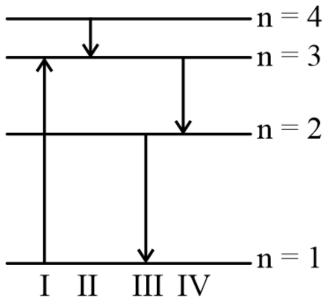
Ultimate KCET Crash Course 2026

PHYSICS

Atoms

DPP :- 01

Q1 The diagram shows the energy levels for an electron in a certain atom. Which transition represents the emission of a photon with the most energy?



(A) IV (B) III
(C) II (D) I

Q2 The circumference of the fourth Bohr orbit of an electron is 8.0×10^{-9} m. What is the de-Broglie wavelength of the electron in this orbit?
(A) 2.0×10^{-9} m
(B) 4.0×10^{-9} m
(C) 8.0×10^{-9} m
(D) 0.50×10^{-9} m

Q3 How many times does the electron go round the first Bohr orbit of hydrogen atoms in 1 s ?
(A) 6.62×10^{15} Hz
(B) 5.60×10^{5} Hz
(C) 3.31×10^{5} Hz
(D) None

Q4 Which one of the following statements is NOT true for de Broglie waves?
(A) All atomic particles in motion have matter waves of some de-Broglie wavelengths associated with them
(B) The higher the momentum, the longer is the wavelength
(C) The faster the particle, the shorter is the wavelength
(D) For the same velocity, a heavier particle has a shorter wavelength

Q5 Least possible energy of an electron in a hydrogen atom is
(A) 13.6eV
(B) -13.6eV
(C) zero
(D) -10.2eV

Q6 The ratio of velocities of an electron in the first and second Bohr orbits of a hydrogen atom is:
(A) 1:2 (B) 2:1
(C) 4:1 (D) 1:4

Q7 In Bohrs hydrogen atom the electron around the nucleus is in a circular orbit of radius 5×10^{-11} m, with a time-period of 1.5×10^{-16} s. The associated current is :
(A) zero
(B) 1.6×10^{-19} A
(C) 0.17 A
(D) 1.07×10^{-3} A

Q8 In which of the following transitions will the wavelength be minimum?
(A) $n = 5$ to $n = 4$
(B) $n = 4$ to $n = 3$
(C) $n = 3$ to $n = 2$
(D) $n = 2$ to $n = 1$.

Q9 As an electron makes a transition from an excited state to the ground state of a hydrogen - like atom/ion
(A) Its kinetic energy increases but potential energy and total energy decrease
(B) Kinetic energy, potential energy and total energy decrease
(C)

Kinetic energy decreases, potential energy increases but total energy remains same
(D) Kinetic energy and total energy decreases but potential energy increases

Q10 If m is mass of electron, v its velocity, r the radius of stationary circular orbit around a nucleus with charge Ze, then from Bohr's first postulate, the kinetic energy $K = \frac{1}{2}mv^2$ of the electron in C.G.S. system is equal to:

(A) $\frac{1}{2}\frac{Ze^2}{r}$ (B) $\frac{1}{2}\frac{Ze^2}{r^2}$
(C) $\frac{Ze^2}{r}$ (D) $\frac{Ze}{r^2}$

Q11 If the binding energy of the electron in a hydrogen atom is 13.6eV, the energy required to remove the electron from the first excited state of Li^{++} is

(A) 30.6eV
(B) 13.6eV
(C) 3.4eV
(D) 122.4eV

Q12 In the hydrogen spectrum, the ratio of the maximum wavelength of the Lyman series to the maximum wavelength of the Balmer series will be

(A) 27 : 5 (B) 5 : 27
(C) 5 : 7 (D) 15 : 17

Q13 What is the angular momentum of an electron in Bohr's hydrogen atom whose energy is -0.544eV ?

(A) $\frac{h}{\pi}$
(B) $\frac{2h}{\pi}$
(C) $\frac{5h}{2\pi}$
(D) $\frac{7h}{2\pi}$

Q14 The ground state energy of hydrogen atom is -13.6 eV. The potential energy of the electron in the first excited state of hydrogen is

(A) –6.8 eV (B) –3.4 eV
(C) –13.6 eV (D) –272 eV

Q15 Energy of an electron in an excited state of hydrogen atom is -3.4 eV. Its angular momentum will be:

(A) 1.11×10^{-34} Js
(B) 1.51×10^{-31} Js
(C) 2.11×10^{-34} Js
(D) 3.72×10^{-34} Js

Q16 The largest wavelength in the ultraviolet region of the hydrogen spectrum is 122 nm. The smallest wavelength in the infrared region of the hydrogen spectrum (to the nearest integer) is

(A) 802 nm
(B) 823 nm
(C) 1882 nm
(D) 1648 nm

Q17 When a hydrogen atom is excited from ground state to first excited state its potential energy

(A) Increases by 10.4 eV
(B) Decreases by 10.4 eV
(C) Increases by 20.4 eV
(D) Decreases by 20.4 eV

Q18 On which of the following factors the radius of the Bohr orbit depends?

(A) n
(B) n^2
(C) $\frac{1}{n^2}$
(D) $\frac{1}{n}$

Q19 The ratio for the speed of the electron in the 3rd orbit of He^+ to the speed of the electron in the 3rd orbit of hydrogen atom will be:

(A) 1:1 (B) 1:2
(C) 4:1 (D) 2:1

Q20 Which one of the following parameters is the same for all hydrogen-like atoms and ions in their ground states?

(A) Radius of the orbit
(B) Speed of the electron
(C) Energy of the atom
(D) Orbital angular momentum of the electron

Q21 The energy of an electron in excited hydrogen atom is -0.85 eV . The angular momentum of the electron according to Bohr theory is:

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(A) 2.11×10^{-34} Js
(B) 2.56×10^{-34} Js
(C) 4.22×10^{-34} Js
(D) 5.26×10^{-34} Js

Q22 The hydrogen atom makes a transition form $n = 4$ ton $= 1$ state. Then the recoil momentum of H-atom is
units of (eV/C) is given

(A) 13.60 (B) 12.75
(C) 0.85 (D) 22.1

Q23 When an electron jumps from n = 4 level to n = 1 level, the angular momentum of the electron changes by

(A) $\frac{h}{2\pi}$ (B) $\frac{3h}{2\pi}$
(C) $\frac{2h}{2\pi}$ (D) $\frac{4h}{2\pi}$

Q24 The energy levels of a certain atom for 1st, 2nd and 3rd levels are E, 4E/3 and 2E respectively. A photon of wavelength λ is emitted for a transition $3 \rightarrow 1$. What will be the wavelength of emissions for transition $2 \rightarrow 1$

(A) $\lambda/3$ (B) $4\lambda/3$
(C) $3\lambda/4$ (D) 3λ

Q25 In hydrogen spectrum, the shortest wavelength in the Balmer series is λ. The shortest wavelength in the Bracket series is :

(A) 4λ (B) 9λ
(C) 16λ (D) 2λ

Q26 In hydrogen atom, when electron jumps from second to first orbit, then energy emitted is

(A) -13.6eV
(B) -27.2eV
(C) -6.8eV
(D) None of these

Q27 If the electron in hydrogen atom jumps from the third to second orbit, the wavelength of the emitted radiation in terms of Rydberg constant R is given by

(A) $\lambda = \frac{36}{5R}$
(B) $\lambda = \frac{5R}{36}$
(C) $\lambda = \frac{5}{R}$
(D) $\lambda = \frac{R}{6}$

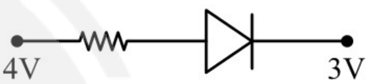
Q28 Energy of an electron in the second orbit of hydrogen atom is E and the energy of electron in 3rd orbit of He will be

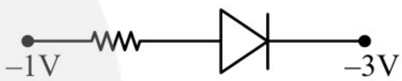
(A) $E_3 = \frac{16E}{3}$
(B) $E_3 = \frac{16E}{9}$
(C) $E_3 = \frac{4E}{9}$
(D) $E_3 = \frac{4E}{3}$

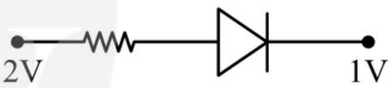
Q29 The first Bohr radius of an atom *Z*= 82 is *R*. The radius of its third orbit is

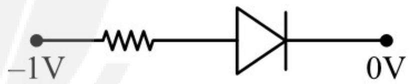
(A) 9*R* (B) 6*R*
(C) 3*R* (D) *R*

Q30 Which among the following diodes is reverse biased?

(A)


(B)


(C)


(D)


Answer Key

Q1	(B)	Q16	(B)
Q2	(A)	Q17	(C)
Q3	(A)	Q18	(B)
Q4	(B)	Q19	(D)
Q5	(B)	Q20	(D)
Q6	(B)	Q21	(C)
Q7	(D)	Q22	(B)
Q8	(D)	Q23	(B)
Q9	(A)	Q24	(D)
Q10	(A)	Q25	(A)
Q11	(A)	Q26	(D)
Q12	(B)	Q27	(A)
Q13	(C)	Q28	(B)
Q14	(A)	Q29	(A)
Q15	(C)	Q30	(D)

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Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Video Solution:

Q2 Text Solution:

For a Bohr orbit the standing-wave condition gives: circumference = $n\lambda$

Here $n = 4$ and circumference = 8.0×10^{-9} m

So $\lambda = \frac{\text{circumference}}{n} = \frac{8.0 \times 10^{-9}}{4}$

$= 2.0 \times 10^{-9}$ m

Hence, option (A) is correct.

Video Solution:

Q3 Video Solution:

Q4 Video Solution:

Q5 Video Solution:

Q6 Text Solution:

(2)

Velocity in Bohr's orbits:

$v_n = \frac{v_1}{n}$

$\frac{v_1}{v_2} = \frac{2}{1} = 2 : 1$

Video Solution:

Q7 Video Solution:

Q8 Video Solution:

Q9 Video Solution:

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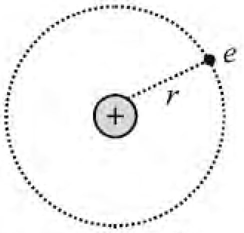
Q10 **Text Solution:**

In the revolution of electron, coulomb force provides the necessary centripetal force



$$\Rightarrow \frac{Ze^2}{r^2} = \frac{mv^2}{r} \Rightarrow mv^2 = \frac{Ze^2}{r}$$

$$\therefore \text{ K.E. } = \frac{1}{2}mv^2 = \frac{Ze^2}{2r}$$

Video Solution:

Q11 **Video Solution:**

Q12 **Video Solution:**

Q13 **Video Solution:**

Q14 **Text Solution:**

The ground state energy of a hydrogen atom is given as –13.6 eV. The total energy is equivalent to the kinetic energy, while the potential energy is twice the kinetic energy.

Therefore, the potential energy of the hydrogen atom in its ground state is:

PE = 2 × (–13.6 eV) = –27.2 eV

For the first excited state of the hydrogen atom, the energy can be calculated using the formula:

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

When n = 2:

$$E_2 = -\frac{13.6 \text{ eV}}{4} = -3.4 \text{ eV}$$

Thus, the potential energy, when n = 2, is:

$$(PE)_{n=2} = 2 \times (-3.4 \text{ eV}) = -6.8 \text{ eV}$$

Video Solution:

Q15 **Text Solution:**

Using $E_n = -\frac{13.6}{n^2} = -3.4\ eV$, we get n = 2

$\therefore$ Angular momentum

$L = \frac{nh}{2\pi} = \frac{2 \times 6.6 \times 10^{-34}}{2 \times 3.14} = 2.11 \times 10^{-34}$ Js

Video Solution:

Q16 Video Solution:

Q17 Text Solution:

Ground state $n = 1$

$n = 2$

$$PE_1 = \frac{-Ke^2}{r_2} = \frac{-Ke^2}{r_0}$$

$$PE_2 = \frac{-Ke^2}{r_2} = \frac{-Ke^2}{4r_0}$$

$$rn = n^2 r_0$$

$$r_0 = 0.53A$$

$$r_2 = (2)^2 r_0$$

$$1\,ev = 1.6 \times 10^{-19} J$$

$$P.E = \frac{Ke^2}{r_0}\left[\frac{-1}{4} + 1\right]$$

$$= \left(\frac{9\times10^9\times\left(1.6\times10^{-19}\right)}{0.53\times10^{-10}} \times \frac{3}{4}\right)$$

$$= 20.37\,eV$$

Video Solution:

Q18 Video Solution:

Q19 Text Solution:

Speed is given by $v = \left(\frac{e^2}{2h\varepsilon_0}\right) \times \frac{Z}{n}$

$v \propto \frac{Z}{n};\ v_{He} \propto \frac{2}{3},\ v_H \propto \frac{1}{3};$

$\frac{v_{He}}{v_H} = \frac{2\times3}{3\times1} = 2:1$

Video Solution:

Q20 Text Solution:

Orbital angular momentum of hydrogen like atom in n^{th} orbit is $\frac{\mathrm{nh}}{2\pi}$ which does not depend on atomic number.

Video Solution:

Q21 Text Solution:

The energy of the electron in the n^{th} orbit is

$E_n = \frac{13.6}{n^2}\mathrm{eV}$

Here, $= \frac{13.6}{n^2} = -0.85$ or $n = 4$

$\text{Angular momentum} = \frac{nh}{2\pi} = \frac{4\times6.63\times10^{-34}}{2\times3.14}$

$= 4.22 \times 10^{-34}\ \mathrm{Js}$

Video Solution:

Q22 Video Solution:

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Q23 Text Solution:

1. Angular momentum in the Bohr model:
$L_n = n\hbar = n\frac{h}{2\pi}$
2. Initial $L_4 = 4\hbar L_1 = 1\hbar$; final $L_1 = 1\hbar$.
3. Change
$\Delta L = L_4 - L_1 = (4-1)\hbar = 3\hbar = \frac{3h}{2\pi}$

Answer: (B)

Video Solution:

Q24 Text Solution:

For transition $3 \to 1$

$$\Delta E = 2E - E = \frac{hc}{\lambda} \Rightarrow E = \frac{hc}{\lambda} \quad \text{... (i)}$$

For transition $2 \to 1$

$$\frac{4E}{3} - E = \frac{hc}{\lambda'} \Rightarrow E = \frac{3hc}{\lambda'} \quad \text{...(ii)}$$

From equation (i) and (ii) $\lambda' = 3\lambda$

Video Solution:

Q25 Text Solution:

$$\frac{1}{\lambda} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

Balmer series: $n_1 = 2$, for smallest λ
$n_2 = \infty$

$$\frac{1}{\lambda_B} = R\left(\frac{1}{2^2} - 0\right) = \frac{R}{4}$$

$$\Rightarrow \lambda_B = \frac{4}{R}$$

Brackett series: $n_1 = 4$, for smallest λ
$n_2 = \infty$

$$\frac{1}{\lambda_{Br}} = R\left(\frac{1}{4^2} - 0\right) = \frac{R}{16}$$

$$\Rightarrow \lambda_{Br} = \frac{16}{R}$$

Take Ratio —

$$\Rightarrow \lambda_{Br} = 4\lambda_B$$

Video Solution:

Q26 Video Solution:

Q27 Video Solution:

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Q28 Text Solution:

$For\ \ 2\,nd\ \ \ orbit\ of\ H - atom$

$E\ = -\frac{13.6}{2^2}\ eV$

$For\ \ 3rd\ \ orbit\ of\ He^+$

$E_3\ \ He^+ = \ -\frac{13.6}{3^2} \times\ 2^2$

$= \ \ -\frac{13.6}{3^2} \times \frac{4}{9} \times 2^2$

$= E\ \times \frac{16}{9} = \frac{16}{9}E$

$Hence\ option\ B\ is\ correct$

Video Solution:

Q29 Text Solution:

The radius of the n-th Bohr orbit for a hydrogen-like atom with atomic number Z is given by the formula $r_n = \frac{n^2 a_0}{Z}$, where a_0 is the Bohr radius constant. For the first orbit $(n = 1)$ of the atom with $Z = 82$,

The radius is given as R: $R = r_1 = \frac{1^2 a_0}{82} = \frac{a_0}{82}$

Define the relationship for the third orbit We need to find the radius of the third orbit $(n = 3)$ for the same atom $(Z = 82)$, which we will call r_3: $r_3 = \frac{3^2 a_0}{82} = \frac{9a_0}{82}$

Express the third orbit radius in terms of R From we can express the constant a_0 in terms of R as $a_0 = 82R$.

Substituting this into the equation from $r_3 = \frac{9\times(82R)}{82}$ The 82 terms cancel out, leaving: $r_3 = 9R$

Video Solution:

Q30 Text Solution:

If p side is at lower potential than n side of $p-n$ junction diode, then diode is in reverse biased condition.

Video Solution:

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