Radioisotope and Radiation Applications
EXERCISES
Week 6b

Topic: Radiation Chemistry

Problem 33:
An equimolar mixture of nitrogen and oxygen at a total pressure of one atmosphere at 298 K is circulated through a 100 liter reaction vessel in an irradiation facility at a dose rate of 10^3 Gy per hour and the oxides of nitrogen produced are condensed out. Calculate the consumption of nitrogen per day if G(-N_2)=5 for this system. Is it likely to provide a suitable basis for an industrial process for the fixation of nitrogen?

Topic: Neutron Activation Analysis, Nuclear Dating

Problem 34:
Study the three natural decay chains and answer the following questions:

- How many α-particles are produced in each chain?
- Which daughter in each chain has the longest half-life?
- After how many years is equilibrium practically established in each chain?

Problem 35:
Show that, if the fields are oriented perpendicular to an ion beam, the following statements apply:

- an electric field constitutes an energy-filter.
- a magnetic field constitutes a momentum-filter.

Furthermore show that, if both fields point into the same direction, all ions with the same e/m-ratio will hit identical parabolas on a screen.

Problem 36:
Assume that a tea sample (mass 1g) containing the tolerance value for methyl bromide of 50mg/kg is irradiated with a neutron flux density of $3.6 \cdot 10^{10}/\mathrm{cm}^2/\mathrm{s}$.

- Which (maximum) activity would the bromine in the sample reach after an infinite irradiation time?
- Which activity has the bromine in the sample after an irradiation time of 30 minutes?

Problem 37:
Become familiar with the Journal *Applied Radiation and Isotopes*.

- Look up the Journal on the Web.
- Extract (if possible) the papers that were discussed in the seminar of week 5 and try to understand the investigations that are described and their results.