DPP
DAILY PRACTICE PROBLEMS

CLASS : XIITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 7

Topic :-Atoms

1 **(d)**

In Raman effect, Stokes' lines are spectral lines having lower frequency or greater wavelength than that of the original line.

2 **(b)**

As $_{55}Cs^{133}$ has larger size among the four atoms given, thus, electrons present in the outermost orbit will be away from the nucleus and the electrostatic force experienced by electrons due to nucleus will be minimum. Therefore, the energy required to liberate electrons from outer orbit will be minimum in case of $_{55}Cs^{133}$.

3 **(a)**

For nth Bohr orbit,

$$r = \frac{\varepsilon_0 n^2 \mathrm{h}^2}{\pi m Z e^2}$$

de-Broglie wavelength

$$\lambda = \frac{\mathrm{h}}{mv}$$

Ratio of both r and λ, we have

$$\frac{r}{\lambda} = \frac{\varepsilon_0 n^2 \mathrm{h}^2}{\pi m Z e^2} \times \frac{mv}{\mathrm{h}}$$

$$= \frac{\varepsilon_0 n^2 \mathrm{h} v}{\pi Z e^2}$$

But $v = \frac{Ze^2}{2\mathrm{h}\varepsilon_0 n}$ for nth orbit

Hence, $\frac{r}{\lambda} = \frac{n}{2\pi}$

4 **(a)**

From Bohr's model of atom, the wave number is given by

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

where R is Rydberg's constant and n_1 and n_2 the energy levels.

Given, n_1=2, n_2=3

$\therefore \quad \frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$

$\frac{1}{\lambda} = R\left[\frac{5}{36}\right]$

$\Rightarrow \quad \lambda = \frac{36}{5R}$

This gives corresponding wavelength of Balmer series.

5 **(c)**

According to Bohr's theory of atom electrons can revolve only in those orbits in which their angular momentum is an integral multiple of $\frac{h}{2\pi}$, where h is Planck's constant.

Angular momentum = $mvr = \frac{2h}{2\pi}$

Hence, angular momentum is quantized.

The energy of electron in nth orbit of hydrogen atom,

$$E = \frac{R_h c}{n^2} \text{ joule}$$

Thus, it is obvious that the hydrogen atom has some characteristics energy state. In fact this is true for the atom of each element, *ie*, each atom has its energy quantized.

Hence, both energy and angular momentum are quantised.

6 **(c)**

In hydrogen atom, the lowest orbit corresponds to minimum energy.

7 **(a)**

When a γ - ray photon is emitted then atomic number and mass number remains unchanged.

11 **(b)**

Here ,area of circular orbit of electron A = πr^2,current due to motion of electron

$$i = \frac{e}{t} = \frac{e}{2\pi r/v} = \frac{ev}{2\pi r}$$

Magnetic moment = iA

$$= \frac{eV}{2\pi r} \times \pi r^2$$

$$= \frac{evr}{2}$$

12 **(b)**

From Bohr's formula , the wave number $\left(\frac{1}{\lambda}\right)$ is given by

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

where Z is atomic number, R the Rydberg's constant and n the quantum number.

$\Rightarrow \quad \lambda \propto \frac{1}{Z^2}$

Atomic number of lithium is 3, of helium is 2 and of hydrogen is 1.

$\therefore \quad \lambda_{Li^{2+}} : \lambda_{He^+} : \lambda_H = \frac{1}{(3)^2} : \frac{1}{(2)^2} : 1$

$= \frac{1}{9} : \frac{1}{4} : 1$

13 **(c)**

Total energy of electron in excited state $= -13.6 + 12.1 = -1.5$ eV, which corresponds to third orbit. The possible spectral lines are when electron jumps from orbit 3rd to 2nd; 3rd to 1st and 2nd to 1st

14 **(c)**

The given type of spectrum has coloured bands of light on a dark-ground. One end of each band is sharp and bright and the brightness gradually decreases towards the other end. Band spectrum is obtained from the molecules in the gaseous state of matter. For example, when discharge is passed through oxygen, nitrogen or carbon dioxide, the light emitted from these gases give band spectrum.

15 **(d)**

Impact parameter $b \propto \cot\frac{\theta}{2}$

Here b=0, hence, $\theta = 180^0$

16 **(a)**

Electron angular momentum about the nucleus is an integer multiple of $\frac{h}{2\pi}$, where h is Planck's constant.

$$I\omega = mvr$$
$$= \frac{nh}{2\pi}$$
$$r \propto n$$

17 **(a)**

When an atom comes down from some higher energy level to the first energy level then emitted lines form of Lyman series.

$$\frac{1}{\lambda_L} = R\left(\frac{1}{1^2} - \frac{1}{n^2}\right)$$

where R is Rydberg's constant.

When an atom comes from higher energy level to the second level, then Balmer series are obtained.

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

For maximum wavelength

$$n=2, \frac{1}{\lambda_L} = R\left(1 - \frac{1}{(2)^2}\right) = R\left(1 - \frac{1}{4}\right) = \frac{3R}{4} \quad \text{.... } (i)$$

$$n = 3, \frac{1}{\lambda_B} = R\left(\frac{1}{(2)^2} - \frac{1}{(3)^2}\right) = R\left(\frac{5}{36}\right) \quad \text{...}(ii)$$

Dividing Eq. (ii) by Eq. (i), we get

$$\frac{\lambda_L}{\lambda_B} = \frac{5}{27}$$

18 **(d)**

$$\bar{v} = R\left[\frac{1}{2^2} - \frac{1}{4^2}\right] = \frac{3R}{4} = 20397 \text{cm}^{-1}$$

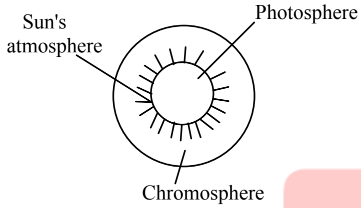
For the same transaction in He atom $(Z = 2)$

$$\bar{v} = RZ^2\left[\frac{1}{2^2} - \frac{1}{4^2}\right] = \frac{3R \times 2^2}{4}$$

$$= 20397 \times 4 = 81588 \text{ cm}^{-1}$$

19 **(d)**

Fraunhofer lines are certain dark lines observed in the otherwise continuous spectrum of the sum. According to Fraunhofer, these dark lines represent the absorption spectrum of the vapours surrounding the sun. The sun consists of a hot central core called photosphere, which is at an extremely high temperature = 1.4×10^7 K. it is surrounded by less dense, luminous and highly compressed gases. They are said to form sun's atmosphere. A continuous spectrum



containing radiations of all wavelengths is emitted by the sun's atmosphere . surrounding this , is another sphere of vapours and gases at a comparatively lower temperature (6000 K). At the time of total solar eclipse, photosphere is covered. Emission lines from vapours of elements in chromosphere appear as bright lines. So, all Fraunhofer lines are changed into bright coloured lines.

20 **(d)**

The angular momenta of an electron is

$$mvr = \frac{nh}{2\pi}$$

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