1. A large sheet of lead one half inch thick is placed normal to a neutron beam. What fraction of the neutrons would you expect to get through this plate without absorption?

For Pb, $\sigma_a=0.17$ barns, $\sigma_s = 11.4$ barns, $\rho=11.35$ g/cm$^3$, $A=207.7$ g/mole

2. Dry air has a density of 0.0013 g/cm$^3$ and is roughly 79% nitrogen by weight and 21% oxygen by weight.

For oxygen: $\sigma_a=0.00027$ barns, $\sigma_s = 3.76$ barns, $A=16$ g/mole
For nitrogen: $\sigma_a=1.85$ barns, $\sigma_s = 10.6$ barns, $A=14$ g/mole

a. What is the macroscopic cross section for scattering and for absorption of thermal (2200 m/s) neutrons in air?
b. What percentage of the neutrons absorbed in air is absorbed in oxygen?
c. What is the probability of a neutron traveling 100 m in air without reacting?

3. When a 0.0025 cm thick foil of material of mass number 10 and density 2 g/cm$^3$ is bombarded with a neutron beam perpendicular to foil plane, it is observed that only 50% of the neutrons pass through. Assuming that scattering is negligible, calculate the microscopic cross section for neutron absorption of this material.

4. A certain medium has the following properties: $\Sigma_s = 0.1$ cm$^{-1}$ and $\Sigma_a = 0.01$ cm$^{-1}$.

a. What is the probability that a neutron will travel 1 cm in this medium without interacting with a nucleus?
b. If the neutron speed is $2 \times 10^5$ cm/s, what is the average time between scattering collisions?