DPP

DAILY PRACTICE PROBLEMS

CLASS : XIITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 2

Topic :-Atoms

1 **(c)**

Given, ground state energy of hydrogen atom

$E_1 = -13.6$ eV

Energy of electron in first excited state (ie, n=2)

$E_2 = -\frac{13.6}{(2)^2}$ eV

Therefore ,excitation energy

$\Delta E = E_2 - E_1$

$= -\frac{13.6}{4} - (-13.6) = -3.4 + 13.6 = 10.2$ eV

2 **(c)**

Given, $E_2 - E_1 = 2.3$ eV

Or $v = \frac{E2 - E1}{h} = \frac{2.3 \times 1.6 \times 10^{-19}}{6.6 \times 10^{-34}}$

$= 0.55 \times 10^{15}$

$= 5.5 \times 10^{14}$ Hz

3 **(c)**

The Spectrum of light emitted by a luminous source is called the emission Spectrum. Neon bulb gives an emission Spectrum. The spectrum of the neon light has several bright lines. The red lines are bright. The emission Spectrum of an element is the exact opposite of its absorption Spectrum, that is, the frequencies emitted by a material when heated are the only frequencies that will be absorbed when it is lighted with a white light. Hence, neon sign does not produce an absorption Spectrum.

4 **(a)**

$$\frac{\lambda_L}{\lambda_B} = \left(\frac{\frac{1}{2^2} - \frac{1}{3^2}}{\frac{1}{1^2} - \frac{1}{2^2}}\right) = \frac{5/36}{3/4} = \frac{5}{27}$$

$$\frac{v_L}{v_B} = \frac{27}{5}$$

5 **(c)**

In Balmer series, $n = 2$

$$E = \frac{13.6}{2^2} = 3.4 \text{ eV}$$

6 **(b)**

$$r \propto n^2$$

$$\frac{r_f}{r_i} = \left(\frac{n_f}{n_i}\right)^2$$

$$\frac{21.2 \times 10^{-11}}{5.3 \times 10^{-11}} = \left(\frac{n}{1}\right)^2$$

$$n^2 = 4$$

$$n = 2$$

7 **(a)**

$$E = Rhc\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$

$$E_{(4\to3)} = Rhc\left[\frac{1}{3^2} - \frac{1}{4^2}\right]$$

$$= Rhc\left[\frac{7}{9 \times 16}\right] = 0.05\ Rhc$$

$$E_{(4\to2)} = Rhc\left[\frac{1}{2^2} - \frac{1}{4^2}\right]$$

$$= Rhc\left[\frac{3}{16}\right] = 0.2\ Rhc$$

$$E_{(2\to1)} = Rhc\left[\frac{1}{(1)^2} - \frac{1}{(2)^2}\right]$$

$$= Rhc\left[\frac{3}{4}\right] = 0.75\ Rhc$$

$$E_{(1\to3)} = Rhc\left[\frac{1}{(3)^2} - \frac{1}{(1)^2}\right]$$

$$= -\frac{8}{9} Rhc = -0.9\ Rhc$$

Thus, transition III gives most energy. Transition I represents the absorption of energy.

8 **(d)**

For ground state, $n = 1$

For first excited state, $n = 2$

As $r \propto n^2$

$\therefore$ radius becomes 4 times.

9 **(c)**

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

$$= 3 \times 10^8 \times 10^7 \left(\frac{1}{2^2} - \frac{1}{4^2}\right) = \frac{9}{16} \times 10^{15} \text{Hz}$$

10 **(d)**

Number of spectral lines obtained due to transition of electrons from nth orbit to lower orbit is,

$$N = \frac{n(n-1)}{2}$$

I case $\quad 6 = \frac{n_1(n_1 - 1)}{2}$

$\Rightarrow \quad n_1 = 4$

II case $\quad 3 = \frac{n_2(n_2 - 1)}{2}$

$\Rightarrow \quad n_2 = 3$

Velocity of electron in hydrogen atom in nth orbit

$$v_n \propto \frac{1}{n}$$

$$\frac{v_n}{v'_n} = \frac{n_2}{n_1}$$

$$\Rightarrow \quad \frac{n_6}{n_3} = \frac{3}{4}$$

11 **(a)**

Ionization energy $= Rc\text{h}Z^2$

$Z = 3$ for Li^{2+}

$\therefore$ Ionization energy $= (3)^2 Rch = 9Rc\text{h}$

12 **(c)**

According to law of conservation of energy, kinetic energy of α-particle

= potential energy of α-particle at distance of closest approach

ie, $\quad \frac{1}{2}mv^2 = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r}$

$\therefore \quad 5\text{MeV} = \frac{9 \times 10^9 \times (2e) \times (92e)}{r}$

$$\left(\because \frac{1}{2}mv^2 = 5 \text{ MeV}\right)$$

$$\Rightarrow \quad \text{r} = \frac{9 \times 10^9 \times 2 \times 92 \times (1.6 \times 10^{-19})^2}{5 \times 10^6 \times 1.6 \times 10^{-19}}$$

$\therefore \quad r = 5.3 \times 10^{-14} \text{ m} \approx 10^{-12} \text{cm}$

13 **(d)**

As $R \propto n^2; V \propto \frac{1}{n}$ and $E \propto \frac{1}{n^2}$

$\therefore VR \propto \left(\frac{1}{n} \times n^2\right) ie, VR \propto n$

14 **(a)**

$$E_5 = -\frac{13.6}{5^2}\,\text{eV} = -0.54\text{ eV}$$

15 **(c)**

These photons will be emitted when electron makes transitions in the shown way.

So, these transitions is possible from two or three atoms.

From three atoms separately.

16 **(a)**

Radius of Bohr's orbit

$$R_n = \frac{A_0 n^2}{Z}$$

$\Rightarrow \quad R_n \propto n^2$ (Z=constant)

$\therefore \quad R_3 = 3^2 R = 9R$

17 **(c)**

We have, $r \propto A^{1/3}$

$$\Rightarrow \quad \frac{r_2}{r_1} = \left[\frac{A_2}{A_1}\right]^{1/3} = \left[\frac{206}{4}\right]^{1/3}$$

$$\therefore \quad r_2 = 3\left[\frac{206}{4}\right]^{1/3} = 11.16\text{ fermi}$$

18 **(b)**

$E_m = -\frac{13.6}{(3)^2} = 1.51$

Minimum energy required by electron should be $+1.51$ eV.

19 **(d)**

Electrostatic force = centripetal force

$$\frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{r^2} = \frac{mv^2}{r}$$

$$\therefore \quad v = \sqrt{\left(\frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{mr}\right)}$$

$$= \sqrt{\frac{9\times 10^9 \times (1.6\times 10^{-19})^2}{(9.1\times 10^{-31})\times(0.1\times 10^{-9})}}$$

$$= 1.59 \times 10^6\text{ms}^{-1}$$

20 **(b)**

Least energy of photon of Balmer series is obtained when an electron jumps to 2nd orbit from 3rd orbit.

$$E = E_3 - E_2 = \left[\frac{-13.6}{3^2} - \left(\frac{-13.6}{2^2}\right)\right]\text{eV}$$

$$= 13.6\left[\frac{1}{4} - \frac{1}{9}\right] = \frac{13.6\times 5}{36}\text{eV} \qquad = 1.89\text{ eV}$$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	C	C	C	A	C	B	A	D	C	D
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	C	D	A	C	A	C	B	D	B