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**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**14-16 AHMADU BELLO WAY, VICTORIA ISLAND LAGOS**

**SEPTEMBER/OCTOBER 2015 EXAMINATION**

**SCHOOL OF SCIENCE AND TECHNOLOGY**

**COURSE CODE: PHY 456**

**COURSE TITLE: NUCLEAR REACTOR PHYSICS**

**Time: 2hrs**

**Instructions: Answer any five questions**

1. (a) List and briefly explain the different ways by which neutrons can interact with nuclei. (b) List and briefly explain the frames of references considered for neutron moderation. (c) Derive the fractional energy $\frac{E\_{1}}{E\_{o}}=\frac{\left[1+A^{2}+2Acosθ\right]}{\left[1+A\right]^{2}}$
2. (i) Define the following terms as related to neutron physics: (a) Slowing Down Power (b) Average Log Energy Decrement (c) Cross section in moderating process (d) Resonance effect.
3. (ii) In an experiment to measure the total cross-section of lead for 10MeV neutrons, it is found that 1cm thick lead attenuate neutron flux to 84.3 per centof its initial value. The atomic weight of lead is 207.21 and its specific gravity is 11.3.Calculate the total crosssectionIn a tabular form write down the intermediate bosons and their properties.
4. If the number of neutrons is reduced to half of its original value after passing through a moderating material (heavy water) of thickness 15cm. Calculate its thermal diffusion area and length given the diffusion co-efficient and absorption cross section of heavy water as 0.87cm and 2.9X10-5cm-1 respectively.
5. (i). State Fick’s Law. (ii). Briefly explain the equation of continuity. (iii). State the steady state equation of continuity and explain what each term stands for in the equation. (iv) State the diffusion equation and explain what each term of the equation stands for.
6. It has been shown in this unit that the flux at the distance *r* from a point source emitting S neutrons per second in an infinite moderator is given by the formula $∅\left(r\right)=\frac{Se^{-^{r}/\_{L}}}{4πDr}$ Where L is a constant. Find expression for (a) the neutron current in the medium, (b) the net number of neutrons flowing out through a sphere of radius r surrounding the source.
7. (i). Distinguish between nuclear fission and nuclear fusion. (ii). Describe the conditions necessary for nuclear fusion to take place. (iii). Mention one example each of physical phenomenon where nuclear fission and fusion can take place.