# Nuclear Physics

1. Find the energy equivalent of an electron, proton and a neutron in the scale of eV.

2. Find the activity of 5 mg of radon $^{222}Rn_{86}$, if the half life is 3.8 days. What is the activity after one week?
3. A piece of wood from the ruins of an ancient dwelling was found to have a $^{14}C$ activity of 13 disintegrations per minute per gram of its carbon content. The $^{14}C$ activity of living wood is 16 disintegration per minute per gram. How long ago did the tree die from which the wood sample came?
4. A rock sample contains 1 mg of $^{206}Pb$ and 4 mg of $^{238}U$, whose half-life is 4.47 By. How long ago was the rock formed?

5. If the radius of a nucleus is of the order $10^{-14}$ m, using uncertainty principle, show that neutrons and protons do not posses any significant kinetic energy.

6. A nuclear reactor is generating energy at the rate of 320 MW. Calculate the number of $U^{235}$ atoms undergoing the fission process, if the average energy released in each fission is 200 MeV.

7. A city requires on average 200 MW of power per day which is being generated by $U^{235}$. The efficiency of the reactor is 30%. Calculate the amount of $U^{235}$ required per day. Given the energy released per fission is 200 MeV.

8. Calculated the time-period required for 10% of thorium to disintegrate. Given the half-life of thorium is $1.4 \times 10^{10}$ years.

9. The half period of two isotopes A and B of a radioactive substance are $2.31 \times 10^9$ and $3.465 \times 10^8$ years respectively. Assuming that at the time of formation of each, A and B were in the ratio of 1:2, calculate the age of earth when their present ratio is 98:2.

10. A carbon specimen found in a cave contained 1/8 as much $C^{14}$ as an equal amount of carbon in living matter. Calculate the approximate age of the specimen. Half-life period of $C^{14}$ is 5568 years.

11. Which of the following reactions are allowed under the conservation of charge and baryon number?
    a. $\pi^+ + n \rightarrow \Lambda^0 + K^+$
    b. $\pi^+ + n \rightarrow K^0 + K^+$
    c. $\pi^- + p \rightarrow \Lambda^0 + K^0$
    d. $p + \gamma \rightarrow p + \pi^0$
    e. $p + p \rightarrow K^+ + \Sigma^+$
    f. $\Lambda^0 \rightarrow K^+ + K^-$

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