Chapter 02

# Atomic Structure

## JEE-FLASHBACK

### JEE MAINS QUESTION

**Q.1** Which of the following is the energy of a possible excited state of hydrogen?

**[JEE-Main 2015]**

(1) –3.4 eV (2) +6.8 eV

(3) +13.6 eV (4) –6.8 eV

**Q.2** What is the value of energy in kJ/mole for a light with $\lambda$ = 633nm, c = $3 \times 10^8$ m/sec

$N_A = 6.02 \times 10^{23}$; h = $6.63 \times 10^{-34}$ Js

**[JEE-Main 2016]**

**Q.3** A 50 watt bulb emits monochromatic red light of wavelength of 795 nm. The number of photons emitted per second by the bulb is x × $10^{20}$. The value of is ____.

[Given : h = $6.63 \times 10^{-34}$ Js c = $3.0 \times 10^8$ $ms^{-1}$]

**[JEE-Mains 2017]**

**Q.4** A metal surface is exposed to 500 nm radiation. The threshold frequency of the metal for photoelectric current is $4.3 \times 10^{14}$ Hz. The velocity of ejected electron is ____ × $10^5$ $ms^{-1}$ (Nearest integer)

[Use : h = $6.63 \times 10^{-34}$ Js, $m_e = 9.0 \times 10^{-31}$ kg]

**[JEE-Mains 2018]**

**Q.5** The ground state energy of hydrogen atom is –13.6 eV. The energy of second excited state $He^+$ ion in eV is : **[JEE Main 2019]**

(1) –54.4 (2) –6.04

(3) –3.4 (4) –27. 2

**Q.6** Heat treatment of muscular pain involves radiation of wavelength of about 900 nm. Which spectral line of H-atom is suitable for this purpose ? **[JEE Main 2019]**

[RH = $1 \times 10^5$ $cm^{-1}$, h = $6.6 \times 10^{-34}$ Js, c = $3 \times 10^8$ $ms^{-1}$]

(1) Paschen, $5 \rightarrow 3$ (2) Balmer, $\infty \rightarrow 2$

(3) Lyman, $\infty \rightarrow 1$ (4) Paschen, $\infty \rightarrow 3$

**Q.7** The de Broglie wavelength ($\lambda$) associated with a photoelectron varies with the frequency ($\nu$) of the incident radiation as, [$\nu_0$ is threshold frequency] : **[JEE Main 2019]**

(1) $\lambda \propto \frac{1}{(\nu - \nu_0)^{\frac{1}{2}}}$ (2) $\lambda \propto \frac{1}{(\nu - \nu_0)^{\frac{1}{4}}}$

(3) $\lambda \propto \frac{1}{(\nu - \nu_0)}$ (4) $\lambda \propto \frac{1}{(\nu - \nu_0)^{\frac{3}{2}}}$

**Q.8** What is the work function of the metal if the light of wavelength 4000 Å generates photoelectrons of velocity $6 \times 10^5$ $ms^{-1}$ form it ?

(Mass of electron = $9 \times 10^{-31}$ kg

Velocity of light = $3 \times 10^8$ $ms^{-1}$

Planck's constant = $6.626 \times 10^{-34}$ Js

Charge of electron = $1.6 \times 10^{-19}$ $JeV^{-1}$)

**[JEE Main 2019]**

(1) 2.1 eV (2) 3.1 eV (3) 0.9 eV (4) 4.0 eV

**Q.9** If the de Broglie wavelength of the electron in nth Bohr orbit in a hydrogenic atom is equal to 1.5 $\pi a_0$($a_0$ is Bohr radius), then the value of n/z is: **[JEE Main 2019]**

(1) 0.40 (2) 0.75 (3) 1.0 (4) 1.50

**Q.10** The quantum number of four electrons are given below : **[JEE Main 2019]**

I. n = 4, l = 2, ml = – 2, ms = $-\frac{1}{2}$

II. n = 3, l = 2, ml = 1, ms = $+\frac{1}{2}$

III. n = 4, l = 1, ml = 0, ms = $+\frac{1}{2}$

IV. n = 3, l = 1, ml = 1, ms = $-\frac{1}{2}$

(1) I < III < II < IV (2) IV < III < II < I

(3) I < II < III < I (4) IV < II < III < I

**Q.11** If p is the momentum of the fastest electron ejected from a metal surface after the irradiation of light having wavelength $\lambda$, then for 1.5 p momentum of the photoelectron, the wavelength of the light should be : (Assume kinetic energy of ejected photoelectron to be very high in comparison to work function) : **[JEE Main 2019]**

(1) $\frac{3}{4}\lambda$ (2) $\frac{4}{9}\lambda$ (3) $\frac{1}{2}\lambda$ (4) $\frac{2}{3}\lambda$

**Q.12** For any given series of spectral lines of atomic hydrogen, let $\Delta\bar{\nu} = \bar{\nu}_{max} - \bar{\nu}_{min}$ be the difference in maximum and minimum frequencies in $cm^{-1}$. The ratio $\Delta\bar{\nu}_{Lyman} / \Delta\bar{\nu}_{Balmar}$ is: **[JEE Main 2019]**

(1) 4 : 1 (2) 5 : 4 (3) 9 : 4 (4) 27 : 4

**Q.13** Which one of the following about an electron occupying the 1s orbital in a hydrogen atom is incorrect ? (The Bohr radius is represented by $a_0$) **[JEE Main 2019]**

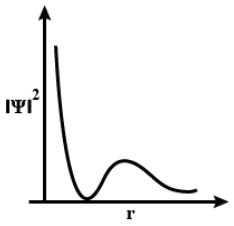
(1) The electron can be found at a distance $2a_0$ from the nucleus

(2) The total energy of the electron is maximum when it is at a distance a0 from the nucleus.

(3) The magnitude of potential energy is double that of its kinetic energy on an average.

(4) The probability density of finding the electron is maximum at the nucleus.

**Q.14** The graph between $|\psi|^2$ and r(radial distance) is shown below. This represents: **[JEE Main 2019]**




(1) 1s orbital (2) 3s orbital

(3) 2s orbital (4) 2p orbital

**Q.15** The ratio of the shortest wavelength of two special series of hydrogen spectrum is found to be about 9. The spectral series are : **[JEE Main 2019]**

(1) Paschen and Pfund

(2) Balmer and Brackett

(3) Lyman and Paschen

(4) Brackett and Pfund

**Q.16** Amongst the following which is not postulate of Dalton's atomic theory **[JEE Main 2020]**

(1) Matter is formed of indivisible atoms

(2) Under identical conditions of pressure and temperature gases combines and give gaseous products in simple volume ratio.

(3) During chemical reactions atoms remains conserved and only pass through rearrangement.

(4) Some atoms have some properties including atomic mass

**Q.17** Given for H-atom

$$\bar{\nu} = R_H\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$

Select the correct options regarding this formula for Balmer series. **[JEE Main 2020]**

(1) $n_1 = 2$

(2) Ionization energy of H atom can be calculated from above formula.

(3) $\lambda_{maximum}$ is for $n_z = 3$.

(4) If $\lambda$ decreases then spectrum line will conserve.

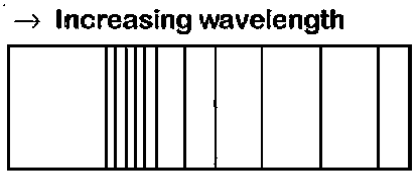
**Q.18** Determine Bohr's radius of $Li^{2+}$ ion for n = 2. Given (Bohr's radius of H-atom = $a_0$ **[JEE Main 2020]**

(1) $\frac{3a_0}{4}$ (2) $\frac{4a_0}{3}$ (3) $\frac{a_0}{3}$ (4) $\frac{16a_0}{9}$

**Q.19** The figure that is not a direct manifestation of the quantum nature of atoms is

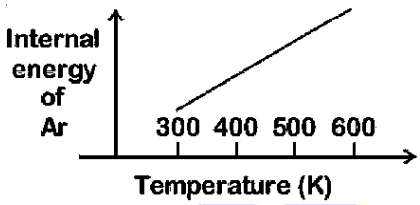
**[JEE Main 2020]**

(1)




Absorption spectrum

(2)

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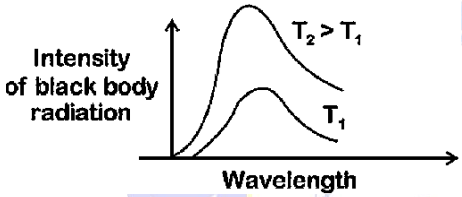


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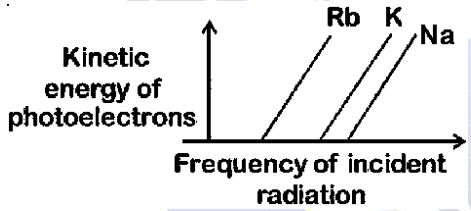



**Q.20** The number of subshells associated with n = 4 and m = –2 quantum numbers is

**[JEE Main 2020]**

(1) 2 (2) 8 (3) 4 (4) 16

**Q.21** The work function of sodium metal is $4.41 \times 10^{-19}$ J. If photons of wavelength 300 nm are incident on the metal, the kinetic energy of the ejected electron will be ($h = 6.63 \times 10^{-34}$ Js; $c \times 10^8$ m/s)_____ $\times 10^{-21}$ J.

**[JEE Main 2020]**

**Q.22** The correct statement about probability density (except at infinite distance from nucleus) is

**[JEE Main 2020]**

(1) It can never be zero for 2s orbital

(2) It can be zero for 3p orbital

(3) It can be zero for 1s orbital

(4) It can be negative for 2p orbital

**Q.23** The de Broglie wavelength of an electron in the 4th Bohr orbit is

**[JEE Main 2020]**

(1) $4\pi a_0$ (2) $2\pi a_0$ (3) $8\pi a_0$ (4) $6\pi a_0$

**Q.24** A proton and a $Li^{3+}$ nucleus are accelerated by the same potential. If $\lambda_{Li}$ and $\lambda_P$ denote the de Broglie wavelengths of $LI^{3+}$ and proton respectively, then the value $\frac{\lambda_{Li}}{\lambda_P}$ of is $x \times 10^{-1}$. The value of is ____.

[Rounded off to the nearest integer] [Mass of $Li^{3+}$ = 8.3 mass of proton] **[JEE Main 2021]**

**Q.25** Electromagnetic radiation of wavelength 663 nm is just sufficient to ionize the atom of metal A. The ionization energy of metal A in k J $mol^{-1}$ is _____. (Rounded off to the nearest integer)

[$h = 6.63 \times 10^{-34}$ Js, $c = 3.00 \times 10^8$ $ms^{-1}$, $N_A = 6.02 \times 10^{23}$ $mol^{-1}$] **[JEE Main 2021]**

**Q.26** A ball weighing 10 g is moving with a velocity of 90 $ms^{-1}$. If the uncertainty in its velocity is 5%, then the uncertainty in its position is ____ $\times 10^{-33}$ m. (Rounded off to the nearest integer)

[Given: $h = 6.63 \times 10^{-34}$ Js] **[JEE Main 2021]**

**Q.27** Arrange the following metal complex/ compounds in the increasing order of spin only magnetic moment. Presume all the three, high spin system. (Atomic numbers Ce = 58, Gd = 64 and Eu = 63.) **[JEE Main 2021]**

(a) $(NH_4)_2[Ce(NO_3)_6]$ (b) $Gd(NO_3)_3$ and (c) $Eu(NO_3)_3$

(1) (b) < (a) < (c) (2) (c) < (a) < (b)

(3) (a) < (b) < (c) (4) (a) < (c) < (b)

**Q.28** A certain orbital has no angular nodes and two radial nodes. The orbital is:

**[JEE Main 2021]**

(1) 2 s (2) 3 s (3) 3 p (4) 2 p

**Q.29** For which of the following orbital, number of angular node and radial node are each 2.

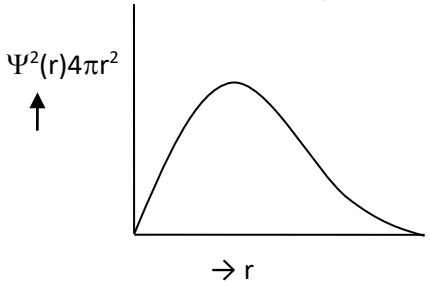
**[JEE Main – 2021]**

(1) 5d (2) 4f (3) 3p (4) 2s

**Q.30** Which of the following probability $4\pi r^2$. Distribution curve is correct for 3s orbital?

**[JEE Main – 2021]**

(1)

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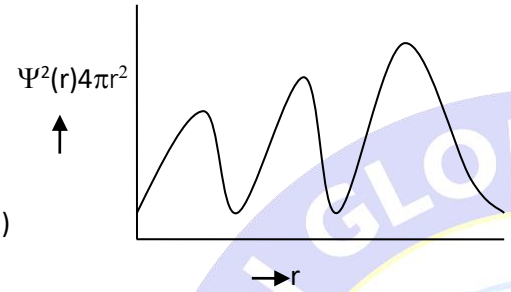


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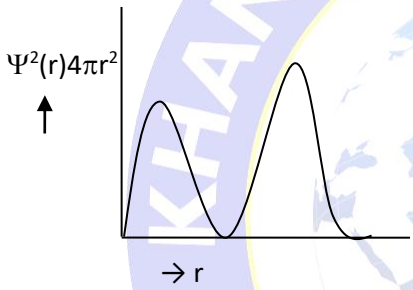


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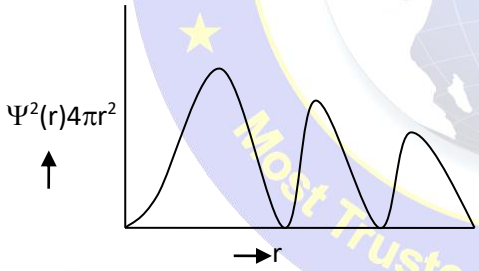



**Q.31** Given below are two statements:

**[JEE Main – 2021]**

**Statements I:** Bohr's theory accounts for the stability and line spectrum of $Li^+$ ion.

**Statements II:** Bohr's theory was unable to explain the splitting of spectral lines in the presence of a magnetic field.

In the light of the above statements choose the most appropriate answer form the option given below

(1) Both statement I and statement II are true.

(2) Statement I is false but statement II are true.

(3) Both statement I and statement II are false.

(4) statement I is true but statement II are false.

**Q.32** The value of magnetic quantum number of the outermost electron of $Zn^+$ ion is____.

**[JEE Main – 2021]**

**Q.33** If the Thomson model of the atom was correct then the result of Rutherfords gold foil experiment would have been:

**[JEE Main – 2021]**

(1) All of the $\alpha$ - particles pass through the gold foil without decrease on speed

(2) $\alpha$- particles are deflected over a wide range of angles

(3) All $\alpha$ - particles get bounced back by 180°

(4) $\alpha$ - particles pass through the gold foil deflected by small angles with reduced speed

**Q.34** Given below are two statements

**[JEE Main – 2021]**

**Statements I:** Rutherford's gold foil experiment cannot explain the line spectrum of hydrogen atom

**Statements II:** Bohr's model of hydrogen atom contradicts Heisenberg's uncertainty principle

In the light of the above statements choose the most appropriate answer form the option given below:

(1) Statement I is false but statement II are true.

(2) Statement I is true but statement II are False.

(3) Both statement I and statement II are false.

(4) Both statement I and statement II are true.

**Q.35** Given below are two statements

**[JEE Main – 2021]**

**Statements I :** According to Bohr's model of an atom, qualitatively the magnitude of velocity of electron increases with decrease in positive charges on the nucleus as there is no strong hold on the electron by the nucleus

**Statements II :** According to Bohr's model of an atom, qualitatively the magnitude of velocity of electron increases with decrease in principle quantum number. In the light of the above statements. Choose the most appropriate answer from the options given below:

(1) Both statement I and statement II are false.
(2) Both statement I and statement II are true.
(3) Statement I is false but statement II are true.
(4) statement I is true but statement II are false.

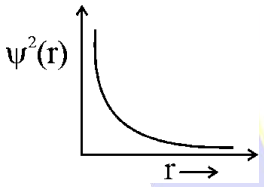
**Q.36** Ge(Z = 32) in its ground state electronic configuration has x completely filled orbitals with $m_l = 0$. The value of is ____.

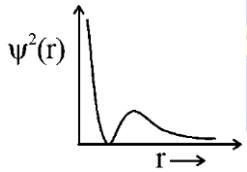
**[JEE Main – 2021]**

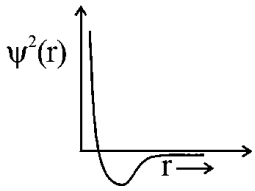
**Q.37** If the work function of a metal is $6.63 \times 10^{-19}$ J, the maximum wavelength of the photon required to remove a photoelectron from the metal is _____ nm. (Nearest integer)
[Given: $h = 6.63 \times 10^{-34}$ J s, and $c = 3 \times 10^8$ m $s^{-1}$]

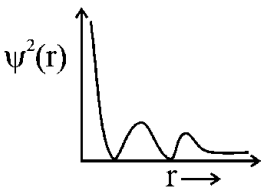
**[JEE Main 2022]**

**Q.38** Which of the following is the correct plot for the probability density $\psi^2(r)$ as a function of distance 'r' of the electron form the nucleus for 2s orbital? **[JEE Main 2022]**

(1) 


(2) 


(3) 


(4) 


**Q.39** When the excited electron of a H atom from n = 5 drops to the ground state, the maximum number of emission lines observed are _____

**[JEE Main 2022]**

**Q.40** Consider an imaginary ion $^{48}_{22}X^{3-}$. The nucleus contains 'a'% more neutrons than the number of electrons in the ion. The value of 'a' is _____. [nearest integer] **[JEE Main 2022]**

**Q.41** The correct decreasing order of energy, for the orbitals having, following set of quantum numbers: **[JEE Main 2022]**

(A) n = 3, 1 = 0, m = 0 (B) n = 4, 1 = 0, m = 0
(C) n = 3, 1 = 1, m = 0 (D) n = 3, 1 = 2, m = 1

(1) (D) > (B) > (C) > (A)
(2) (B) > (D) > (C) > (A)
(3) (C) > (B) > (D) > (A)
(4) (B) > (C) > (D) > (A)

**Q.42** If wavelength of the first line of the Paschen series of hydrogen atom is 720 nm, then the wavelength of the second line of this series is _____ nm. (Nearest integer)

**[JEE Main 2023]**

**Q.43** The number of given orbitals which have electron density along the axis is _____
$p_x$, $p_y$, $p_z$, $d_{xy}$, $d_{yz}$, $d_{xz}$, $d_{z^2}$ , $d_{x^2-y^2}$

**[JEE Main 2023]**

**Q.44** Given below are two statements:
**Statement I:** According to Bohr's model of hydrogen atom, the angular momentum of an electron in a given stationary state is quantised.
**Statement II:** The concept of electron in Bohr's orbit, violates the Heisenberg uncertainty principle.
In the light of the above statements, choose the most appropriate answer from the options given below: **[JEE Main 2023]**

(1) Both Statement I and Statement II are incorrect
(2) Statement I correct but Statement II is incorrect
(3) Both Statement I and Statement II are correct
(4) Statement I is incorrect but Statement II is correct

**Q.45** Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

**Assertion A:** In the photoelectric effect, the electrons are ejected from the metal surface as soon as the beam of light of frequency greater than threshold frequency strikes the surface.

**Reason R:** When the photon of any energy strikes an electron in the atom, transfer of energy from the photon to the electron takes place.

In the light of the above statements, choose the most appropriate answer from the options given below: **[JEE Main 2023]**

(1) Both A and R are correct and R is the correct explanation of A.
(2) A is not correct but R is correct
(3) A is correct but R is not correct
(4) Both A and R are correct but R is the incorrect explanation of A.

## JEE ADVANCED QUESTION

**Paragraph for Question No. 1 to 3**

The hydrogen like species $Li^{2+}$ is in a spherically symmetric state $S_1$ with one radial node. Upon absorbing light the ion undergoes transition to a state $S_2$. The state $S_2$ has one radial node and its energy is equal to the ground state energy of the hydrogen atom. **[JEE 2010]**

**Q.1** The state $S_1$ is:
(1) 1s (2) 2s (3) 2p (4) 3s

**Q.2** Energy of the state $S_1$ in units of the hydrogen atom ground state energy is:
(1) 0.75 (2) 1.50 (3) 2.25 (4) 4.50

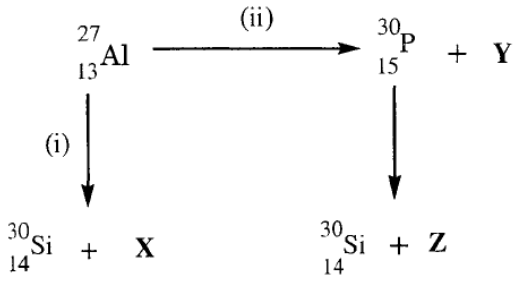
**Q.3** The orbital angular momentum quantum number of the state $S_2$ is:
(1) 0 (2) 1 (3) 2 (4) 3

**Q.4** The work function ($\phi$) 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 **[JEE 2011]**

| 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 |

**Q.5** The maximum number of electrons that can have principle quantum number, n = 3, and spin quantum number, $m_s = -½$, is

**Q.6** Bombardment of aluminum by $\alpha$-particle leads to its artificial disintegration in two ways, (I) and (ii) as shown products X, Y and Z respectively are, **[JEE 2011]**




(1) proton, neutron, positron
(2) neutron, positron, proton
(3) proton, positron, neutron
(4) positron, proton, neutron

**Q.7** The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is [$a_0$ is Bohr radius]:

(1) $\frac{h^2}{4\pi^2 m a_0^2}$ (2) $\frac{h^2}{16\pi^2 m a_0^2}$
(3) $\frac{h^2}{32\pi^2 m a_0^2}$ (4) $\frac{h^2}{64\pi^2 m a_0^2}$

**Q.8** The periodic table consists of 18 groups. An isotope of copper, on bombardment with protons, undergoes a nuclear reaction yielding element X as shown below. To which group, element X belongs in the periodic table?

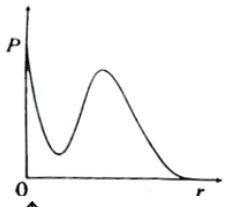
$^{63}_{29}Cu + ^{1}_{1}H \longrightarrow 6^{1}_{0}n + ^{4}_{2}\alpha + 2^{1}_{1}H + X$ **[JEE 2012]**

**Q.9** In an atom, the total number of electrons having quantum numbers n = 4, $|m_\ell| = 1$ and $m_s = ½$ is **[JEE Advance 2014]**

**Q.10** Not considering the electrons spin, the degeneracy of the second excited state (n = 3) of H atom is 9, while the second excited state of H- is **[JEE Advance 2015]**

**Q.11** P is the probability of finding the 1s electron of hydrogen atom in a spherical shell of infinitesimal thickness, dr, at a distance r from the nucleus. The volume of this shell is $4\pi r^2 dr$. The qualitative sketch of the dependence of P on r is **[JEE Advance 2016]**

(1)

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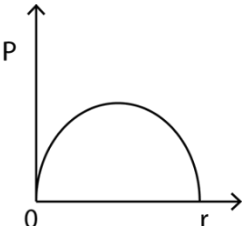


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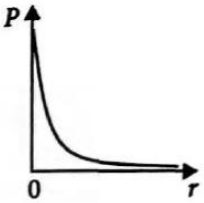


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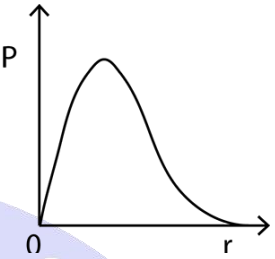
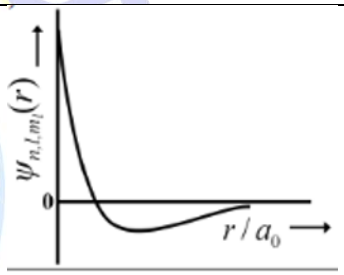



- **Answer Q.12, to Q.14 by appropriately matching the information given in the three columns of the following table.**

| Column 1 | | Column 2 | | Column 3 | |
|---|---|---|---|---|---|
| **(I)** | 1s orbital | **(i)** | $\Psi_{n}l,m_{l} \propto \left(\frac{Z}{a_0}\right)^{\frac{2}{3}} e^{-\left(\frac{Zr}{a_0}\right)}$ | **(P)** | $\Psi_{n}l,m_{l}$,   |
| **(II)** | 2s orbital | **(ii)** | One radial node | **(Q)** | Probability density at nucleus $\propto \frac{1}{a_0^3}$ |
| **(III)** | $2p_z$ orbital | **(iii)** | $\Psi_{nl,m_l} \propto \left(\frac{Z}{a_0}\right)^{\frac{5}{2}} re^{-\left(\frac{Zr}{2a_0}\right)} \cos\theta$ | **(R)** | Probability is maximum at nucleus |
| **(IV)** | $3d_{z^2}$ orbital | **(iv)** | xy-plane is a nodal plane | **(S)** | Energy needed to excite electron from n = 2 state to n = 4 state is $\frac{27}{32}$ times the energy needed to excite electron from n = 2 state to n = 6 state |

**Q.12** For $He^+$ ion, the only INCORRECT combination is
(1) (I) (i) (S) (2) (II) (ii) (Q)
(3) (I) (iii) (R) (4) (I) (i) (R)

**Q.13** For the given orbital in Column 1, the only CORRECT combination for any hydrogen-like species is
(1) (II) (ii) (P) (2) (I) (ii) (S)
(3) (IV) (iv) (R) (4) (III) (iii) (P)

**Q.14** For hydrogen atom, the only CORRECT combination is
(1) (I) (i) (P) (2) (I) (iv) (R)
(3) (II) (I) (Q) (4) (I) (i) (S)

**Q.15** The ground state energy of hydrogen atom is –13.6 eV. Consider an electronic state $\Psi$ of $He^+$ whose energy azimuthal quantum number and magnetic quantum number are –3.4 eV, 2 and 0 respectively. Which of the following statement(s) is(are) true of the state $\Psi$ ?
**[JEE Advance 2019]**
(1) It has 2 angular nodes
(2) It has 3 radial nodes

(3) It is a 4d state

(4) The nuclear charge experienced by the electron in this state is less than 2e, where e is the magnitude of the electronic charge.

**Direction : Q.16 - 17**

Answer the following by appropriately matching the lists based on the information given in the paragraph. Consider the Bohr's modal of a non-electron atom where the electron moves around the nucleus. In the following List-I contains some quantities for the $n^{th}$ orbit of the atom and List-II contains options showing how they depend on n. **[JEE Advance-2019]**

| List-I | | List-II | |
|---|---|---|---|
| **(I)** | Radius of the $n^{th}$ orbit | **(P)** | $\propto n^{-2}$ |
| **(II)** | Angular momentum of the electron in the $n^{th}$ orbit | **(Q)** | $\propto n^{-1}$ |
| **(III)** | Kinetic energy of the electron in the $n^{th}$ orbit | **(R)** | $\propto n^{0}$ |
| **(IV)** | Potential energy of the electron in the $n^{th}$ orbit | **(S)** | $\propto n^{1}$ |
| | | **(T)** | $\propto n^{2}$ |
| | | **(U)** | $\propto n^{1/2}$ |

**Q.16** Which of the following option has the correct combination considering List-I and List-II?

(1) (II) (R) (2) (I), (P)

(3) (I), (T) (4) (II), (Q)

**Q.17** Which of the following options has the correct combination considering List-I and List-II?

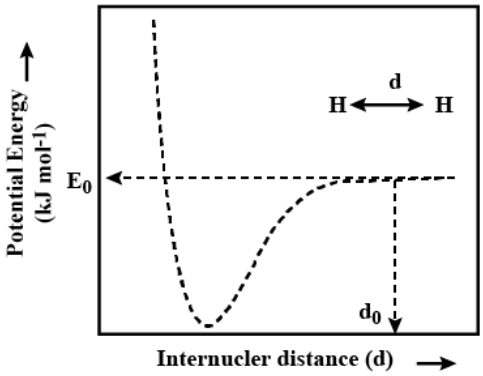
(1) (III), (S) (2) (IV), (Q)

(3) (IV), (U) (4) (III), (P)

**Q.18** The figure below is the plot of potential energy versus internuclear distance (d) of $H_2$ molecular in the electronic ground state. What is the value of the net potential energy $E_0$ (as indicated in the figure) in kJ $mol^{-1}$, for $d=d_0$ at which the electron-electron repulsion and the nucleus-nucleus repulsion energy of H atom is taken as zero when its electron and the nucleus are infinitely far apart.

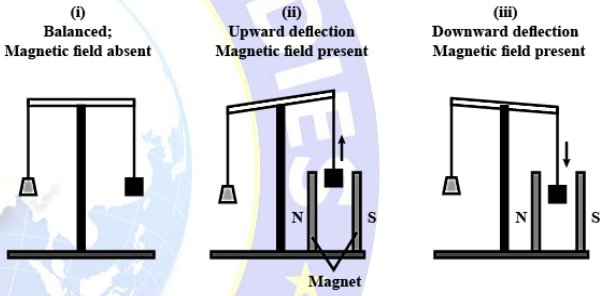
Use Avogadro constant as $6.023 \times 10^{-23}$ $mol^{-1}$.

**[JEE Advance 2020]**




**Q.19** In an experiment, m grams of a compound X (gas/liquid/solid) taken in a container is loaded in a balance as shown in figure I below. In the presence of a magnetic field, the pan with X is either deflected upwards (figure II), or deflected downwards (figure III), depending on the compound X. Identify the correct statement(s).

**[JEE Advance 2020]**




(1) If X is $H_2O(l)$, deflection of the pan is upwards.

(2) If X is $K_4[Fe(CN)_6](s)$, deflection of the pan is upwards.

(3) If X $O_2(g)$, deflection of the pan is downwards.

(4) If X is $C_6H_6(l)$, deflection of the pan is downwards.

**Q.20** Consider a helium (He) atom that absorbs a photon of wavelength 330nm. The change in the velocity (in cm $s^{-1}$) of He atom after the photon absorption is___. **[JEE Advance 2021]**

(Assume: Momentum is conserved when photon is absorbed.)

Use: Planck constant = $6.6 \times 10^{-34}$ J s,

Avogadro number = $6 \times 10^{23}$ $mol^{-1}$, Molar mass of He = 4g $mol^{-1}$)

**Q.21** For $He^+$, a transition takes place from the orbit of radius 105.8 pm to the orbit of radius 26.45 pm. The wavelength (in nm) of the emitted photon **[JEE Advance 2023]**

[Use:

Bohr radius, a = 52.9 pm

Rydberg constant, RH = $2.2 \times 10^{-18}$ J

Planck's constant = $6.6 \times 10^{-34}$ J s,

Speed of light, c = $3 \times 10^8$ m $s^{-1}$]

# ANSWER KEY

## JEE-FLASHBACK

### JEE MAINS QUESTIONS

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | 1 | 181 | 2 | 5 | 2 | 4 | 1 | 1 | 2 | 4 | 2 | 3 | 2 | 3 | 3 |
| **Que.** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** |
| Ans. | 2 | 3 | 2 | 2 | 1 | 222 | 2 | 3 | 2 | 180 | 1 | 4 | 2 | 1 | 2 |
| **Que.** | **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** | **41** | **42** | **43** | **44** | **45** |
| Ans. | 2 | 0 | 4 | 4 | 3 | 7 | 300 | 2 | 4 | 4 | 1 | 492 | 5 | 4 | 3 |