

# Effects on the Chemical Equilibrium

## Self-Study Module

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### Objectives

- To understand how a chemical equilibrium responds to changes in concentration, pressure and temperature.
- To be able to apply Le Châtelier's principle and to use the law of mass action for qualitative considerations.
- To get an idea of how the theory of chemical equilibrium is used to implement chemical synthesis.

### Prerequisites

- Chemical equilibrium & law of mass action
- Avogadro's law
- Identification of the ions present in a salt

### Time required

- Altogether 3½ lessons:
  - Part 1 (concentration change): 1½ lessons. Since a whole lesson is needed for the students' experiments, problems #1 and 2 should be solved in the previous lesson.
  - Parts 2 and 3 (Le Châtelier's principle, ammonia synthesis): 1 lesson each - students who need more time complete the work at home.

### Didactic and methodical suggestions

- While the students work on their own, the teacher can answer individual questions and support students as necessary.
- The students' experiments are meant to be done in pairs.
- The last two pages contain the answers to the problems. For classes with a low level of self-discipline, it may be advisable not to distribute them to the students but to put just a few copies on a table in the classroom, which are not to be removed.

- Additional tasks for students who work fast:
  - Watch the film “Ammonia.mpg”<sup>1</sup> and answer the questions on the worksheet “Equilibrium-questions-about-the-film.pdf”.
  - Perhaps simulate the experiments with the iron-thiocyanate complex on the computer. A suitable program can be found in chapter 15.1 on the CD “Central Science Live” (see the following list of resources).

## Resources

- Material for the experiments: see page 2 of the students’ handout.
- Computer or DVD player to watch the film “Ammonia.mpg”.
- Optional: computer and the CD “Central Science Live” provided with the book “Chemistry: The Central Science” from Brown & LeMay & Bursten, ISBN 0-13-084517-5.

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<sup>1</sup> Source: [www.rsc.org/education/teachers/learnnet/alchemy/index2.htm](http://www.rsc.org/education/teachers/learnnet/alchemy/index2.htm)