

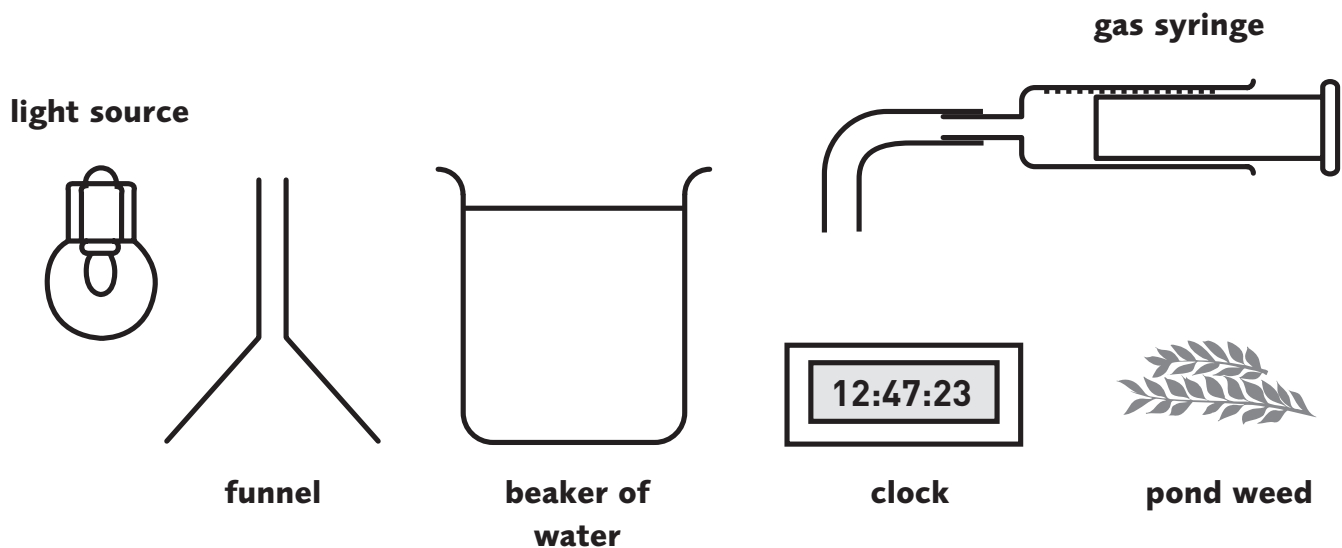
Science Bank: Biology

Programme 8: Biological Reactions

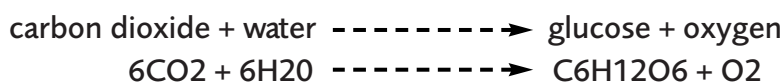
Activity 1 worksheet: Photosynthesis

A. Look at the graphics of items you could use for experiments to investigate the rate of photosynthesis.

How would you assemble them?



Here is the equation that summarises the process of photosynthesis.



- Which of the substances are
 - a) raw materials?
 - b) products?

The amount of oxygen produced by photosynthesis can be used to estimate the rate at which the process is happening. This is because the amount of oxygen given out increases when the rate of photosynthesis increases. The oxygen is produced as a gas.

- What would you expect to see happening when the apparatus is assembled and photosynthesis occurs?
- Suggest briefly how you could use this idea and the simple apparatus shown, to measure or estimate a change in the rate of photosynthesis.

Science Bank: Biology

Programme 8: Biological Reactions

Activity 1 worksheet: Photosynthesis

B. The data below was collected by a class of students investigating photosynthesis of a pond plant, using a similar set of apparatus to that shown in A above.

The table shows the oxygen produced (cm^3/min) at 10°C , 20°C and 30°C for arbitrary units of light intensity.

	Light intensity (arbitrary units)				
	1	2	3	4	5
Temperature 8°C					
10	0	0	0	0.5	0.55
20	1	1	1.5	2.3	3.1
30	1.8	2.5	3.6	4.8	6.0

- Use a software package to draw graphs of this data. Put light intensity on the x-axis and oxygen produced on the y-axis.
- Which variables alter during this experiment?
- Suggest one variable which might be kept constant during this experiment.
- What evidence is there to suggest that temperature affects the rate of photosynthesis?
- What evidence is there to suggest that light intensity affects the rate of photosynthesis?

C. Outline a method for investigating the effect of altering CO_2 concentration on the rate of photosynthesis. A source of carbon dioxide can be obtained from a gas cylinder, or by adding sodium hydrogen carbonate solution to the pond water.

In your report you need to include:

- the aim of your investigation, and a prediction of the outcome
- a description of the apparatus and how it is assembled
- which variables are kept constant and which are varied
- exactly what you do
- how you record the results
- how you display the results using software for a spreadsheet and drawing graphs

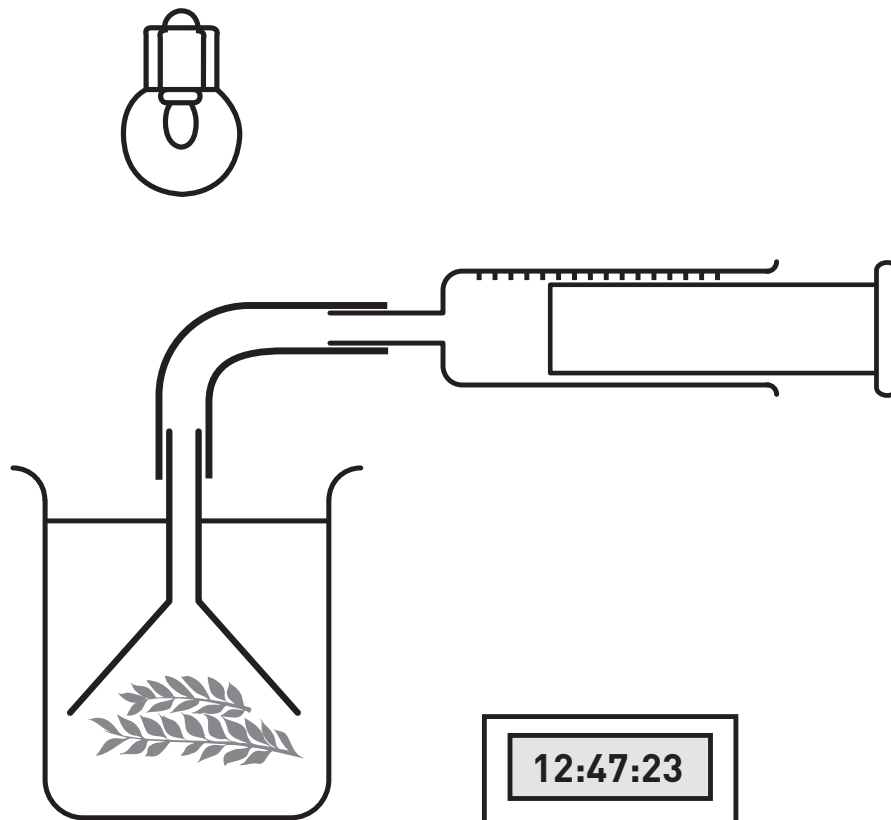
If you are able to do this in class, the results from the whole class can be collected in one spreadsheet. Also you will need to write a conclusion of what these results mean.

Science Bank: Biology

Programme 8: Biological Reactions

Activity 1 answersheet: Photosynthesis

A. To investigate the rate of photosynthesis the apparatus should be assembled as below.



Here is the equation that summarises the process of photosynthesis.



- Carbon dioxide and water are raw materials
- Glucose and oxygen are products

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Programme 8: Biological Reactions

Activity 2 worksheet: World food supplies and GM (genetically modified) foods

This activity involves researching some information online, which you can use to write a brief report including both facts and your opinion about GM foods.

First you may want to set up a file so that you can keep brief notes, or copy useful data.

A. Finding out some facts

Some places to look for information include:

- World Health Organisation
- New Scientist
- The ministry of agriculture, food and fisheries
- The Times Grolier encyclopaedia
- The Food Institute
- Supermarket websites

Here are some questions to help you research about GM foods:

- does the world produce enough food to feed its population?
- why do some people have too little food?
- what was the green revolution?
- how does plant breeding help in the production of crops?
- what are GM foods?

B. Writing a short report using the title 'The debate about GM foods'.

Here are some questions to help you decide what to put in your report.

- does the world produce enough food to feed its population?
- why do some people have too little food?
- what was the green revolution?
- how does plant breeding help in the production of crops?
- what are GM foods?
- what are the advantages for a farmer of using genetically modifying plants and animals?
- what are some people concerned about using genetically modified food products?

Remember to include some factual information, and also summarise by adding your own opinion.

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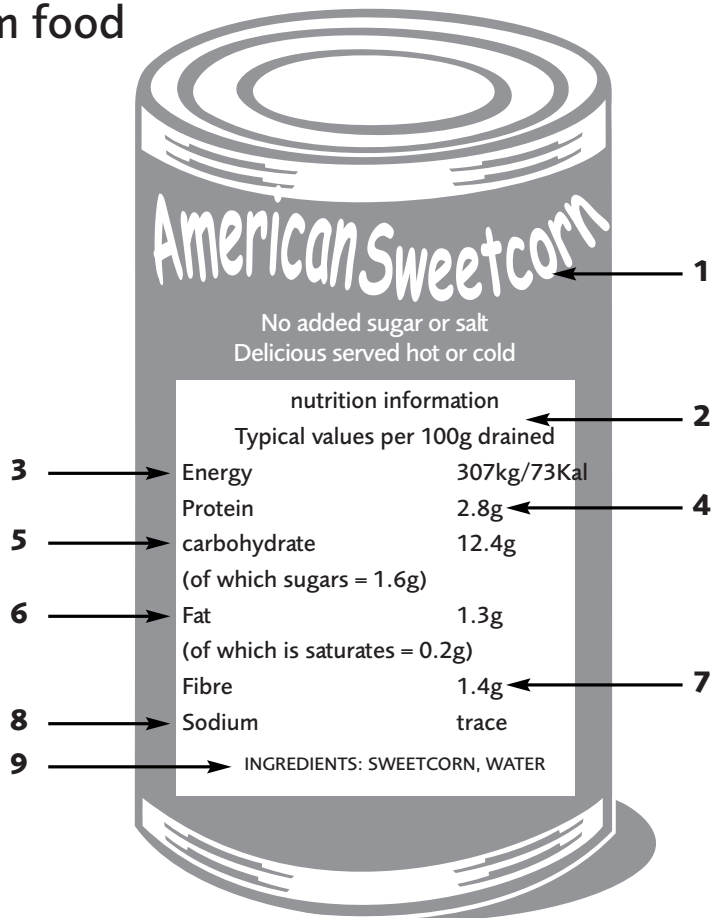
Programme 8: Biological Reactions

Activity 3 worksheet: Energy from food

Life processes such as movement, reproduction and sensitivity require energy, and we get this energy from food. The energy is originally stored in food during photosynthesis. When we eat and digest food it passes into the bloodstream and then to the cells where respiration happens.

A. The nutritional information about what a food contains is usually displayed on the label of a container. The label shows the different food types contained in the product, and any additives. The amount of energy that we are likely to gain from a food is also shown.

Fill in the missing words in the descriptions below, then match the descriptions to the correct part of the label on this tin of sweetcorn.

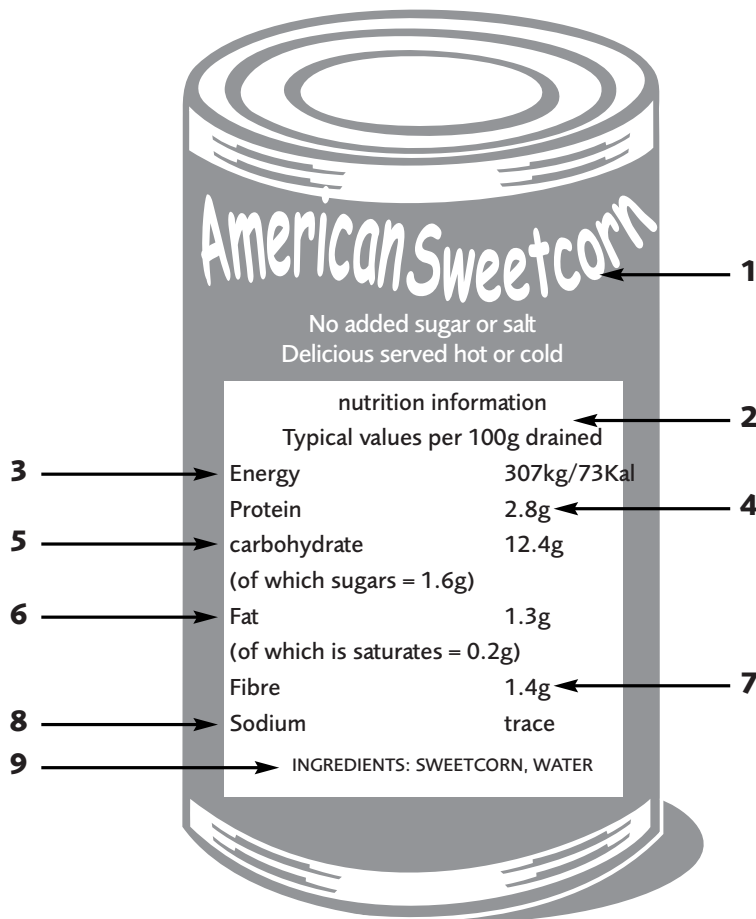


- General information that quickly catches the shopper's attention.
- The data is estimated for _____g of product, so that different brands can be compared easily.
- One _____ = 1000 joules
- _____ contains nitrogen. Cells need nitrogen to make the _____ that build new cells.
- _____ include starches and sugars. They are one of the main energy sources in our diet.
- _____ is a high energy food. Saturated _____ come from animal sources, and too much may contribute to high cholesterol levels in the blood.
- _____ is indigestible plant material, mostly cellulose, which helps the gut muscles push food along.
- _____ is a component of salt. Too much salt contributes to high blood pressure.
- Some people have particular food _____, which is why the ingredients are clearly displayed.

Science Bank: Biology

Programme 8: Biological Reactions

Activity 3 answersheet for A.: Energy from food



1. General information that quickly catches the shopper's attention.
2. The data is estimated for 100g of product, so that different brands can be compared easily.
3. One kilojoule = 1000 joules
4. Protine contains nitrogen. Cells need nitrogen to make the proteins that build new cells.
5. Carbohydrates include starches and sugars. They are one of the main energy sources in our diet.
6. Fat is a high energy food. Saturated fats come from animal sources, and too much may contribute to high cholesterol levels in the blood.
7. Fibre is indigestible plant material, mostly cellulose, which helps the gut muscles push food along.
8. Sodium is a component of salt. Too much salt contributes to high blood pressure.
9. Some people have particular food allergies, which is why the ingredients are clearly displayed.

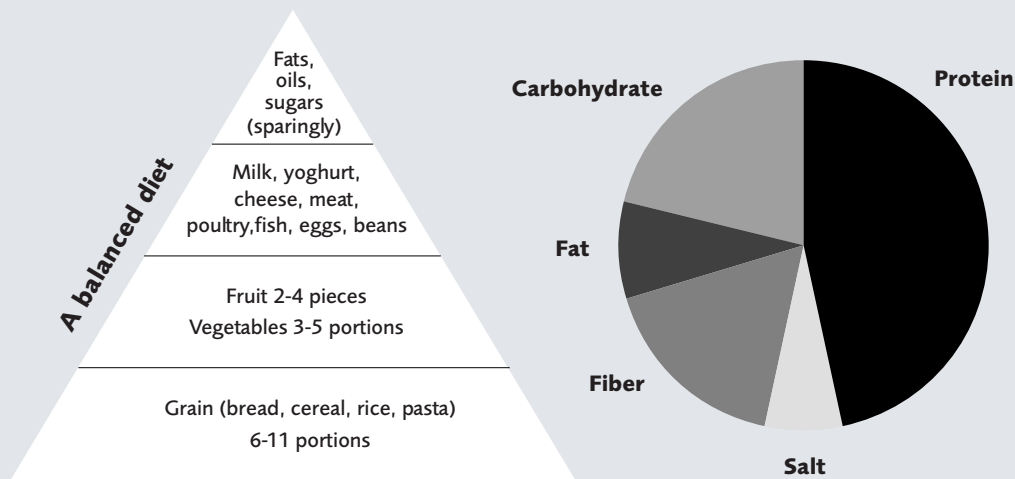
Science Bank: Biology

Programme 8: Biological Reactions

Activity 3 worksheet: Energy from food

B. Collect data from a variety of foods and display the results using a spreadsheet. In particular, record the amount of carbohydrate, fat and protein (g/100g) and energy content (kilojoules/100g). You decide which foods to survey. For example you could do this only for foods that you eat, or you could compare different brands of the same type of product, such as yoghurt.

Name of food	Carbohydrate g/100g	Protein g/100g	Fat (Lipids) g/100g	Energy kj	Other comments
Baby yoghurt					
Healthy eating yoghurt					



- Try displaying some of this data in the form of charts, for example, showing fat content and energy content, or protein content and energy content.
- From your charts, can you see a link between the type of food (carbohydrate, fat or protein) which a product is mostly made of, and its energy content?
- Talk with your teacher about the possibility of monitoring your diet for energy content for say a week.

Science Bank: Biology

Programme 8: Biological Reactions

Activity 4 worksheet: How energetic are you?

This activity is about estimating the amount of energy needed to accomplish the various physical tasks done during the course of a day. The first thing you need to do is to keep a log of activities under the headings shown in this table:

Energy requirements of daily activities

Activity	Estimated energy required (kilojoules/hour)
walking	1200
sleeping	300
running	2400
playing active sport	2800
sitting and relaxing	500
working at a desk	650
standing	300

- Use the data in the above table to estimate how much energy you would require in one day, by multiplying the number of hours for each activity with the amount of energy for that activity per hour. The total energy required for all the activities in one day, will tell you about how much energy you require for that day's activities.

Experts on diet and nutrition give us estimates of how much energy should be in an adult diet, to maintain body mass at a steady level.

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Programme 8: Biological Reactions

Activity 4 worksheet: How energetic are you?

Energy requirements during life

Activity	Estimated average energy needs kJ per day	
	Male	Female
Age		
0-3 months	2280	2160
7-9 months	3440	3200
1-3 years	5150	4860
4-6 years	7160	6460
7-10 years	8240	7280
11-14 years	9270	7720
15-18 years	11510	8830
19-50 years	10600	8100
60-64 years	9930	7990
75+ years	8770	7610

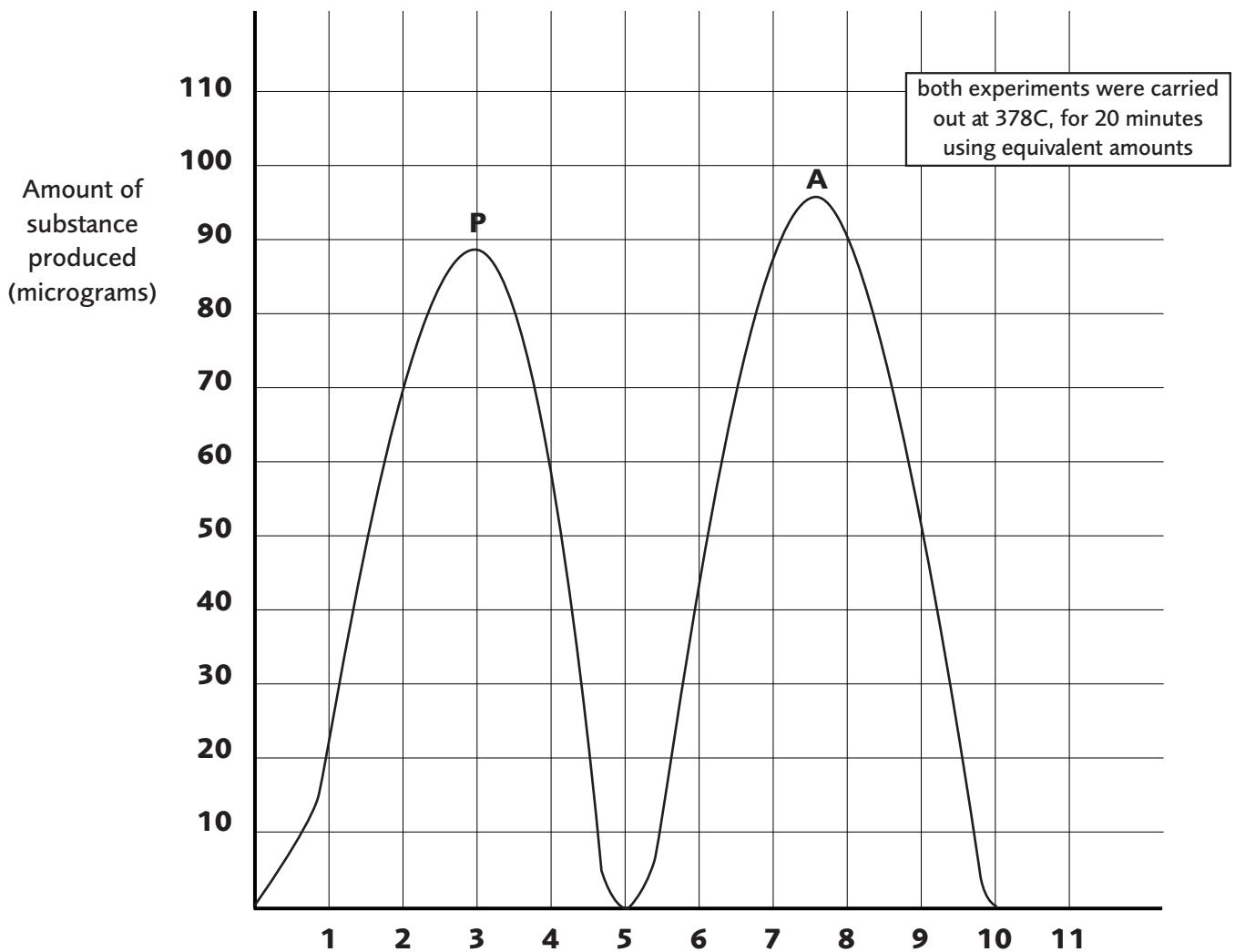
- What would be a likely effect on a man if he ate twice the energy content required for a male per day?
- Suggest a reason why children need a plentiful energy supply.
- Why do explorers who go to the North or South Pole need a very high energy content in their diet?

Science Bank: Biology

Programme 8: Biological Reactions

Activity 5 worksheet: Enzymes in action

A scientist was investigating two enzymes, P and A. P is a protein-digesting enzyme, and A digests starch. Here are the results:



1. How much substance was produced in the reaction catalysed by enzyme P in four minutes?
2. At what pH was 40 mg of substance produced by
 - a) enzyme P? b) enzyme A?
3. Enzyme A is amylase. What is produced when amylase acts on starch?
4. Suggest a name for a protein-digesting enzyme produced in the human gut.
5. Where is protein first digested in the human gut?
6. Biological washing powders contain protein-digesting enzymes that help to get rid of stains. What would be the best pH for the action of this type of washing powder?

Science Bank: Biology

Programme 8: Biological Reactions

Activity 6 worksheet: Enzymes in the gut

Complete this table to summarise information about the enzymes which operate in the gut. The first row has been done for you.

gut enzyme	substrate (food it works on)	products of catalysis	pH at which enzyme operates best	where produced
amylase	starch	starch	8	salivary glands
pepsin				
carbohydrase				
protease				
lipase				