

八十五學年度 核工與 2 物系(所) 組碩士班研究生入學考試

科目 反應器分析 科號 3805 共 2 頁第 1 頁 \*請在試卷【答案卷】內作答

1. (21%)

Assume the scattering of neutrons with moderator of mass number  $A$  is isotropic in the COM system.  $\alpha = \left(\frac{A-1}{A+1}\right)^2$ .

a) Prove the probability that a neutron with laboratory energy  $E$  will emerge from

a collision with an energy  $E'$  is

$$P(E \rightarrow E') = \begin{cases} \frac{1}{E(1-\alpha)}, & \alpha E < E' < E \\ 0, & \text{otherwise} \end{cases}$$

b) Show that for elastic scattering between velocities  $v$  and  $v'$  is given by:

$$P(v \rightarrow v') = \begin{cases} \frac{2v'}{(1-\alpha)v^2}, & \sqrt{\alpha}v < v' < v \\ 0, & \text{otherwise} \end{cases}$$

c). Find the average speed after a collision.

2. (20%)

Find the critical condition for a reflected spherical reactor with core radius  $R$  and reflector thickness  $T$ .

3. (15%)

a) Explain the inner iteration in a one-dimensional problem with

$\phi = 0$  at the boundaries.

b) Explain the outer iteration for obtaining the multiplication constant.

4. (12%)

Prove that for the case of neutron slowing down from sources uniformly distributed throughout an infinite, nonabsorbing, homogeneous medium, the slowing down density,  $q(E)$ , is a constant.

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5. (12%)

Neutrons slow down from 2 MeV in an infinite medium of hydrogen. What is the relative probability that they do not undergo a collision in the resonance region, say from 5 eV to 200 eV. That is, what is the probability that they jump over the resonance region entirely.

6. (10%)

- Explain qualitatively the NR and NREM approximations.
- Discuss the energy dependence of the applicability of the NR and NREM approximations.

7. (10%)

- What is the resonance self-shielding? Explain how it occurs.
- What is its physical significance?