Demonstration corner

THE NORTHERN LIGHTS

The phrase 'The Northern Lights' probably conjures up an image similar to that shown in Figure 1. The phenomenon arises from the interaction/collision of charged particles with atoms or molecules in the upper reaches of the earth's atmosphere. A significant proportion of the energy released from such processes appears in the visible part of the electromagnetic spectrum.

Figure 1 *- Image attributed to Rafal Konieczny. Downloaded from http://commons.wikimedia.org/wiki/File:Aurora_Borealis_NO.JPG (accessed October 10th 2013).*

We have come across another use of the term 'The Northern Lights' and it is this latter usage which forms the basis of this contribution from the Demonstration Corner Team.

The Northern Lights demonstration was first shown to us by Simon Quinnell of the National Science Learning Centre (NSLC) in York. Simon in turn had been shown the demonstration by Tracey Padgham when she was a participant on a course run at NSLC. Our searches in the literature have failed to locate other mentions of the demonstration.

Materials

You will the following items:

- 500 cm^3 or 1 dm^3 wide-necked conical flask;
- 20 cm^3 of concentrated HCl;
- 200 cm^3 distilled water;
- 5-6 g $CuCl_2.2H_2O$;
- Spatula;
- Heat proof mat;
- Aluminium foil (approximately 20 cm x 20 cm, screwed up into a loose ball shape);
- Safety screen;
- Matches;
- Splints.

Method

1) Place the conical flask on a heat proof mat, surrounded by safety screens.
2) Add water and then HCl (must do it this way round).
3) Add $CuCl_2.2H_2O$.
4) Add aluminium foil.
5) Turn the room lights down (or if safe to do so turn them off).
6) Allow the reaction to continue for approximately 30 s then using a lit splint ignite the hydrogen gas that will have built up (this should be at arm's length and from behind the screen).
7) Step 6 can be repeated a few times.
8) Once the reaction mixture has cooled down the production of copper can be shown.

Observation

On the basis of their positions in the reactivity series we can predict that copper will be displaced from its salts by aluminium. Because of the presence of an impermeable oxide layer on the aluminium foil the reaction would not normally proceed in aqueous solution. The presence of the acid has 2 effects. The acid removes the oxide layer thereby exposing 'pure' metal. The displacement of the copper then proceeds. A second reaction which takes place is the production of hydrogen gas as a result of the reaction between aluminium and the acid. After a time delay (30 s or so) sufficient hydrogen is produced to allow its ignition. The hydrogen which has been produced is of course moist and the moisture contains some copper ions because of their solubility. Upon ignition of the hydrogen the characteristic green flame test colour of copper is observed.