

EXERCISES 13.2 (submit by 10.07.2015)

1. A container of volume 20 litres is filled with air consisting of 80% of nitrogen and 20% of oxygen. Nitrogen is flowing into the container at speed 0.1 litre per second, immediately mixes with the air in the container, and flows out of the container at the same speed. Find the time at which the container will contain 99% of nitrogen.
2. A body cools down from 100 C to 60 C in 10 minutes in an environment with constant temperature of 20 C. Find the time at which the body cools down to 25 C, if it is known that the rate of cooling is proportional to the difference between the body temperature and the temperature of the environment.
3. *Uranium-lead dating.* A piece of rock contains 100 mg of uranium and 14 mg of lead. Find the age of the rock, given that uranium decays to half of its initial value in $4.5 \cdot 10^9$ years, and the complete decay of 238 g of uranium produces 206 g of lead. Assume that the rock did not contain any lead at creation, and neglect all intermediate radioactive products between uranium and lead. Use the law of radioactive decay that the rate of decay is proportional to the number of atoms.