



Projects In A Box

Hydrogen Project

1 Synopsis

This project is aimed at learning of the importance of hydrogen for the conservation of the environment.

It may be used for individual or for team learning.

Pupils first make hydrogen and oxygen and learn about them.

They are then asked to make hydrogen using sustainable energy.

The main part of the project is to write a report outlining how to mass produce hydrogen and answer question such as “where should hydrogen be produced?” and to estimate the costs of bulk delivery to UK.

2 Teachers’ Guide

2.1 Making Hydrogen

Safety glasses must be used by all and a safety shield used when lighting hydrogen and oxygen. Do not collect more than a test tube full.

Pupils should make hydrogen from water by electrolysis. Start with distilled water to demonstrate failure and learn why, then add a pinch of salt to achieve ionisation and electrolysis. Catch the hydrogen and oxygen in test tubes.

Prove which is which using a glowing splint. Oxygen re-lights the splint. Hydrogen explodes.

Now ask how to tell if either is heavier or lighter than air. Prove it by turning the test-tube with the mouth upwards/downwards so the gas flows out and the glowing splint test fails.

2.2 Making Hydrogen Using Sustainable Energy

Choose from or use all:

- use a solar cell (e.g. use the system from a garden light) to generate DC electricity
- use an electric motor in reverse, as a generator, with a diode rectifier, a fan blade. Use an air blower (e.g. vacuum cleaner in reverse)

In all cases, measure the voltage and current with a multi-meter.

You can use a lamp to light the solar cell, note how the current & voltage change with the distance from the lamp.

2.3 Making Hydrogen In Bulk

Which forms of sustainable energy can be used?

Where should hydrogen be made? Does this depend upon the way you generate electricity?

Consider:

- off shore wind power – if so where in the world? – what about storms and hurricanes?
- electrolysis - if so where – at sea? in sahara desert? mountain top?
- make the electricity distant from the electrolysis plant?
- costs of transporting the hydrogen or conveying electricity?

2.4 Report

Pupils should write a report with an initial summary which encourages the reader to read the entire report. Perhaps the reader is the Managing Director of a company and does not have time to read the whole report to find out the recommendation.

Where possible, costs, both investment and running costs, should be estimated and reported.

Profitability should be estimated if duty free prices are 50% of diesel

Compare with diesel prices published at <http://www.roadtransport.com/staticpages/dieselpricesandfueltax.htm> and elsewhere.

Calculate distribution costs as 1p per tonne/mile for hydrogen compressed at 1000 bar.

3 Pupil Guide

Most pupils have heard of the hydrogen powered cars and how hydrogen can be used to provide electrical energy.

This project helps you to learn about hydrogen and how to make it.

The main part of the project is to work out where and how the hydrogen should be produced in bulk.

You must write up the project so that the reader (e.g. the Managing Director of the company you work for) is given a summary on the first page and which is sufficiently compelling for the reader to continue.

You should make extensive use of the internet to gather ideas and facts.

3.1 Making Hydrogen

You have first to learn how to make hydrogen. Use whatever means you can to discover how and to make some.

As a by-process you may also make oxygen. How do you know which is which? Which one is lighter than air?

3.2 Making Hydrogen Using Sustainable Energy

Now you must make hydrogen using sustainable electric power.

What forms of sustainable electric power generation do you know about? Use one or more methods to make hydrogen.

3.3 Making Hydrogen In Bulk

What would be the best way to make hydrogen?

Where should you make it?

Where should you generate the power to make the hydrogen?

How would you transport the hydrogen a storage depot in the UK?

Alternatively, how would you send the power from the generator to the hydrogen making plant in UK?

Can you estimate the costs – capital investment costs and manufacture and distribution costs?

3.4 Reporting

Write a report with an initial summary which encourages the reader to read the entire report.

Where possible, costs, both investment and running costs, should be estimated and reported.

If possible, calculate the profitability if UK sales are made equal to the sales of diesel but at a price equal to 50% of the pre-duty price of diesel.

4. Artwork

none

5. Health and Safety Risk Analysis

Standard Classroom Health and Safety Risk Analysis.

plus:

Hazard	Risk	Preventive Measures	Score if over 10 additional measures are required		
			Severity	Likelihood	S x L
Hydrogen	Burns	Chemistry Laboratory Health and Safety Measures. Use fume cupboards. Wear Safety Glasses and Gloves. Close surveillance of pupils	4	1	4