(f) Calculate the energy released when a thermal neutron is captured by the nucleus of a ^{235}U atom that then fissions to produce ^{137}Cs, ^{97}Zr and two neutrons.

[Atomic masses: n=1.0087u, ^{235}U=235.0439u, ^{137}Cs =136.9070u, ^{97}Zr =96.9110u; 1u=931.48 MeV/c^2]

(g) Show that the reactor equation $\nabla^2\Phi + 3(k_\infty - 1)\overline{\Sigma}_A\overline{\Sigma}_S\Phi = 0$ has solutions of the form

$$\Phi = A\cos(k_1 x)\cos(k_2 y)\cos(k_3 z)\ ,$$

where x, y, z are the variables and k_1, k_2, k_3 are constants.

If the reactor takes the form of a cube of side a, with the origin for the xyz coordinate system at the cube centre, show that $k_1 = k_2 = k_3 = \pi / a$ and that

$$(k_\infty - 1)\overline{\Sigma}_A\overline{\Sigma}_S = \frac{\pi^2}{a^2}\ .$$