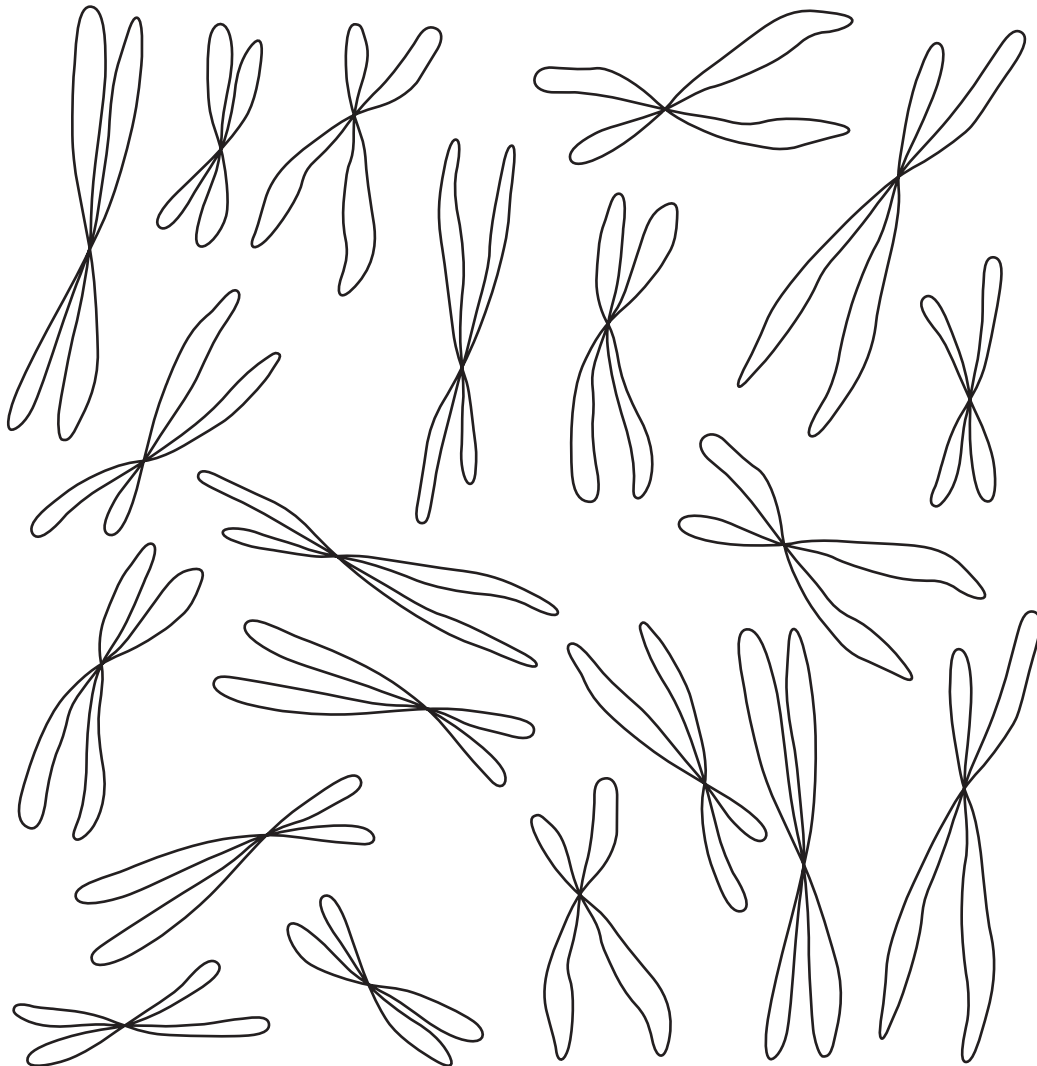


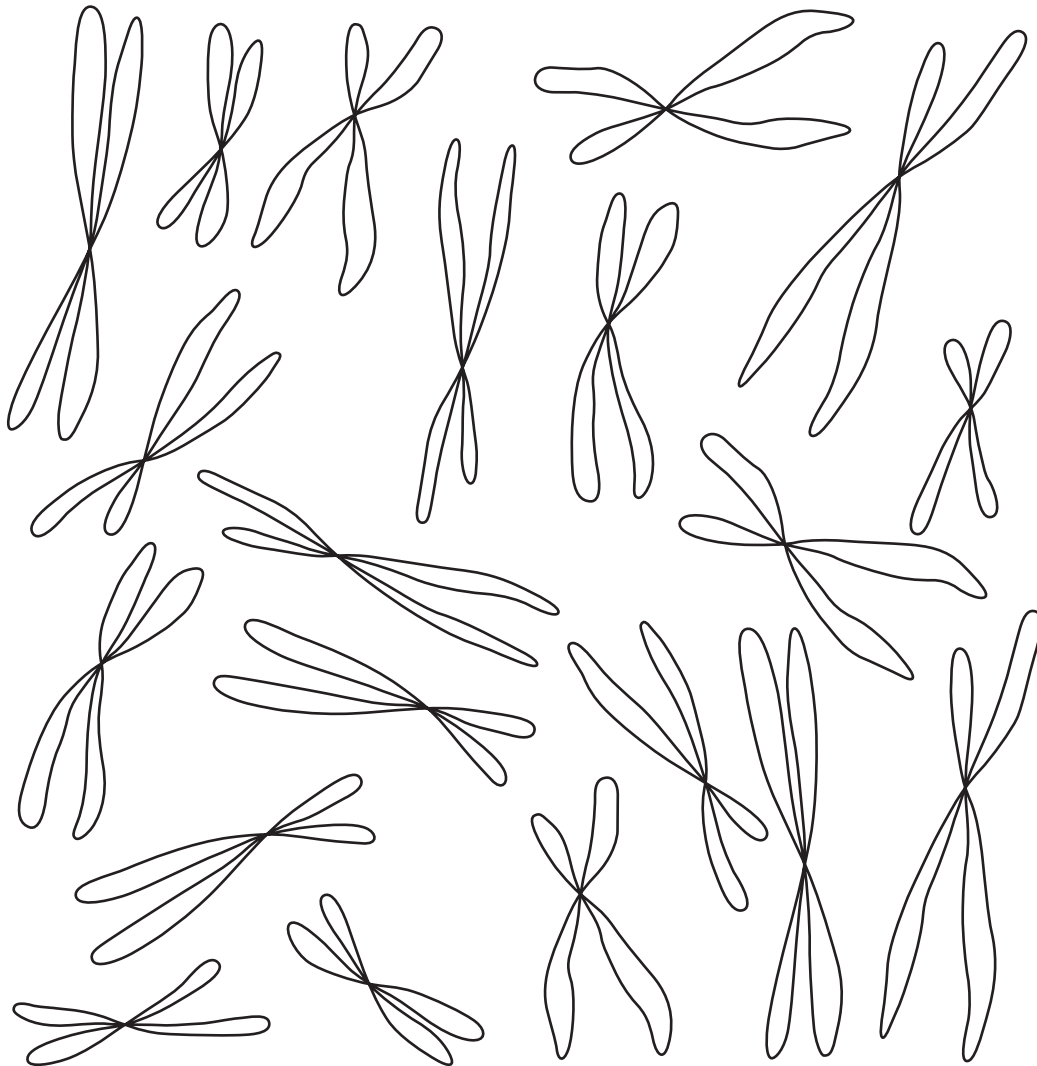
Chromosomes

Cut out the shapes of the chromosomes and try to arrange them in pairs so that the two chromosomes in a pair are the same shape and size. Are there any left over that cannot be matched into a pair?



Chromosomes

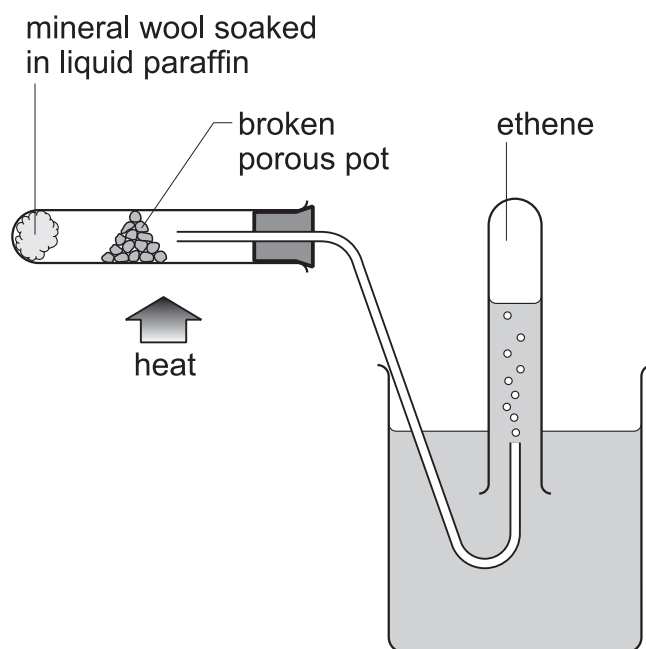
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Cracking alkanes

'Cracking' is the word used to describe the breaking of large organic molecules into smaller ones. One way to do this is by heating them – this is called 'thermal cracking'. In this activity you will crack some large alkane molecules to make ethene. You will then test the ethene.

- 1 Soak some mineral wool in heavy (medicinal) paraffin.
- 2 Heat the paraffin in the apparatus shown below. Keep the porous pot very hot and occasionally move the burner quickly onto the paraffin. Collect several tubes of the gas produced. (Do not collect the first few bubbles of gas – why not?)



- 3 Carry out the following tests on the gas:
 - Smell it. Ethene has a sweet smell.
 - Set fire to a tube of gas. Ethene burns with a yellow flame. Note the condensation on the tube. Test the gas that remains in the tube with limewater.

- Add a few drops of bromine water to one tube and note any colour change.
- Add a few drops of potassium manganate (VII) solution and note the colour change.

Determining the percentage of sodium hydrogen carbonate in commercial baking powder

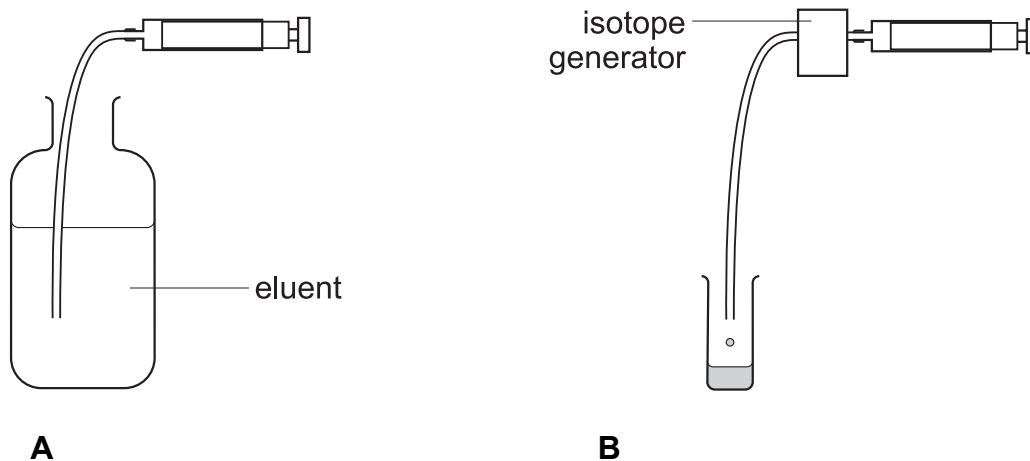
- 1 Weigh around 5 g of baking powder accurately on a watch glass.
- 2 Wash the powder into a 250 cm³ volumetric flask using distilled water. Top up the flask to the mark with distilled water. Stopper and repeatedly invert the flask to dissolve all soluble matter.
- 3 Pour out about half the contents of the flask into a clean dry beaker through a clean dry filter funnel and filter paper.
- 4 Wash a clean burette with a small amount of standard 0.1 M hydrochloric acid. Run out the washings, close the tap and fill the burette with the acid.
- 5 Suck a small quantity of the filtrate into a pipette (use a pipette filler), wash out the pipette and discard the washings. Wash a clean conical flask with distilled water and pipette exactly 25 cm³ of the filtrate into it.
- 6 Carry out a rough titration with the 0.1 M acid using methyl orange as indicator.
- 7 Repeat step 5 and carry out repeated accurate titrations until two titres agree to within 0.1 cm³. Use this value in step 8.
- 8 Calculate the molarity of the sodium hydrogen carbonate in the filtrate.
- 9 Calculate the mass of sodium hydrogen carbonate in the 250 cm³ volumetric flask.
- 10 Calculate the percentage sodium hydrogen carbonate in the original baking powder.

Plotting a radioactive decay curve and calculating the half life

Instructions for the teacher

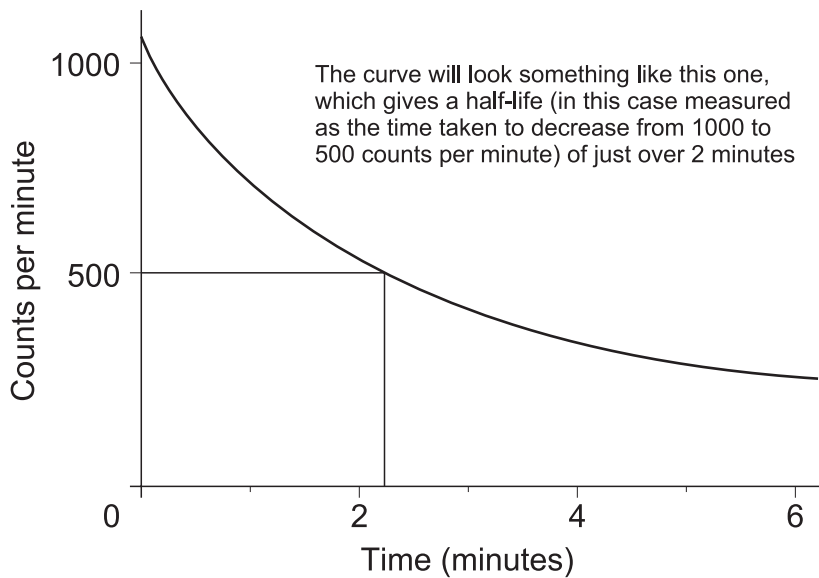
The isotope generator in the kit can be used to obtain a tiny sample of barium-137, which decays with a half-life of 2.6 minutes. The barium isotope is a daughter isotope of caesium-137, which is sealed in the generator.

- 1 Set up the Geiger counter to count continuously each minute.
- 2 Suck up a bit of the eluent into the syringe as shown in diagram A.
- 3 Screw the syringe into the isotope generator. Put the plastic tube on the other end of the generator. Slowly press the plunger and collect the eluent as shown in diagram B. This will contain a tiny quantity of barium-137.



- 4 Place the tube containing the eluent in front of the Geiger–Müller tube and press Start.
- 5 Allow the count to continue for about 10 minutes.
- 6 Recover the counts for each minute from the memory (or note the count after each minute and reset to zero if the counter has no memory).

- 7 Plot a decay curve with time on the x-axis and the counts per minute on the y-axis, joining the points with a smooth curve.



- 8 From the graph, work out the half-life as shown.
- 9 Clearing up. Barium-137 is a very short-lived isotope and is present in very small quantities; it is not therefore a health hazard. However, care should always be taken with radioactive materials. Return the eluent to the bottle. Using the syringe, blow air through the generator down the tube into the bottle. Make sure the tube is empty of liquid. Return everything to its lined box.

