CHEMISTRY

BOOKS - P BAHADUR CHEMISTRY (HINGLISH)

ATOMIC STRUCTURE

Exercise 1

1. (i) Calculate the number of electrons which will together with one gram .

(ii) Calculate the mass and charge on one mole of electrons .

2. (i) Calculate the total number of electrons present in 1 mole of methane .

(ii) Find (a) the total number and (b) the total mass of neutrons in 7 mg of $.^{14}C$. (Assume that mass of a neutron $= 1.675 \times 10^{-27} g$)

(iii) Find (a) the total mnumber of protons and (b) the total mass fo protons in $32mg$ of NH_3 at STP. (mass of proton $= 1.672 \times 10^{-27} g$)

Will the answer change if the temperature and pressure are changed ?

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3. Yellow light emitted from a sodium lamp has a wavelength (λ) of $580nm$. Calculate the frequency (v). Wave number and energy of yellow light photon .

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4. Express the Rydberg constant $R = 109678cm^{-1}$ in (a) J/atom (b) J/mol.

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5. What is the number fo photons fo light with a wavelngth fo $400pm$ that provide $1J$ of energy ?

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6. Electromagnetic radiation of wavelength 242 nm is just sufficient to ionise a sodium atom. Calculate the energy corresponding to this wavelength and the ionisation potential of Na.

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7. A 25 watt bulb emits monochromatic yellow light of wavelength of 0.57μ m. Calculate the rate of emission of quanta per second .

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8. Calcualte the mass fo a photon fo sodium light having wavelength 5894 Å and velocity $3 \times 10^9 ms^{-1}$, $h = 6.6 \times 10^{-34} kg^2 s^{-1}$.

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9. What is the nergy difference (in kJ mol^{-1}) between the first and second shell fo H-atom if the first emission in the Lyman series occurs at $\lambda = 121.5$ nm ?

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10. Calculate the wave number for the longest wavelength transition in the Balmer series fo atomic hydrogen . $(R_H = 109677 cm^{-1})$.

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11. What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition $n = 4$ to $n = 2$ of $He^{\oplus}$ spectrum?

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12. What is the maximum number of emission lines when the excited electron of a H atom in $n = 6$ drop to the ground state?

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13. An electron in H-atom in its ground state absorbs 1.5 times as much energy as the minimum required for its escape (i. e., 13 . 6 eV) from the atom . Calculate the wavelength of emitted electron.

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14. A photon of wavelength $4 \times 10^{-7} m$ strikes on metal surface , the work function fo the metal being $2.13 eV$ Calculate :

(i) the energy of the photon (ev)

(ii) the kinetic energy fo the emission and the velocity fo the photoelectron $(1eV = 1, 6020 \times 10^{-19} J)$,

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15. Electrons are emitted with zero velocity from a metal surface when it is exposed to radiation of wavelength 6800 Å . Calculate threshold frequency (v_0) and work function (W_0) of the metal.

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16. The minimum energy required for the emission of photoelectron from the surface fo a metal is

$4.94 \times 10^{19} J$. Calcualte the critical reequency and the corresponding wavelength of the critical frequency and the corresponding wavelngth of the photon requred to ejerct the electron. $\left(h = 6.6 \times 10^{-234} Jesc^{-1}\right)$.

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17. The energy required to remove and elrctron from the surface fo sodium metal is $2.3 eV$. What is the longest wavelength of radiation with which it can shown photoelectric effect ?

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18. Light of wavelength 300×10^{-9} m strikes a metal surface with photoeoctric work function of $2.13eV$. Find out the kinetic enrgy fo the most energetic photoelectron .

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19. The critical frequency for emitting photoellectrons from a metal surface is $5 \times 10^{14} \sec^{-1}$. What should be the frequency fo radiation to produce photoelectons having twice the kinetic energy of those produced by the radiation fo frequency $10^{15} \sec^{-1}$?

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20. A metal surface fo threshold frequency $5.3 \times 10^{14} \text{src}^{-1}$. Is exposed to a photon fo radiation having energy 3.5×10^{-19} J will it exhibit photoelectic effect ?

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21. Show that radius fo (II) shell fo H- atom is almost four times fo (I) shell .

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22. How many times dies the electon go round the first Bohr`s orbit of hydrogen in one second ?

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23. The ionisation energy of $He^{\oplus}$ is $19.6 \times 10^{-18} Ja \rightarrow m^{-1}$ .The energy of the first stationary state of Li^{2+} will be

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24. What is the wavelength of light emitted when the electron of a hydrogen atom undergoes a transition from an energy level with $n = 4$ to an energy level with $n = 2$? What is the colour corresponding to this wavelength?

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25. A hydrogen atom with an elerctron in the first shell (n = 1) absorbls UV light of a wavelength $1.03 \times 10^{-7} m$ To what shell does the electron jumps ?

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26. How much energy is required to ionise a H atom if the electron occupies $n = 5$ orbit?

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27. The energy associatied with the first orbit in the hydrogen atom is $-217 \times 10^{18} \mathrm{J\ atom}^{-1}$. What is the energy associated with the fifth orbit ?

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28. What is the energy in joules required to shift the elertcon of the hydrogen atom from the first Bohr orbit to the fifth Bohr orbit ? And what is the wavelenght of the light emitted when the electron returns to the ground state ? The ground state electron energy is -218×10^{-11} erg.

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29. The electron energy in hydrogen atom is given by $E_n = \left(-21.7 \times \frac{10^{-12}}{n^2}\right) erg$. Calculate the energy required to remove an electron completely from the $n = 2$ orbit.What is the longest wavelength (in cm) of light can be used to cause this transition ?

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30. According to Bohr's theory, the electronic energy of an electron in the n^{th} orbit is given by $E_n = (-2.17 \times 10^{-18}) \times \frac{z^2}{n^2} J$

Calculate the longest wavelength of light that will be needed in remove an electron from the third Bohr orbit of $He^{\oplus}$

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31. Calculate the wavelength and energy of radiation for the elctronic transition form infinity to ground state for one H-atom . Given $e_1 = -13.6eV\left(11eV = 1, .6 \times 10^{-19}J\right)$.

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32. How much energy is needed to obtain to H-atom in first excted state from ground state ?

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33. Calculate the enrgy required for the process ,

$He^{+}(g) \rightarrow He^{2+}(g) + e$

The ionization energy for the H-atom in the grounds state is $2.18 \times 10^{-18} J atom^{-1}$.

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34. Calculate the de-Broglie wavelngth of electron in next to inner orbit .

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35. Calcuate the wavelength of a moving electron having $4.55 \times 10^{-25} J$ of kinetic enrgy .

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

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37. The mass of an electron is $9.1 \times 10^{-31} kg$. If its K.E. is $3.0 \times 10^{-25} J$, calculate its wavelength

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38. Two particels (A) and (B) are in motion . If the wavelngth wavelength associated with particel (B) if its momentum is half of (A).

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39. The sodium flame test has a characteristic yellow colour due to the emission of a wavelength of $589 nm$.

What is the mass equivalent of one photon of this wavelength?

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40. Calculate the uncertinty in the velocity fo a wagon of mass $200kg$ whose position is known to an accuracy of $\pm 10m$.

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41. Calculate the uncertainty in the position of a dust particle with mass equal to $1mg$ if the uncertiainty in its velocity is $5.5 \times 10^{-20} ms^{-1}$

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42. A dust particle has mass equal to $10^{-11}g$, diameter equal to 10^{-4} cm and velocity equal to$10^{-4}cms^{-1}$. The error in the measurment of velocity is 0.1% . Calculate the uncertiainty in its position. Comment on the result

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43. Point out the followings:

(a) How many energy subshells are pssible in $n=3$ level ?

(b) How many orbitals of all kinds are possible in $n=3$ level ?

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44. What values are assigned to quantum numbers n, l, m for ?

(a) 3s,

(b) $4p_z$,

(c) $4d_{x^2-y^2}$,

(d) $5d_{z^2}$.

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45. Given below are the sets of quantum nummbers for given orbital. Name these orbitals .

(a) $\underset{m=-1}{\underset{l=1}{n=3}}$

(b) $\underset{m=0}{\underset{l=2}{n=5}}$

(c) $\underset{m=\pm 1}{\underset{l=1}{n=4}}$

(d) $\underset{m=0}{\underset{l=0}{n=2}}$

(e). $\underset{m=\pm 1}{\underset{l=2}{n=4}}$

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46. Calculate the angular momentum of the following :

(a) 3 rd orbit , (b) 4 p orbital , (c) 3 d orbital .

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47. If there were three possible values $(-1/2, 0, +1/2)$ for the spin magnetic quantum number , m_s how many elements would there be in the $4th$ period of periodic table ?

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48. What are the numbers of nodes present in : (a) 1 s, (b) 2s, (c) 2 p, (d) 3 p, orbitial s?

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49. The angular momentum of an electron due to its spin is given as ....

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50. What is the significance of ψ_{210} ? Find out angular momentum , spherical nodes and angular node for ψ_{210} .

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51. An atom fo an elecment has 13 electrons . Its nucleus has 14 neutrons . Find out atomic no. and approximate atomic weight . Indicate the the element .

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52. A neutral atom of an element has $2k, 8L, 8L, 9M$ and $2N$ electrons . Find out the following :

(a) Atomic no.

(b) total no. of s-electrons ,

(c) total no. of s-electrons ,

(d) total no. of s-electrons ,

(e) Valency of element .

(f) No, of unpaired elecrons) .

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53. Calculate the total spin and magnitic moment for atoms having atomic numbers $7, 24, 34$ and 36.

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54. Write electronic configuration of Fe^{2+}, Mn^{4+}, n^{3-} and O^{2-} ions .

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55. a.Calculate the velocity of an electron in the first Bohr's orbit of hydrogen atom (given $r = a_0$).

b. Find de Broglie's wavelength of the electron in the first Bohr's orbit.

c. Find the orbital angular momentum of $2p$ orbital in terms of $h/2\pi$ units.

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Exercise 2

1. An iodine molecule dissociates into atom after absorbing light of wavelength $4500Å$. If quantum of radiation is absorbed by each molecule calculate the kinetic energy of iodine (Bond energy of I_2 is 240 $kJmol^{-1}$)

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Exercise

1. A bulb emits light of 4500Å. The bulb is rated as 150 watt and 9% of the energy is emited as light . How many photons are emitted by the bulb per second ?

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2. Find the energy required to excite 1.10 L of hydrogen gas at $1.0 \ Nm^{-2}$ and 298K to the first excited state of atomic hydrogen. The energy required for the dissociation of $H-H$ bond is $436kJmol^{-1}$. Also calculate the minimum frequency of a photon to break this bond.

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3. Calculate the velocity of an electron placed in (III) orbit of h-atom . Also calculate the no . of revalution /sec . Round the nucleus .

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4. Consider the hydrogen atom to be a proton embedded in acavity fo radius a_0 (Bohr 's radius) , whos echarge ius neutralized by the addition of an elerctron to the cavity in vacuum , infinitiely slowly.

(a) Estimate the average of total energy of an elerctron in its ground state in a hydrogen atom as the work done in the above neutralization process , Also , If the halt the magnitude fo the averge potential enrgy find the average potential nergy .

(b) Also derve the wavelength of the elertron when it is a_0 from the proton . How does this compare with the wavelength of an elerctron in the ground statBohr's orbit ?

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5. The ionisation enrgy of H-atom is $13.6eV$. What will be ionisation energy ofg He^{2+}. Ions ?

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6. The ionisation energy of $He^{\oplus}$ is $19.6 \times 10^{-18} Ja \rightarrow m^{-1}$ .The energy of the first stationary state of Li^{2+} will be

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7. Calcultat the frequency of the spectral line emitted when the elercton in $n = 3$ in $H -$ atom de-excites to ground state $R_H = 109737 cm^{-1}$.

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8. Wavelength of high enrgy trabsition fo H-atoms is $91.2 nm$. Calculate the corresponding wavelength of

He^{+}.

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9. Calculate the wavelnght of radistions emertted producing a line in Lyman serices , wne an electron falls from fourth stationargy state in hydrogen atom . $(R_H = 12 \times 10^7 m^{-1})$.

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10. Calculate the energy emitted when electrons of $1.0g$ of hydrogen undergo transition giving spectrum lines of the lowest energy in the visible region of its atomic spectrum.

$R_H = 1.1 \times 10^7 m^{-1}, c = 3 \times 10^8 ms^{-1}$ and $h = 6.62 \times 10^{-34} Js$

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11. Estimate the difference in energy between the first and second Bohr's orbit for a hydrogen atom. At what minimum atomic number , a transition from $n = 2$ to $n = 1$ energy level would result in the emission of X - rays with $\lambda = 3.0 \times 10^{-8} m$? Which hydogen -like species does this atomic number correspond to ?

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12. What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition $n = 4$ to $n = 2$ of $He^{\oplus}$ spectrum?

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13. A gas of identical hydrogen-like atoms has some atoms in the lowest in lower (ground) energy level A and some atoms in a partical upper (excited) energy level B and there are no atoms in any other energy level.The atoms of the gas make transition to higher energy level by absorbing monochromatic light of photon energy $2.7eV$.

Subsequenty , the atom emit radiation of only six different photon energies. Some of the emitted photons have energy $2.7eV$ some have energy more , and some have less than $2.7eV$.

a Find the principal quantum number of the intially excited level B

b Find the ionization energy for the gas atoms.

c Find the maximum and the minimum energies of the emitted photons.

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14. Find out the number of waves made by a bohr electron in one complete revolution in its third orbit.

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15. An electron beam can undergo defraction by crystals .Through what potential should a beam of electrons be accelerated so that its wavelength becomes equal to 1.54Å

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16. Write down elerctronic fonfigureation of the following and reprot no. of unpaired electron in each .

(a) Mn^{2+}

(b) Cr^{2+}.

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17. The decreasing order of energy for the electrons represented by the following sets of quantum number is :

1.$n = 4, l = 0, m = 0, s = \pm 1/2$

2.$n = 3, l = 1, m = 1, s = -1/2$

3.$n = 3, l = 2, m = 0, s = +1/2$

4.$n = 3, l = 0, m = 0, s = -1/2$

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18. A compound of vanadium has a magnetic moment of $1.73BM$. Work out the electronic configuration of vanadium ion in the compound.

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19. The wave function of $2s$ electron is given by

$$\psi_{2s} = \frac{1}{4\sqrt{2\pi}}\left(\frac{1}{a_0}\right)^{3/2}\left(2 - \frac{r}{a_0}\right)e^{-\frac{r}{a_0}}$$

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

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Exercise 3A

1. The radius of first Bohr orbit is x, then de-Broglie wavelength of electron in 3rd orbit is nearly

A. $3\pi x$

B. $6\pi x$

C. $9x/2$

D. $x/2$

Answer: B

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2. For an atom with atomic numner 14 the number of orbits and orbitals in which elrctrons are prresent are respectively :

A. $3, 6$

B. 6, 3

C. 7, 3

D. 3,8

Answer: D

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3. Of the following which of the statement (s) regarding Bohr theory is woring ?

A. kinetic energy of an electron is half of the magnitude of its potential energy

B. Kinetic energy of an electron is negative of total energy electron

C. Energy of electron decreases with increase in the value of the principal qwuantum bnumber

D. The ionization enrgy fo H-atom in the first excited state is negative fo one fourth of the enrgy of an elecron in the ground state ,

Answer: C

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4. The wavelngth fo a spectrl line for an electronic transition is inversely related to :

A. No. of electrons undergoing transition

B. the nuclear charge of the atom

C. The velociy of an electron undergoing transition

D. The difference in the energy levels involved in the transition .

Answer: D

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5. The relativistic mass of electron with velocity of light is :

A. $2m$

B. $3m$

C. ` Infinite

D. zero

Answer: C

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6. The potential enrgy fo the electron present in the grojnd state of Li^{2+} ion is represencted by :

A. $+\dfrac{3e^2}{4\pi\varepsilon_0 r}$

B. $+\dfrac{3e^2}{4\pi\varepsilon_0 r}$

C. $+\dfrac{3e^2}{4\pi\varepsilon_0 r}$

D. $+\dfrac{3e^2}{4\pi\varepsilon_0 r}$

Answer: D

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7. Which d-orbital has different shape from rest of all d-orbitals ?

A. $d_{x^2-y^2}$

B. d_z^2

C. $d_x^2 y$

D. d_{xy} or d_{yz}

Answer: B

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8. If uncertainty in possition of electron is zero, then the uncertainty in its momentum would be ....

A. Zero

B. $h/2\pi$

C. $h/4\pi$

D. $\propto$

Answer: D

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9. the energy levels for Z^{+z-1} can be given by :

A. $E_n f \text{ or } A^{+z=-1} = Z^2 \times E_n f \text{ or } H$

B. $E_n f \text{ or } A^{+z=-1} = Z \times E_n f \text{ or } H$

C. $E_n f \text{ or } A^{+z=-1} = \frac{1}{Z^2} \times E_n f \text{ or } H$

D. $E_n f \text{ or } A^{+z=-1} = \frac{1}{Z} \times E_n f \text{ or } H$

Answer: A

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10. In s_1 be the specific charge (e/m) of cathode rays and (S_2) be that of positive rays , then which is true ?

A. $S_1 = S_2$

B. $S_1 < S_2$

C. $S_1 > S_2$

D. Either of these

Answer: C

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11. For an electron in a hydrogen atom , the wave function Φ is proparitional to exp -r/a_p where a_0 is the

Bohr's radius What is the radio of the probability of finding the electron at the nucless at the nucless to the probability of finding id=f at a_p ?

A. e

B. e^2

C. $1/e^2$

D. Zero

Answer: B

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12. Photoelectric effect shows :

A. Particle - like behaviour of light

B. Wave-like behaviour fo light

C. Both wave -like and particle -like behaviour of light

D. Neither wave-like nor particle -like behaviour of light

Answer: A

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13. IfE_(1),E_(2) and E_(3)` represent respectively , the kinetic energies of an elctron an alpha particle and a proton each having same de Broglie wavelength , then

A. $E_1 > E_3 > E_2$

B. $E_1 > E_3 > E_2$

C. $E_1 > E_3 > E_2$

D. $E_1 > E_3 > E_2$

Answer: A

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14. When the frequency fo light incident an a metallic plate is doubled , the 1KE` of the emitted photoelectrons will be :

A. Double

B. Halved

C. Increased but more than doubled fo the previous KE

D. Unchanged

Answer: C

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15. Bragg`s equation will have bno solution if :

A. $\lambda > 2d$

B. $\lambda < 2d$

C. $\lambda > d$

D. $\lambda = d$

Answer: A

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16. The increasing order (lowest first) for the value of $e/m(\text{charge}/\text{mass})$ for electron(e), proton (p) neutron (n) and alpha particle (α) is

A. $e, p, n. \alpha$

B. n, α, p, e

C. n, p, e, α

D. n, p, α, e

Answer: B

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17. How many unpaired electrons are there in Ni^{2+}?

A. Zero

B. 2

C. 4

D. 8

Answer: B

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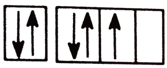
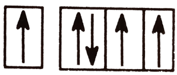
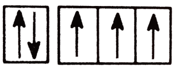
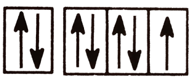
18. The orbital diagram in which the Aufbau principle is violated is

A. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer: B

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19. Predict the total spring in Ni^{2+} ion :

A. $- + 5/2$

B. $- + 3/2$

C. $- + 1/2$

D. $- + 1$

Answer: D

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20. Photoelectric emission is observed from a surface for frequencies $v_1 \text{and} v_2$ of the incident radiation $(v_1 > v_2)$. If maximum kinetic energies of the photo electrons in the two cases are in the ratio $1:K$, then the threshold frequency is given by:

A. $\dfrac{v_2 - v_1}{k - 1}$

B. $\dfrac{v_2 - v_2}{k - 1}$

C. $\dfrac{v_2 - v_1}{k - 1}$

D. $\dfrac{v_2 - v_1}{k - 1}$

Answer: B

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21. Suppose a completely filled or half fillled set fo (p) or d-orbitials is spherically symmetrical :

A. o

B. 3

C. 1

D. 4

Answer: C

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22. The ratio of the differrence between the first and second Bohr orbit energies to that between second and third Bohr orbit energies is

A. $1/3$

B. $27/5$

C. $9/4$

D. 4//9`

Answer: B

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23. The number of vacant d-orbitals in completely excited Cl atom is :

A. 2

B. 3

C. 1

D. 4

Answer: A

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24. Isoelectronic structures among the following structures are :

$(I) CH_3^+, (II) H_3O^+ (III) NH_3, (IV) CH_3^-$.

A. I and II

B. III and IV

C. I and II

D. II, III and IV

Answer: D

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25. Possible muber of orientations fo a subshell is :

A. l

B. n

C. $2l+1$

D. n^2

Answer: C

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26. If each hydrogen atom is excited by giveng $8.4eV$ of energy , then the number fo spectral lines emeitted si equal to :

A. 0

B. 2

C. 3

D. 4

Answer: A

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27. The magneit moment fo electron in an atom (excluding orbitial magnetci moment) is given by :

A. $\sqrt{n(n+2)}$ Bohr Magneton

B. $\sqrt{n(n+1)}BM$

C. $\sqrt{n(n+3)}BM$

D. None fo the above

Answer: A

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28. Atom conssit of electrons , protons and neutrons . If the mass attributed to neutron were halved and that attributed to the electrons were doubled , the atomic mass fo $._{6}C^{12}$ would be approximately :

A. Same

B. Doubled

C. Halved

D. Reduced by 25%

Answer: D

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29. As an electron is brought form an infinite distance close to the nucleus fo the atom the enrgy of the electron -nucleus system :

A. Increased to a grater positive value

B. Decreases to a smaller positiive value

C. Decreases to a smaller positiive value

D. Increased to a grater positive value

Answer: C

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30. Which orbital is nearest to the nucleus ?

A. $5d$

B. $6s$

C. $6p$

D. $4f$

Answer: D

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31. Which ion has the maximum magnetic moment ?

A. Mn^{3+}

B. Cu^{2+}

C. Fe^{3+}

D. V^{3+}

Answer: C

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32. The quantum number that does not describe the distance and the angular disposition of the eelctron :

A. n

B. l

C. m

D. s

Answer: D

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33. In hydrogen atom which enrgy level order si bnot correct ?

A. $1s < 2p$

B. $2p = 2s$

C. $2p > 2s$

D. $2p < 3s$

Answer: C

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34. If the atomic weight oc C and SI are 12 and 28 respectively , then what is the ratio of the number of neatrons in them?

A. $3:7$

B. $7:3$

C. $3:4$

D. $6:28$

Answer: A

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35. Which will be the most stble among $Cu^{+}, Fe^{+} Fe^{2+}$ and Fe^{3+}.

A. Fe^{2+}

B. Fe^{+}

C. Cu^{+}

D. Fe^{3+}

Answer: D

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36. Which jave the same number of s-electrons as the d-dlectrons in Fe^{2+} ?

A. Li

B. Na

C. N

D. P

Answer: B

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37. Which orbital has two angular nodal planes ?

A. s

B. p

C. d

D. f

Answer: C

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38. ψ^2 ,(psi) the wave function resperesents the probability of finding electron . Its value depends :

A. How much it is inside the nucleus

B. How much it is far from the the nuycleus

C. How much it is near the nucleus

D. Upon the type of orbital

Answer: D

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39. " Positronium " is the name given to an aotm like combination formed between :

A. A positiron and a proton

B. A positron and a neutron

C. A positron and alpha-particle

D. A positron an electron

Answer: D

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40. The configureation is $1s^2 2s^2 2p^5$, $3s^1$ shows :

A. Groun state fo fluorine

B. Exctred state fo fluoine

C. Excite state of noen atom

D. Excited state fo O^{-} ion

Answer: C

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41. The orbital cylindrically symmetrical abut x-axis is :

A. P_z

B. P_y

C. P_x

D. d_{xz}

Answer: C

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42. Which orbital is represented by the complete wave funcion ψ_{420} ?

A. $4d$

B. $3d$

C. $4p$

D. $4s$

Answer: A

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43. The number fo bodal planes is greatest for the orbital :

A. $1s$

B. $2p$

C. $3d$

D. $2s$

Answer: C

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44. The electronic velocity in the fourth Bohr's orbit fo hydrogen is u . The velocity of the electron in the first orbit would be :

A. $4u$

B. $16u$

C. $u/4$

D. $u/16$

Answer: A

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45. Atomic weight of Ne is $20.2 Ne$ is a mixuture of Ne^{20} and Ne^{22}. Relative abundaunce fo heavior isotope is :

A. 90

B. 20

C. 40

D. 10

Answer: D

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46. The ammount of enrgy requred to remove the electron from a Li^{2+} ion in its grojnd state is , how many times greater than the amount of enrgy reuired to remove the elrcton firm an H-atom in its grojn state ?

A. 9

B. 2

C. 3

D. 5

Answer: A

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47. The ration of spectific charge (e//m) of a proton to that of an alpha-particle is :

A. $1:4$

B. $1:2$

C. $1:1/4$

D. $2:1$

Answer: D

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48. The work function for a metal si $4eV$. To emit a photoelectron of zero velocity from the surface fo the metal the wavelength of incident light showld be :

A. 2700Å

B. 1700Å

C. 5900Å

D. 3100Å

Answer: D

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49. In two individual hydrogen atoms electrons move around the nucleus in circular orbits of radii R and 4R.

The ratio of the time taken by them to complete one revolution is:

A. $1:4$

B. $4:1$

C. $1:8$

D. $8:7$

Answer: C

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50. If the series limit of wavelngth of the Lymman series for the hydrogen atoms si 912Å , then the serice limit of wavelngth for the Balmer seies fo the hydrogen atom si :

A. $912 Å$

B. $912 \times 2 Å$

C. $912 \times 4 Å$

D. $912 / 2 Å$

Answer: C

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51. What is the difference in the angular momentum associated with the electron in two successive orbits of a hydrogen atom?

A. h / π

B. $h / 2\pi$

C. $h / 2$

D. $(n - 1)h / 2\pi$

Answer: B

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52. Ionisation potential fo hydrogen atomn is $13.6eV$. Hydrogen atom in the groun state ae exctred by monochromatic light fo enrgy $12.1eV$. The spectral lines emitted by hydrogen according to Bohr`s theoury will be.

A. One

B. Two

C. Three

D. four

Answer: C

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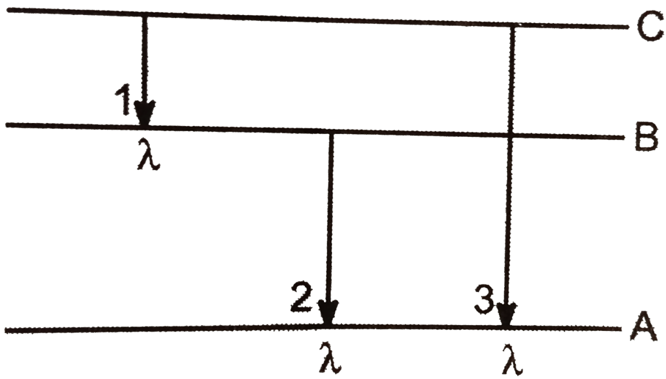
53. Energy levels A. B, C. of a certain atom correspoinds to increasing value fo enrgy i.e., E_A lt E_B lt E_C If λ_1, λ_2

, and λ_3 are the wavelengths of radistions corresponding to the transitions (C) to B, B to (A) and (C) to (A) respectively wich fo the following wstatemnt is correct



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

B. $\lambda_3 \frac{\lambda_2}{\lambda_1 + \lambda_2}$

C. $\lambda + 1 + \lambda - 02 + \lambda_3 = 0$

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

Answer: B

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54. One requiored enrgy R_n to remove mucleon and an energy E_e to remove an electron form the orbit of an atom , then :

A. $E_n = E_e$

B. $E_n < E_e$

C. $E_n > Ee$

D. $E_n \leq E_e$

Answer: C

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55. Atomic radius is of the order of $10^{-8} cm$ and nuclear radius is of the order of $10^{-13} cm$. What fraction of an atom is occupied by nucleus ?

A. 10^{-5}

B. 10^{5}

C. 10^{-15}

D. None fo these

Answer: C

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56. Suppose $10^{-17} J$ of light enrgy is needed by the interor of human eue to see an object . The photons fo green light $\cdot \lambda = 550nm)$ needed to see to object are :

A. 27

B. 28

C. 29

D. 30

Answer: B

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57. A photon of $300nm$ ios absorbed by a gas and then re-emits two photons . One re-emitte photon has wavelnght $4967nm$, the wavelength fo second re-emitte photon is :

A. 757

B. 857

C. 957

D. 657

Answer: A

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58. The shortest wavelength in H sopecitrum of lyman series when $R_H = 109678cm^{-1}$ is

A. 911Å

B. 700Å

C. 600Å

D. 811Å

Answer: A

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59. The longest λ for the Lyamn series is .... (Given $R_H = 109678cm^{-1}$) :

A. 1215

B. 1315

C. 1415

D. 1515

Answer: A

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60. Number of elrctrons in $1.8mL$ of H_2O are :

A. 6.02×10^{23}

B. 6.02×10^{24}

C. 6.02×10^{22}

D. 6.02×10^{25}

Answer: A

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61. The total number of electrons presnt in 1 mL Mg

Given density of $._{12} Mg^{24} = 1. 2g / mL.$

A. $0. 6N$

B. $6N$

C. $2N$

D. 3N`

Answer: A

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62. What transition in $He^{\oplus}$ ion shall have the same wave number as the first line in Balmer series of H atom ?

A. $3 \rightarrow 2$

B. $6 \rightarrow 4$

C. $5 \rightarrow 3$

D. $7 \rightarrow 5$

Answer: B

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63. Three isotopes fo an elecment have mass numbers $(m, (m+1)$ and $(M+2)$. If the mean mass number is (M + 0. 5) then which of the following ratios may be accepted for $M, (M+1)$ and $(M+2)$ in tha order ?

A. `1: 1:1

B. `4:1:1

C. $3:2:1$

D. `2:1:1

Answer: B

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64. The radii of two of the first four Bohre's orbits of the hydrogen atom are in the ratio $1:4$. The enrgy differnce betweeen them may be :

A. Either $12.09eV$ or $3.4eV$

B. Either $2.55eV$ or $10.2Ev$

C. $Either 13.6eV$ or $3.4ev$

D. Either 3.4eV or 0. 85 eV`

Answer: B

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65. When photon of energy $25eV$ strike the surface of a metal A, the ejected photelectron have the maximum kinetic energy photoelectrons have the maximum kinetic energy $T_A eV$ and de Brogle wavelength λ_A .The another kinetic energy of photoelectrons liberated from another metal B by photons of energy $4.76eV$ is $T_B = (T_A = 1.50)eV$ .If the de broglie wavelength of these photoelectrons is $\lambda_B = 2\lambda_A$ then

i.$(W_B)_A = 2.25eV II.\ (W_0)_B = 4.2eV$

III$T_A = 2.0eV IV.\ T_B = 3.5eV$

A. The work function fo (A) is $2.\ 25eV$

B. The work function of (B) is $3.\ 25eV$

C. $T_A 2.00eV$

D. $T_B = 2.75 eV$

Answer: D

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66. If the total enrgy fo an electron in a hydrogen linke atom in an ecited state is $-3.4 eV$, the the de-Broglie wavelngth of the electron is :

A. 6.6×10^{-10}

B. 3×10^{10}

C. 5×10^{-9}

D. 9.3×10^{10}

Answer: A

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67. The highest excited state that unexcited hydrogen atom can ereach when they are bombarged with $12.2eV$ electron is :

A. $n = 1$

B. $n = 2$

C. $n = 3$

D. $n = 4$

Answer: C

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68. The approximate quantum number fo a circular orbit of diamere , $20, nm$ of the hydrogen atom according to Bohr`s theory is :

A. 10

B. 14

C. 12

D. 16

Answer: B

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69. A boll of mass $200g$ is moving with a velocity of $10m\sec^{-1}$. If the error in measurement of velocity is 0.1% , the uncertainty in its position is :

A. $3.3 \times 10^{31}m$

B. $3.3 \times 10^{-27}m$

C. $5.3 \times 10^{-25}m$

D. $2.64 \times 10^{-32}m$

Answer: D

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70. p-orbitals fo an atom in presence fo magnetic field are :

A. Three fold degenerat

B. Tow fold degenrate

C. Non-degenerat

D. None fo the above

Answer: C

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71. In absence of Pauli exclusion principle , the elecrronic configureation of Li in ground state may be:

A. $1s^2, 2s^1$

B. $1s^3$

C. $1s^1, 2s^2$

D. $1s^2, 2s^1 2p^1$

Answer: B

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72. Heavy water molecule made from $\_1H^3$ and $\_8O^{18}$ has an mol . Wt . Of :

A. 18

B. 20

C. 22

D. 24

Answer: D

Watch Video Solution

73. The possible form of H_2 molecule on the basis fo three isotopes can be :

A. 3

B. 6

C. 8

D. 19

Answer: B

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74. H has two natural isotopes fo $\_1H-1$ and (O) has two isotopes O^{16} and O^{18} Which of the following mol . Wt , o f H_2O will not be possible ?

A. 19

B. 20

C. 24

D. 22

Answer: C

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75. Select the one :

A. $4f$

B. $5d$

C. `3s

D. $6p$

Answer: C

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76. The angular momentum of an electron in 2p-orbital is :

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

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

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

D. None of these

Answer: B

Watch Video Solution

77. The ratio of the enrgy of the electron in groun state of hydrogen to the elecron in first excited state of

Be^{2+} is :

A. $1:4$

B. $1:8$

C. $1:16$

D. $16:1$

Answer: A

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78. The number of d-electrons in $Fe^{2+}(Z=26)$ is not equal to that of :

A. p-electrons in $Ne(Z=10)$

B. p-electrons in $Me(Z = 12)$

C. p-electrons in $Fe(Z = 26)$

D. p-electrons in $Cl(Z = 17)$

Answer: D

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79. Magentic moment of $Fe^{a+}(Z = 26)$ is $\sqrt{24}BM$. Hence muber of unpaired electron and value If a respectively are :

A. 4, 2

B. 2, 4

C. $3, 1$

D. $0, 2$

Answer: A

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80. The radial distributio curve of $2s$ sublevel consists of x nodes x is :

A. 1

B. 3

C. 2

D. 0

Answer: A

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81. Magnetic moment of $V(Z=23), Cr(Z=24),$ and $Mn(Z=25)$ are x, y, zrepectively hence

A. $x=y=z$

B. $x<y<z$

C. $x<y<z$

D. $x<y<z$

Answer: A

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82. If the uncertainties in the measurement of position and momentum of an electron are equal, calculate the uncertainty in measuring the velocity.

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

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

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

D. None fo these

Answer: C

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83. Which of the following ions has the highest magnetic moent ?

A. Mn^{3+}

B. Zn^{2+}

C. Sc^{2+}

D. Ti^{3+}

Answer: A

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84. If the shortest wavelength of H-atom in Lyman series is x, then longest wavelnght in Balmer series of

HE^{2+} is :

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

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

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

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

Answer: A

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85. Which represents and orbital ?

A. ψ

B. ψ^2

C. $\left|\psi^2\right|\psi$

D. `None of these

Answer: A

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86. If n and l are respectively the rpincipal and azimuthal quantum numbes , then the expression for calculating the total number of electrons in any energy level is :

A. $\sum_{l=1}^{l=n} 2(2l+1)$

$l=n+1$

B. $\sum_{l=1-1}^{l=n} 2(2l+1)$

C. $\sum_{l=0}^{l=n+1} 2(2l+1)$

D. $\sum_{l=0} 2(2l+1)$

Answer: D

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87. Assuming the velocity to be same , which sub-atomic particle possesses smallest de-Broglie wavelngth :

A. An electron

B. A proton

C. An alpha-partcle

D. All have same wavelnght

Answer: C

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88. How many electron in an atom with atomic number 105 can have $(n+l)=8$?

A. 30

B. 17

C. 15

D. unpredictable

Answer: B

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89. Which of the following species will produce the shortest wavelength for the transition $n = 2$ to $n = 1$?

A. H-atom

B. D-atom

C. He^{+} ion

D. Li^{2+} ion

Answer: D

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90. The first emission line of Balmer series in H spectrum has the wave number equal to :

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

B. $\frac{9R_H}{144}cm^{-1}$

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

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

Answer: D

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91. Which sub-shell has maximum energy (poly-elecronic system) :

A. $4f$

B. $6s$

C. $5d$

D. $5p$

Answer: C

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92. When greater number of excited hydrogen atoms reach the ground state :

A. More number of lines are found in Lyman series

B. The ines in Balmer seies increases

C. The intensity of lines in Lyman seies increase

D. Both the intensity and number of lines in Lyman series increased .

Answer: C

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93. The number of waver made by an elercrtron moving in an orbit having maximum magetic quantum number $+3$ is :

A. 4

B. 3

C. 5

D. 6

Answer: A

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94. For which of the following process enrgy is absorbed :

A. Separation an electron form an electron

B. Separating an eelctron from a proton

C. Separating a proton form a proton

D. Adding an electron into a neurral atom

Answer: B

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95. An ion $\left(Mn^{a+}\right)$ has the magnetic moment equal to 4.9 B.M` What is the value of (a) :

A. 3

B. 4

C. 2

D. 5

Answer: A

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96. The ratio of kinetic energy and potential energy of an electrron in an orbit is equato to :

A. 0

B. `-0.5

C. -2

D. $\propto$

Answer: B

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97. The angular momentum of elerctro of ` H-atom is proprtional to :

A. r^2

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

C. $\sqrt{r}$

D. $\frac{1}{\sqrt{r}}$

Answer: C

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98. The total number of electron is $1. gCH_4$ are :

A. $N/10$

B. N

C. $2N$

D. $3N$

Answer: B

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99. The probability of finding elercrtron at a distance r form the nucleus for H or H like atom is :

A. ψ

B. $\frac{1}{\pi}\left[\frac{Z}{a_0}\right]^3 \cdot \frac{e^{-2zr}}{a_0}$

C. $\frac{1}{\pi}\left[\frac{Z}{a_0}\right]^{3/2} - \frac{e^{zr}}{a_0}$

D. None of these

Answer: B

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100. In aufbau principle, the word aufbau represents :

A. The name of scientist

B. German term meaning for buliding up

C. The enrgy of elerctron

D. The angular momentum of electron

Answer: B

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101. Two elecrtrons A and B in an atom have the following set of quantum numbers . What is true for A and B ?

A. A and B have same enrgy

B. A has more enrgy than (B)

C. B has more energy thah A

D. (A) and (B) represent same electron.

Answer: B

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102. The first obrital of H or H like atom is represencted by

$$\psi = \frac{1}{\sqrt{\pi}}\left(\frac{Z}{a_0}\right)^{3/2} e^{-ze/a_0}$$

where $a_0 =$ Bohr's orbit . The actual probability of fiding the elercrton at a distance r form the nucleus is :

A. $\psi^2 dr$

B. $\int \psi^2 4\pi r^2 dV$

C. $\psi^{24} 4d$

D. $\int \psi dV$

Answer: C

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103. Total numbr of nodal planes aresame in :

A. $3s4d$

B. $4s, 3p$

C. $5s, 4s, 4p$

D. $4s, 4p$

Answer: D

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104. The change in molar enrgy noticed during atomic transimission of 5 hertz frequency from a monoatomic molecule :

A. $33 \times .1 \times 10^{-34} J$

B. $1.99 \times 10^{-9} J$

C. $30.1 \times 10^{-9} J$

D. None of these

Answer: B

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105. The angular momentum of an electron in a orbital is given as ....

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

B. $\frac{h}{2\pi} \times \sqrt{l(l+1)}$

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

D. None of these

Answer: B

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106. The first atom with obncomplete d-shell is :

A. Sc

B. Cu

C. Fe

D. Zn

Answer: A

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107. Six valence electrons of oxygen are labelled as AB in 2s orbitals and CD , E, f in $rp_x, 2p_z$ and $2p0_y$ orbitals repectively . If spin quantum number of A, Cm Fis1/2` the group of electron with three of the quantum numbers same are :

A. $[AB], [DEF]$

B. $[AB], [CEF], [AE]$

C. $[AD], [BDF]$

D. $[AB], [CE], [AE]$

Answer: A

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108. The correct Schrodingers's wave equation for an electron with e as tatal energy and V as potential energy is :

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

Answer: C

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109. For an elecrron in g-orbital what is correct ?

A. n is ≤ 4

B. l is $= 4$

C. $m \neq 0$

D. $s \neq +\frac{1}{2}$

Answer: B

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110. The maxium sum of number of neutrons and protons in an isotope of hydrogen is :

A. 6

B. 5

C. 4

D. 3

Answer: D

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111. The ratio of speed of gamma-rays and X-rays is :

A. 1

B. < 1

C. >1

D. None of these

Answer: A

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112. Which of the following sets of quantum numbers represents an impossible arrangement?

A. $n, 3l, 2, m - 2s, 1/2$

B. $n, 4, l, 0m, 0, s, 1/2$

C. $n, 4, l, 3s, \ -31/2$

D. $n5, l, 3, s0, s, 1/2$

Answer: C

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113. Two elements in I transition series have four unparired electrons in their $+2$ states . Thers are :

A. Cr, Mn

B. Mn. Fe

C. Cr, Fe

D. Fe, Ni

Answer: C

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114. The line spectrum of two elements is not identical because

A. They do not have same number of neutrons

B. They have dissimilar mass number

C. They have diffeent enrgy level schemes

D. They have different number of velence eelctrons

Answer: C

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115. If the speed of electron in the first bohr orbit of hydrogen atom is x then the speed of the electron in the third Bohr orbit of hydrogen is

A. $x/9$

B. $x/3$

C. $3x$

D. $9x$

Answer: B

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116. The elecronic configuration $1s^2, 1s^2 2p^6, 3s^1 3p^1$ correctly describes :

A. Ground state of Na

B. Ground state of Si^+

C. Excited state of mg

D. Excited state of Al^{3+}

Answer: C

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117. Which of the following statement //s is not correct ?

A. The angular wave function for the goundstat of H-atom is equatl of $\frac{1}{2\sqrt{\pi}}$

B. The Schrodinger equation restrictsthe electron in H-atom to certain sharp orbits

C. A negative enrgy state is more stablerelatve to a zero enrgy state

D. The radialwave function ot the groun state H-atom decrease exponentilly towrds zero as r increases

Answer: B

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118. Rutherfore's alpha particke scatterubg exoerunebt evebtykk ked if tge cibckysuib tgat :

A. Mass and enrgy are relate

B. Electrons occupy speace around the mucleus

C. Neutrons are buried deep into the nucleus

D. The point of impact with matter can be preecisly detrmine

Answer: B

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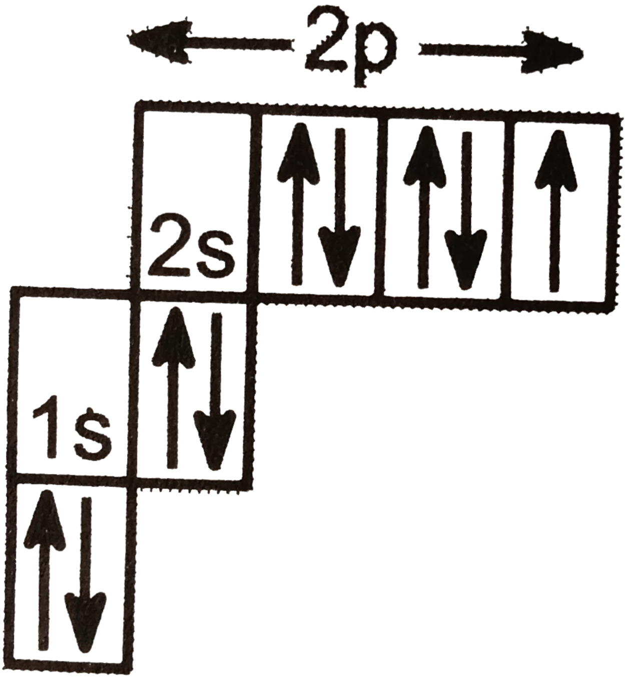
119. Which element isrepresencted by the following electronic configuration ?



A. Nitrogen

B. Oxygen

C. Fluorine

D. None of these

Answer: C

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120. F-orbitals in presence of magnetic field are :

A. Non-degeneratg

B. Five fold-degenerat

C. Sevenfole-degenerat

D. None of the above

Answer: A

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121. how fast is an elecreon moving if it has a wavelength equal to the distance travelled in one second ?

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

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

C. $\frac{\sqrt{h}}{p}$

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

Answer: B

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122. The work functio of a substance is $4.0 eV$. The longest wavelength of light that can cause photoelectron emission form this substance is approximately :

A. $540 nm$

B. $400 nm$

C. $310 nm$

D. $220 nm$

Answer: C

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123. The electron in a hydrogen atom makes a transition from an excited state to the fgeround state . Which of the following istrue ?

A. It's kinetic energy increases and it's potential and total enrgies decrease

B. It's kinetic energy decreases , potential energy increases and total energy remains same

C. It's kinetic and total energy decrease and its potential energy increase

D. It's kinetic, potential and total energy decreases

Answer: A

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124. The transition from state $n = 4$ to $n = 3$ in a $He^{\oplus}$ ion result in ultraviolet radition Intrated radiation will be abtained in the transiion from

A. $2 \rightarrow 1$

B. $3 \rightarrow 2$

C. $4 \rightarrow 2$

D. $5 \rightarrow 4$

Answer: D

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125. A hydrogen atom and a Li^{2+} ion ae both in the second excited state . If l_H and l_{li} are their respective angular momentum in an orbit and E_H and E_{Li} are their respective enrgies, then :

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

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

C. $l_H > l_{Li}$ and $E_H > E_{Li}$

D. $l_H > l_{Li}$ and $E_H > E_{Li}$

Answer: B

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126. ψ_{310} has :

A. 1 aredial node and 1 angualr node

B. 1 aredial node and 1 angualr node

C. 1 aredial node and 1 angualr node

D. 1 aredial node and 1 angualr node

Answer: A

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127. de-Broglie concept of wave is related to :

A. Electron

B. Light

C. Matter

D. Photon

Answer: C

Watch Video Solution

128. Which of the following is correct for the same radius of ion ieach pair ?

A. $r_4 He^+$ and $r_1 H$

B. $r_2 Be^{3+}$ and $r_1 H$

C. $r_2 He^+$ and $r_1 H$

D. $r_3 Li^{2+}$ and $r_1 H$

Answer: B

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129. IE_1 for $._1 H^2$ and IE_1 for $._1 H^1$ are related as ?

A. $IE_1 \quad ._1 H^2 > IE_1 \quad ._1 H^!$

B. $IE_1 \quad ._1 H^2 = IE_1 \quad ._1 H^!$

C. $IE_1 \quad ._1 H^2 < IE_1 \quad ._1 H^!$

D. $IE_1 \quad ._1 H^2 \geq IE_1 \quad ._1 H^!$

Answer: A

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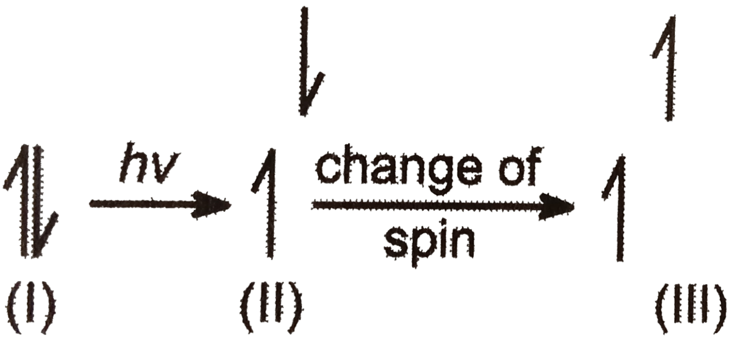
130. The spein multipltcity for the orbital enryron si $2s+1$where (s) is total enrctrons pin. The spin multiplicity for stage (I) , (II) and (III)are respectively



A. $1, 1, 1$

B. $1, 2, 3$

C. $1, 13$

D. $1, 3, 1$

Answer: C

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131. The enrgy level fo 4s-orbital is less than 3d- orbital because :

A. 4s-orbital is more near to nucleus than 3d-orbital

B. 4s-orbital penetrates more into the nucleus than 3d-orbital

C. 4s-orbital can have only two elecrrons whereas 3d can have 10 electrons

D. 4s-orbital is spherical and 3d-orbital is doulbe dumb-bell

Answer: B

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132. The number fo spectiral lines produced according to Bohr's concept when one elecrron umps form $5th$ to $2nd$ shell are :

A. 6

B. 8

C. 10

D. 12

Answer: A

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133. A s-orbital is symmetricla aout the :

A. x-axis only

B. y-axis only

C. z-axix only

D. Nucleus

Answer: D

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134. Which orbital has appearance like a body soother ?

A. d_{xy}

B. $(d)_{yz}$

C. $d_{x^2 - y^2}$

D. d_{z^2}

Answer: D

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135. Degenrate orbitals means :

A. Orbitals having same enrgy

B. Orbitals having same wave function

C. Orbitials having different enrgy but different wave function

D. Orbitlas having different enrgy and same wave function .

Answer: A

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136. Which is correct paramagnetic or der ?

A. Mn Cr Zn

B. Fe Zn Co

C. Cr Fe Zn

D. Hg Mn Fe

Answer: C

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137. In ground state fo $._{24}Cr$:

A. 13 electrons have spin in one direction and (11) elecrtrons in other direction

B. 14 electrons have spin in one direction and (10) elecrtrons in other direction

C. 15 electrons have spin in one direction and (9) elecrtrons in other direction

D. 15 electrons have clockwis direction and (9) elecrtrons in other direction

Answer: C

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138. The maxium number of electrons in an orbital having same spin quantum number will be:

A. $l + 2$

B. $2l + 1$

C. $l(l+1)$

D. $\sqrt{l}(l+1)$

Answer: B

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139. The electronic configuration of $._{46}\ Pd$ is :

A. $4d^9 5s^1$

B. $4d^{10}$

C. $4d^8 5s^1$

D. $4d^1 5s^2$

Answer: B

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140. The pair having identical velue fo e/m:

A. A proton and a neutron

B. A proton and a deutrium ion

C. An alpha-particel and a deuterium ion

D. An elecrron and gamma-rays

Answer: C

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141. For an electron the product of velocity fo electron and pricipa quantum no.

A. Energy of elecron

B. Revolution number

C. Wavelength of electron

D. principal quantum number

Answer: D

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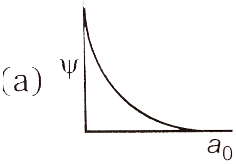
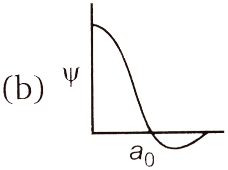
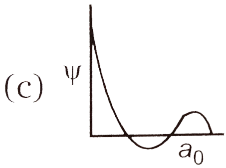
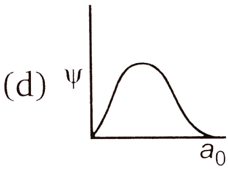
142. Which of the following corresponds to one node ?

A. 

B. 

C. 

D. 

Answer: B

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143. For a satellite moving in an orbit aroun the earth the ratio of kinetic enrgy and potential enrgy is :

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

B. 2

C. $\sqrt{2}$

D. $\frac{1}{\sqrt{2}}$

Answer: A

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144. A photosensitve metallic surface has work fuction hv_0 If photons of $2hv_0$ fall on the suface , the electrons come out with a maximum velocity of $4 \times 10^6 m/s$. If photon energy is increases to $5hv_0$ the maximum velocity of photoelectrons will be:

A. $2 \times 10^7 m/s$

B. $82 \times 10^6 m/s$

C. $2 \times 10^{76} m/s$

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

Answer: B

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145. The work functions for metals A, B and (C) are presepctively $1.\ 92 eV$, $2, 0$ eV 1 and $5.0 eV$ According to Einstein equation , the metal which will emit photoelectron for a radistion fo wavelingth $4100\AA$/are

A. A only

B. (A) and (B) only

C. A, B and (C)

D. None of these

Answer: B

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146. Carbo , silicon and Germanitum atomshave four valence electrons each . Their velence and conduction bands are separeated by energy nands gaps represented by $(E_g)_C$, $(E_g)_{Si}$, $(E_g)_{Ge}$ repectively . Which relativon is correct ?

A. $(E_g)_C < (E_g)_{Ge}$

B. $(E_g)_C < (E_g)_{Si}$

C. $(E_g)_C = (E_g)_{Si}$

D. $(E_g)_C > (E_g)_{Si}$

Answer: D

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147. The total enrgy of electron in the firdt state fo H-atom is $-3.4eV$. Its kinetic enrgy in this state is :

A. $-3.4eV$

B. $3.4eV$

C. $6.8eV$

D. $-68eV$

Answer: B

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148. If λ_v, λ_x and λ_m represents the wavelength of visible light X-ray and microwave respectively then :

A. $\lambda_m > \lambda_v > \lambda_x$

B. $\lambda_m > \lambda_x > \lambda_v$

C. $\lambda_v > \lambda_m > \lambda_x$

D. $\lambda_v > \lambda_x > \lambda_m$

Answer: A

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149. Which of the following connot be obtained form the solution of Schrodinger wave equation ?

A. Wave function of an electron

B. Energy of an elecrtron in a $1-D$ box

C. Energyof an electron in orbitals

D. Velocity of electron in circular orbits

Answer: D

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150. Which of the following does not characteristic X - rays ?

A. The radistiaon can ionise gase

B. It causes ZnS to fluoresecence

C. Defected by electroic or magentic field

D. Have wavelength shorter than the UV rays

Answer: C

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151. Which electronic level would allow the hydrogen atom to absorb a photon but not to emit a photon ?

A. 3s

B. $2p$

C. $1s$

D. $3d$

Answer: C

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152. The mass fo 1 mole pghoton of wavelength $589nm$ is :

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153. Number of degenerate orbitals in a level of H-atom having $E_n = \frac{Rh}{9}$:

A. 3

B. 6

C. 9

D. 14

Answer: C

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154. The orientiation of an atomic orbital is governed by

:

A. Magnetic quantum numbre

B. Principal quantum bumber

C. Aximumthal quantum number

D. Spin quantum number

Answer: A

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155. The uncertaintuy invelved in the measurement fo velocity within a distance of 0.1Å is :

A. $5.79 \times 10^8 ms^{-1}$

B. $5.79 \times 10^5 ms^{-1}$

C. $5.79 \times 10^6 ms^{-1}$

D. $5.79 \times 10^7 ms^{-1}$

Answer: C

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156. The speed of an electron having its wavelength being equal to speed can vbegiven by :

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

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

C. $\frac{\sqrt{h}}{p}$

D. $\frac{\sqrt{h}}{2KE}$

Answer: A

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157. The differnce between nth and $(n+1)$ the Bohr radius of B atom is equal to be its $(n-1)$ th Bohr radius .The value of n is

A. 1

B. 2

C. 3

D. 4

Answer: D

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158. Fill up a sutiable figure in each set in respective choices for $\psi_{3,1,0}$ in Be^{3+} ion:

A. 3,9,3,3

B. $3, 3, 2, 3$

C. 3,3,1,3

D. 3,3,3,

Answer: D

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159. If the uncertainties in the measurement of position and momentum of an electron are equal, calculate the uncertainty in measuring the velocity.

A. $\dfrac{1}{m}\dfrac{\sqrt{h}}{\pi}$

B. $\dfrac{\sqrt{h}}{\pi}$

C. $\frac{1}{22m}\frac{\sqrt{h}}{\pi}$

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

Answer: C

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160. Ratio of m^{th} wavelength of Lyman series in H-atom is equal to:

A. $\frac{\lambda_m}{\lambda_m}=\frac{(m^2-1)\times n^2}{(n^2-1)\times m^2}$

B. $\frac{\lambda_m}{\lambda_n}=\frac{(m+1)^2}{(n+1)^2}\times\frac{(n+1)^2-1}{(m+1)^2-1}$

C. $\frac{\lambda_m}{\lambda_n}=\frac{(m+1)^2}{(n+1)^2}\times\frac{(n+1)^2-1}{(m+1)^2-1}$

D. $\frac{\lambda_m}{\lambda_m}=\frac{(m^2-1)\times n^2}{(n^2-1)\times m^2}$

Answer: B

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161. IE_1 for (H) and De are 13.6 eV 1 and 24.6 eV respectively . Thus enrgy liberated during the formation fo He by

$He^{2+} + 2e \rightarrow H3,$ is:

A. $54.4eV$

B. $49.\ 2eV$

C. $0.\ 27,\ 4eV$

D. $13.\ 6\lambda$

Answer: D

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162. The circumfernce fo n^{th} orbit in H-atom can be expressed in tems fo de.Broglie wavelngth λ as :

A. $\sqrt{n\lambda}$

B. $n\lambda$

C. $0.529h\lambda$

D. 13. 6 lambda`

Answer: B

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163. Ration of m^{th} to n^(th)` wavelength of Balmer series in H-atom is equal to :

A. $\dfrac{\lambda_n}{\lambda_n} = \dfrac{(m+2)^2}{(n+2)^2} \times \dfrac{(n+2)^2 - 4}{(m+2)^2 - 4}$

B. $\dfrac{\lambda_n}{\lambda_n} = \dfrac{(m+2)^2}{(n+2)^2} \times \dfrac{(n+2)^2 - 4}{(m+2)^2 - 4}$

C. $\dfrac{\lambda_n}{\lambda_n} = \dfrac{(m+2)^2}{(n+2)^2} \times \dfrac{(n+2)^2 - 4}{(m+2)^2 + 4}$

D. $\dfrac{\lambda_n}{\lambda_n} = \dfrac{(m+2)^2}{(n+2)^2} \times \dfrac{(n+2)^2 - 4}{(m+2)^2 + 4}$

Answer: A

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164. An excited hydrogen atom returns to the ground state . The wavelength of emittted photon is λ The principal quantium number fo the excited state will be :

A. $\left[\dfrac{R+1}{\lambda R}\right]^{2/2}$

B. $[\lambda R(\lambda R+1)]^{1/2}$

C. $\left[\dfrac{R+1}{\lambda R-1}\right]^{2/2}$

D. $\left[\dfrac{1}{\lambda R(\lambda R+1)}\right]^{1/2}$

Answer: C

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165. When an electron fo mass 6 m and charge $6e$ moves with a velocity of $7u$ about the nuclar charge Ze in a circular orbit fo radius r . The potential energy of the electron will be:

A. Zw

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

C. $\frac{-6Ze^2}{r}$

D. $\frac{2\pi^2me^4Z^2}{n^2h^2}$

Answer: C

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166. If λ_0 is the Threshold wavelength of a metal for photoelencron emisssion . If the metal is exposed to the light of wavelngth λ then the velocity of ejectred electgron will be $\sqrt{\frac{2h}{m}(\lambda_0 - \lambda)K}$. The value fo (K) is :

A. 1

B. $\frac{c}{\lambda_0 \lambda}$

C. $\frac{1}{\lambda \lambda_0}$

D. $\frac{c.\,\lambda}{\lambda_0}$

Answer: B

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167. The emission of electrons from a metal surface exposed to light radiation of appropriate wavelength is called photoelectric effect .The emitted electron are called photo-electron work function of threshold energy may be defined as the minimum amount of energy required to eject electrons from a metal surface .According to Einstein

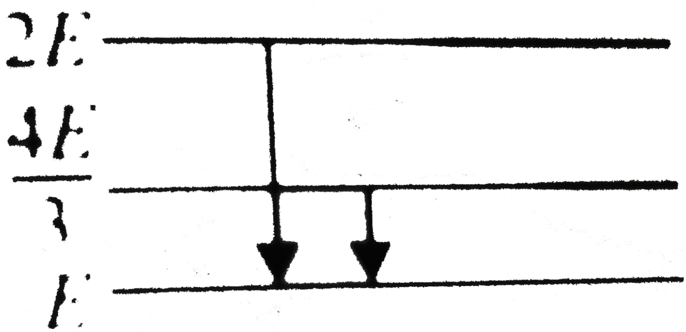
Maximum kinetic energy of ejected electron = Absorbed energy - Work function

$$\frac{1}{2}mv_{\max}^2 = h(v) - h(v_0) = hv\left[\frac{1}{\lambda} - \frac{1}{\lambda_0}\right]$$

Where v_0 and λ_0 are threshold frequency and threshold wavelength respectively

Stopping potential : it is the minimum potential at which the photoelectric current becomes zero if V_0 is the stopping potential $eV_0 = h(v - v_0)$.

The following figure indicates the energy levels of a certain atom .When the system moves from $2E$ level to E level a photon of wavelength λ is emitted .The wavelength of the photon produced during the transition from level $4E/3$ to level E is



A. $\lambda/3$

B. $4\lambda/3$

C. 3λ

D. $3\lambda/4$

Answer: C

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168. The number fo electrons present in $1 cm^3$ of Mg (density of $._{12} Mg^{24} gcm^{-3}$) is:

A. 5.24×10^{23}

B. $4\lambda / 3$

C. 3λ

D. $3\lambda / 4$

Answer: A

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Exercise 3B

1. Select the correct statements :

A. The total intenesity of radiations (power emitted /surface area) over all wavelingths is directluy proportional to fourth power of absolutie temperature during black body radiations .

B. The degeneracy of orbitals fo a sghell in absence of magenetic field exst only in one electron systems .

C. An irbutak cab be defucbed by for quantum numbers .

D. Agsorpotion spectera are used by asronomers to identify elements in the outer layer if stars.

Answer: A::B::D

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2. Which sets of quantum no. are consistent with the thory ?

A. $n = 2, l = 1, m = 0, s = -1/2$

B. $n = 4, l = 3, m = -2s = -1/2$

C. $n = 3, l = 3, m = -2, s = -1/2$

D. $n = 3, l = 3, m = -2, s = -1/2$

Answer: A::B::D

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3. Which statements are correct ?

A. The enrgies of the vaious subl-levels in the sme shell fo H-atom are in rodes $s > p > d > f$

B. s-orbital is no-directional

C. Electrons in moton behave as if they are waves .

D. an orbitla can accomodatie a maximum of two electrons with paralledl spins .

Answer: B::C

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4. An electron jumps from nth level to the first level .The correct face (s) about H atomic is//are

A. Number of specteal lines $=\sum\frac{n(n-1)}{2}$

B. Number fo spectal lines $=\sum(n-1)$

C. Number fo spectal lines $=\sum(n-1)$

D. If $n=4$ the no.of spectral lines = six.

Answer: A::B::D

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5. Many elements have non-integral atomic masses because

A. They have isotops

B. their isotopes have non-integral masses

C. their isotipe hacve different masese

D. the constiunts neutrons , protons and electons combine to given fractional mases

Answer: A::C

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6. When alpha particle are sent through a thin metal foil ,most of them go straight through the foil because

A. `alpha-particels are mauch haveier ha elecrons

B. alpha-particels are positively cahrged

C. most part fo the atom is empty space

D. apha-partcle mvoe eith higth velocity

Answer: A::C

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7. Which fo the following statement (s) is are correct ?

A. The electronic configruation of cr is $[Ar]3d^5m4s^1$

B. The magnetic quatum no. may have abegative value

C. In silve atom 23 eelctrons have a spin of one type and 24 of the oppositive type (an. of . Ag is 74)

D. The oxidation no. of nitrogen in N_3H is -3

Answer: A::B::C

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8. Decrease in atomic mnumber is boserved during :

A. alpha-emission

B. `beta-emission

C. positron-emission

D. electron capture

Answer: A::C::D

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9. A metal surface having v_0 as threshode frequency is incident by light of frequency (v) then select the correct :

A. $u = \sqrt{2h(\lambda_0 - \lambda)}$

B. $u = \sqrt{2h(\lambda_0 - \lambda)}$

C. $u = \sqrt{2h\frac{\lambda_0 - \lambda}{m}}$

D. $u = \sqrt{2h\frac{\lambda_0 - \lambda}{m}}$

Answer: A::B::D

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10. Which of the following reflectst the wave nature of light ?

A. phopotelectric effect

B. $E = mc^2$

C. diffraction

D. indterfeence

Answer: C::D

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11. The electron in a hydrogen atom makes a transition $n_1 rar n_2$ wher n_1 and n_2 are the principal quuantum numbers fo the two states . Assume the Bohr model to gbe veloid the time pertiod fo the electron in the initial state is eight times that tin the final state . The posible velues of n_1 and n_2 are :

A. $n_1 = 4, n_2 = 2$

B. $n_1 = 8, n_2 = 2$

C. $n_1 = 8, n_2 = 1$

D. $n_1 = 6, n_2 = 3$

Answer: A::D

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12. Which fo the following product in a hdrogen atom are independent fo the principal quantum bumber (n) ?

A. v_n

B. E_r

C. E_n

D. v_r

Answer: A::B

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13. Photoelectric effect supports quantum nature fo light because :

A. there is a minum freqwuency below which no photoelectrons are emitted

B. the maximum kinetic erngy fo the photoelectorns depends only on the frequency fo light and not on its intensity

C. eve when the metal surface si fiantyl illuminated the photoelectrons levae the surfae immeditely

D. electric charge fo thephotelcteons is quantixzwed

Answer: A::B::C

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14. In which of the following situations, the heavier of the two particles has smaller de broglie wavelength ? The two particle

A. move with the same speed

B. move with the same linear momentum

C. move with the same kineric erngy

D. have fallen throuh the same height

Answer: A::C::D

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15. Ionisation enrgy of a h-like ion (A) is greater than that of another H-like ion (B) Let r, u, e and (L) represent the radius fo the orbit speeed of the electron , energy of the atom and orbital angualr momentum of the electron repectively . In groun state :

A. $r_A > r_B$

B. $u_A > u_B$

C. $E_A < E_B$

D. $LA_A > L_B$

Answer: C::D

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16. The mangnitue of spin angular momentum of electron is givenby :

A. $s = \sqrt{s(s+1)}\frac{1}{2\pi}$

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

C. $s = \pm\frac{1}{2}\cdot\frac{h}{2\pi}$

D. $s = \sqrt{\frac{3}{2} \cdot \frac{h}{9} 2\pi}$

Answer: A::D

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17. A photon of wavelenght is $4.0 \times 10^{-7} m$ strikes on a mnetal surfce , the work function of metal being $3.4 \times 10^{-19} J$. Select the correct statyements :

A. The enrgy of pghoton is $4.97x10^{19} J$

B. The kinetic enrgy fo the emeission is $1.57 \times 10^{-19} J$

C. The kinetic enrgy fo the emission is $0.98 eV$

D. The velocity fo photoelectron is $5.87 \times 10^5 ms^{-1}$.

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

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18. Select the incrorect statement (s) :

A. A negative enrgy state is more stable relative to a zero erngy state .

B. The kinetic erngy fo photoelectrons emitted by a photosensitive surface depends on the intensity of radiation .

C. In a photoelectric emission process , the maximum energy of the photoelectron increases with increasing intensity of the incident light .

D. The value for ψ_{1s}^2 increase with the distance of the electron form the nucleus .

Answer: B::C::D

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19. Select the correct statements (s) :

A. The co-ordinate (θ) in $\psi(r, \theta, \phi)$ is the angle form the positive z-axis (the nroth pole) representing lattiude .

B. The co-ordinate (θ) in $\psi(r, \theta, \phi)$ is the angle about the z-axis represnting the longitude ,

C. Tehe schrodinger equation restricts the elcron in a H-atom decrease exponentially towres zereo or (r) increase .

D. The co-ordinate (θ) in $\psi(r, \theta, \phi)$ is the angle about the z-axis represnting the longitude ,

Answer: A::B::D

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Exercise 4

1. In a hydrogen atom, if energy atom, if energy of an electron in group state is $-13.6eV$, then that in the 2^{nd} excited state is :

A. $-1.51eV$

B. $-34eV$

C. $-6.04eV$

D. $-6.04eV$

Answer: A

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2. Uncertainty in position of minute of mass $25g$ in space is $10^{-5}m$. The uncertaint in its veloty (in ms^{-1} is :

A. 2.1×10^{-34}

B. 0.5×10^{-34}

C. 2.1×0^{-28}

D. 0.5×10^{-23}

Answer: C

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3. Wich has the maxmum magnetic moment ?

A. Mn^{2+}

B. Fe^{2+}

C. Ti^{2+}

D. Cr^{2+}

Answer: A

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4. The number fo d-electrons retatined in Fe^{2+} ion is :

A. 5

B. 6

C. 3

D. 4

Answer: B

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5. The orbital angular momentum for an electron revolving in an orbit is given by $\sqrt{l(l+1)}\frac{h}{2\pi}$. What is the momentum of an s-electron?

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

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

C. $+\frac{1}{2}\frac{h}{2\pi}$

D. Zero

Answer: D

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6. In Bohr series of lines of hydrogen spectrum, third line from the red end corresponds to which one of the following inner orbit jumps of electron for Bohr orbit in atom in hydrogen :

A. $4 \rightarrow 1$

B. $2 \rightarrow 5$

C. $3 \rightarrow 2$

D. $5 \rightarrow 2$

Answer: D

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7. The de-Broglie wavelngth of a tennis ball mass $60g$ moving with a velocity fo $10m$ per second is approximately :

A. $10^{-16}m$

B. $10^{-25}m$

C. $10^{-33}m$

D. $10^{-31}m$

Answer: C

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8. Which set is correct for an electron in 4 f-orbital ?

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

B. $n = 3, l = 2, m_l = -4, m_s = +\frac{1}{2}$

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

D. $n = 3, l = 2, m_l = -4, m_s = +\frac{1}{2}$

Answer: C

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9. Consider the ground state Cr atom $(Z = 24)$. The number of electron with the azimuthal number $l = 1$ and 2 ,respectively are

A. $16 \text{ and } 5$

B. $12 \text{ and } 5$

C. $16 \text{ and } 4$

D. $12 \text{ and } 4$

Answer: B

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10. The wavelength of the radiation emitted , when in a hydrogen atom electron falls from infinity to stationary state 1 , would be :

(Rydberg constant = $1.097 \times 10^7 m^{-1}$)

A. $9.1 \times 10^{-8} nm$

B. $192 nm$

C. $406 nm$

D. $91 nm$

Answer: D

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11. Of the following outer lectronic configurations fo atoms the highest oxdation state is achieved by wbhich one fo them :

A. $(n-1)d^5ns^2$

B. $(n-1)d^5ns^2$

C. $(n-1)d^3ns^2$

D. $(n-1)d^8ns^2$

Answer: A

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12. In a malti-electrons atom which of the following orbitals deseribed by the three quantum number will have the same energy in the absence of megnetic and electric field ?

I.$n = 1, l = 0, m = 0$

II. $n = 2, l = 0, m = 0$

III.$n = 2, l = 1, m = 1$

IVgt$n = 3, l = 2, m = 1$

V$n = 3, l = 2, m = 0$

A. (i)and (ii)

B. (ii) and(iii)

C. (iii) and (iv)

D. (iv) and (v)

Answer: D

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13. Which of the following statement is correct in relation to the hydrgen atom ?

A. 3-s-orbitl is lower in enrgy thabn 3p-orbital

B. 3-s-orbitl is higher in enrgy thabn 3p-orbital

C. 3s-orbitla is lower in erngy than 3d-orbital

D. 3s, 3p and 3d-orbitlas all have the same enrgy .

Answer: D

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14. According to Boohr's theory the angular momentum of an electron in 5th orbit is :

A. $25\frac{h}{\pi}$

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

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

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

Answer: D

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15. Uncertainty in the position of an electron mass $(9.1 \times 10^{31} kg)$ moving with a velocity $300 ms^{-1}$ accurate uptp 0.001% will be :

A. $19.2 \times 10^{-2} m$

B. $5.75 \times 10^{-2} m$

C. $1.92 \times 10^{-5} m$

D. $3.584 \times 10^{-2} m$

Answer: C

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16. The sping only maagentic mome (in Bohr magneton , M_C) of Hi^{2+} in aqueouse solution would be :

A. 2.84

B. 4.90

C. 0

D. 1.73

Answer: A

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17. Which one of the following sets of ions represents a colloection of isoelectronic species ?

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

B. $K^{+}, Cl^{-}, Ca^{2+}, Sc^{2+}, Sc^{3+}$

C. $N^{3-}, O^{2-} F^{-}, S^{2-}$

D. $Li^{+}, Na^{+}, Mg^{2+}, ca^{2+}$.

Answer: A

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18. Which of the following sets of quantum numbers reperesent the highest energy of an atom ?

A. $n = 3, l = 1, m = 1, s = +1/2$

B. $n = 3, l = 2, m = 1, s = +1/2$

C. $n = 3, l = 0, m = 0, s = +1/2$

D. $n = 3, l = 0, m = 0, s = +1/2$

Answer: B

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19. The ionization enthalpy of hydrogen atom is $1.312 \times 10^6 Jmol^{-1}$. The energy required to excite the electron in the atom from $n = 1$ to $n = 2$ is :

A. $8.51 \times 10^5 Jmol^{-1}$

B. $6.56 \times 10^5 Jmol^{-1}$

C. $7.56 \times 10^5 Jmol^{-1}$

D. $9.84 \times 10^5 Jmol^{-1}$

Answer: D

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20. In an atom an electrron is momving with a speed fo $600m/s$ with an accuracy fo 0.005% . Cenrtatinty with which the position fo the elelcron can be locatied si :

$(h = 6.6 \times 10^{-34} kgm^2 s^{-1}$,

mass of electron $(e_m) = 9.1 \times 10^{-31} kg)$.

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

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

C. $2.5nm$

D. $14.\ 0nm$

Answer: C

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21. Calculate the awavength (in naometer) assoricatioed with a protojn moving at 1.0×10^3 (Mass of proton $= 1.67 \times 10^{-27} kg$ and $h = 6.63 \times 10^{-34} js)$:

A. $0.0032nm$

B. $0.\ 40nm$

C. $2.5nm$

D. $14, 0mn$

Answer: B

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22. Ionisation energy of He^{+} is $19.6 \times 10^{-18} J \text{atom}^{-1}$. The energy of the first stationary state $(n = 1)$ of Li^{2+} is.

A. $4.41 \times 10^{-16} J \quad \text{atom}^{-1}$

B. -4.41×10^{-17} J "atom"^(-1)`

C. $-2.2 \times 10^{-15} J \quad \text{atom}^{-1}$

D. $8.82 \times 10^{-17} J \text{ atom}^{-1}$.

Answer: B

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23. The energy required to break one mole of $Cl - Cl$ bonds in Cl_2 is $242 kJ mol^{-1}$. The longest wavelength of light capable of breaking a since $Cl - Cl$ bond is

A. $1035 nm$

B. $325 nm$

C. $742 nm$

D. $518 nm$

Answer: D

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24. A gas absorbs a photon fo $355nm$ and emits at two wavelengths . If one fo the emission is at 680 nm , the other si at :

A. $n = 4, l = 1$

B. $n = 4, l = 0$

C. $n = 3, 1 = 2$

D. $n = 3, l = 1$

Answer: C

25. The electrons identifted by quantum nymbers (n) and (l) :

can be placed in order fo increasing enrgy as :

A. $(4) < (2) < (3) < (1)$

B. $(2) > (40) > (1) > (3)$

C. $(1) > (3) < (2) < (4)$

D. $(3) < (4) < (2) < (1)$

Answer: A

26. A 3p-orbital has :

A. Two spherical nodes

B. Two non-sphericl nodes

C. One spherical and one non -sphertical nond

D. One spherical and two non-spherical nodes

Answer: C

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27. Which has maimum number fo unpaired elecron ?

A. Mg^{2+}

B. Ti^{3+}

C. V^{3+}

D. Fe^{2+}

Answer: D

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28. For a d electron the orbital angular momentum is

A. $\sqrt{6}h$

B. $\sqrt{2}h$

C. h

D. $2h$

Answer: A

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29. The first use of quantum theory to explain the structure of atom was made by

A. Heisenbeg

B. Bohr

C. Planck

D. einstiein

Answer: B

Watch Video Solution

30. The energy of an electron in the first Bohr orbit of H atom is $-13.6eV$ The potential energy value (s) of excited state(s) for the electron in the Bohr orbit of hydrogen is(are)

A. $-3.4eV$

B. $-4.3eV$

C. $-6.8eV$

D. $+6.8eV$

Answer: A

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31. The electrons, identified by quantum number n and l

i. $n = 4, l = 1$ ii. $n = 4, l = 0$ iii. $n = 3, l = 2$ iv. $n = 3, l = 1$

Can be palced in the order of increasing energy from the lowest to highest,its

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

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

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

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

Answer: A

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32. The electronic configuration of an element is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$ .This represents its

A. Excited state

B. Ground state of Si^+

C. Catinic form

D. Anionic form

Answer: A::B

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33. The wavelength associtated with a golf ball weight $200g$ 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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34. Number fo nodal plane in p_x orbital is :

A. 1

B. 2

C. 3

D. 0

Answer: A

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35. If nitrogen atoms had el,ectonic configuration is ? It would have energy lower than that of the nornal ground state configuration $1s^2 2s^2 2p^3$ because the electrons would be clear to the nucleus yet $1s^2$ is not oberved because it violates ?

A. Heisenberg's uncertainty principle

B. Hund's rule

C. pauli exclusion principle

D. Bohr postulate of statinary orbits

Answer: C

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36. The quantum number $+1/2$ and $-1/2$ for the electron spin represent

A. rotation fo the electron in clockwise and anticlockewise direction repectively

B. rotation of the electon in anticlockwise and clockwese direction repectively

C. magnetic moment of the electron pointing up

D. two quantum mechanical states which jave classical analogue

Answer: D

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37. The radius of which of the following orbit is same as that of the first Bohr's orbit of hydrogen atom.

A. $He^{+}(n=3)$

B. $Le^{2+}(n=2)$

C. $Li^{2+}(n=3)$

D. $Be^{3+}(n=2)$

Answer: D

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38. The number of radial nodes of $3s$ and $2p$ orbital are, respectively

A. $12, 0$

B. $0, 2$

C. $1, 2$

D. $2, 1$

Answer: A

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39. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is [a_0 is Bohr radius] :

A. $\frac{h^2}{4\pi^2 m a_0^2}$

B. $\frac{h^2}{16\pi^2 m a_0^2}$

C. $\frac{h^2}{32\pi^2 m a_0^2}$

D. $\frac{h^2}{64\pi^2 m a_0^2}$

Answer: C

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Exercise 6

1. If the electron enrgy is -3.4 eV, find the principal quantum number fo H-atom .

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2. The velocity of an electron in a certain Bohr's orbibit of H-atom bears the ratio $1:275$ to the velocity of light . The find the quantum number (n) of orbit .

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3. An ion $\left(Mn^{a+}\right)$ has the magnetic moment equal to 4.9 B.M` What is the value of (a) :

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4. An oil drop has $8.01 \times 10^{-19}C$ charg .Calculate the number of electrons in this drop.

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5. The wavelngth of m^{th} shell to 2^{nd} shell . How orbital is 4103Å . What is the value of (m) ?

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6. An electron jumps form 5^{th} sehell to 2^{th} shell . How many state fo transition are possinle ?

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7. Find out the number of waves made by a Bohr's electron in one complete revolution in its third orbit.

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8. Find out the numer fo angualr nodes in the orbital to which the last electron of Cr enter .

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9. The differnce between nth and $(n+1)$ the Bohr radius of B atom is equal to be its $(n-1)$ th Bohr radius .The value of n is

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10. Find out the degeneracy of hydrogen atom that has the erngy equal to $-\frac{R_H}{9}$ (R_H = Rydberg costant).

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11. The magneit moment of a transitio metal is $\sqrt{15}$ B.M . Fin dout the mubner of unpaired electrons in it .

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12. Magnetic moment fo A^{2+} ion is $5.48 \times 10^{-23} J/R$. Find out the number of unpaired elecrrons in it . $(9.27 \times 10^{-24} J/T = 1B.M.)$.

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13. Find the ratio ofenergy of a photon of 2000Å wavelength radiation to that of 400Å wavelength radiation to that of 4000Å radiation .

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14. The electron in Li^{2+} ions are exctied form gound stte by absorbing $8.4375Rh$ energy /electron . How much emission lines are expected during de-excitation of electrons to ground state ?

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15. What is the ratio of wavelength of (II) line fo Balmer series and (I) line fo Lyman seies ?

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16. Ionisation potential of hydrogen atom is $13.6eV$. Hydrogen atom in the ground state is excited by monochromatic light fo energy $12.1eV$. The spectral lines emitted by hydrogen according to Bohr`s theory will be.

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17. The velocity of an electron in a certain Bohr's orbibit of H-atom bears the ratio $1:275$ to the velocity of light . The find the quantum number (n) of orbit .

Watch Video Solution

18. A single electron system has ionization enrgy $1.118 \times 10^7 Jmol^{-1}$. Calculate the numner of protons in the nucleus fo te system .

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19. Find the total numer of degenerate orbitals in $\psi_{4,2,0}$ of H-atom.

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20. Find the number of waves in an orbit fo H-atom having radius equal to $8.464 \times 10^{-10} m$.

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21. 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

$$\begin{pmatrix} Metal & Li & Na & K & Mg & Cu & Ag & Fe & Pt & W \\ \phi(eV) & 2.4 & 2.3 & 2.2 & 3.7 & 4.8 & 4.3 & 4.7 & 6.3 & 4.75 \end{pmatrix}$$

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22. The maximum number of electrons can have principal quantum number $n=3$ and spin quantum number $m_s = 1/2$ is

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Exercise 7

1. Rutherford proposed the atomic meodel after his most stiking experiment an apha-scattering leading to discoveluy of nucleus . Bohr later on modified the atomci model on the balis of Planck's quantum theory of light and prosed the concept of stateonry cireclar orbits of quanise enrgy $\frac{nh}{2\pi}$ The colloection of fine lines in line spectrum led Sommerfeld to gae the idea fo elliptical orbits .He successfully explained the existence fo subshells and their number in a shell . The angular momentum of subshells was proposed as $\sqrt{l(l+120)}.\ \frac{h}{2\pi}$. The emission of a spectral line in atomic spectra was supposed to be due to the jump of elecrtron from one enrgy level to other .

The angular momentum fo elecron i $2p$ orbital is :

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

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

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

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

Answer: B

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2. Rutherford proposed the atomic meodel after his most stiking experiment an apha-scattering leading to discoveluy of nucleus . Bohr later on modified the atomci model on the balis of Planck's quantum theory of light and prosed the concept of stateonry cireclar orbits of quanise enrgy $\frac{nh}{2\pi}$ The colloection of fine lines in line spectrum led Sommerfeld to gae the idea fo elliptical orbits .He successfully explained the existence fo subshells and their number in a shell . The angular momentum of subshells was proposed as $\sqrt{l(l+120)}.\frac{h}{2\pi}$. The emission of a spectral line in atomic spectra was supposed to be due to the jump of elecrtron from one enrgy level to other .

The volume occupied by the nucleus is about .... times fo volume fo atom :

A. 10^{-15}

B. 10^{-15}

C. 10^{-12}

D. 10^{-10}

Answer: A

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3. Rutherford proposed the atomic meodel after his most stiking experiment an apha-scattering leading to discoveluy of nucleus . Bohr later on modified the atomci model on the balis of Planck's quantum theory of light and prosed the concept of stateonry cireclar orbits of quanise enrgy $\frac{nh}{2\pi}$ The colloection of fine lines in line spectrum led Sommerfeld to gae the idea fo elliptical orbits .He successfully explained the existence fo subshells and their number in a shell . The angular momentum of subshells was proposed as $\sqrt{l(l+120)}.\ \frac{h}{2\pi}$. The emission of a spectral line in atomic spectra was supposed to be due to the jump of elecrtron from one enrgy level to other .

No-directional orbitals is :

A. $3s$

B. $4f$

C. $4d$

D. $4p$

Answer: A

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4. Rutherford proposed the atomic meodel after his most stiking experiment an apha-scattering leading to discoveluy of nucleus . Bohr later on modified the atomci model on the balis of Planck's quantum theory of light and prosed the concept of stateonry cireclar orbits of quanise enrgy $\frac{nh}{2\pi}$ The colloection of fine lines in line spectrum led Sommerfeld to gae the idea fo elliptical orbits .He successfully explained the existence fo subshells and their number in a shell . The angular momentum of subshells was proposed as $\sqrt{l(l+120)}.\ \frac{h}{2\pi}$. The emission of a spectral line in atomic spectra was supposed to be due to the jump of elecrtron from one enrgy level to other .

The total number of undamental particels in $\_(14)^{6}C$

is :

A. 6

B. 8

C. 14

D. 20

Answer: D

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5. Rutherford proposed the atomic meodel after his most stiking experiment an apha-scattering leading to discoveluy of nucleus . Bohr later on modified the atomci model on the balis of Planck's quantum theory of light and prosed the concept of stateonry cireclar orbits of quanise enrgy $\frac{nh}{2\pi}$ The colloection of fine lines in line spectrum led Sommerfeld to gae the idea fo elliptical orbits .He successfully explained the existence fo subshells and their number in a shell . The angular momentum of subshells was proposed as $\sqrt{l(l+120)}.\ \frac{h}{2\pi}$. The emission of a spectral line in atomic spectra was supposed to be due to the jump of elecrtron from one enrgy level to other .

The ninumum enrgy is given out when an elecrton jumps form one obit to oter form :

A. 2 to 1

B. 3 to 2

C. 4 to 3

D. 5 to 4

Answer: D

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6. Rutherford proposed the atomic meodel after his most stiking experiment an apha-scattering leading to discoveluy of nucleus . Bohr later on modified the atomci model on the balis of Planck's quantum theory of light and prosed the concept of stateonry cireclar orbits of quanise enrgy $\frac{nh}{2\pi}$ The colloection of fine lines in line spectrum led Sommerfeld to gae the idea fo elliptical orbits .He successfully explained the existence fo subshells and their number in a shell . The angular momentum of subshells was proposed as $\sqrt{l(l+120)}. \frac{h}{2\pi}$. The emission of a spectral line in atomic spectra was supposed to be due to the jump of elecrtron from one enrgy level to other .

An oxide on (N) has vapount density 46. The total number fo elcrrons in $92g$ of it are :

A. N

B. $46N$

C. $23N$

D. $92N$

Answer: C

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7. Rutherford proposed the atomic meodel after his most stiking experiment an apha-scattering leading to discoveluy of nucleus . Bohr later on modified the atomci model on the balis of Planck's quantum theory of light and prosed the concept of stateonry cireclar orbits of quanise enrgy $\frac{nh}{2\pi}$ The colloection of fine lines in line spectrum led Sommerfeld to gae the idea fo elliptical orbits .He successfully explained the existence fo subshells and their number in a shell . The angular momentum of subshells was proposed as $\sqrt{l(l+120)}.\frac{h}{2\pi}$. The emission of a spectral line in atomic spectra was supposed to be due to the jump of elecrtron from one enrgy level to other .

An oxide on (N) has vapount density 46. The total number fo elcrrons in $92g$ of it are :

A. 4

B. 3

C. 2

D. 1

Answer: A

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8. Find out the number of waves made by a bohr electron in one complete revolution in its third orbit.

A. 1

B. 2

C. 3

D. 4

Answer: C

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9. Bohr proposed his atomic model based on Planck's quantum theory and derived following relation for one electron system in $C.G.S$ units :

For H-atom : $r_n = n_2 \times r_2, E_n = E_1 \times Z^2, u_n = \frac{u_1}{n}$,

$r_1 = 0.529\overset{\circ}{A}, u_1 = 2.19 \times 10^8 cm/\sec$. ,

$E_1 = -13.6eV$.

For 1 elecron systems . ther than (H) .

$$r_n = \frac{n^2 \times r_{1H}}{X}, E_n = \frac{E_{1H} \times Z^2}{n^2}, u_n = \frac{u_{1H} \times Z}{n}$$

Later on de-Broglie propsed the dual nature of elecrron and put forwared his wave concept . The wavelnght of electron in an orbit was given by λ/μ.

The circumfenerc (in m0 if 3rd bohr obit in H-atom is :

A. 3.0×10^{-7}

B. 3.0×10^{-8}

C. 3.0×10^{-6}

D. $3. \times 10^{-9}$

Answer: D

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10. Bohr proposed his atomic model based on Planck's quantum theory and derived following relation for one electron system in $C.G.S$ units :

For H-atom : $r_n = n_2 \times r_2, E_n = E_1 \times Z^2, u_n = \frac{u_1}{n}$,

$r_1 = 0.529\overset{\circ}{A}, u_1 = 2.19 \times 10^8 cm/\sec$. ,

$E_1 = -13.6eV$.

For 1 elecron systems . ther than (H) .

$$r_n = \frac{n^2 \times r_{1H}}{X}, E_n = \frac{E_{1H} \times Z^2}{n^2}, u_n = \frac{u_{1H} \times Z}{n}$$

Later on de-Broglie propsed the dual nature of elecrron and put forwared his wave concept . The wavelnght of electron in an orbit was given by λ / μ.

The wavelnght 9 in m^(-1)) of moving electron in 3rd orbit of H-atom is :

A. 1.0×10^{-9}

B. 2.0×10^{-7}

C. 1.0×10^{-7}

D. 1.0×10^{-8}

Answer: A

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11. Bohr proposed his atomic model based on Planck's quantum theory and derived following relation for one electron system in $C.G.S$ units :

For H-atom : $r_n = n_2 \times r_2, E_n = E_1 \times Z^2, u_n = \frac{u_1}{n}$, $r_1 = 0.529\overset{\circ}{A}, u_1 = 2.19 \times 10^8 cm/\sec$. , $E_1 = -13.6eV$.

For 1 elecron systems . ther than (H) .

$$r_n = \frac{n^2 \times r_{1H}}{X}, E_n = \frac{E_{1H} \times Z^2}{n^2}, u_n = \frac{u_{1H} \times Z}{n}$$

Later on de-Broglie propsed the dual nature of elecrron and put forward his wave concept . The wavelnght of electron in an orbit was given by λ/μ.

The potential ergy fo electro in $3rd$ Bohr orbit of H-atom is :

A. $-2.4 = 2 \times 10^{-12} erg$

B. $-4.84 \times 10^{-12} erg$

C. $+4.84 \times 10^{12} erg$

D. $+2.42 \times 10^{-12} erg$

Answer: B

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12. Bohr proposed his atomic model based on Planck's quantum theory and derived following relation for one electron system in $C.\ G.\ S$ units :

For H-atom : $r_n = n_2 \times r_2, E_n = E_1 \times Z^2, u_n = \frac{u_1}{n}$,

$r_1 = 0.529\overset{\circ}{A}, u_1 = 2.\ 19 \times 10^8 cm / \sec$. ,

$E_1 = -13.\ 6eV.$

For 1 elecron systems . ther than (H) .

$$r_n = \frac{n^2 \times r_{1H}}{X}, E_n = \frac{E_{1H} \times Z^2}{n^2}, u_n = \frac{u_{1H} \times Z}{n}$$

Later on de-Broglie propsed the dual nature of elecrron and put forward his wave concept . The wavelnght of electron in an orbit was given by λ / μ.

The momentum of electron in $3rd$ Bohr orbit fo H-atom is :

A. $6.65 \times 10^{25} kgm \sec^{-1}$

B. $6.65 \times 10^{28} kgm \sec^{-1}$

C. $6.65 \times 10^{29} kgm \sec^{-1}$

D. $6.65 \times 10^{20} kgm \sec^{-1}$

Answer: A

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13. de-Broglie proposed dual natrue for elecrton by putting his famous equation $\lambda = \frac{\lambda}{\mu}$, Later on Heisenberg proposed uncertiainty principle as . $\Delta p. \Delta x \leq \frac{h}{2}\left(h = \frac{h}{2\pi}\right)$. On the contray particel natrue of electron wa estabilshed on the basis fo photoelectric effect . When a photon strikes the metal suface it given up its energy to the electro . Part of this enrgy (say W) is used by the electrons to escpe form the metal and the remaining imparts he kinetc enrgy $(1/2\mu^2)$ to photoeleton . The potential applied on the surface to reduce the velocity fo photoelecton to zero is known as stoppong potential .

With what velocity must an electon travel so that its momentum is equal to that of photon fo wavelength of $\lambda = 5200\text{Å}$?

A. $800ms^{-1}$

B. $1400ms^{-1}$

C. $400ms^{-1}$

D. $200ms^{-1}$

Answer: B

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14. de-Broglie proposed dual natrue for elecrton by putting his famous equation $\lambda = \frac{\lambda}{\mu}$, Later on Heisenberg proposed uncertiainty principle as . $\Delta p. \Delta x \leq \frac{h}{2}\left(h = \frac{h}{2\pi}\right)$. On the contray particel natrue of electron wa estabilshed on the basis fo photoelectric effect . When a photon strikes the metal suface it given up its energy to the electro . Part of this enrgy (say W) is used by the electrons to escpe form the metal and the remaining imparts he kinetc enrgy $(1/2\mu^2)$ to photoeleton . The potential applied on the surface to reduce the velocity fo photoelecton to zero is known as stoppong potential .

The wavelngth helium atom wheose speed is equal to its rms speed at 27° C`:

A. $7.29 \times 10^{-11} m$

B. $4.28 \times 10^{-10} m$

C. $5.31 \times 10^{-11} m$

D. $6.28 \times 10^{-11} m$

Answer: A

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15. de-Broglie proposed dual natrue for elecrton by putting his famous equation $\lambda = \frac{\lambda}{\mu}$, Later on

Heisenberg proposed uncertiainty principle as . $\Delta p.\, \Delta x \leq \frac{h}{2}\left(h = \frac{h}{2\pi}\right)$. On the contray particel natrue of electron wa estabilshed on the basis fo photoelectric effect . When a photon strikes the metal suface it given up its energy to the electro . Part of this enrgy (say W) is used by the electrons to escpe form the metal and the remaining imparts he kinetc enrgy $(1/2\mu^2)$ to photoeleton . The potential applied on the surface to reduce the velocity fo photoelecton to zero is known as stoppong potential .

With what potnetical should a gbeam of elctron be accelrated so that its wavelength becomes equal to $1.54\overset{\circ}{A}$?

A. $63.3V$

B. $6.33V$

C. $633V$

D. None of these

Answer: A

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16. de-Broglie proposed dual natrue for elecrton by putting his famous equation $\lambda = \frac{\lambda}{\mu}$, Later on Heisenberg proposed uncertiainty principle as . $\Delta p. \Delta x \leq \frac{h}{2}\left(h = \frac{h}{2\pi}\right)$. On the contray particel natrue of electron wa estabilshed on the basis fo photoelectric effect . When a photon strikes the metal suface it given up its energy to the electro . Part of this enrgy (say W) is used by the electrons to escpe form the metal and the remaining imparts he kinetc enrgy $(1/2\mu^2)$ to photoeleton . The potential applied on the surface to reduce the velocity fo photoelecton to zero is known as stoppong potential

The binding eenrgy fo electron in a metal is $250 kJmol^{-1}$. The threshold frequency of metal is :

A. $6 \times 10^{-12} \sec^{-1}$

B. $6 \times 10^{-14} \sec^{-1}$

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

D. $6 \times 10^{-12} \sec^{-1}$

Answer: B

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17. de-Broglie proposed dual natrue for elecrton by putting his famous equation $\lambda = \frac{\lambda}{\mu}$, Later on Heisenberg proposed uncertiainty principle as . $\Delta p. \Delta x \leq \frac{h}{2}\left(h = \frac{h}{2\pi}\right)$. On the contray particel natrue of electron wa estabilshed on the basis fo photoelectric effect . When a photon strikes the metal suface it given up its energy to the electro . Part of this enrgy (say W) is used by the electrons to escpe form the metal and the remaining imparts he kinetc enrgy $(1/2\mu^2)$ to photoeleton . The potential applied on the surface to reduce the velocity fo photoelecton to zero is known as stoppong potential .

If uncettainties in position and momentum of an electron are same them unceratinty in its velocity can be given by :

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

B. $\frac{\sqrt{u\lambda}}{4\pi m}$

C. $\geq \frac{\sqrt{h}}{2m^2}$

D. Either of these

Answer: D

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18. de-Broglie proposed dual natrue for elecrton by putting his famous equation $\lambda = \frac{\lambda}{\mu}$, Later on Heisenberg proposed uncertiainty principle as . $\Delta p. \Delta x \leq \frac{h}{2}\left(h = \frac{h}{2\pi}\right)$. On the contray particel natrue of electron wa estabilshed on the basis fo photoelectric effect . When a photon strikes the metal suface it given up its energy to the electro . Part of this enrgy (say W) is used by the electrons to escpe form the metal and the remaining imparts he kinetc enrgy $(1/2\mu^2)$ to photoeleton . The potential applied on the surface to reduce the velocity fo photoelecton to zero is known as stoppong potential

The element mlst commonly used in photoelectric cell is :

A. Na

B. Ba

C. Cs

D. Ni

Answer: C

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19. de-Broglie proposed dual natrue for elecrton by putting his famous equation $\lambda = \frac{\lambda}{\mu}$, Later on Heisenberg proposed uncertiainty principle as . $\Delta p. \Delta x \leq \frac{h}{2}\left(h = \frac{h}{2\pi}\right)$. On the contray particel natrue of electron wa estabilshed on the basis fo photoelectric effect . When a photon strikes the metal suface it given up its energy to the electro . Part of this enrgy (say W) is used by the electrons to escpe form the metal and the remaining imparts he kinetc enrgy $(1/2\mu^2)$ to photoeleton . The potential applied on the surface to reduce the velocity fo photoelecton to zero is known as stoppong potential .

The wavelength fo a golf ball weightin $200g$ and moving at a speed fo `5 meter //hr 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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20. The electrons in a poly -electronic atom are filled one by one in roder fo increasing energy level . The enrgy fo subsgells and orientation depeds upon the values of three quantum numbers 9 i.e., n. l and m respectively derived from Schrodinger wave equation . The different orbitals fo a subsshells however possess same energy level and are called degenerater orbitals but their enrgy level charges in presenct fo magentic field and the orbitals are non-degenerate . (A) spectral line is noticed it an electron jups form one level to tohere . the paramgnetic nature of eelment sis due to the presence of unpaired electron .

Which is each pair is most stable ion?

Cu^{+} or Cu^{2+} and Fe^{2+} or $Fe^{=}$.

A. Cu^{+}, Fe^{3+}

B. Cu^{2+}, Fe^{3+}

C. Cu^{2+}, Fe^{3+}

D. Cu^{+}, Fe^{3+}

Answer: B

Watch Video Solution

21. The electrons in a poly -electronic atom are filled one by one in roder fo increasing energy level . The enrgy fo subsgells and orientation depeds upon the values of three quantum numbers `9 i.e., n. l and m respectively) derived from Schrodinger wave equation . The different orbitals fo a subsshells however possess same energy level and are called degenerater orbitals but their enrgy level charges in presenct fo magentic field and the orbitals are non-degenerate . (A) spectral line is noticed it an electron jups form one level to tohere . the paramgnetic nature of eelment sis due to the presence of unpaired electron .

The umner of upaired electrons in cr atoms is :

A. 2

B. 3

C. 5

D. 6

Answer: D

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22. The electrons in a poly -electronic atom are filled one by one in roder fo increasing energy level . The enrgy fo subsgells and orientation depeds upon the values of three quantum numbers 9 i.e., n. l and m respectively) derived from Schrodinger wave equation .

The different orbitals fo a subsshells however possess same energy level and are called degenerater orbitals but their enrgy level charges in presenct fo magentic field and the orbitals are non-degenerate . (A) spectral line is noticed it an electron jups form one level to tohere . the paramgnetic nature of eelment sis due to the presence of unpaired electron .

The element which has as many as s electrons as (p) electrons by belong to (III) period is ?

A. O

B. Mg

C. Al

D. C

Answer: B

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23. The electrons in a poly -electronic atom are filled one by one in roder fo increasing energy level . The enrgy fo subsgells and orientation depeds upon the values of three quantum numbers 9 i.e., n. l and m respectively derived from Schrodinger wave equation . The different orbitals fo a subsshells however possess same energy level and are called degenerater orbitals but their enrgy level charges in presenct of magentic field and the orbitals are non-degenerate . (A) spectral line is noticed it an electron jups form one level to tohere . the paramgnetic nature of eelment sis due to the presence of unpaired electron .

The total mangetic moment fo Ni^2 ion is :

A. $\sqrt{2}BM$

B. $\sqrt{8}BM$

C. $\sqrt{15}BM$

D. $\sqrt{12}BM$

Answer: B

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24. The electrons in a poly -electronic atom are filled one by one in roder fo increasing energy level . The enrgy fo subsgells and orientation depeds upon the values of three quantum numbers 9 i.e., n. l and m respectively derived from Schrodinger wave equation . The different orbitals fo a subsshells however possess same energy level and are called degenerater orbitals but their enrgy level charges in presenct of magentic field and the orbitals are non-degenerate . (A) spectral line is noticed it an electron jups form one level to tohere . the paramgnetic nature of eelment sis due to the presence of unpaired electron .

The number of spherical and angular nodes in $2p$ orbitals are :

A. 1, 1

B. 2, 1

C. 1, 0

D. 0, 1

Answer: D

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25. The electrons in a poly -electronic atom are filled one by one in roder fo increasing energy level . The enrgy fo subsgells and orientation depeds upon the values of three quantum numbers 9 i.e., n. l and m respectively derived from Schrodinger wave equation .

The different orbitals fo a subsshells however possess same energy level and are called degenerater orbitals but their enrgy level charges in presenct fo magentic field and the orbitals are non-degenerate . (A) spectral line is noticed it an electron jups form one level to tohere . the paramgnetic nature of eelment sis due to the presence of unpaired electron .

The possible muber of spectral lines when an eelcron can jump $5th$ shell to 2nd shell is :

A. 4

B. 2

C. 3

D. 6

Answer: D

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26. The electrons in a poly -electronic atom are filled one by one in roder fo increasing energy level . The enrgy fo subsgells and orientation depeds upon the values of three quantum numbers 9 i.e., n. l and m respectively derived from Schrodinger wave equation . The different orbitals fo a subsshells however possess same energy level and are called degenerater orbitals but their enrgy level charges in presenct of magentic field and the orbitals are non-degenerate . (A) spectral line is noticed it an electron jups form one level to to here . the paramgnetic nature of eelment sis due to the presence of unpaired electron .

The coarrect orde for menry levels in H-atom is ?

A. $3s = 3p = 3d = \ > 2s$

B. $3d > 3p > 3s > 2s$

C. $3s > 3p > 3s > 2s$

D. $3d > 3p > 3s = 2s$

Answer: A

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27. The electrons in a poly -electronic atom are filled one by one in roder fo increasing energy level . The enrgy fo subsgells and orientation depeds upon the values of three quantum numbers 9 i.e., n. l and m respectively derived from Schrodinger wave equation . The different orbitals fo a subsshells however possess same energy level and are called degenerater orbitals but their enrgy level charges in presenct fo magentic field and the orbitals are non-degenerate . (A) spectral line is noticed it an electron jups form one level to tohere . the paramgnetic nature of eelment sis due to the presence of unpaired electron .

which element has 18 electrons in its outermost shell ?

A. Cu

B. Pd

C. Cd

D. Te

Answer: B

Watch Video Solution

28. The electrons in a poly -electronic atom are filled one by one in roder fo increasing energy level . The enrgy fo subsgells and orientation depeds upon the values of three quantum numbers 9 i.e., n. l and m respectively derived from Schrodinger wave equation .

The different orbitals fo a subsshells however possess same energy level and are called degenerater orbitals but their enrgy level charges in presenct fo magentic field and the orbitals are non-degenerate . (A) spectral line is noticed it an electron jups form one level to tohere . the paramgnetic nature of eelment sis due to the presence of unpaired electron .

Total number of valence electrons in NH_4^+ is :

A. 9

B. 8

C. 6

D. 11

Answer: B

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29. The electrons in a poly -electronic atom are filled one by one in roder fo increasing energy level . The enrgy fo subsgells and orientation depeds upon the values of three quantum numbers ` 9 i.e., n. l and m respectively derived from Schrodinger wave equation . The different orbitals fo a subsshells however possess same energy level and are called degenerater orbitals but their enrgy level charges in presenct fo magentic field and the orbitals are non-degenerate . (A) spectral line is noticed it an electron jups form one level to tohere . the paramgnetic nature of eelment sis due to the presence of unpaired electron .

The ion having maximum number of unpaired eelctrons is :

A. Mg^{2+}

B. Ti^{3+}

C. V^{3+}

D. Fe^{2+}

Answer: D

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30. The electrons in a poly -electronic atom are filled one by one in roder fo increasing energy level . The enrgy fo subsgells and orientation depeds upon the values of three quantum numbers 9 i.e., n. l and m respectively derived from Schrodinger wave equation . The different orbitals fo a subsshells however possess same energy level and are called degenerater orbitals but their enrgy level charges in presenct fo magentic field and the orbitals are non-degenerate . (A) spectral line is noticed it an electron jups form one level to tohere . the paramgnetic nature of eelment sis due to the presence of unpaired electron .

p^{3-} is isloelectronic with :

A. N^{3-}

B. As^{3+}

C. Cl^{-}

D. F^{-}

Answer: C

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31. The hydrogen -like species Li^{2+} is in a spherically symmetric state S_1 whth one radisal node . Upon absorbing light the ion undergoes transitoj ot a state S_2 has one radial node and its energy is equal to the groun sate energy of hhe hydrogen atom.

The state S_1 is :

A. $1s$

B. $2s$

C. $2p$

D. $3s$

Answer: B

Watch Video Solution

32. The hydrogen -like species Li^{2+} is in a spherically symmetric state S_1 whth one radisal node . Upon absorbing light the ion undergoes transitoj ot a state S_2 has one radial node and its enrgy is equal to the groun sate energy of hhe hydrogen atom.

Energy fo the (S_1) in units fo the hydrogen atom groun sate enrgy is :

A. 0.75

B. 1.50

C. 2.25

D. 4.50

Answer: C

Watch Video Solution

33. The hydrogen -like species Li^{2+} is in a spherically symmetric state S_1 whth one radisal node . Upon absorbing light the ion undergoes transitoj ot a state S_2 has one radial node and its enrgy is equal to the groun sate energy of hhe 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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Exercise 8

1. Statement : The 3p-orbital has higher energy level than 3s in He^{+} ion.

Explanation: The energy of an orbital depends upon n and l.

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: C

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2. Statement : Specific charge of α-particles is twice to that of proton .

Explanation : Specific charge is given by e/m

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: B

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3. Statement : d-orbital are five fold non-degenerate in presence of magnetic field.

Explanation : In presence of magnetic field, the energy of orbitals becomes altogether different.

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: C

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4. Statement : electromangetic radiations will be emitted for the transtition of $2p$ to$2s$ orbitals in H-atom .

Explanation : Both have same energy level and thus no transition .

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: B

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5. Statement : The ψ_{640} represents an orbital .

Explanation : The orbital may be $6g$.

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: D

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6. Statement : Monochromatic X-rays fall on lighter elements such as carbon and show scattering and effect is known as Compoton effect .

Explanation : λ scattered light is always lower than $lmbda$ incident light .

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: A

Watch Video Solution

7. Statement : $._{24} Cr$ has more paramangetic nature than $._{25} Mn$.

Explanation : Cr has more number of unpaired electron than Mn.

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: C

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8. Statement : The possible number of electrons in a subshell is (4l + 2)`.

Explanation : The possible number of orientaions of a subshell are (2 l+ 1).

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: C

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9. Statement : Aufbau rule is violated in writing electronic configurations of Pd.

Explanation: Pd show diamagnetic nature.

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: C

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10. Humphry series discovered in $H-\text{atomic}$ spectra has lowest energy radiations among all series.

Lowest state for this series is $n_1 = 6$.

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: C

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11. Assertion (A) : Hydrogen has only one electron in its 1s orbital but it produces several spectral lines.

Reason (R) : There are many excited energy levels available in H atoms.

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: C

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12. Statement : Wave number of a spectral line for an electronic transition is quantised .

Explanation : Wave number is directly proportional to the velocity of electron undergoing the transition .

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: D

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13. Statement : The tendency of a atom to reach a stable electronic arrangement may be satisfied by the transfer of electrons form one atom to another.

Explanation : Loss and gain of electron constitute reduction and oxidation respectively .

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: D

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14. Statement : For $n=3, l$ may be $0, 1$ and $2,$ and (m) may be $0, 0, \pm 1,$ and $0, \pm 1$ and $\pm 2.$

Explanation : For each value of (n) there are 0 to (n-1) possible values of l, and for each value of l there are (0) to ± 1 values of (m).

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: C

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15. Statement : Number of waves in an orbit of atom is equal to number of that orbit .

Explanation : Number of waves in an robit is derived by $\frac{2\pi r_n}{\lambda}$.

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: C

Watch Video Solution

16. Statement : wavelength of (I) line of Humphry series is more than (I) line of Lyman series in H-atom

Explanation : $\Delta E = \frac{hc}{\lambda}$.

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: C

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17. Statement : All s-orbitla in H-atom corresponds to a non-zero probability density at nucleus .

Explanation : The probability density is given by ψ^2 and $\psi \propto e^{Z2/2a_0}$.

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: C

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18. Statement : The energy radiated per unit volume , i.e., energy density in block body radiation depends upon the temperature .

Explanation : Green light in never emitted in black body radiations .

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: D

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19. Statement : The plot of atomic number (y -axis) versus number of neutrons (x -axis) for stable nuclei shows a curvature towards x-axis fron the line of 45° slope as the atomic number is increased .

Explanation : proton -proton electrostatic repulsions begin to overcome attracive forces involving protons and neutrons in heavier nuclides.

A. S is correct but E is wrong

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S

D. Both S and E are correct but E is not correct explanation of S

Answer: A

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Exercise 9

1. A monoatomic (X) ion has a charge of +3 the nucleus of the ion has a mass number of 45. the number of neutrons in the nucleus is 1.14 times that of number protons. Find out :

(a) Number of electrons in atom x.

(b) Number of electrons in X^{3+} ion.

(c) Configurations of X, X^{3+} and X^{1+} ion.

(d) Suggest which of the these $\left(X, X^{3+}\right.$ and $\left.X^{+}\right)$ are paramagentic

(e) the Total magnetic moment of X^{+} ion.

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2. Two $1.0g$ carbon disks $1.00cm$ apart have opposite charges of equal magnitude such that there is a $1.00 \times 10^{-5}N$ force between then . Calculate the ration of excess electron between them . Calculate the ration charged disk.

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3. How much energy will be released when a sodium ion and a chloride ion, originally at infinite distance are brought together to a distance of $2.76Å$ (the shortest distance fo approach in a sodium chloride crystal ? Assume that the ions act as point charges , each with a mangitude of $1.60 \times 10^{-19}C$ (the electronic charge)

Also if lattice enrgy of Nacl is 185 kcal , how the lower value obtained per mole by above calculation can be explained ?

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4. The eyes of a reptille pass a visual signal to the brain when the visual receptors are struck by photons of wavelength 859 nm. If an energy of $3.15 \times 10^{-14} J$ is required to trip the signal, what is minimum number of photons that must strike the receptor $(h = 6.6 \times 10^{-34})$?

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5. The dissociation energy of H_2 is $430.53 kJmol^{-1}$, If H_2 is of dissociated by illumination with radiation of wavelength $253.7 nm$, the fraction of the radiant energy which will be converted into ikinetic energy is given by

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6. O_2 undergoes photochemical dissociation into one normal oxygen atom and one excited oxygen atom. Excited oxygen atom is $1.967 eV$ more energetic than normal . The dissociation of O_2 into two normal atoms of oxygen required $498 kJmol^{-1}$, what is the maximum wavelength effective for photochemical dissociation of O_2?

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7. A certain dye absorbs light of $\lambda = 4000 Å$ and then fluresces light of $5000 Å$. Assuming that under given conditions 50% of the absorbed energy is re-emitted out as fluorescence, calculate the ratio of number of quanta emitted out to the number of quanta absorbed.

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8. A photon of $300nm$ is abosorbed by a gas and then re-emits two photons . One re-emitted photon has wavelength $496nm$. Caluclate energy of other photon re-emitteed out .

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9. Calculate the wavelength of first line of Lyman series of ten times ionised sodium atom $(Z = 11)$ and compare with the wavelength of fire line of Balmer series of (H) atom .

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10. What is the difference in energy between $1s$ and $2p$-orbitals in the hydorgen atom ? In the X-ray spectrum of Cu , radiation of 1.54Å wavelength is emitted when an electron charges form $2p$ to 1s-orbital . What is the energy difference between these orbitals in copper ?

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11. The ionisation energy of a H-like atom is $4R_h$

a. Calculate the wavelength of radiation emitted when an electron jumps from the first excited state to the ground state

b. What is the radius of first orbit of this atom?

Given $1R_h = 2.18 \times 10^{-19} J$

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12. Calculate frequency, energy and wavelength of the radiation corresponding to the speciral line of the lowest frequency in lyman series in the spectrum of a hydrogen atom .Also calculate the energy for the coresponding line in the spectrum of Li^{2+}. $(R_H = 109677 cm^{-1}, c = 3 \times 10^8 ms^{-1}, Z = 3)$

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13. The IE_1 of H is $13.6 eV$. It is exposed to electromagnetic waves of 1028Å and gives out induced radiation. Find out orbit of these induced radiation.

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14. $1.8g$ hydrogen atoms are excited by a radiation. The study of species indicates that 27% of the atom are in third energy level and 15% of atom in second energy level and the rest in ground state. If IP of H is $13.6eV$, calculate

a. Number of atoms present in first and third energy levels

b. Total energy involved when all the atoms return to the ground state.

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15. Consider three electron jumps described below for the hydrogen atom

X: n=3 to n=1

Y: n=4 to n=2

Z: n=5 to n=3

(a) The photon emited in which trasition X, Y or (Z) will have shortest wavelength ?

(b) For which transition will the electron experience the longest charge in robit radius ?

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16. A series of lines in the spectrum of atomic H lies at wavelengths $656.46, 486.27, 434.17, 410.29nm$. What is the wavelength of the next line in this series?

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17. A hydrogen-like atom (atomic number Z) is in a higher excited state of quantum number n.This excited atom can make transition to the first excited state by succesively emitting two photons of energies $10.20 eV$ and $17.00 eV$ respectively. Alternatively, the atom from the same excited state can make a transition to the second excited state by successively emitting two photons of energies $4.25 eV$ and $5.95 eV$ respectively. Determine the values of n and z

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18. Calculate the Rydberg constant R_H if He^+ ions are known to have the wavelength difference between the from (of the longest wavength) lines fo Balmer and Lyman series equal to $133.7nm$.

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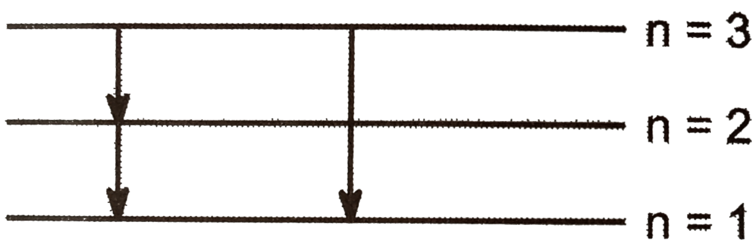
19. Consider the follwoing two elerctronic transition possibilites in a hydrogen atom as pictured below :



(1) The electron drops from third Bohr's orbit to second Bohr's obit followed with the next transition from

second to first Bohr's orbit .

(2) The electron drops from third Bohr's orbit to first Bohr's orbit directly .

Show that :

(a) The sum of the enrgies for the transitions $n=3$ to $n=2$ and $n=2$ to $n=1$ is equal to the energy of transiton for $n=3$ to $n=1$.

(b) Are wavelengths and frequencies of the emitted spectrum also additive in the same way as their energies are ?

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20. The angular momentum of electron in a Bohr's orbit of H atom is $4.2178 \times 10^{-34} kgm^2 s^{-1}$. Calculate the wavelength of the spectral line when the electrton falls from this level to the next lower level.

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21. Find the quantum number n corresponding to the excited state of $He^{\oplus}$ ion if on transition to the ground state that ion emits two photon in succession with wavelength 108.5 and $30.4nm$

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22. Calculate the angular frequency of an electron occupying the second Bohr orbit of $He^{\oplus}$ ion

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23. Two hydrogen atom collide Collide head on and end up with zero kinetic energy. Each atom then emit a photon of wavelength $121.6nm$. Which transition leads to the wavelength? How fast were the hydrogen atoms travelling before collision?

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24. The kinetic energy of an electron in H-like atom is $6.04eV$. Find the area of the third bohr orbit to which this electron belongs. Also report the atom.

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25. How many spectral linears are emitted by atomic hydrgen excited to the nth energy level ?

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26. The hydrogen atom in the ground state is excited by mass of monchromatic radiations of wavelength $\lambda \text{Å}$. The resulting spectrum consists fo maximum 15 different lines . What is the value of λ ? ($R_H = 109737 cm^{-1}$).

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27. A single electron orbits around a stationary nucleus of charge $+Ze$ where Z is a constant and e is the magnitude of electronic charge. It requires 47.2 eV to excite the electron from the second bohr orbit to the third bohr orbit

a. Find the value of Z

b. Find the energy required to excite the electron from $n=3$ to $n=4$

c. Find the wavelength of radiation required to remove the electron from the second bohr orbit to infinity

d. Find the kinetic energy, potential energy and angular momentum of the electron in the first orbit

e. Find the ionisation energy of above electron system in electron-volt.

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28. Determine de-Broglie wavelength of an electron having kinetic energy of 1.6×10^{-6} erg. $\left(m_c = 9.11 \times 10^{-28} g, h = 6.62 \times 10^{-27} erg - \text{sec}\right)$.

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29. Show that de-Broglie wavelength of electron acceleratated through (V) volt is nearly given by :

$$\lambda(\text{in}\text{Å}) = \left[\frac{150}{V}\right]^{1/2}.$$

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30. Calculate the momentum of electron moving with $1/3$ 3rd velocity of light .

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31. Calculate the accelerating potential that must be imparted to a proton beam to give it an effective wavelength of $0.0005nm$.

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32. An electron in a hydrogen like atom is in an excited state3 . It has a total energy of -3 4 eV. Calculate :

(a) The kinetic energy of electron .

(b) The de-Broglie wavelength of electron . ($h = 6.6 \times 10^{023}, m_e = 9.108 \times 10^{-31} kg)$

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33. A green ball weighs $75g$ and comes travelling towards you at $400cm / \sec$. A photon of light emitted form green ball has wavelength of 5×10^{-5} cm . Assuming that the error in the position of ball is the same as the wavelength of itself calculate the error in momentum of the green ball .

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34. Stationary $He^{\oplus}$ ion emits a photon corresponding to the first line of the lyman series. The photon then emitted strikes a H atom in the ground state. Find the velocity of the photoelectron ejected out of the hydrogen atom. The value of R is $1.097 \times 10^7 m^{-1}$

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35. 2.4 mole of H_2 sample was taken . In one experiment 60% of the sample was exposed to conitnuous radiations of frequency $4.47 \times 10 Hz$, of which all he electrons are removed from the atom . In another experiment remaining sample was irradiated with light of wavelength $600 Å$, when all the electrons are removed from the surface , Calculate the ratio of maximum velocity of the ejected electron in the two cases . Also report the velocity of ejected electron in each case . Assume that ejected electrons does not interact wih any photon . (Ionization potential of $H = 13.6eV$).

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36. what is he maximum precision with which the momentum of an electron can be known of the uncertainity in the position fo electron is $\pm 0.001 \text{Å}$? Will there be any problem in describing the momentum of it has a value of $\frac{h}{2\pi a_0}$, where a_0 is .

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37. The photoelectric emission requires a threshold frequency v_0 . For a certian metal $\lambda_1 = 2200\text{Å}$ and $\lambda_2 = 1900\text{Å}$ produce electrons with a maximum kinetic enrgy KE_1 and KE_2, if $KE_2 = 2KE_1$, calculate v_0 and corresponding λ_0,

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38. Point out the anugular momentum of an electron in, (a) $4s$ orbital (b) $3p$ orbital (c) 4^{th} orbit)according to Bohr model)

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