

D1: Chemiluminescent Ammonia Fountain

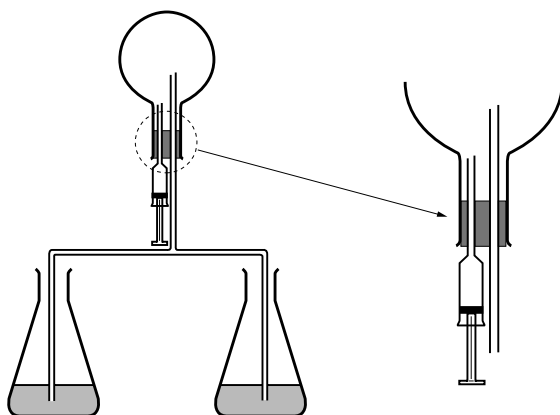
- Preparation time 30-60 minutes
- Demonstration time less than 5 minutes


Requirements


weighing balance	ammonia solution, NH_3 (aq), concentrated '880'
2 x 1 dm ³ conical flasks	0.2 g luminol*
round bottomed flask (strong), volume between 500 cm ³ and 2 dm ³	4 g sodium carbonate, Na_2CO_3
stirring rod	24 g sodium hydrogencarbonate, NaHCO_3
plastic syringe	0.5 g ammonium carbonate, $(\text{NH}_4)_2\text{CO}_3$
assorted bungs and delivery tubes	0.4 g copper sulphate, CuSO_4
to set up the apparatus in the diagram	50 cm ³ hydrogen peroxide, H_2O_2 , 3%
safety screen	
access to a fume cupboard	eye protection

*Advance warning: luminol is available from Aldrich Chemicals, see Section 3 for address.

Method



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Set up the apparatus as shown in the diagram, behind a safety screen or in a fume cupboard.
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Prepare solution A: Dissolve 4 g Na_2CO_3 in 500 cm³ of water and add 0.2 g luminol. Stir to dissolve. Add 24 g NaHCO_3 , 0.5 g $(\text{NH}_4)_2\text{CO}_3$ and 0.4 g CuSO_4 . Stir well until all the solids dissolve. Dilute to 1 dm³ with water. Fill one of the conical flasks with this solution.
- Prepare solution B: Dilute 50 cm³ of 3% H_2O_2 to 1 dm³ with distilled water. Fill the other conical flask with this solution.



conduct this demonstration behind safety screens or in a fume cupboard, wearing eye protection



CORROSIVE
'880' ammonia solution



HARMFUL
copper sulphate solid



TOXIC
ammonia gas

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4.

Fill the round bottomed flask with NH_3 gas in one of two ways.

Either swirl a small amount of concentrated '880' ammonia (approx. 1 cm^3) around the flask. Take great care with this.

Or heat the concentrated '880' ammonia in another flask to which you have attached a delivery tube. Fill the round bottomed flask from this flask for about 5 minutes to ensure that it contains a good supply of gas.

5. Fill the syringe with water.

6. Turn off the lights and darken the room if possible.

7. Inject several cm^3 of water from the syringe into the ammonia-filled flask. This starts the reactions.

8. By increasing the concentration of H_2O_2 or the amount of luminol, the chemiluminescence increases.

Chemical background

When a small amount of water is injected into the flask containing ammonia, the ammonia dissolves. The reduction in pressure causes solution A and B to be simultaneously drawn into and mixed in the inverted flask. This should produce a bright blue luminescent fountain.

Luminol is oxidised by hydrogen peroxide to the aminophthalate ion which is produced in an excited state and emits light when it drops down to the ground state.

