

### Activity 1 – sheet 1 of 2

### Programme Questions

#### Ammonia

1. What makes ammonium nitrate such a useful fertiliser?

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2. Why is the formation of ammonia from nitrogen and hydrogen described as a reversible reaction?

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3. In order to get the optimum yield, what temperature and pressure are used during the manufacture of ammonia?

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4. Why is an iron catalyst used during the Haber process?

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5. Which three materials are used to manufacture nitric acid?

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6. Why is the manufacture of ammonium nitrate described as a neutralisation process?

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#### Plastics and Polymers

1. Which raw material is used to manufacture most plastics?

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2. Which two elements are present in the alkane family of chemicals?

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3. Which catalyst is used during the catalytic cracking of alkanes?

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4. How can you tell that the products of cracking are insoluble in water?

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### Activity 1 – sheet 2 of 2

### Programme Questions

5. What is the chemical test for alkenes?

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6. Which monomer is used to manufacture polystyrene?

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### Sulphuric Acid

1. Which gas is produced when sulphur burns?

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2. In what state does sulphur arrive at the sulphuric acid plant?

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3. Which catalyst is used to convert sulphur dioxide into sulphur trioxide?

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4. Why must the reactor vessel not get too hot?

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5. Which particular property of sulphuric acid makes it very useful in a range of industries?

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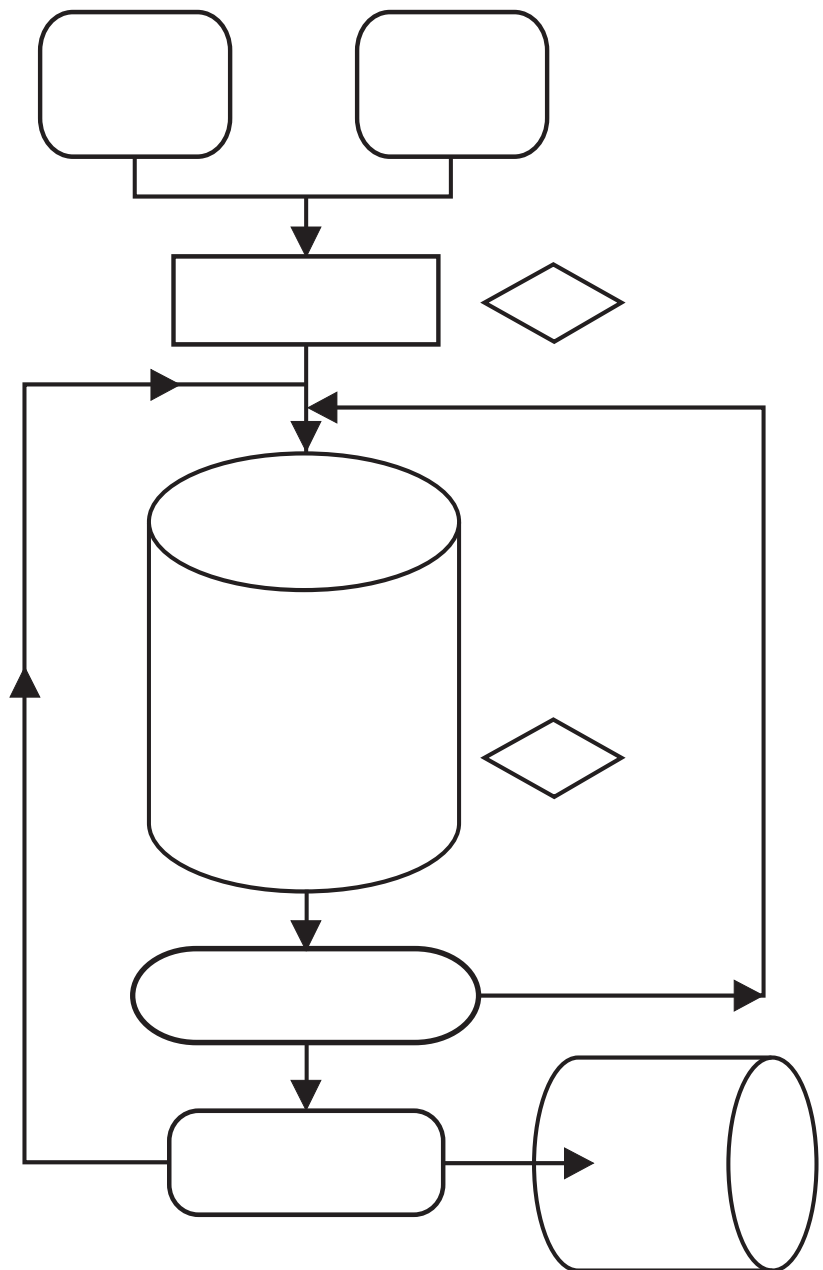
### Activity 2 – sheet 1 of 1

### The Haber process for Manufacturing Ammonia

Use the information below to label your diagram of the Haber process.

- a) Label the boxes with names of materials and processes.
- b) The diamonds should contain the values for temperature and pressure.
- c) Label any arrows that show things being recycled

Nitrogen gas from the air and hydrogen gas produced from methane is passed into a compressor. This raises the pressure of the gases to around 250 atm (atmospheres). The compressed gases pass into the reaction chamber. Here they pass over a finely-divided iron catalyst at a temperature of around 450°C. Here the gases react to form a small percentage of ammonia gas. The hot materials pass out of the reaction chamber and through a heat exchanger. In this section they are cooled and the extracted heat is recycled to warm up the gases as they enter the reaction chamber. From the heat exchanger the ammonia, hydrogen and nitrogen pass into a condenser. The ammonia turns to a liquid and is sent into a storage vessel. Any unreacted hydrogen and nitrogen are recycled back into the reaction chamber to make more ammonia.



### Activity 3 – sheet 1 of 2

### Waste Not Want Not – Disposal of Plastics

Plastics have often been seen as less than environmentally-friendly materials. This image is linked to a number of issues.

One issue relates to the raw material used for making plastics. Most plastics are manufactured from crude oil and some people think that this is not a sensible way to use such an important energy resource.

Another issue is the problems associated with disposing of waste plastics.



In this activity you will think about some of the strategies plastics manufacturers and users could adopt to deal with these kinds of issue. For example:

- trying to cut down on our use of plastics
- recycling waste plastics
- burning waste plastics to produce energy
- putting waste plastics into landfill sites.

#### Your task:

- Your group will be given a set of cards which contain information and facts about these four strategies. Cut these out.
- In your group you must take a card, read it and then decide as a group which of the four strategies the statement refers to. Do this for each card.
- Once you have four sets of cards, take each set in turn and decide whether the statements support, or do not support, that strategy.
- Use your sets of statements to draw up a table of pros and cons for each strategy.

**Concentrated liquids can be used and put into smaller bottles, which use less plastic.**

**Detergents can be bought in refill packs using less plastic.**

**In Europe only about 7 percent of plastics are recycled.**

More cards on sheet 2

**Activity 3** – sheet 2 of 2**Waste Not Want Not – Disposal of Plastics**

<b>Plastics are difficult to sort because objects can be made of more than one plastic mixed together.</b>	<b>Plastic bottle banks collect less than 10 percent of plastic bottles.</b>	<b>Reprocessing plastics produces low grade material unsuitable for quality applications.</b>
<b>Washing dirty plastics uses as much energy as it takes to make them.</b>	<b>People are finding more and more applications for plastics.</b>	<b>Second bins for plastic and paper waste can get 70 percent of bottles returned.</b>
<b>In America and Europe plastic packaging carries a code to identify the plastic.</b>	<b>In Britain most plastic is disposed of in landfill sites.</b>	<b>Landfill sites are becoming more and more scarce.</b>
<b>Most plastics are not biodegradable (they don't rot).</b>	<b>Plastic waste has a high energy content.</b>	<b>Many polymers give off toxic fumes when they burn.</b>
<b>When buried, plastics do not produce harmful degradation products.</b>	<b>It is expensive to treat the fumes from burning plastics.</b>	<b>Waste from plastic incinerators can be used in road construction.</b>