Demonstration (5th - 10th grade)	**Ammonia Fountain**	**Time:** max. 15-20 min.

Safety:

safety glasses (possibly gloves)

Instruments:

- 1 5ml ampoule bottle (from micro-glassware set)
- 1 10 ml ampoule bottle (from micro-glassware set)
- 1 30 ml narrow-necked flask (plastic) with spray block
- 1 coupling (from micro-glassware set)
- 1 candle
- 1 Laborboy (scissor lift platform)
- (yellow) Eppendorf pipette tips
- matches or lighter
- Retort stand, clamps, etc.

Chemicals:

- sodium hydroxide pellets (H: 314; P: 280-301+330+331-309-310-305+351+338)
- ammonium chloride (H: 302-319; P305+351+338)

Preparation:

Part 1:
Screw a coupling onto a 5 ml ampoule and then immobilize the ampoule using the retort stand material. Place a 30 ml narrow-necked flask upside-down onto the coupling. The narrow-necked flask is not tightly screwed onto the coupling, but rather only placed upon it (see photo 1).

Part 2:
Screw a lid with a hole onto a 10 ml ampoule. Push a yellow Eppendorf tip through the lid hole so that the end is sticking out of the ampoule. This construct can be lengthened by adding additional Eppendorf tips above or below the first. Place the cap of the narrow-necked flask onto the protruding tip, so that the flask can be securely screwed onto the apparatus in the second part of the experiment. The apparatus should be constructed as airtight as is possible.

Photo 1

Experiment:

Part 1: Gas synthesis

- Place 2 pellets of sodium hydroxide (NaOH) and a pinch of ammonium chloride (NH_4Cl) in the 5 ml ampoule.
- Pour a small amount of water into the vessel, fasten the ampoule into the apparatus, and capture the escaping gas with the narrow-necked flask.
- The reaction can be sped up by very carefully warming the reactants with a candle.

Part 2: Fountain

- Fill the 10 ml ampoule in the second apparatus with water and a few drops of phenolphthalein and place the flask into the second retort stand construct.
- As soon as enough gas is collected (in Part 1) or the reactants have completely reacted, place the narrow-necked flask into the second apparatus as described (see above) and fasten it in place.

Observations:

In the first part the evolving of gas bubbles can be observed. In the second part of the experiment a nice ammonia fountain can be observed. The water in the narrow-necked flask turns pink.

Results:

Part 1: Gas synthesis

$NaOH\ (s) + NH_4Cl\ (s) \rightarrow NH_3\ (g) + H_2O\ (l) + NaCl\ (aq)$

Part 2: Fountain

The ammonia gas (NH_3) is quite soluble in water.

$NH_3\ (g) + H2O \rightarrow NH_4^+\ (aq) + OH^-\ (aq)$

Negative pressure develops. This pulls the water-indicator mixture into the narrow-necked flask. Since an alkaline solution has resulted (see equations above), the indicator turns pink.

Indication of OH^- ions using phenolphthalein:
Phenolphthalein is an indicator.
Between pH 0 - 8,2 the indicator remains colorless; at pH > 8,2 it becomes pink-purplish.

Disposal:

The solutions can be strongly diluted, then poured down the drain.
