DPP

DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 7

Topic :- NUCLEI

1 **(a)**

$$\frac{1}{\lambda} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] \Rightarrow \frac{\lambda_{\min}}{\lambda_{\max}} = \frac{\left[\frac{1}{2^2} - \frac{1}{3^2}\right]}{\left[\frac{1}{2^2} - \frac{1}{\infty}\right]} = \frac{5}{9}$$

2 **(c)**

Average life $\frac{1}{\lambda} = \frac{1600}{0.693} = 2308 \approx 2319\ years$

3 **(d)**

$\lambda_{IR} > \lambda_{UV}$ also wavelength of emitted radiation $\lambda \propto \frac{1}{\Delta E}$

4 **(b)**

$$A = A_0\left(\frac{1}{2}\right)^{t/T_{1/2}} \Rightarrow 5 = A_0\left(\frac{1}{2}\right)^{\frac{2\times 60}{30}} = \frac{A_0}{16} \Rightarrow A_0 = 80 s^{-1}$$

5 **(d)**

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

6 **(b)**

Number of atoms undecayed $N = N_0 e^{-\lambda t}$

Number of atoms decayed $= N_0 - N = N_0(1 - e^{-\lambda t})$

$\Rightarrow$ Decyaed fraction $f = \frac{N_0 - N}{N_0} = 1 - e^{-\lambda t}$

i.e., fraction will rise up to 1, following exponential path as shown in graph (B)

8 **(a)**

For Lyman series

$$v_{\text{Lyman}} = \frac{c}{\lambda_{\max}} = RO\left[\frac{1}{(1)^2} - \frac{1}{(2)^2}\right] = \frac{3RC}{4}$$

For Balmer series

$$v_{\text{Balmer}} = \frac{c}{\lambda_{\max}} = RO\left[\frac{1}{(2)^2} - \frac{1}{(3)^2}\right] = \frac{5RC}{36}$$

$$\therefore \frac{v_{\text{Lyman}}}{v_{\text{Balmer}}} = \frac{27}{5}$$

9 **(c)**

$$E=\frac{(\text{momentum})^2}{2M}=\frac{\left(\frac{hv}{c}\right)^2}{2M}$$

10 **(c)**

As the $\gamma-$ particle has no charge and mass

11 **(b)**

Nuclear fusion takes place in stars which results in joining of nuclei accompanied by release of tremendous amount of energy

12 **(c)**

When there is an excess of protons in the nucleus and it is not energetically possible to emit an $\alpha-$ particle, β^+ decay occurs.

Resulting in reducing atomic numbers by 1. New atomic number $= Z-1$, mass number $= A$. Gamma ray emission occurs with β^+ emission. Since, gamma rays have no charge or mass their emission does not change the chemical composition of the atom.

Hence atomic number $= Z-1$,

mass number $= A$

13 **(b)**

In negative β-decay a neutron in the nucleus is transformed into a proton, an electron and an antineutrino. Hence, in radioactivity decay process, the negatively charged emitted β-particles are the electrons produced as a result of the decay of neutrons present inside the nucleus.

14 **(b)**

According to Kepler's 3rd law.

$$T^2\propto r^3$$

$$\therefore\ \frac{T_1}{T_2}=\left(\frac{r_1}{r_2}\right)^{3/2}=8$$

$$\frac{r_1}{r_2}=8^{2/3}=4$$

According to Bohr atom model, $r\propto n^2$

$$\therefore\ \frac{n_1^2}{n_2^2}=\frac{r_1}{r_2}=4;\ \frac{n_1}{n_2}=2$$

If $n_1=2$, then $n_2=1$

15 **(d)**

Speed of electron in n^{th} orbit (in CGS) $v_n=\frac{2\pi Ze^2}{nh}(k=1)$

For first orbit of H_1;$n=1$ and $Z=1$

So $v = \frac{2\pi e^2}{h} \Rightarrow \frac{v}{c} = \frac{2\pi e^2}{hc}$

16 **(d)**

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

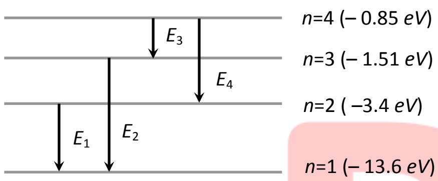
Here $b = 0$, hence $\theta = 180°$

17 **(c)**

When uranium is bombarded by neutrons, each uranium nucleus is broken into nearly equal fragments and along with it huge energy and two or three fresh neutrons are liberated. Under favourable conditions these neutrons fission other uranium nuclei in the same way. Thus, a chain of nuclear fission is established which continues till the whole of uranium is consumed.

18 **(b)**

From diagram



$E_1 = -13.6 - (-3.4) = -10.2eV$

$E_2 = -13.6 - (-1.51) = -12.09eV$

$E_3 = -1.51 - (-0.85) = -0.66eV$

$E_4 = -3.4 - (-0.85) = (-2.55)eV$

E_3 is least, *i.e.*, frequency is lowest

19 **(d)**

Lyman series lies in the UV region

20 **(a)**

Mass of Uranium nucleus = mass of proton + mass of neutron.

$= 92 \times 1.6725 \times 10^{-27} + 143 \times 1.6747 \times 10^{-27})$

$= (153.87 \times 10^{-27} + 239.48 \times 10^{-27})$

$= 3.93.35 \times 10^{-27}$ Kg

since, radius of nucleus is of the order of 10^{-15} m, hence, volume is

$V \propto (10^{-15})^3 \text{ m}^3 \propto 10^{-45} \text{ m}^3$

$\therefore$ Density $= \frac{\text{mass}}{\text{volume}} = \frac{393.35 \times 10^{-27}}{10^{-45}} = 10^{20} \text{ kgm}^{-3}$

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