radius (s_0).

A. $1.34A^\circ$

B. $1.53A^\circ$

C. $1.66A^\circ$

D. $1.46A^\circ$

Answer: C

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7. A gas absorbs a photon of 355 nm and emits at two wavelengths. If one of the emissions is at 680 nm, the other is at

A. 325 nm

B. 743 nm

C. 518 nm

D. 1035 nm

Answer: B

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8. Based on the equation $\Delta E = -\left(2.0 \times 10^{-18} J\right)\left(\frac{1}{n_2^2} - \frac{1}{n_1^2}\right)$ the wavelength of the light that must be absorbed to excite hydrogen

electron from level n=1 to level n=2 will be

(Given : $h = 6.625 \times 10^{-34} Js, c = 3 \times 10^{8} ms^{-1}$)

A. $1.325 \times 10^{-7} m$

B. $1.325 \times 10^{-10} m$

C. $2.650 \times 10^{-7} m$

D. $5.300 \times 10^{-10} m$

Answer: A

Watch Video Solution

9. Hydrogen atom in its ground state is excited by a radiation of wavelength 97.26 nm. The longest wavelength it emits is

A. 1250 nm

B. 1400 nm

C. 1875 nm

D. 2050 nm

Answer: C

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Level Iii Multiple Correct Answer Type

1. Which of the following statements are correct for an electron that has n = 4, and m = -2 ?

A. The electron may be in a d-orbital

B. The electron is the fourth principal electronic shell

C. The electron may be in a p-orbital

D. The electron must have the spin quantum number =+1/2

Answer: A::B

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2. The angular momentum of electron can have the value(s):

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

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

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

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

Answer: A::B::C

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3. In which of the following sets of orbitals, electrons have equal orbital angular momentum?

A. 1s and 2s

B. 2s and 2p

C. 2p and 3p

D. 3p and 3d

Answer: A::C

Watch Video Solution

4. Which of the following statements are correct regarding a hydrogen atom?

A. Kinetic energy of the electron is maximum in the first orbit

B. Potential energy of the electron is maximum in the first orbit

C. Radius of the second orbit is four times the radius of the first orbit

D. Various energy levels are equally spaced

Answer: A::C

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5. Select the correct statements:

A. Heisenberg's principle is applicable to stationary electron:

B. Pauli's exclusion principle is not applicable to photons:

C. For an electron in hydrogen atom, the product of velocity and principal quantum number will be independent of principal quantum number.

D. Quantum numbers l and m determine the value of angular wave function.

Answer: B::C::D

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6. Select the correct statements regarding 3P, orbital:

A. Total no: of nodes are 2

B. Number of maxima in the curve $4\pi r^2 R^2$ vs r are two.

C. Quantum no: n, l and m for orbital may be 3, 1, -1 respectively

D. The magnetic quantum number may have a positive value .

Answer: A::B::C::D

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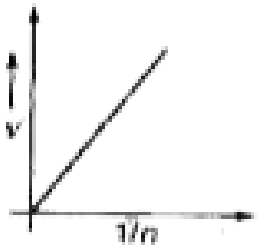
7. Select the correct curves:

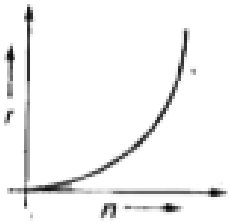
If v=Velocity of electron in Bohr's orbit, r = Radius of electron in Bohr's orbit.

P.E.=Potential energy of electron in Bohr's orbit, K.E.=Kinetic energy of electron in Bohr's orbit

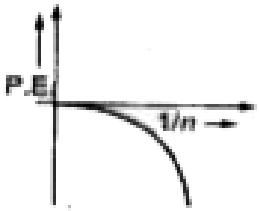
A.



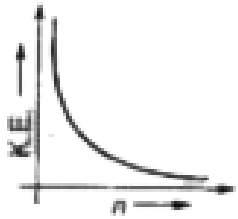
B.



C.



D.



Answer: A::B::C::D

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8. Select the incorrect statements among the following.

A. In $d_{x^2-y^2}$ orbital, two nodal planes are present in xz-and yz-plane.

B. d_{xy} and $d_{x^2-y^2}$ have one common nodal plane.

C. One 4d orbital contains only two electrons of the same spin.

D. One 3d orbital contains a total of 10 electrons.

Answer: A::B::C::D

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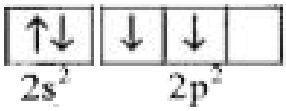
9. Which of the following can be a stable ground state electronic configuration (only valence shell) of carbon atom? :



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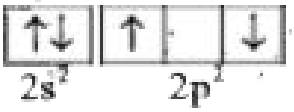

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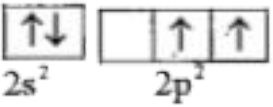

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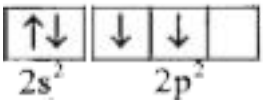
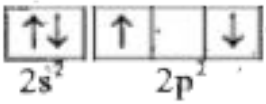
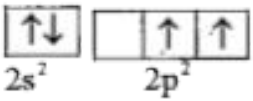
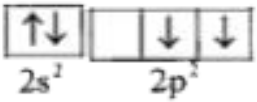
A.


B.


C.




D.

Answer: A::C::D

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10. Which of the following species is isoelectronic with Ne? : H_2O, C^{4-}, Na^- , NH_2^-

A. H_2O

B. C^{4-}

C. Na^-

D. NH_2^-

Answer: A::B::D

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11. Which of the following statements are correct about the Bohr model of hydrogen atom?

A. The acceleration of the electron in then=2 orbit is more than that in then=1 orbit. :

B. The angular momentum of the electron in the n=2 orbit is more than that in the n=1 orbit.

C. The kinetic energy of electron in the n=2 orbit is less than in the n=1 orbit.

D. The centripetal force on electron in then=2 orbit is more than that in the n=1 orbit.

Answer: B::C

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12. Which of the following are true informations ?

A. 3s orbital is spherically symmetrical with two nodes.

B. $d_{x^2-y^2}$ orbital has lobes of electron density in XY-plane along X-and Y-axis.

C. The radial probability curve of Is, 3p and 5d have one, two and three regions of maximum probability.

D. $3d_{z^2}$ has zero electron density in XY-plane.

Answer: A::B::C

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13. Which of the following statements are correct?

A. The electronic configuration of Cr is $[Ar]3d^5 4s^1$ (Atomic Number of Cr = 24).

B. The magnetic quantum number may have a negative value.

C. In silver atom, 23 electrons have a spin of one type and 24 of the opposite type.

D. The oxidation state of nitrogen in NH_3 is - 3.

Answer: A::B::C

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14. Select the correct statements among the following

A. Outside any orbital, the probability of finding electron is zero.

B. For single electronic atom or ion, the most probable distance of electron in an orbital having no radial node is $\frac{n^2 a_0}{Z}$ from the nucleus, where a, is the first Bohr radius.

C. The average distance of electron (belonging from the same orbit) form the nucleus decreases with the increase in the value of angular momentum quantum number for the orbital.

D. The angular wave function of any s-orbital is independent from θ and ϕ.

Answer: B::C::D

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Level Iii Numerical Type

1. Find the quantum no: 'n' corresponding to the excited state of He+ ion if on transition to the ground state that ion emits two photons in succession with wavelengths.108.5 and 30.4 nm.

A. 7

B. 5

C. 3

D. 4

Answer: 5

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2. The wavelength of m^{th} line Balmer series for an orbital is 4103Å. The value of m represents:

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3. Ionisation potential of hydrogen atom is 13.6 eV. If ground state of H-atom is excited by monochromatic radiations of 12.1 eV, then number of spectral lines emitted by H-atom or de-excitation will be:

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4. If magnetic quantum number of a given electron in an atom is -3, then what will be its minimum principal, quantum no. ?

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5. How many of the following ions have the same magnetic moments?

$Fe^{2+}, Mn^{2+}, Cr^{2+}, Ni^{2+}$

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6. The work function (ϕ) of some metals is listed below. The number of metals which will show photoelectric effect when light of 300 nm wavelength falls on the metal is Metal

Metal	Li	Na	K	Mg	Cu	Ag	Fe	Pt	W
(ϕ)	2.4	2.3	2.2	3.7	4.8	4.3	4.7	6.3	4.75

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7. Not considering the electronic spin, the degeneracy of the second excited state (n=3) of H atom is 9, while the degeneracy of the second excited state of H^{Θ} is

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8. The maximum number of electrons that can have principal quantum number n=3 and spin quantum number:

$m_s = -\frac{1}{2}$ is

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9. A atomic masses of He and Ne are 4 and 20 amu respectively. The value of the de Brogile wavelength of He as at -73° is "M" times that of the de Brogile wavelength of Ne at $727^\circ C$. M is:

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Level Iii Matching Column Type

1. Match the orbitals of List-I with the nodal properties of List-II :

List-I	List-II
A) 2s	p) Angular node = 1
B) 1s	q) Radial node = 0
C) 2p	r) Radial node = 1
D) 3p	s) Angular node = 0

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2. Match the electronic transitions in H-atom of List-I with spectral properties of List-II.

List-I	List-II
A) $n = 6 \longrightarrow n = 3$	p) 10 lines in the spectrum
B) $n = 7 \longrightarrow n = 3$	q) Spectral lines in visible region
C) $n = 5 \longrightarrow n = 2$	r) 6 lines in the spectrum
D) $n = 6 \longrightarrow n = 2$	s) Spectral lines in infrared region

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3. Match the following columns

Column-I	Column-II
A) 2s	p) $n = 3, l = 2, m = 0$
B) $2p_z$	q) $n = 4, l = 2, m = -2$ or $+2$
C) $4d_{x^2-y^2}$	r) $n = 2, l = 1, m = 0$
D) $3d_{z^2}$	s) $n = 2, l = 0, m = 0$

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4. Match the following:

Column-I	Column-II
A) Ratio of speed of electron in the fifth and third excited state of H-atom	p) $\frac{4}{1}$
B) Ratio of limiting wavelength of Balmer series to Lyman series of H-spectrum	q) $\frac{2}{3}$
C) Ratio of wavelength corresponding to 2^{nd} line of Lyman series and 3^{rd} line of Paschen series of H-spectrum	r) $\frac{1}{4}$
D) Ratio of energy difference between 3^{rd} and 1^{st} orbits of H-atom to that of He^+ ion	s) $\frac{3}{32}$

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5. According to Bohr's theory, $E_n =$ Total energy, K_n = Kinetic energy, V_n =Potential energy, $r_{\frac{n}{\square}}$ = Radius of orbit.

Column-I	Column-II
A) $V_n / K_n =$	p) 0
B) If radius of n^{th} orbit $\propto E_n^x$; x =	q) –1
C) Orbital angular momentum in lowest energy	r) – 2
D) $\frac{1}{r_n} \propto Z^y$; y =	s) 1

Each of these questions contains two statements: Statement 1 and Statement2. Each of these questions has four alternative choices, only one of which is the correct answer.

A. Statement 1 is True, statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement2 is True: Statement2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is True.

Answer:

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Level Iii Statementtype

1. Statement 1 : The plots of probability density and radial probability function versus distance r from the nucleus for any particular orbital are not identical,

Statement 2 : Probability density is ψ^2 whereas radial probability function represents probability of finding the electron in a shell of thickness dr.

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2. Statement 1 : On increasing the intensity of incident radiation, the number of photoelectrons ejected and their KE increases,

Statement 2: Greater the intensity means greater the energy which in turn means greater the frequency of the radiation.

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3. Statement 1: According to de Broglie, the wavelengths associated with electrons and other subatomic particles can be detected experimentally.

Statement 2 : The wavelength associated with any material particle is directly proportional to its mass.

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4. Statement 1: In hydrogen and hydrogen like species, orbital energy depends only on the quantum number n whereas in multi-electron atoms it depends on quantum numbers n and l.

Statement 2 : The principal quantum number determine the size and the energy of the orbital.

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5. Statement 1 : The position of an electron can be determined exactly with the help of an electron microscope.

Statement 2 : The product of uncertainty in the measurement of its

momentum and the uncertainty in the measurement of the position cannot be less than a finite limit.

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Level Iii Linked Comprehension Type

1. The hydrogen-like species Li^{2+} is in a spherically symmetric state S_1 with one radial node. Upon absorbing light the ion undergoes transition to a state S_2 The state S_2 has one radial node and its energy is equal to the ground state energy of the hydrogen atom.

The state S_1 is: 1s, 2s, 2p, 3s

A. 1s

B. 2s

C. 2p

D. 3s

Answer: B

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2. The hydrogen-like species $\mathrm{L}i^{2+}$ is in a spherically symmetric state S_1 with one radial node. Upon absorbing light the ion undergoes transition to a state S_2 The state S_2 has one radial node and its energy is equal to the ground state energy of the hydrogen atom.

Energy of the state S_1 in units of the hydrogen atom ground state energy is:

A. 0.75

B. 1.50

C. 2.25

D. 4.50

Answer: C

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3. The hydrogen-like species $\mathrm{L}i^{2+}$ is in a spherically symmetric state S_1 with one radial node. Upon absorbing light the ion undergoes transition to a state S_2 The state S_2 has one radial node and its energy is equal to the ground state energy of the hydrogen atom.

The orbital angular momentum quantum number of the state S_2 is:

A. 0

B. 1

C. 2

D. 3

Answer: B

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4. Werner Heisenberg considered the limits of how precisely we can measure the properties of an electron or other microscopic particle. He determined that there is a fundamental limit to how closely we can

measure both position and momentum. The more accurately we measure the momentum of a particle, the less accurately we can determine its position. The converse is also true. This is summed up in what we now call the Heisenberg uncertainty principle. The equation is $\Delta x \Delta(mv) \geq \frac{h}{4\pi}$ The uncertainty in the position or in the momentum of a macroscopic object like a baseball is too small to observe. However, the mass of microscopic object such as an electron is small enough for the uncertainty to be relatively large and significant.

If the uncertainties in position and momentum are equal, the uncertainty in the velocity is:

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

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

C. $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$

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

Answer: C

Watch Video Solution

5. Werner Heisenberg considered the limits of how precisely we can measure the properties of an electron or other microscopic particle. He determined that there is a fundamental limit to how closely we can measure both position and momentum. The more accurately we measure the momentum of a particle, the less accurately we can determine its position. The converse is also true. This is summed up in what we now call the Heisenberg uncertainty principle. The equation is $\Delta x \Delta(mv) \geq \frac{h}{4\pi}$ The uncertainty in the position or in the momentum of a macroscopic object like a baseball is too small to observe. However, the mass of microscopic object such as an electron is small enough for the uncertainty to be relatively large and significant.

If the uncertainty in velocity and position is same, then the uncertainty in momentum will be:

A. $\sqrt{\frac{hm}{4\pi}}$

B. $m\sqrt{\frac{h}{4\pi}}$

C. $\sqrt{\frac{h}{4\pi m}}$

D. $\frac{1}{m}\sqrt{\frac{h}{4\pi}}$

Answer: A

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6. For one-electron species, the wave number of radiation emitted during the transition of electron from a higher energy state (n_2) to a lower energy state (n_1) is given by: $\bar{v} = \frac{1}{\lambda} = R_H \times Z\left(\frac{1}{n_1^2}\frac{1}{n_2^2}\right)$ where $R_H = \frac{2\pi m_s k^2 c^4}{h^3 c}$ is Rydberg constant for hydrogen atom. Now, considering nuclear motion, the accurate measurement would be obtained by replacing mass of electron (m_e) by the reduced mass (μ) in the above expression, defined as $\mu = \frac{m_n \times m_e}{m_n + m_e}$ where m_n = mass of nucleus. For Lyman series, $n_t = 1$ (fixed for all the lines) while $n_2 = 2, 3, 4....$ For Balmer series: $n_1 = 2$ (fixed for all the lines) while $n_2 = 3, 4, 5....$

If proton in hydrogen nucleus is replaced by a positron having the same mass as that of an electron but same charge as that of proton, then considering the nuclear motion, the wavenumber of the lowest energy transition of He+ ion in Lyman series will be equal to

A. $\frac{2}{3}R_H$

B. $\frac{3}{2}R_H$

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

D. R_H

Answer: B

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7. For one-electron species, the wave number of radiation emitted during the transition of electron from a higher energy state (n_2) to a lower energy state (n_1) is given by: $\bar{v} = \frac{1}{\lambda} = R_H \times Z\left(\frac{1}{n_1^2}\frac{1}{n_2^2}\right)$ where $R_H = \frac{2\pi m_s k^2 c^4}{h^3 c}$ is Rydberg constant for hydrogen atom. Now, considering nuclear motion, the accurate measurement would be obtained by replacing mass of electron (m_e) by the reduced mass (μ) in the above expression, defined as $\mu = \frac{m_n \times m_e}{m_n + m_e}$ where m_n = mass of nucleus. For Lyman series, $n_t = 1$ (fixed for all the lines) while $n_2 = 2, 3, 4....$ For Balmer series: $n_1 = 2$ (fixed for all the lines) while

$n_2 = 3, 4, 5....$

The ratio of the wave numbers for the highest energy transition of electron in Lyman and Balmer series of hydrogen atom is

A. $4:1$

B. $6:1$

C. $9:1$

D. $3:1$

Answer: A

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8. The wavelength (in cm) of second line in the Lyman series of hydrogen atomic spectrum is (Rydberg constant $= \mathrm{R\,cm^{-1}}$)

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

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

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

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

Answer: B

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Question

1. A radiostation broadcasts on a frequency of 1550 kHz. Calculate the wavelength.

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2. Calculate the time taken by light to travel 1 astronomial unit (au $1 = 1.5 \times 10^{11} m$)

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3. Calculate the frequency of visible light of wavelength 650 nm.

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4. Calculate the wave rumber of yellow light of wavelength 585 nm.

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5. Calculate the energy of an electron moving with a wavelength of 525 nm.

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6. Calculate the frequency and energy of a photon of wavelength 589 nm.

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7. How many photons having wavelength 4557Å are needed to provide 1 Joule of energy ?

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8. A photon of wavelength 250 nm, absorbed by a substance was subsequently emitted as two photons. The first photon had a wavelength of 600 nm. What was the wavelength of the second photon?

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9. Calculate energy in terms of blue light of wavelength 450 nm.

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10. Calculate the mass of a photon of light of wavelength 580 nm.

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11. A 150 W hollow-cathode lamp of an atomic absorption spectrophotometer emits monochromatic light of wavelength 553.5 nm. Calculate the number of photons emitted in one minute (150 watts $150 Js^{-1}$).

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12. A photon of wavelength 450 nm strikes a metal surface whose work function is 2.5 eV. Calculate

the energy of the photon

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13. Photoelectrons of threshold wavelength350 nm are emited by u.v light of 250 nm wavelength, from a metal surface. Calculate the kinetic energy of the emitted electrons.

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14. Calculate the energy of 1 mole of photons whose frequency is 6.0×10^{14} Hz.

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15. Calculate the wavelength of the second line in Balmer series.

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16. Calculate the wavelength of the limiting line in Balmer series.

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17. Why is the negative sign for energy of the electron in hydrogen atom for all possible orbits?

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18. What is a free electron at rest?

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19. Calculate the radius of the second orbit of Li^{2+}

Watch Video Solution

20. Calculate the radius of the I^{st} Bohr orbit of He^{+}

Watch Video Solution

21. Calculate the velocity of an electron placed in the 3^{rd} orbit of He^{2+} ion.

Watch Video Solution

22. Find out the quantum number 'n' coresponding to the exited state of He^+ ion if on transition to the ground state that ion emits two photons in sucession with wavelengths 1026.7 and 304 Å $\left(R_H = 1.096 \times 10^7 m^{-1}\right)$.

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23. Calculate the wavelengths of the first line and the series limit for the Lyman series for hydrogen $\left(R_H = 109678 cm^{-1}\right)$.

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24. Calculate the de Broglie wavelength of a ball of mass 0.05 kg moving with a velocity of $50 ms^{-1}$.

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25. Calculate the mass of a photon of wavelength 55 pm.

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26. Calculate the wavelength of an electron moving with a velocity of $2.7 \times 10^{7} ms^{-1}$.

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27. Find the de Broglie wavelength of an electron with kinetic energy $9.6 \times 10^{-19} J$.

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28. With what velocity must an electron travel so that its momentum is equal to that of a photon of wavelength of $\lambda = 5000 Å$?

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29. The wavelength of an electron moving in the second orbit of H-atom is an integral multiple of its circumference. Calculate

speed of electron in the second orbit

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30. What is the uncertainty in the position of electron, if uncertainty in its velocity is 0.006 m/s ?

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31. Calculate the uncertainty in velocity of a cricket ball of mass 145g, if the uncertainty in its position is of the order of 1 Å.

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32. What is the uncertainty in position of a golf ball of mass 40g and speed 35 m/s if the speed can be measured within an accuracy of 2%?

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33. What is the orbital angular momentum of an electron in 3p orbital?

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34. Given below are the sets of quantum number for given orbitals. Name the orbital.

$n = 2, l = 1, m_1 = -1$

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35. Given below are the sets of quantum numbers for given orbitals. Name these orbitals.

$n = 4, l = 2$

Watch Video Solution

36. Representation of the orbital with quantum numbers n=3, l=1 is .....

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37. Given below are the sets of quantum numbers for given orbitals. Name these orbitals.

$n = 4, l = 2, m_1 = \pm 2$

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38. For n=5, suggest

Total number of electrons that it can have

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39. Find the number of radial nodes in 3p orbital.

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40. Find the number of radial nodes in 3d.

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41. Predict total spin for configuration:

$1s^2, 2s^2, 2p^4$

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42. Predict total spin for configuration:

$1s^2, 2s^2, 2p^4$

Watch Video Solution

43. Predict total spin for configuration:

$1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^5, 4s^1$

Watch Video Solution

44. Predict total spin for configuration:

$1s^2, 2s^1$

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45. A compound of vanadium has magnetic moment of 1.73 BM. What is the electronic configuration of the vanadium ion in the compound ?

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46. An α-particle having kinetic energy of 7.5 MeV is scattered by gold (Z=79) mucleus through 180°. Calculate the distance of closest approach.

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47. The Schrodinger wave equation for hydrogen atom is

$$\psi_{2r}^2 = 0 = \left[\frac{1}{4\sqrt{2\pi}}\right]^2 \left(2 - \frac{r_0}{a_0}\right) e^{-r_n/a_0}$$

where a_0 is Bohr's radius. Let the radial node be at r_0 then find r in terms of a_0.

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48. For an orbital in B^{+4}, radial function is

$$R_{(r)} = \frac{1}{9\sqrt{6}} \left(\frac{Z}{a_0}\right)^{3/4} (4 - \sigma)\sigma e^{-\sigma/2}$$

where $\sigma = \frac{Zr}{a_0}$, $a_0 = 0.529\text{Å}$, $Z =$ atomic number, and r is the radial distance from the nucleus. Find the distance of the rdial node from the nucleus.

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49. The wave inction of 3s electron is given by

$$\Psi = \frac{1}{81\sqrt{3\pi}}\left(\frac{1}{a_0}\right)^{3/2}\left[27 - 18\left(\frac{r}{a_0}\right) + 2\left(\frac{r}{a_0}\right)^3\right]e^{r/3a_0}$$

It has a node at $r = r_0$. Find the relation between r_0 and a_0.

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50. For an electron in a hydrogen atom, the wave function y is proportional to exp-r/a_0, where a_0 is the Bohr radius. Find the ratio of probability of finding the electron at the nucleus to the probability of finding it at a_0.

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51. The wave function of atomic orbital of H-like atom is

$$R_{2,0} \text{ or } R_{2s} = \frac{1}{4\sqrt{2\pi}}Z^{3/2}(2 - Zr)e^{Zr/2}$$

Given that the radius is in Å, then what is the radius for nodal surface for He^+ ion.

A. 1.75

B. 1.5

C. 1

D. 0.5

Answer:

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Level I

1. The absolute value of charge on the electron was determined by:

A. J.J. Thomson

B. R.A. Millikan

C. Rutherford

D. Chadwick

Answer: B

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2. Rutherford's experiment on scattering of α- particles showed for the first time that the atom has:

A. electrons

B. protons

C. neutrons

D. nucleus

Answer: D

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3. Which of the following conditions is incorrect for a well behaved wave function (Ψ)?

A. Ψ must be finite

B. Ψ must be single valued

C. Ψ must be infinite

D. Ψ must be continuous

Answer: C

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4. Neutrino has:

A. charge +1, mass 1

B. charge 0, mass 0

C. charge-1, mass 1

D. charge 0, mass 1

Answer: B

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5. Which of the following does not characterise X-rays?

A. The radiations can ionise gases

B. It causes ZnS to fluorescence

C. Deflected by electric and magnetic fields

D. Have wavelengths shorter than ultraviolet rays

Answer: C

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6. The ratio of the volume of the atom and the volume of the nucleus is:

A. 10^{10}

B. 10^{12}

C. 10^{15}

D. 10^{20}

Answer: C

Watch Video Solution

7. The spectral lines corresponding to the radiation emitted by an electron jumping from higher orbits to first orbit belong to:

A. Paschen series.

B. Balmer series

C. Lyman series

D. Brackett series

Answer: C

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8. The quantum number not obtained from the Schrodinger's wave equation is:

A. n

B. l

C. m

D. s

Answer: D

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9. An electron has a spin quantum number +1/2 and a magnetic quantum number -1, It cannot be present in:

A. d-orbital

B. f-orbital

C. s-orbital

D. p-orbital

Answer: C

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10. The correct set of four quantum numbers for the valence electrons of rubidium atom (Z=37) is :

A. $5, 1, 1, +\frac{1}{2}$

B. $5, 0, 1, +\frac{1}{2}$

C. $5, 0, 0, +\frac{1}{2}$

D. $5, 1, 0, +\frac{1}{2}$

Answer: C

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11. Maximum number of electrons is a subshell with l = 3 and n = 4 is

A. 14

B. 16

C. 10

D. 12

Answer: A

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12. Two electrons occupying the same orbital are distinguished by which quantum number ?

A. Principal quantum number

B. Magnetic quantum number

C. Azimuthal quantum number

D. Spin quantum number

Answer: D

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13. Ratio of energy of photon of wavelength 3000 A° and 6000 A° is

A. $3:1$

B. $2:1$

C. $1:2$

D. $1:3$

Answer: B

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14. Which one of the following sets of quantum numbers is possible ?

A. $n=3, l=3, m_l=-3, m_s=+\frac{1}{2}$

B. $n = 2, l = 1, m_l = 2, m_s = -\frac{1}{2}$

C. $n = 2, l = 0, m_s = +\frac{1}{2}$

D. $n = 1, l = 0, m_l = 0, m_s = 0$

Answer: C

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15. 'Heisenberg's uncertainty principle can be expressed as

A. $\Delta x \geq \frac{\Delta p \times h}{4\pi}$

B. $\Delta x \times \Delta p \geq \frac{h}{4\pi}$

C. $\Delta x \times \Delta p \geq \frac{h}{x}$

D. $\Delta p \geq \frac{\pi h}{\Delta x}$

Answer: B

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16. Calculate the wavelength (in nanometer) associated with a proton moving at $1.0 \times 10^3 ms^{-1} s$ (mass of proton $= 1.67 \times 10^{-27} kg$ and $h = 6.63 \times 10^{-34} Js$)

A. 0.032 nm

B. 0.40 nm

C. 2.5 nm

D. 14.0 nm

Answer: B

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17. The total spin resulting from a d^8 configuration is

A. $3/2$

B. $1/2$

C. 2

D. 1

Answer: A

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18. An ion that has 18 electrons in the outermost shell is

A. Cu^+

B. Th^{4+}

C. Cs^+

D. K^+

Answer: A

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19. The wavelength associated with a golf ball weighing 200g and moving at a speed of 5 m/h is of the order of

A. $10^{-10}m$

B. $10^{-20}m$

C. $10^{-30}m$

D. $10^{-40}m$

Answer: C

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20. Which of the following pairs is isodiaphers?

A. ${}^{14}_{6}C$ and ${}^{23}_{11}Na$

B. ${}^{24}_{12}Mg$ and ${}^{23}_{11}Na$

C. ${}^{234}_{90}Th$ and ${}^{238}_{92}U$

D. ${}^{12}_{6}C$ and ${}^{15}_{7}N$

Answer: C

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21. In Bohr's stationary orbits

A. Electrons do not move

B. Electrons move emitting radiations

C. Energy of the electron remains constant

D. Angular momentum of the electron is $h/2\pi$

Answer: C

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22. The distance between 4^{th} and 3^{rd} Bohr orbits of He^{+} is :

A. $2.645 \times 10^{-10} m$

B. $1.322 \times 10^{-10} m$

C. $1.851 \times 10^{-10} m$

D. $2.33 \times 10^{-10} m$

Answer: C

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23. Line spectra is characteristic of :

A. molecules

B. atoms

C. radicals

D. both A and B

Answer: B

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24. With increasing principal quantum number, the energy difference between adjacent energy levels in H-atom:

A. decreases

B. increases

C. remains constant

D. decreases for low value of Zand increases for higher value of Z.

Answer: A

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25. The total number of orbitals in L shell of an atom is

A. 1

B. 4

C. 9

D. 16

Answer: C

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26. Which of the following statements is correct?

A. A. The 3d orbitals remain degenerate in the presence of magnetic field.

B. B. The electron densities in the xy and yz planes are zero in $3d_{xz}$ orbital.

C. C. The electron density in the xy plane in $3d_{z^2}$ orbital is zero.

D. D. The electron density in the xy plane in $3d_{xy}$ orbital zero.

Answer: B

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27. The number of unpaired electrons in $_{27}Co$ is

A. 2

B. 3

C. 4

D. 5

Answer: B

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28. What are the numbers of spherical and angular nodes in 4f orbitals, from the given options?

A. 1, 3

B. 1, 4

C. 2, 3

D. 0, 3

Answer: D

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29. Which of the following sets represents isoelectronic species?

A. K^+, Ca^{2+}, Sc^{3+}

B. Na^+, F^-, V^{3+}

C. K^+, Cl^-, Mg^{2+}

D. $Cr^{3+}, Fe^{2+}, Co^{3+}$

Answer: A

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30. The electronic configuration of $_{24}Cr$ is

A. $[Ar]3d^5 4s^1$

B. $[Ar]3d^4 4s^2$

C. $[Ar]3d^6 4s^0$

D. $[Ar]4d^5 4s^1$

Answer: A

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31. The number of possible orientations of d orbitals in space is

A. 2

B. 3

C. 4

D. 5

Answer: D

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32. Which electronic configuration does not follow the Aufbau rule?

A. $1s^2 2s^2 2p^6$

B. $1s^2 2s^2 2p^6 3s^2$

C. $1s^2$

D. $1s^2 2s^2 2p^4 3s^2$

Answer: B

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33. The subshells which are filled just before and just after the filling of 5p subshell are respectively: 5s, 5d; 4d, 6s; 4d, 4f; None of these

A. 5s, 5d

B. 4d, 6s

C. 4d, 4f

D. 6s, 4f

Answer: B

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34. The magnetic moment and nature for isolated gaseous ion Au^{3+} is. : zero and diamagnetic, 2.82 BM and diamagnetic, 2.82 BM and paramagnetic, None of these

A. zero and diamagnetic

B. 2.82 BM and diamagnetic

C. 2.82 BM and paramagnetic

D. None of these

Answer: C

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35. The correct set of quantum numbers for the last electron of Na^{+} is3 , 0 , 0 , – 1/ 2 3 , 1 , 0 , + 1/ 2 3 , 1 , 1 , + 1/ 2 None of these

A. $3, 0, 0, -\frac{1}{2}$

B. $3, 1, 0, +\frac{1}{2}$

C. $3, 1, 1, +\frac{1}{2}$

D. $2, 1, 0, -\frac{1}{2}$

Answer: D

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36. Select the correct statement for Ne.

A. It is not isoelectronic with H_2O

B. Its last electron enters in s orbital

C. The value of m must be zero for the last electron

D. The value of Imust be 1 for the last electron

Answer: D

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37. Which of the following may have same set of quantum numbers? :

A. Last electron of Sc and last electron of Fe.

B. An unpaired electron of C and an unpaired electron in Si.

C. Last electron of Sc and last electron of Y.

D. An unpaired electron in 2p orbital of N and unpaired electron in 2p orbital of B.

Answer: D

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38. Choose the correct statement among the following:

A. Number of orbitals in n^{th} shell are n^2.

B. Number of orbitals in a subshell are $(2l-1)$.

C. Number of subshell in n^{th} shell are (n - 1).

D. Number of electrons in an orbital of a subshell are $2(2l + 1)$

Answer: A

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39. In boron atom, shielding of the last electron is due to

A. electrons of K shell only.

B. all the electrons of K and L shells

C. two electrons each of 1s and 2s.

D. all the electrons of L shell only.

Answer: C

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40. Which of the following statements is correct?

A. Total number of electrons in a subshell is $2l + 1$.

B. p_z, $d_{x^2-y^2}$ and d_{z^2} orbitals are non-axial

C. Only s orbital has directional orientation while p_z d and f orbitals have non-directional properties.

D. Spin multiplicity of nitrogen atom is 4.

Answer: D

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41. Which of the following species has the magnetic moment value of 3.87 B.M.?

A. Fe^{3+}

B. Cu^{2+}

C. Co^{2+}

D. Au^{3+}

Answer: C

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42. The first emission line in the atomic spectrum of hydrogen in the Balmer series appear at.

A. $\frac{9R}{400}cm^{-1}$

B. $\frac{7R}{144}cm^{-1}$

C. $\frac{3R}{4}cm^{-1}$

D. $\frac{5R}{36}cm^{-1}$

Answer: D

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43. Which of the following orbit of He^+ ion will have the same energy as that of second orbit of hydrogen atom?

A. n = 1

B. n = 2

C. n = 3

D. n = 4

Answer: D

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44. The ratio of potential energy and total.energy of an electron in Bohr orbits of hydrogen atom is

A. 2

B. $1/2$

C. 1

D. $-1/2$

Answer: A

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45. The number of possible spectral lines emitted when electron in n=4 Bohr orbit reaches to n=1 Bohr orbit is.

A. 1

B. 2

C. 4

D. 6

Answer: D

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46. The correct order of penetrating power of 3s, 3p, 3d electrons is:

A. $3d > 3p > 3s$

B. $3s > 3p > 3d$

C. $3s > 3d > 3p$

D. $3d > 3s > 3p$

Answer: B

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47. Which of the following rules could explain the presence of three unpaired electrons in N-atom?

A. Hund's rule

B. Aufbau's principle

C. Heisenberg's uncertainty principle

D. Pauli's exclusion principle

Answer: A

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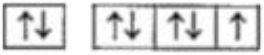
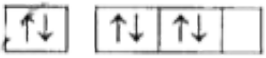
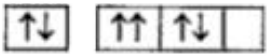
48. The orbital diagram in which both the Pauli's exclusion priciple and Hund's rule are violated, is:  

A. 

B. 

C. 

D. 

Answer: D

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49. The correct order of screening effects of s, p, d, f sub-shells is:

A. $s > p > d > f$

B. $s < p < d < f$

C. $d > p > s > f$

D. $s > f > d > p$

Answer: A

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50. Which of the following subshells can accommodate as many as 10 electrons?

A. 2d

B. 3d

C. 4f

D. 5g

Answer: B

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Level Ii

1. Which point does not pertain to electron in Bohr's model of atom? : Angular momentum is an integral multiple of $h/(2\pi)$, The path of the electron within an atom is circular, Force of attraction of electron towards nucleus is balanced by centrifugal force, For a moving electron, energy changes continuously.

A. Angular momentum is an integral multiple of $h/(2\pi)$

B. The path of the electron within an atom is circular

C. Force of attraction of electron towards nucleus is balanced by centrifugal force

D. For a moving electron, energy changes continuously

Answer: D

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2. Which of the following electron transitions in hydrogen atom will require largest amount of energy?From n=1 to n=2 From =2 to n=3 From n=2 to n=0 From n=3 to n=5

A. From n = 1 to n = 2

B. From n = 2 to n = 3

C. From n = 2 to n = ∞

D. From n = 3 to n = 5

Answer: A

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3. The speed of the electron in the Ist orbit of the hydrogen atom in the ground state is (c is the velocity of light):c 1/1.37 c/ 1370 c/ 13.7 c/ 137

A. $\frac{c}{1.37}$

B. $\frac{c}{1370}$

C. $\frac{c}{13.7}$

D. $\frac{c}{137}$

Answer: D

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4. The longest wavelength of He^+ when its electron return to third Bohr orbit is 'm' then shortest wavelength of Be^{3+} in the corresponding transition series in terms of 'm' is

A. $\frac{7}{64}$m

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

C. $\frac{64}{7}m$

D. $\frac{53}{8}$m

Answer: A

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5. For the energy levels in an atom which one of the following statements is correct?

A. The 4s sub-energy level is at a higher energy than the 3d sub-energy level

B. The M-energy level can have maximum of 32 electrons

C. The second principal energy level can have four orbitals and contain a maximum of 8 electrons

D. The 5^{th} main energy level can have maximum of 72 electrons

Answer: C

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6. The ionization enthalpy of hydrogen atoms is $1.312 \times 10^6 J \ \text{mol}^{-1}$ The energy required to excite the electron the atom from n =1 to n=2 is :

A. $9.84 \times 10^5 \text{J mol}^{-1}$

B. $8.51 \times 10^5 \text{J mol}^{-1}$

C. $6.56 \times 10^5 \text{J mol}^{-1}$

D. $7.56 \times 10^5 \text{J mol}^{-1}$

Answer: A

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7. Ionization energy of He^+ is 19.6×10^{-18} J atom^{-1} The energy of the first stationary state (n=1) of Li^{2+} is :

A. $-2.2 \times 10^{-15} \text{J atom}^{-1}$

B. $8.82 \times 10^{-17} \text{J atom}^{-1}$

C. $4.41 \times 10^{-16} \text{J atom}^{-1}$

D. $-4.41 \times 10^{-17} \text{J atom}^{-1}$

Answer: D

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8. A metal is irradiated with light of wavelength 600 nm. Given that the work function of the metal is 1.0 eV, the de Broglie wavelength of the ejected electron is close to:

A. $6.6 \times 10^{-7} m$

B. $8.9 \times 10^{-11} m$

C. $1.19 \times 10^{-9} m$

D. $6.6 \times 10^{-13} m$

Answer: C

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9. Ionization energy of gaseous Na atoms is $495.5 \text{ kJ mol}^{-1}$. The lowest possible frequency of light that ionizes sodium atom is $\left(h = 6.626 \times 10^{-34} Js, N_A = 6.022 \times 10^{23} \text{ mol}^{-1}\right)$

A. $7.50 \times 10^{4} s^{-1}$

B. $4.76 \times 10^{14} s^{-1}$

C. $3.15 \times 10^{15} s^{-1}$

D. $1.24 \times 10^{15} s^{-1}$

Answer: D

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10. The energy required to break one mole of Cl - Cl bonds in Cl_2, is 242 kJ mol^{-1}. The longest wavelength of lig capable of

breaking Cl-Cl bonds is

$\left(c = 3 \times 10^8 \ \text{ms}^{-1} \text{ and } N_A = 6.02 \times 10^{23} \ \text{mol}^{-1}\right)$

A. 494 nm

B. 594 nm

C. 640 nm

D. 700 nm

Answer: A

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11. A 1kW radio transmitter operates at a frequency of 880 Hz. How many photons per second does it emit?

A. 1.71×10^{-21}

B. 1.71×10^{33}

C. 6.02×10^{23}

D. 2.85×10^{28}

Answer: B

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12. Calculate the energy of radiation emitted for the electronic transition from infinity to ground state for hydrogen atom. Given $c = 3 \times 10^8 \ \text{ms}^{-1}, R_H = 1.09678 \times 10^7 m^{-1}, h = 6.6256 \times 10^{-34} \ \text{J s}^{-1}$

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

B. $3.25 \times 10^{-18} J$

C. $4.05 \times 10^{-18} J$

D. $2.39 \times 10^{-18} J$

Answer: A

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13. Wavelength of high energy transition of hydrogen atoms is 91.2 nm. Calculate the corresponding wavelength of He atoms.

A. 22.8 nm

B. 20.5 nm

C. 14.6 nm

D. 17.9 nm

Answer: A

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14. The de Broglie wavelength of a tennis ball of mass 60g moving with a velocity of $10ms^{-1}$ is approximate [Planck's constant $= 6.63 \times 10^{-34}Js$]

A. $10^{-33}m$

B. $10^{-31}m$

C. $10^{-16}m$

D. $10^{-25}m$

Answer: A

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15. In an atom, an electron is moving with a speed of $600ms^{-1}$ with an accuracy of 0.005%. Certainty with while the position of the electron can be located is $\left(h = 6.6 \times 10^{-34}kgm^2s^{-1}\right)$, mass of electron $m_e = 9.1 \times 10^{-31}k$

A. $1.52 \times 10^{-4}m$

B. $5.10 \times 10^{-3}m$

C. $1.92 \times 10^{-3}m$

D. $3.84 \times 10^{-3}m$

Answer: C

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16. Which of following pairs of d-orbitals will have electron density along the axis?

A. $dz^2, dx^2 - y^2$

B. $dxy, dx^2 - y^2$

C. dz^2, dxz

D. dxz, dyz

Answer: A

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17. In hydrogen atomic spectrum, a series limit found at $12186.3cm^{-1}$. Then it belongs to.

A. Lyman series

B. Balmer series

C. Paschen series

D. Brackett series

Answer: C

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18. The maximum kinetic energy of the photoelectrons is formed to be $6.63 \times 10^{-19} J$, when the metal is irradiated with a radiation of requency $2 \times 10^{15} Hz$. The threshold frequency, of the metal is about?

A. $1 \times 10^{15} s^{-1}$

B. $2 \times 10^{15} s^{-1}$

C. $3 \times 10^{15} s^{-1}$

D. $1.5 \times 10^{15} s^{-1}$

Answer: A

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19. Energy of an electron is given by, $E = -2.178 \times 10^{-18} 4\left(\frac{Z^2}{n^2}\right) J.$ Wavelength of light required to excite an electron in hydrogen atom from level n = 1 to n = 2 will be: $\left(h = 6.62 \times 10^{-34} Js \text{ and } c = 3 \times 10^8 ms^{-1}\right)$

A. $6.500 \times 10^{-7} m$

B. $8.500 \times 10^{-7} m$

C. $1.214 \times 10^{-7} m$

D. $2.816 \times 10^{-7} m$

Answer: C

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20. A photon with initial frequency 10^{11} Hz scatters off electron at rest. Its final frequency is 0.9×10^{11} Hz. The speed of scattered electron is close to: $\left(h = 6.63 \times 10^{-34} Js.\ M_e = 9.1 \times 10^{-31} kg\right)$

A. $4 \times 10^3 ms^{-1}$

B. $3 \times 10^2 ms^{-1}$

C. $2 \times 10^6 ms^{-1}$

D. $30 ms^{-1}$

Answer: A

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21. Calculate the uncertainty in velocity of an oxygen molecule $\left(5.3 \times 10^{-26} kg\right)$, trapped within a sac of average diameter 5×10^{-10} m.

A. 3.11 m/sec

B. 2.65 m/sec

C. 4.31 m/sec

D. 1.99 m/sec

Answer: D

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22. The orbital angular momentum of an electron in a d-orbital is :

A. $\sqrt{6}\frac{h}{2\pi}$

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

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

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

Answer: A

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23. Light of frequency 6×10^{14} Hz is incident on a metal whose work function is 2eV $\left(h = 6.63 \times 10^{-34} Js, \leq V = 1.6 \times 10^{-19} J\right)$. The maximum energy of electrons emitted will be:

A. 2.49eV

B. 4.49 eV

C. 0.49 eV

D. 5.49eV

Answer: C

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24. Increasing order (lowest first) for the values of e/m (charge/mass) for electron (e), proton (p), neutron (n) and $\alpha -$ particle (α) is :

A. e, p, n, α

B. n, p, e, α

C. n, p, α, e

D. n, α, p, e

Answer: D

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25. The triad of nuclei that is isotonic is

A. ${}_{6}^{14}C, {}_{7}^{14}N, {}_{9}^{19}F$

B. ${}_{6}^{12}C, {}_{7}^{14}N, {}_{9}^{19}F$

C. ${}_{6}^{14}C, {}_{7}^{14}N, {}_{9}^{17}F$

D. ${}_{6}^{14}C, {}_{7}^{15}N, {}_{9}^{17}F$

Answer: D

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26. Which of the following statements is incorrect? : The frequency of radiation is inversely proportional to its wavelength., Energy of radiation increases with increase in frequency., Energy of radiation decreases with increase in wavelength., The frequency of radiation is directly proportional to its wavelength.

A. The frequency of radiation is inversely proportional to its wavelength.

B. Energy of radiation increases with increase in frequency.

C. Energy of radiation decreases with increase in wavelength.

D. The frequency of radiation is directly proportional to its wavelength.

Answer: D

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27. A 600 W mercury lamp emits monochromatic radiation of wavelength 331.3 nm. How many photons are emitted from the lamp per second ? ($h = 6.626 \times 10^{-34}$ Js, velocity of light $= 3 \times 10^{8} ms^{-1}$)

A. 8.35×10^{19}

B. 8.35×10^{21}

C. 8.35×10^{20}

D. 8.35×10^{23}

Answer: C

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28. Which one of the following is not the characteristic of Planck's quantum theory of radiation?

A. The energy is not absorbed or emitted in whole number multiple of quantum

B. Radiation is associated with energy

C. Radiation energy is not emitted or absorbed continuously but in the form of small packets called quanta

D. The magnitude of energy associated with a quantum is proportional to the frequency.

Answer: A

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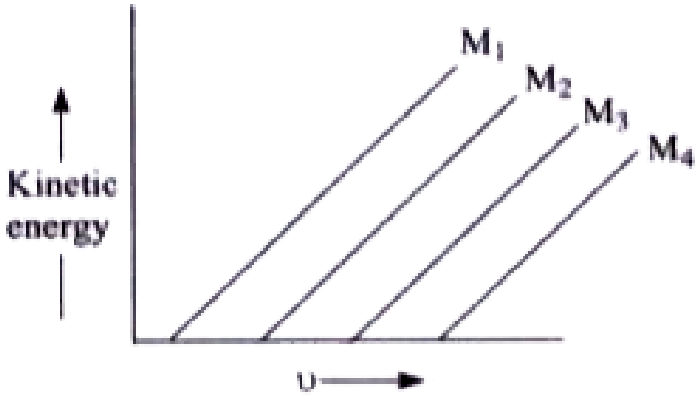
29. A plot of the kinetic energy $\left(\frac{1}{2}mv^2\right)$ of ejected electrons as a function of the frequency (υ) of incident radiation for four alkali metals (M_1, M_2, M_3, M_4) is given below:



The alkali metals (M_1, M_2, M_3, M_4) are respectively.

A. Li, Na, K and Rb

B. Rb, K, Na and Li

C. Na, K, Li and Rb

D. Rb, Li, Na and K

Answer: B

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30. The highest energy in Balmer series, in the emission spectra of hydrogen is represented by: $\left(R_H = 109737 \text{cm}^{-1}\right)$

A. $4389.48 cm^{-1}$

B. $2194.74 cm^{-1}$

C. $5486.85 cm^{-1}$

D. $27419.25 cm^{-1}$

Answer: D

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31. If the electronic configuration of nitrogen had $1s^7$, it would have energy lower than that of the normal ground 'state configuration

$1s^2 2s^2 2p^3$ because the electrons would be closer to the nucleus. Yet $1s^7$ is not observe because it violates:

A. Heisenberg uncertainty principle

B. Hund's rule

C. Paul's exclusion priciple

D. Bohr postulates of stationary orbits

Answer: C

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32. An excited He^+ ion emits photon of wavelength λ in returning to ground state from n^{th} orbit. If 'R' is Rydberg constant, then

A. $n = \sqrt{\frac{4\lambda R}{4\lambda R - 1}}$

B. $n = \sqrt{\frac{4\lambda R}{4\lambda R + 1}}$

C. $n = \sqrt{\frac{4\lambda R - 1}{4\lambda R}}$

D. $n = \sqrt{\frac{4\lambda R + 1}{4\lambda R}}$

Answer: A

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33. If the energy of H-atom in the ground state is-E, the velocity of photo-electron emitted when a photon having energy E_ρ strikes a stationary Li^{2+} ion in ground state, is given by: $v = \sqrt{\frac{2(E_\rho - E)}{m}}$, $v = \sqrt{\frac{2(E_\rho + 9E)}{m}}, v = \sqrt{\frac{2(E_\rho - 9E)}{m}}, v = \sqrt{\frac{2(E_\rho - 3E)}{m}}$

A. $v = \sqrt{\frac{2(E_p - E)}{m}}$

B. $v = \sqrt{\frac{2(E_p + 9E)}{m}}$

C. $v = \sqrt{\frac{2(E_p - 9E)}{m}}$

D. $v = \sqrt{\frac{2(E_p - 3E)}{m}}$

Answer: C

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34. The energy of I, II and III energy levels of a certain atom are $E, \frac{4E}{3}$ and $2E$ respectively. A photon wavelength λ is emitted during a transition from III to I. What will be the wavelength of emission for transition II to I?

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

B. λ

C. 2λ

D. 3λ

Answer: D

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35. An electron in a hydrogen atom in its ground state absorbs 1.5 times as much energy as the minimum require for it to escape from the atom.

What is the velocity of the emitted electron?

A. $1.54 \times 10^6 m/s$

B. $1.54 \times 10^8 m/s$

C. $1.54 \times 10^3 m/s$

D. $1.54 \times 10^4 m/s$

Answer: A

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36. An α-particle having kinetic energy 5 MeV falls on a Cu-foil. The shortest distance from the nucleus of Cu to which α-particle reaches is (Atomic no. of $Cu = 29$, $K = 9 \times 10^9 \ \ \mathrm{Nm}^2/C^2$)

A. $2.35 \times 10^{-13} m$

B. $1.67 \times 10^{-14} m$

C. $5.98 \times 10^{-15} m$

D. $6.32 \times 10^{-15} m$

Answer: B

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37. The energy of separation of an electron in a Hydrogen like atom in excited state is 3.5 eV. The de-Broglie wave length (in Å) associated with the electron is: (Given radius of I orbit of hydrogen atom is 0.53 Å)

A. 3.33

B. 6.66

C. 13.31

D. 31.31

Answer: B

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38. Photons of frequency, v, fall on metal surface for which the threshold frequency is v_0. Then

A. All ejected electrons have the same kinetic energy, $h(v - v_0)$.

B. The ejected electrons have a distribution of kinetic energy from zero to $h(v - v_0)$.

C. The most energetic electron has kinetic energy hv.

D. The average kinetic energy of ejected electrons is $h(v - v_0)$.

Answer: B

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39. When electron jumps from the fourth orbit to the second orbit in Het ion, the radiation emitted out will fall inultraviolet region visible region infrared region radio wave region

A. ultraviolet region

B. visible region

C. infrared region

D. radio wave region

Answer: B

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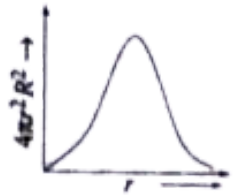
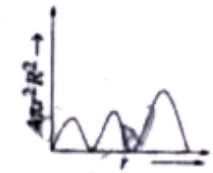
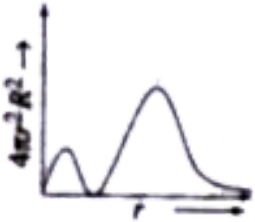
40. Which of the following graph represents the radial probability function of 3d electron?

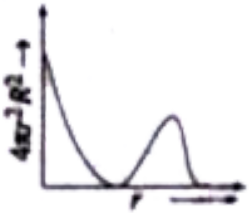
A. 

B. 

C.



D.



Answer: A

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41. For an atom or ion having single electron, compare the energies of the following orbitals:

$S_1 =$ a spherically symmetrical orbital having two spherical nodes.

S_2= an orbital which is double dumb-bell and has no radial node.

S_3= an orbital with orbital angular momentum zero and three radial nodes.

S_4 = an orbital having one planar and one radial node.

A. $S_1 = S_2 = S_3 = S_4$

B. $S_1 = S_2 = S_4 < S_3$

C. $S_1 > S_2 > S_3 > S_4$

D. $S_1 < S_4 < S_3 < S_2$

Answer: B

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42. Excited hydrogen atom emits light in the ultra violet region at 2.47×10^{15} Hz. With this frequency, the energy of a single photon is (Given: $h = 6.63 \times 10^{-34} Js$)

A. $8.041 \times 10^{-40} J$

B. $2.680 \times 10^{-19} J$

C. $1.640 \times 10^{-18} J$

D. $6.111 \times 10^{-17} J$

Answer: C

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43. Which of the following statements on quantum numbers is not correct?

A. Quantum numbers n, l, m and m_s are needed to describe an electron in an atom completely.

B. Quantum numbers n, l, m and s are obtained by solving the Schrodinger wave equation.

C. A subshell-in an atom can be designated with two quantum numbers n and l.

D. The maximum value of l is equal to n-1 and that of m is $\pm l$.

Answer: B

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44. The quantum numbers n and l of four electrons are given:

$(i) n = 4, l = 1 \quad (ii) n = 4, l = 0 \quad (iii) n = 3, l = 2 \quad (\text{iv}) \quad n = 3, l =$

The correct order of increasing energy for the orbitals is

A. $(i) < (iii) < (ii) < (iv)$

B. $(iii) < (iv) < (ii) < (i)$

C. $(iv) < (ii) < (iii) < (i)$

D. $(ii) < (iv) < (i) < (iii)$

Answer: C

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45. The kinetic and potential energy (in eV) of an electron present in 2^{nd} Bohr's orbit of hydrogen atom are respectively?

A. $-1.51, \ -3.02$

B. $3.40, \ -6.80$

C. $-3.02, 1.51$

D. $6.80, \ -1.51$

Answer: B

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46. The de-Broglie wavelength of the electron when it is emitted from the metal surface will be: Provided that the stopping potential of the electrons emitted in a photoelectric experiment is V.

A. $h^2/\sqrt{2emV}$

B. $h/\sqrt{2emV}$

C. $h^2/2emV$

D. $h/2emV$

Answer: B

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47. If the uncertainity in locating the position of a proton $\left(m = 1.67 \times 10^{-27kg}\right)$ is $5\mu m$, the uncertainitiy in its speed will be

A. $\geq 9.3 \times 10^{-3} ms^{-1}$

B. $\geq 6.3 \times 10^{-3} ms^{-1}$

C. $\geq 6.3 \times 10^{-2} ms^{-1}$

D. $\leq 6.3 \times 10^{-2} ms^{-1}$

Answer: B

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48. Consider the ground state of Cu atom (Z = 29). The number of electrons with the azimuthal quantum numbers l=1 and 2 are, respectively,12,5 12,10 16,6 14,8

A. 12, 5

B. 12, 10

C. 16, 6

D. 14, 8

Answer: B

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49. For which of the following hydrogen-like species, the wavelength of radiation emitted due to electron shifts from n = 2 to n= 1, has a maximum value?H H e + L i 2 + B e 3 +

A. H

B. He^+

C. Li^{2+}

D. Be^{3+}

Answer: A

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50. The correct Schrodinger's wave equation for an electron with total energy E and potential energy V is given by :

$\frac{\partial^2\Psi}{\partial x^2}+\frac{\partial^2\Psi}{\partial y^2}+\frac{\partial^2\Psi}{dz^2}+\frac{8\pi^2}{mh^2}(E-V)\Psi=0;$

$\frac{\partial^2\Psi}{\partial x^2}+\frac{\partial^2\Psi}{\partial y^2}+\frac{\partial^2\Psi}{\partial z^2}+\frac{8\pi m}{h^2}(E-V)\Psi=0$;

$\frac{\partial^2\Psi}{\partial x^2}+\frac{\partial^2\Psi}{\partial y^2}+\frac{\partial^2\Psi}{\partial z^2}+\frac{8\pi^2 m}{h^2}(E-V)\Psi=0$;

$\frac{\partial^2\Psi}{\partial x^2}+\frac{\partial^2\Psi}{\partial y^2}+\frac{\partial^2\Psi}{\partial z^2}+\frac{8\pi^2 h}{m^2}(E-V)\Psi=0$

A. $\frac{\partial^2\Psi}{\partial x^2}+\frac{\partial^2\Psi}{\partial y^2}+\frac{\partial^2\Psi}{dz^2}+\frac{8\pi^2}{mh^2}(E-V)\Psi=0$

B. $\frac{\partial^2\Psi}{\partial x^2}+\frac{\partial^2\Psi}{\partial y^2}+\frac{\partial^2\Psi}{\partial z^2}+\frac{8\pi m}{h^2}(E-V)\Psi=0$

C. $\frac{\partial^2\Psi}{\partial x^2}+\frac{\partial^2\Psi}{\partial y^2}+\frac{\partial^2\Psi}{\partial z^2}+\frac{8\pi^2 m}{h^2}(E-V)\Psi=0$

D. $\frac{\partial^2\Psi}{\partial x^2}+\frac{\partial^2\Psi}{\partial y^2}+\frac{\partial^2\Psi}{\partial z^2}+\frac{8\pi^2 h}{m^2}(E-V)\Psi=0$

Answer: C

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Level Ii Assertion Reason Type

1. Assertion : Limiting line in the Balmer series has a wavelength of 364.4 mm.

Reason : Limiting line is obtained for a jump of electron from $n = \infty$: If both (A) and (R) are correct and (R) is the correct explanation of(A)., If both (A) and (R) are correçt, but (R) is not the correct explanation of (A)., If (A) is correct, but (R) is incorrect., If both (A) and (R) are incorrect.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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2. Assertion : In Bohr model of H atom, the velocity of electron decreases with increase in principal quantum number.

Reason : In Bohr model of H atom, velocity of electron is inversely proportional to radius of the orbit.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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3. Assertion : The radial probability of 1s electron first increases, till it is maximum at 53Å and then decreases to zero.

Reason : Bohr radius for the first orbit is 53Å.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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4. Assertion : Aspectral line will be seen for a $2p_x - 2p_y$ transition.

Reason : Energy is released in the form of waves of light when the

electron drops from $2p_x$ to $2p_y$ orbital.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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5. Assertion : Spin quantum number can have two values, $+\frac{1}{2}$ and $-\frac{1}{2}$.

Reason : +and -signs signify the positive and negative wave functions.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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6. Assertion : In Li^{2+} ion, an electron make transition from higher state to n=2. Then the photon observed will fall in the visible range.

Reason : Line falling in n=2 is balmer series line which belongs to visible range in all type of H-like atom orion.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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7. Assertion : The transition of electrons $n_3 \rightarrow n_2$ in H-atom will emit radiation of higher frequency than $n_4 \rightarrow n_3$.

Reason : Principal shells n_2 and n_3 have lower energy than n_4.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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8. Assertion : All isotopes of a given element show the same type of chemical behaviour.

Reason : The chemical properties of an atom are controlled by the number of electrons in an atom.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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9. Assertion : Hydrogen has one electron in its orbit but it produces several spectral lines.

Reason : There are many excited energy levels available. If both (A) and (R) are correct and (R) is the correct explanation of(A)., If both (A) and (R) are correçt, but (R) is not the correct explanation of (A)., If (A) is correct, but (R) is incorrect., If both (A) and (R) are incorrect.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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10. Assertion : Only principal quantum number determines the energy of an electron in an orbital of Na atom.

Reason : For one electron system, the expression of energy is quite different from that obtained in Bohr's theory. : If both (A) and (R) are correct and (R) is the correct explanation of(A)., If both (A) and (R) are correçt, but (R) is not the correct explanation of (A)., If (A) is correct, but (R) is incorrect., If both (A) and (R) are incorrect.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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11. Statement 1 : The plots of probability density and radial probability function versus distance r from the nucleus for any particular orbital are not identical,

Statement 2 : Probability density is ψ^2 whereas radial probability function represents probability of finding the electron in a shell of thickness dr.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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12. Assertion : The characteristics of cathode rays do not depend upon the material of electrodes and the nature of the gas present in the cathode ray tube.

Reason : Cathode rays consist of negatively charged particles, called electrons.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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13. Statement 1: According to de Broglie, the wavelengths associated with electrons and other subatomic particles can be detected experimentally.

Statement 2 : The wavelength associated with any material particle is directly proportional to its mass.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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14. Statement 1: In hydrogen and hydrogen like species, orbital energy depends only on the quantum number n whereas in multi-electron atoms it depends on quantum numbers n and l.

Statement 2 : The principal quantum number determine the size and the energy of the orbital.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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15. Assertion : The maximum number of electrons in the shell with principal quantum number nis equal to $2n^2$?.

Reason : Two electrons in an orbital have the same value of three quantum numbers n, l and m, but must have different spin quantum numbers.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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16. Assertion : The outer electronic configurations of Cr and Cu are $3d^5 4s^1$ and $3d^{10} 4s^1$ respectively.

Reason : Electrons are filled in orbitals in order of their increasing energies given by $(n + l)$ rule.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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17. Assertion : 2p orbitals do not have any spherical node.

Reason : The number of nodes in p-orbitals is given by $(n-2)$ where n is the principal quantum number.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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18. Assertion : The opposite lobes of ap-orbital have opposite sign whereas opposite lobes of d-orbital have the same sign.

Reason : The opposite lobes of a p-orbital have opposite charge whereas opposite of lobes of d- orbital have the same charge.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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19. Assertion : In Lymàn series of H-spectra, the maximum wavelength of linės is 121.56 nm.

Reason : Wavelength is maximum when the transition is from the very next level.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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20. Assertion : The free gaseous Cr atom has six unpaired electrons.

Reason : Half-filled s-orbital has greater stability. : If both (A) and (R) are correct and (R) is the correct explanation of(A)., If both (A) and (R) are correçt, but (R) is not the correct explanation of (A)., If (A) is correct, but (R) is incorrect., If both (A) and (R) are incorrect.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correçt, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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