

- (g) Define the 'mean free path' λ for a neutron in a material.

Water is used as the moderator in a PWR. Calculate the mean free path of a thermal neutron in water given that the absorption cross section for thermal neutrons in water is $\sigma = 0.66$ barns.

What are the consequences for the spacing of the fuel rods in a PWR?

[You may assume the formula $\lambda = \frac{1}{\sigma N}$ and the density of water $\rho = 1000 \text{ kg m}^{-3}$.]

- (h) A breeder reactor operates at a rating of 500 MW per tonne of ^{233}U .

What other element is required for the production of ^{233}U in the breeding process?

If the breeding ratio $B = 1.16$, and the reactor is run for 10 years, calculate how much surplus ^{233}U is produced per tonne of ^{233}U consumed assuming an energy release of 200 MeV per fission.