CHAPTER 13

OPEN STUDENT FOUNDATION
Physics (Class 12)
PRACTICE SHEET DAY 13

Date : 27/02/24

Section A

● **Write the answer of the following questions. [Each carries 1 Mark]** **[10]**

1. How long can an electric lamp of 100 W be kept glowing by fusion of 2 kg of deuterium ? Take the fusion reaction as ${}^{2}_{1}H + {}^{2}_{1}H \rightarrow {}^{3}_{2}He + n + 3.27\ MeV$

2. (a) Suppose, we think of fission of a ${}^{56}_{26}Fe$ nucleus into two equal fragments, ${}^{28}_{13}Al$. Is the fission energetically possible? Argue by working out Q of the process. Given $m\left({}^{56}_{26}Fe\right) = 55.93494\,u$ and $m\left({}^{28}_{13}Al\right) = 27.98191\,u$

   (b) The fission properties of ${}^{239}_{94}Pu$ are very similar to those of ${}^{235}_{92}U$. The average energy released per fission is 180 MeV. How much energy, in MeV, is released if all the atoms in 1 kg of pure ${}^{239}_{94}Pu$ undergo fission ?

3. How long can an electric lamp of 100 W be kept glowing by fusion of 2.0 kg of deuterium ? Take the fusion reaction as
   ${}^{2}_{1}H + {}^{2}_{1}H \rightarrow {}^{3}_{2}He + n + 3.27\ MeV$

4. Given the mass of iron nucleus as 55.85 u and A = 56, find the nuclear density.

5. Obtain approximately the ratio of the nuclear radii of the gold isotope ${}^{197}_{79}Au$ and the silver isotope ${}^{107}_{47}Ag$.

6. Describe the nuclear force and its characteristics.

7. Explain the process of thermonuclear fusion as a source of energy in the Sun and stars.

8. The Q value of a nuclear reaction A + b → C + d is defined by Q = [$m_A + m_b - m_C - m_d$]c^2 where the masses refer to the respective nuclei. Determine from the given data the Q-value of the following reactions and state whether the reactions are exothermic or endothermic.
   (i) ${}^{1}_{1}H + {}^{3}_{1}H \rightarrow {}^{2}_{1}H + {}^{2}_{1}H$
   (ii) ${}^{12}_{6}C + {}^{12}_{6}C \rightarrow {}^{20}_{10}Ne + {}^{4}_{2}He$
   Atomic masses are given to be :
   $m({}^{2}_{1}H) = 2.014102\ u$
   $m({}^{3}_{1}H) = 3.016049\ u$
   $m({}^{12}_{6}C) = 12.000000\ u$
   $m({}^{20}_{10}Ne) = 19.992439\ u$

9. From the relation $R = R_0 A^{1/3}$, where R_0 is a constant and A is the mass number of a nucleus, show that the nuclear matter density is nearly constant (i.e. independent of A).

10. Write and explain the Einstein theory of special relativity.

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Section [A] : 1 Marks Questions					
No	Ans	Chap	Sec	Que	Universal_QueId
1.	-	Chap 13	S8	5	QP23P11B1211_P2C13S8Q5
2.	-	Chap 13	S9	21	QP23P11B1211_P2C13S9Q21
3.	-	Chap 13	S9	18	QP23P11B1211_P2C13S9Q18
4.	-	Chap 13	S9	17	QP23P11B1211_P2C13S9Q17
5.	-	Chap 13	S9	11	QP23P11B1211_P2C13S9Q11
6.	-	Chap 13	S10	20	QP23P11B1211_P2C13S10Q20
7.	-	Chap 13	S10	19	QP23P11B1211_P2C13S10Q19
8.	-	Chap 13	S10	18	QP23P11B1211_P2C13S10Q18
9.	-	Chap 13	S10	11	QP23P11B1211_P2C13S10Q11
10.	-	Chap 13	S10	13	QP23P11B1211_P2C13S10Q13

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➠ $t = 4.99 \times 10^4$ year

2. (a) Suppose, we think of fission of a ${}_{26}^{56}Fe$ nucleus into two equal fragments, ${}_{13}^{28}Al$. Is the fission energetically possible? Argue by working out Q of the process. Given $m\left({}_{26}^{56}Fe\right) = 55.93494\,u$ and $m\left({}_{13}^{28}Al\right) = 27.98191\,u$

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➠ Try Yourself

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(i) ${}_1^1H + {}_1^3H \rightarrow {}_1^2H + {}_1^2H$

(ii) ${}_6^{12}C + {}_6^{12}C \rightarrow {}_{10}^{20}Ne + {}_2^4He$

Atomic masses are given to be :

$m({}_1^2H) = 2.014102\ u$

$m({}_1^3H) = 3.016049\ u$

$m({}_6^{12}C) = 12.000000\ u$

$m({}_{10}^{20}Ne) = 19.992439\ u$

➠ Try Yourself

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10. Write and explain the Einstein theory of special relativity.

➠ Try Yourself