Reactions of metals with acids

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This is for those who were away on the history trip to the Imperial War Museum to catch up on the work missed. You should copy these notes up into your book, filling in any gaps and answering questions, which should take less than one hour. Please email me if you have any questions, and note that this work may be included in the test on 13 December.

In this lesson, we found out what happened when various metals react with hydrochloric acid. Most metals will react with acids, but some will react only very slowly with a strong, concentrated acid, and other will be much more vigorous, even exploding!

We tested whether various metals would react with quite strong (2 M) hydrochloric acid: magnesium (small pieces of ribbon), copper (fine shavings), iron (fine wool) and zinc (small pellets).

The laboratory test for hydrogen is to bring a lighted splint to a sample of the gas in a test tube. Hydrogen will burn with a squeaky pop.

Zinc pellets

When a small pellet of zinc metal is added to some hydrochloric acid, we found that it reacts, giving off bubbles of gas, although this is quite slow. To produce enough of the gas to test, the reaction had to be heated gently on a bunsen burner, and then the gas was found to be hydrogen.

$$\text{Zinc} + \text{Hydrochloric acid} \longrightarrow \text{Hydrogen} + \text{Zinc chloride}$$

$$\text{Zn} + 2\,\text{HCl} \longrightarrow \text{H}_2 + \text{ZnCl}_2$$

1. How do we know there is a reaction when we add zinc metal to hydrochloric acid?

Magnesium ribbon

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Magnesium ribbon fizzed quite vigourously when a small piece was added to hydrochloric acid. The bubbles of gas which were given off were found to be hydrogen.

$$\text{Magnesium} + \text{Hydrochloric acid} \longrightarrow \text{Hydrogen} + \text{Magnesium chloride}$$

$$\text{Mg} + 2\,\text{HCl} \longrightarrow \text{H}_2 + \text{MgCl}_2$$

2. What is the test for hydrogen gas?

Copper shavings

Copper would not react with the hydrochloric acid in our experiments, even when heated. This unreactivity might give some clue as to why copper is used in water pipes!

Iron wool

Despite the fact that the iron was drawn out into a fine wool, there were only a few bubbles as evidence that the iron had reacted with the acid. Not enough hydrogen gas was produced to prove that it was in fact hydrogen, even when the reaction was gently heated:

3. Write the word equation for the reaction between iron and hydrochloric acid.

4. Balance the symbol equation below:

$$\square\ \mathrm{Fe} + \square\ \mathrm{HCl} \longrightarrow \square\ \mathrm{H_2} + \square\ \mathrm{FeCl_2}$$

Reactivity series

From the experiments we have done this lesson, we can establish a series of reactivity:

Most reactive			**Least reactive**
Magnesium	Zinc	Iron	Copper