Making Hydrogen – Teacher's Instructions

For Demonstration/Class Activity

Make Sure You Have…

Sodium Hydroxide (NaOH, 6 M) solution

Aluminium Foil (Al)

Crystallising dish

Detergent in water (adding a bit of glycerol can help to make the bubbles stay!)

Test tube with side arm

Test tube stopper

Rubber tubing

Clamp stand

Plastic pipette with bulb cut off

Splint

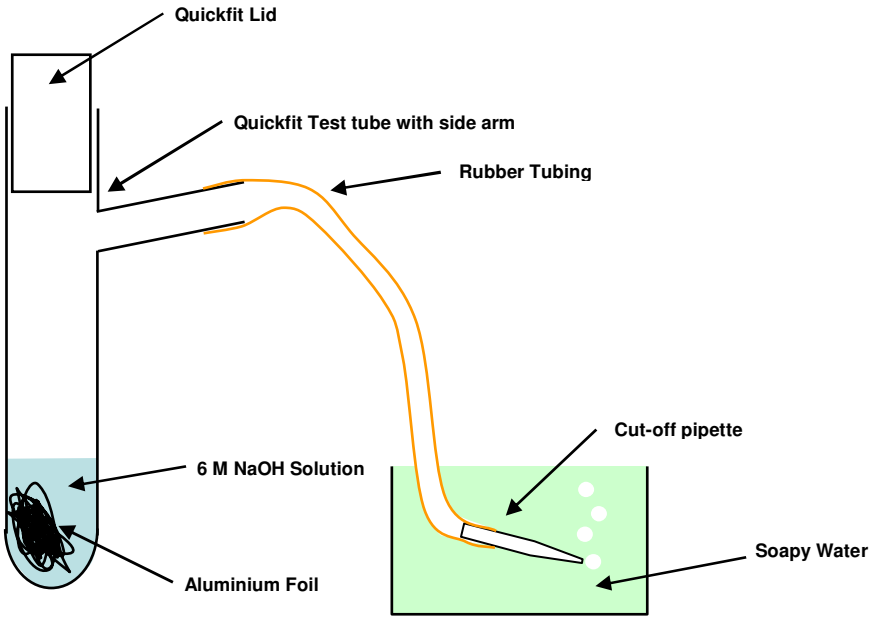
Matches

Pipette

What To Do….

1. Attach the rubber tubing to the side arm of the test tube
2. Push the cut pipette into the other end of the rubber tubing
3. Clamp your newly-made bubbling apparatus (it will get hot!)
4. Fill the crystallising dish with about 1 cm depth of soapy water
5. Put a small lump of aluminium foil in the test tube
6. **Carefully** measure ~10 cm^3 of sodium hydroxide solution pour onto the foil in the test tub
7. Stopper the test tube

8. Put the end of the pipette in the detergent/water solution and allow a few bubbles to develop (set up shown below).



9. Remove the pipette to a safe distance (remember it will probably still be producing hydrogen)
10. Pop the bubbles with a lit splint (**keep hair/faces/sleeves well back!**)

    The bubbles are flammable so there should be a good pop and a flame

11. Wash everything carefully with water into the bucket provided and leave the station as you found it.
12. Wash everything up (solutions can go down the sink)

What's Happening?

Sodium hydroxide reacts with Aluminium to produce Hydrogen, the most common element in the universe.

$$2Al(s) + 2NaOH(aq) + 6H_2O \rightarrow 2Na^+(aq) + 2[Al(OH)_4]^- + 3H_2(g)$$

Note that it takes a few seconds for the reaction to get going. This is because Aluminium is always covered by a layer of un-reactive Aluminium Oxide. In order for the Aluminium to react, the Aluminium oxide layer has to be broken down first.

Hydrogen reacts with oxygen to form water. This reaction is extremely quick and produces a lot of energy. You will have seen this from the bubbles of hydrogen that you lit with the splint.

$$2H_2 + O_2 \rightarrow 2H_2O$$

A lot of research is being done into using this energy to power things such as cars. This is better than fossil fuels such as petrol as hydrogen can be made from renewable sources and the only chemical produced when you burn it is water!

Hydrogen Powered Cars are already used in some countries as Hydrogen is a good source of "Clean" Energy (http://www.ornl.gov/)