Ammonia Fountain

Description: A small amount of water is introduced into an inverted flask containing NH₃ gas. The flask is connected to a beaker filled with water by a glass tube. As NH₃ (g) dissolves in the water, a vacuum is created causing the water in the beaker to rise into the inverted flask.

Materials:

- Water
- Phenolphthalein
- Dry NH₃ gas
- Medicine dropper
- 2-L round bottomed flask
- 2-L beaker
- 2-hole stopper
- Glass tube (~2 ft. in length)
- Ring stand and clamps

Procedure:

1. Fill the 2-L flask with dry NH₃ and seal with a rubber stopper. Be sure there is no residual water on the walls of the flask prior to filling with gas. This can be done by rinsing the walls with acetone and drying. NH₃ can be obtained from a tank or generated chemically. NH₃ can be generated by gently heating (in a hood) a 1:1 mixture of NH₄Cl:NaOH in a glass tube. Another method involves gently heating (in a hood) a small amount of concentrated NH₄OH inside the flask to be used.

2. Once the NH₃ flask is filled, setup the demonstration as depicted in the figure below. The glass tube should be about ½ inch from the bottom of the inverted flask and cannot rest flat against the bottom of the flask. Fill the beaker with 1.5 L of water. To this, add 1 mL of indicator solution.

3. Remove the bulb from the medicine dropper and fill it with water. Place it back on the dropper and squeeze the water into the flask. The NH₃ gas will dissolve in the water and cause the water from the beaker to rise into the flask. At this point the phenolphthalein present will indicate a basic solution (pink).
Discussion: Ammonia gas is extremely soluble in water because it reacts with water to generate NH$_4^{1+}$ as shown below. In this demonstration, the small volume of water introduced by the medicine dropper begins to dissolve the NH$_3$ in the flask. This creates a vacuum in the flask which causes the water from the beaker to rise through the tube and begin to fill the flask. As more water enters the flask, more NH$_3$ is dissolved until the beaker is empty.

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\text{NH}_3 (\text{aq}) + \text{H}_2\text{O (l)} \rightarrow \text{NH}_4^{1+} (\text{aq}) + \text{OH}^{1-} (\text{aq})
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Safety: Wear proper protective equipment including gloves and safety glasses when preparing and performing this demonstration. NH$_3$ is irritating to the eyes and lungs and should only be prepared or handled inside a fume hood. Mixtures of NH$_3$ gases should be kept away from sparks or open flame.

Disposal: Neutralize the basic solution with acetic acid and flush the resulting solution down the drain with plenty of water.
References:


Summerlin, L. R.; Ealy, J. L. In Chemical Demonstrations: A Sourcebook for Teachers; American Chemical Society: 1985; Vol. 1, p 10-11.


Video:
http://www.youtube.com/watch?v=hpSdR2SEaXI

http://www.youtube.com/watch?v=sLpITPAqdUI (chemiluminescent)