Which Bleach?

Contents: Survey, practical work and questions about the consumer testing of bleaches.

Time: 4 periods. More time may be needed if pupils plan and carry out their own investigations as suggested in Part 1 instead of following the instructions in Part 2.

Intended use: GCSE Chemistry and Science. Links with work on the halogens, alkalis, measurement skills and the safe handling of chemicals.

Aims:

- To complement and revise prior work on chlorine and alkalis
- To develop consumer awareness including the critical evaluation of commercial products
- To develop awareness of the appropriate safety precautions when handling corrosive chemicals
- To provide an opportunity for planning and carrying out an investigation
- To provide an opportunity to practise practical skills involving observation and measurement.

Requirements: Students' worksheets No.904. Several brands of commercial bleach including some varieties which have been thickened. See below for detailed requirements for Parts 1 and 2.

Author: John Raffan (adapted from an experiment originally developed for the Salters Chemistry Course)

This unit shows how students can investigate domestic bleach which contains the active ingredient sodium hypochlorite. It might be used after SATIS unit 307, *Chemicals from Salt.*

Part 1 starts with a preliminary examination of the bleaches to be tested. Some pupils may then come up with such good ideas for a quantitative investigation that Part 2 is not needed.

Part 2 is available for those who cannot arrive at a satisfactory answer to the planning exercise at the end of Part 1.

Part 1 A first look at the bleaches to be tested

Requirements

Each group will need:

test tube
test tube holder
eye protection

Access to:

a range of household bleaches (for example, Domestos, Milton, Parazone, Vortex, and various 'own-brand' bleaches) — the assortment should include thick and thin brands
blue ink in a dropper bottle (for example, Quink blue ink — dilute 10 cm^3 ink to 200 cm^3)
universal indicator paper

Note The choice of ink is critical. Teachers should test the ink in advance and check that the dilution is appropriate.

The planning exercise and Part 2 are based on the assumption that the ability of sodium hypochlorite to bleach ink is related to its ability to kill germs. Students may wish to consider whether they think that this is a fair test — see question 12. The bleaching of ink and the germicidal action both depend on the fact that sodium hypochlorite is an oxidizing agent.

Part 2 Which bleach gives the best value for money?

Requirements

Each group will need:

Either

the apparatus they have chosen for use in the investigation they have planned

Or

conical flask, 100 cm^3
2 measuring cylinders, 10 cm^3
measuring cylinder, 100 cm^3
2 dropping pipettes
test tube
eye protection

Access to:

one of the bleaches examined in Part 1
blue ink, diluted as in Part 1

Some teachers may prefer to dilute the bleach in advance. This avoids the need for students to handle the concentrated solution.

The experiment on the worksheet uses simple apparatus. Clearly it could be done with burettes instead. Some pupils will need to be taken through the instructions step by step to avoid confusion.

The instructions suggest that each group should test just one brand. They repeat the measurements three times to get an average value for the volume of ink bleached by 1 cm^3 of the brand being investigated.

When it comes to the calculations, some pupils will need help when they work out the value to put in column 6 of the table.

Cost of 1 cm^3 bleach (column 4) = **a** pence
Volume of ink reacting with 1 cm^3 bleach = **b** cm^3

Cost of bleach reacting with 100 cm^3 ink $= \frac{100}{\mathbf{b}} \times \mathbf{a}$ pence

Scaling up by a factor of 100 makes the final numbers easier to compare when assessing the value for money.

Extension work

This unit might be extended by asking students to consider the design of bleach containers.

Possible questions to think about:

- Is the bottle easy to handle, even when wet?
- Are the bottles strong enough?
- Are the bottles made from a suitable material?
- Will the bottles break if dropped?
- Is the cap designed to make it difficult for a child to open the bottle?
- Why can a well designed container help to prevent accidents?

Students can record their assessments in a table such as the following:

Brand	*X*	*Y*	*Z*	*etc*
Bottle easy to handle if wet				
Bottle strong				
Cap well designed				
Clear hazard warning				
etc.				

Acknowlegements This unit is adapted by permission from an experiment originally developed for the Salters Chemistry Course. Figure 1 supplied by J. Sainsbury.

WHICH BLEACH?

Household bleach is often used in three ways:

- to kill germs in drains and toilets
- to clean sinks and work surfaces
- to clean and bleach laundry.

Household bleach is made by dissolving chlorine in a solution of sodium hydroxide.

In this unit you will make a survey of several brands of bleach and try to decide which one you think is the 'best buy'.

Part 1 A first look at the bleaches to be tested

Safety

Look carefully at the labels on several bleach containers. Figure 1 is an example of a label taken from a bleach bottle.

Bleach is corrosive and can attack skin and eyes. It is important that bottles of bleach on sale should carry clear safety warnings. The label should also give advice about first aid in case of accidents.

Now try questions 1 to 4.

Questions

1 *When should you use undiluted bleach in the home?*

2 *When should bleach be diluted before use?*

3 *Which fabrics are damaged by bleach?*

4 *Which household articles should not be cleaned with bleach?*

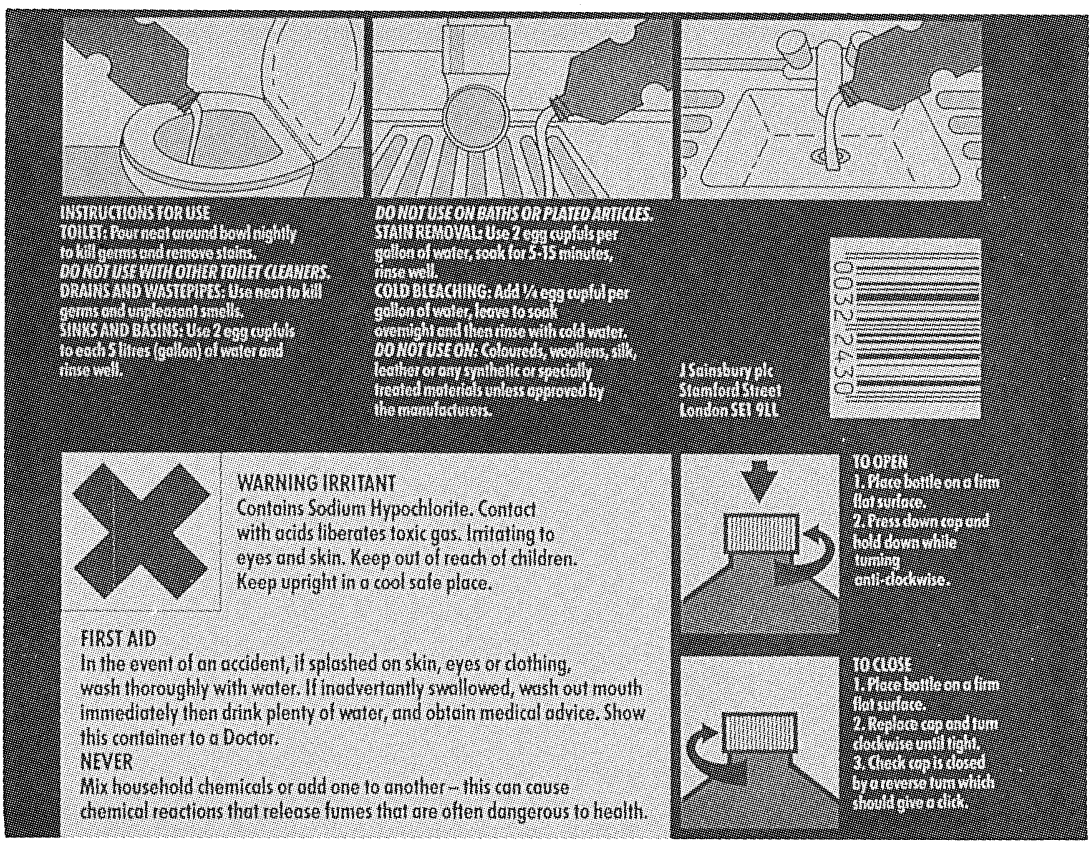

Figure 1

It is dangerous to mix bleach with other toilet cleaners, especially cleaners designed to remove lime scale.

Bleach can damage some fabrics and metals.

Now answer questions 5 to 7.

Questions

5 *Why is it dangerous to mix bleach with other toilet cleaners? What type of chemical is needed to remove lime scale?*

6 *Try to find out about the chemistry of the reaction between bleach and cleaners which remove lime scale. (Ask your teacher for help or look in reference books.)*

7 *Look at all the bleach labels and check the safety warnings and the information about first aid. Draw up a label of your own which includes all the best features of the labels you have looked at.*

Testing the bleaches

CAUTION

Bleach is harmful to skin and eyes. It will bleach your clothes if it gets splashed on them. Wear goggles when you are handling bleach, and wash off any splashes at once with water.

Pour a little bleach into a beaker or test tube. How easy is it to pour from the container?

Thick or thin?

Some brands of bleach are thickened. Which of the brands are runny and which are thickened?

Colour and smell

The colour and smell of bleach can be a guide to how strong it is. **Care:** Smell very cautiously. Use your hand to waft the gas towards your nose.

Effect on indicator

Dip a piece of universal (or full-range) indicator into the bleach.

Bleaching action

Pour about 0.5 cm^3 of any one of the bleaches into a test tube. Add a drop of blue ink and gently shake the test tube. Keep adding ink one drop at a time, with shaking, until all the bleach is used up.

Now answer questions 8 to 11.

Questions

8 *Draw up a table to show the results of your first look at bleaches.*

9 *Some bleaches are thickened. What is the advantage of this?*

10 *What colour changes do you see when adding ink to bleach? How can you tell when all the bleach has been used up?*

Planning further investigation

Try to plan an investigation to find out which of the bleaches gives the best value for money. You can find out the volume of bleach in each container and the cost of the bleach. You might use the action of bleaches on ink to compare the concentrations of the various brands. What other information do you think you need?

Part 2 Which bleach gives the best value for money?

You will be able to find the volume of bleach in each container from the label. You can find out the cost of each bottle of bleach. You also need a method of comparing the effectiveness of the various bleaches.

In this investigation you will compare the brands by seeing how much ink they can bleach. The idea is to take a fixed volume of bleach and then to add ink bit by bit until all the bleach has been used. You will then work out the value for money by assuming that a stronger brand will bleach more ink.

You should use diluted bleach. This is safer and more economical. Each group should carry out the experiment with one bleach. Then you can compare results with other groups in the class.

CAUTION
Bleach is harmful to skin and eyes. It will bleach your clothes if it gets splashed on them. Wear goggles when you are handling bleach, and wash off any splashes at once with water.

Preparing the diluted bleach

Use a small measuring cylinder to put 5 cm^3 of the bleach into a conical flask. Then add 95 cm^3 of distilled water from a large cylinder and mix well. This dilutes the bleach 20 times and gives you plenty for your experiment.

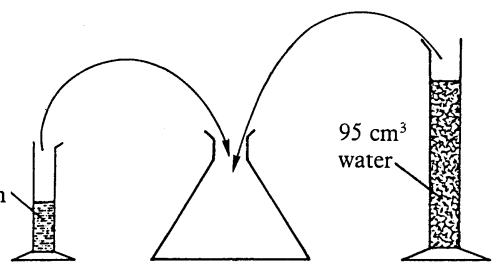

Figure 2

Measuring the strength of the bleach

Follow the instructions in **A** to **D** below. Record your readings in a table like Table 1 on page 4. Repeat the experiment two or three times.

A Put some diluted bleach in a small measuring cylinder. Carefully fill the cylinder to the 5 cm^3 mark. Use a dropping pipette to remove exactly 1 cm^3 bleach from the cylinder and transfer it to a test tube.

B Fill a second small measuring cylinder to the 10 cm^3 mark with ink. Use a dropper to add this ink drop by drop to the 1 cm^3 sample of bleach in the test tube. After each drop shake the mixture.

C Go on adding ink and shaking until all the bleach has been used up and the mixture stays blue. You may need to practise this and repeat the experiment several times to get consistent results.

D Read off the volume of ink left in the cylinder. This will let you work out how much ink has been bleached by your 1 cm^3 sample.

Results

Record your measurements in a table like Table 1 below.

Table 1

	Volume of ink used/ cm^3
Experiment 1	
Experiment 2	
Experiment 3	
Average value	

Calculations and discussion

Make a copy of Table 2.

Table 2

Name of bleach (1)	*Price paid* (2)	*Volume of the container* (3)	*Cost of 1 cm^3 bleach* (4)	*Volume of ink reacting with 1 cm^3 bleach* (5)	*Cost of bleach reacting with 100 cm^3 ink* (6)

For the bleach you have tested:

a Fill in columns 1 to 4 in Table 2 with the help of the information on the bleach container.

b Take your average value from Table 1 and enter it in column 5 of Table 2.

c Work out the cost of bleach needed to react with 100 cm^3 ink, and enter the value in column 6. This gives you a figure which you can use to compare the value for money of the bleaches.

Complete the table for other bleaches with the information from the rest of your class.

Now answer questions 11 to 14.

Questions

11 Do you think that it is fair to assume that the effect of bleach on ink is a measure of its germ killing and cleaning action?

12 Comment on the method used in this experiment. Is it accurate and reliable enough to make a fair comparison of the bleaches?

13 Write a report on your findings in Part 1 and Part 2. What advice would you give in an article about bleaches in a magazine for consumers? Which bleach is the best buy?

14 Design a poster advertising one of the bleaches.

The Impact of Information Technology

Contents: Reading, questions and discussion activities about the impact of information technology on our lives.

Time: 2 to 3 periods

Intended use: GCSE Physics, Electronics and Science. Links with work on computers and microelectronics.

Aims:

- To complement and revise prior work on the applications of microelectronics
- To show the wide scope of modern electronic information technology, and to illustrate some of its applications
- To develop an awareness of the impact of information technology on society
- To provide opportunities to practise skills in reading and comprehension, and to encourage willingness to enter into discussion.

Requirements: Students' worksheets No.905.

Author: Martin Brown

Pages 1 and 2 of this unit may be read in school or for homework. This can be followed by small-group discussion prompted either by the discussion points on page 3 or the group analysis exercise on page 4 (or both). The SATIS *General Guide for Teachers* includes some advice about brainstorming (page 61).

The information about IT is very condensed and could usefully be supplemented with other resource material. There is plenty available. Examples are listed below.

Further resources

The Department of Trade and Industry publish a series of leaflets on Information Technology and its applications. They are written primarily for adults, but they contain information that would be of use to students. They are available free from: Department of Trade and Industry, Room 514, 29 Bressenden Place, London SW1E 5BR.

The Department of Trade and Industry has also produced a series of videos about IT. Again, they are intended primarily for adults, but would be of some use in schools. Titles available include:

IT General Introduction	IT in Shops and Banks
IT in the Home	IT — Fibre Optics
IT in the Office	IT — Water
IT in Education	IT — Satellites
IT in Health	IT — the Chip
IT in Work	Introducing IT (a series of four programmes)

All available on free loan from: Central Film Library, Chalfont Grove, Gerrards Cross, Bucks SL9 8TN.

Acknowledgement Figures 1, 3 and 4 supplied by IBM.

THE IMPACT OF INFORMATION TECHNOLOGY

What is IT?

Think of all the different kinds of information that people use daily. Information:

- about things they buy in the shops
- about their money
- about their social lives
- about what's happening in the world (news)
- from their doctor
- learnt in school or college

— and so on.

Information technology (IT) is about the ways this information is used, stored and transferred from one place to another.

Until very recently most information was transferred on paper in the form of books, bills, newspapers, payslips and much more. Today we have *electronic* information technology as well — television, computers, telecommunications and so on — and that is what this unit is about.

Figure 2 shows how three separate technologies have come together in recent years to produce an 'information explosion'.

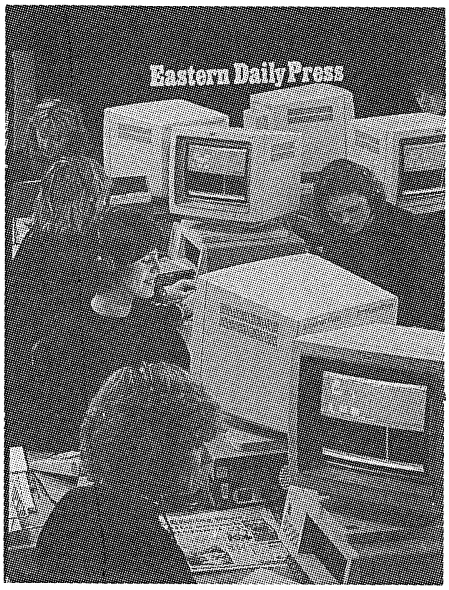

Figure 1 Taking details and entering the text for classified advertisements in a newspaper

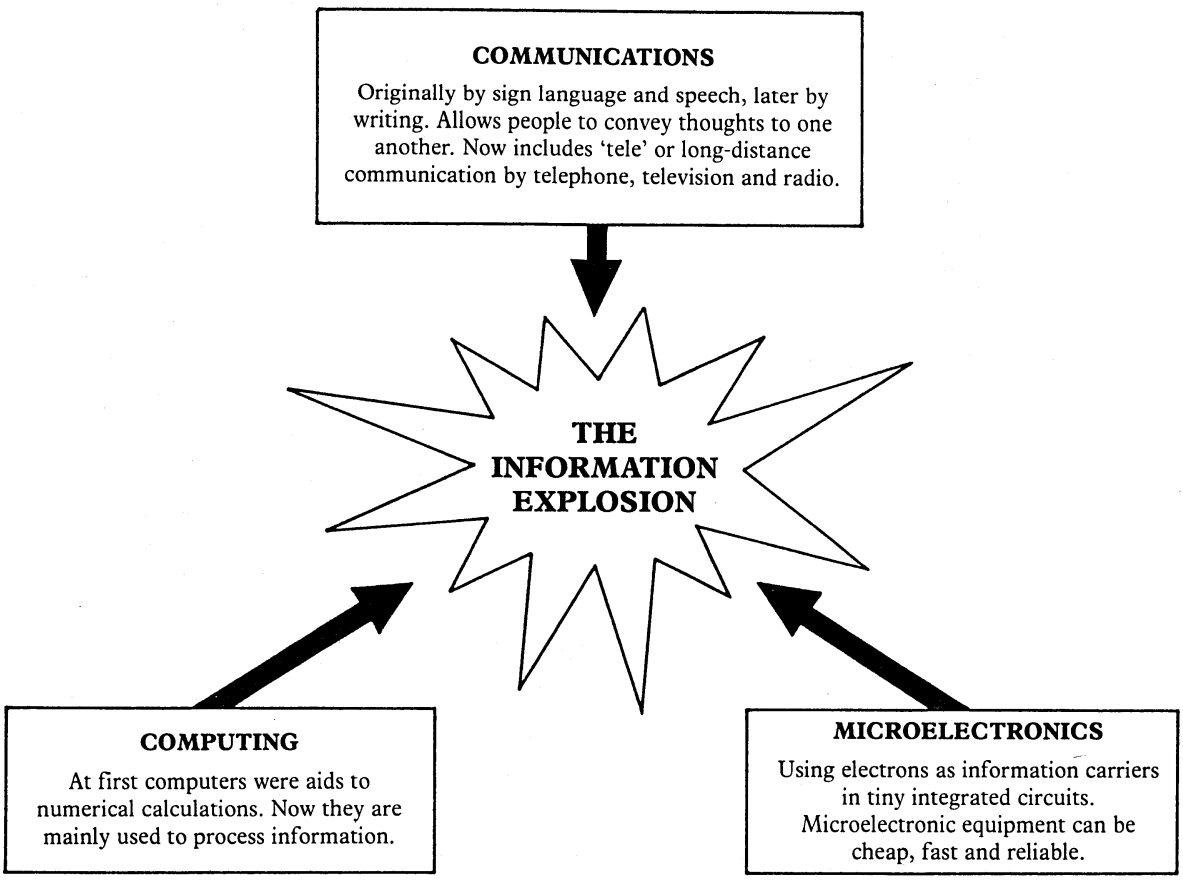

Figure 2 The information explosion

Where is IT having an impact?

Information technology is affecting almost every aspect of life. Here are some examples.

In shops

Automatic bar code readers mean that the person at the check-out does not have to key in the price of each item. The customer gets a more detailed till receipt.

In banks

Automatic cash machines pay out money and also provide up-to-date information about bank accounts.

In industry

Computers can control all the records of stock, accounts, orders, sales and so on. Robots and computer controlled tools can do repetitive and dangerous jobs. One person can now supervise many more machines.

At home

Telephone, television, video, Prestel and Ceefax transfer more and more information in and out of the home. Increasingly it is possible to do banking and shopping from home using IT.

In education

Students have access to much more information in words and pictures with the help of computers, telephones, television and video. Computer aided learning can guide students in their work.

In health care

Computers can be used for record keeping. They are being used in interviews with patients. They can help to find out what is wrong with patients.

On the farm

IT can control conditions inside animal houses and greenhouses. Robot controlled tractors are being developed which can plough without a driver.

Figure 4 Customers can use Nat-West's Stockbroker Service for information on shares and share transactions

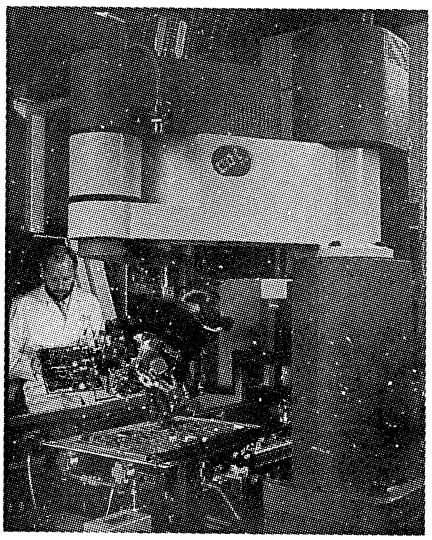

Figure 3 A computer-controlled robot assembling printed circuit boards

Questions

1 *Give examples (from the list on this page, or elsewhere) of the ways IT is changing*
   (a) the way we store *information;*
   (b) the way we transfer *information; and*
   (c) the way we use *information.*

2 *Give some more examples of the applications of IT to add to those listed on this page.*

3 *Describe in more detail the example of IT which you think has had the biggest effect on your life so far.*

Points to discuss about IT

- Here are some reactions to IT. For each one decide whether you

strongly agree/agree/feel neutral/disagree/strongly disagree

(a) 'It won't have much effect on day-to-day life, so we needn't bother too much about it'

(b) 'It will take away people's jobs, so it should be stopped'

(c) 'Society will be completely different by the year 2000 because of information technology, so we should scrap what we are doing now and start again from scratch'

(d) 'Development of information technology can't be avoided so we should accept its advantages, and also try to keep what is best in what we do at present'

(e) 'Information technology is exciting, so we should try as many experiments as we can and develop those which work best'

(f) 'Learning to write on paper is a waste of time because we will soon be able to talk to computers which will record and print out what we say'

(g) 'Information technology will make life inhuman so we shouldn't let it go too far'

(h) 'If Britain doesn't make full use of information technology it will fall behind other countries like Japan and the USA'

(i) 'Information technology is a threat to freedom because it allows authorities such as the police to find out too much about individual people'

- Which jobs will be affected by IT? For each of the jobs below, say what change you think there will be in the number of jobs available.

Choose from:

large increase/increase/no change/decrease/large decrease/ job will disappear

Supermarket checkout operators

Typists	Bank clerks	
Teachers	Nurses	Travel agents
Meter readers	Tractor drivers	Artists
Coal miners	Journalists	Soldiers

- IT may lead to more people working from home. With a telephone, a computer terminal and possibly a video link in their home, people will not need to go to work in an office every day. What do you think are the advantages and disadvantages of working at home in this way?

Group analysis exercise

a Think of an activity like getting off to school in the morning, organising the school sports team lists, making a meal, planning a holiday, painting and papering a room, or helping a blind person around the house.

b Have a brainstorming session, listing any problems within this activity which could be helped or solved by some form of IT. One of the group should write down every suggestion. Don't reject any idea, however wild.

c Decide which ideas are technologically possible. Don't reject for any other reason.

d Make a rough costing of those ideas left. Classify them as low, medium, or high cost.

e Now pick the two or three most promising ideas. Look at these in human terms. Who is better off? Is anyone worse off (noise and the neighbours, for example)? Are there any other likely problems (size, your parents won't like it, etc.)?

f Decide which is the best idea.

IT in Greenhouses

Contents: Reading and questions about the use of information technology to control the environment in greenhouses.

Time: 1 to 2 periods

Intended use: GCSE Science, Biology and Electronics

Aims:

- To complement and revise prior work on plant growth and nutrition
- To illustrate an important application of electronic control systems
- To show that the applications of science may call for an interdisciplinary approach
- To provide opportunities to practise skills in reading and comprehension.

Requirements: Students' worksheets No.906.

Author: John Holman

The first two pages of this unit focus mainly on the biological aspects while the last two pages deal more with IT. It may be appropriate for students to study unit 905 *(The Impact of Information Technology)* first if the main emphasis is being given to the IT aspects of this unit.

Page 1 provides an opportunity for students to reflect on their knowledge and understanding of photosynthesis and the factors which control plant growth and development.

It helps to distinguish growth from development. This is important for growers. With lettuce the product is green leaves and only growth is concerned. With chrysanthemums and tomatoes the grower has to switch the crop from a vegetative to a reproductive phase to produce flowers in one case and fruit in the other. In commercial operations the grower has to consider economic factors. The optimum biological conditions may not give the most profitable outcome.

The unit is based on one of the leaflets about IT published by the Department of Trade and Industry. Sources of further information about IT are listed in the teachers' notes for unit 905.

Notes on some of the questions

Q.4 This sequencing activity is one of several methods of helping students to reflect on what they read. A discussion of these activities is included in the SATIS *General Guide for Teachers* (pages 35-9).

Figure 5 has been simplified in a number of ways. Carbon dioxide is not usually supplied from a cylinder. The commonest method of enrichment is to burn natural gas, LPG or paraffin in special burners in the greenhouse. The pure gas is more usually delivered from bulk liquid storage tanks than from cylinders.

The accepted method of monitoring carbon dioxide concentrations is to use a pump to extract gas samples from the greenhouse and pass them to an infra-red absorption analyser.

Q.7 (e) The human operator is needed in case of breakdown, power cuts, etc., to collect data as required, to input new data, to respond to alarm signals and so on.

(f) The central computer would need to be given new data, for example, when a new crop is to be grown, or if the growing parameters currently employed were found to be unsatisfactory.

(g) Disadvantages might include the initial cost of the system and the possibly serious and costly consequences of major breakdowns or power cuts.

Q.8 There have been automatic control systems in greenhouses since the 1930s. These systems have developed from simple on/off mechanisms through electro-mechanical and electronic systems to the present microprocessor networks. The advantage of IT is that several factors can be monitored and the interaction between them controlled to give optimum results in terms of environmental and economic performance.

Acknowledgement Photographs (Figures 2, 3, 4) by Peter Fiske, Head of Photography and Visual Aids, Glasshouse Crops Research Institute.

IT IN GREENHOUSES

The initials IT stand for information technology. Modern methods of collecting, storing and using information can help many people to do their work better. This unit describes the way in which IT can help market gardeners grow better crops more efficiently.

A controlled environment for plants

In a greenhouse, it is possible to control a plant's growing environment. Greenhouses can provide conditions which are close to the ideal for plants to grow as fast as possible.

Big market growers use greenhouses to produce crops such as tomatoes and cucumbers throughout the year. They need to get the conditions right for growth and development. It is particularly important to control the conditions shown in Figure 1.

Answer questions 1 to 3.

Questions

1 *Look at Figure 1. Four of the conditions listed can affect the rate at which plants lose water by transpiration. Which are the four?*

2 *Why is it likely that the conditions inside a greenhouse will change rapidly in the early morning and in the evening?*

3 *Why does burning natural gas (or paraffin) in a greenhouse provide extra carbon dioxide?*

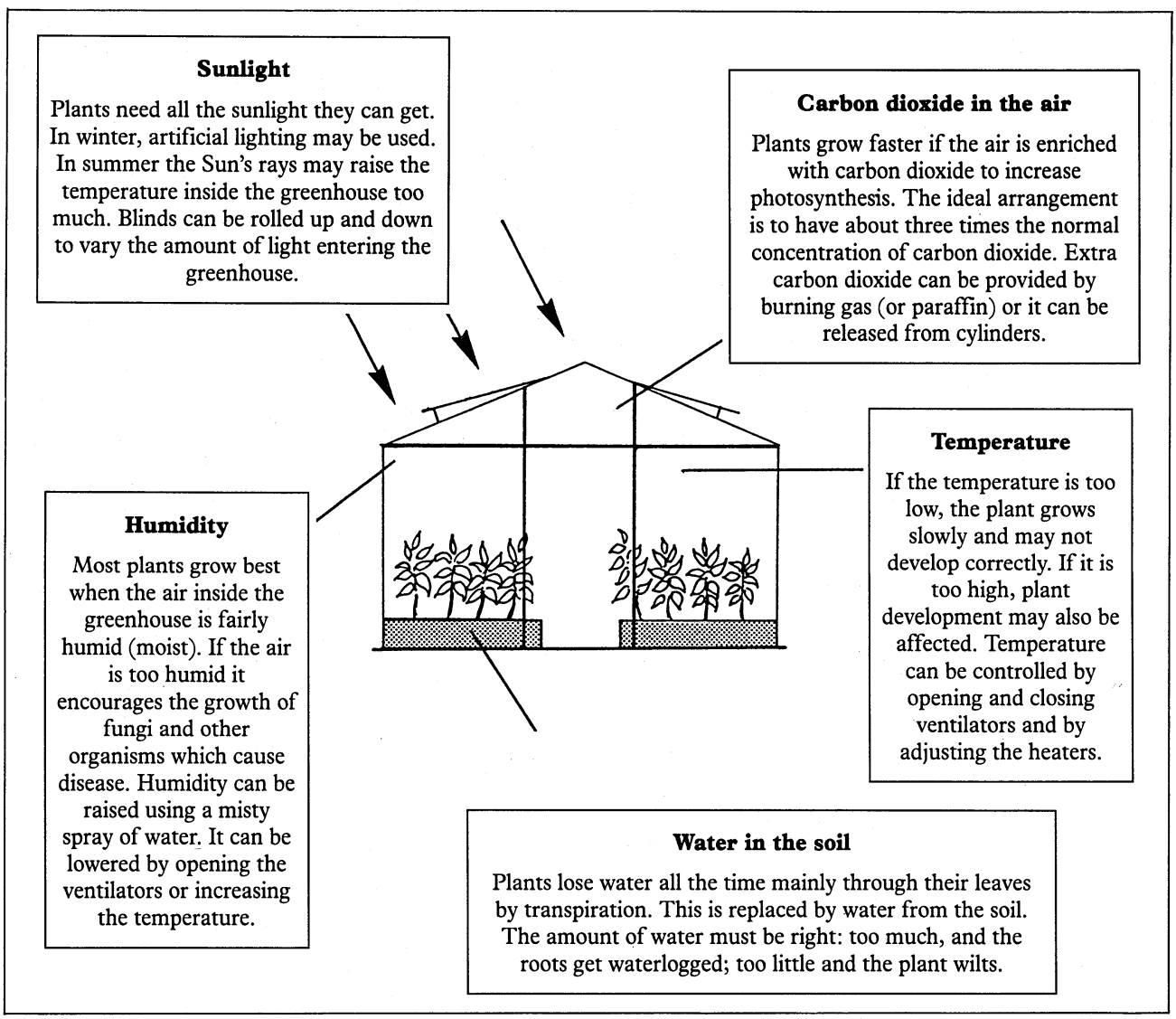

Figure 1 Controlling the conditions inside a greenhouse

How does information technology help?

In Figure 2 chrysanthemums are being grown in a greenhouse which is 20 metres wide. Flowers are picked for market throughout the year. This is possible because flowering is programmed by controlling the length of daylight and the temperature. Daylight is controlled with blackout screens. They are shown rolled back in the eaves in this picture. There is automatic ventilation equipment and an overhead irrigation system.

Figure 2 A large commercial greenhouse

Here are just a few of the control problems faced by a market grower in charge of a big greenhouse such as the one shown in Figure 2.

- The grower may have greenhouses spreading over tens of hectares. Controlling conditions in all of them is a big task.
- At certain times of day conditions change rapidly. This is likely to be the case at sunrise and at sunset. Checks and adjustments have to be made every few minutes to keep the growing environment constant.
- Heating a greenhouse in winter can be very expensive. Thousands of pounds can be saved by keeping the temperature just high enough, but not too high.
- Other factors have to be controlled as well as the conditions shown in Figure 1. These may include the amounts of minerals in the soil and the pH of the soil.

Figure 3 (left) shows some of the sensors which send information to the microprocessor which controls this greenhouse. The plants are lettuces

Figure 4 (right) shows tomatoes being grown in a solution of nutrients. The system is microprocessor controlled

How do the control systems work?

Let's take the carbon dioxide concentration as an example (see Figure 5). Here are the steps involved in an automatic adjustment to the amount of carbon dioxide in greenhouse air. The steps are **not** in the correct order.

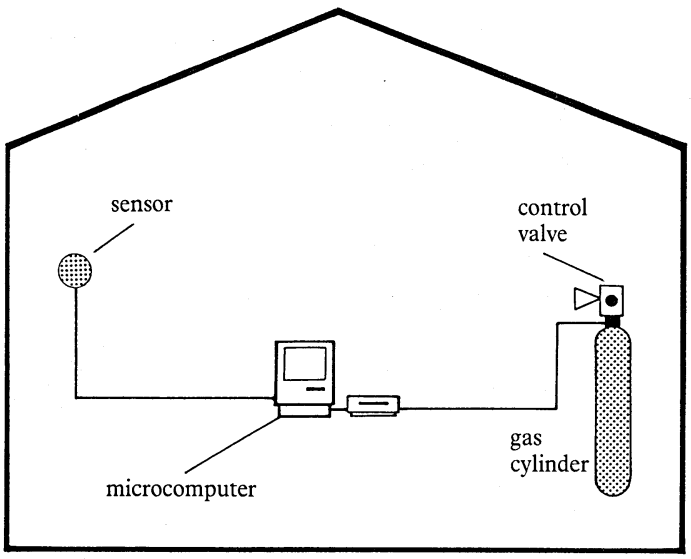

Figure 5 Carbon dioxide control by IT

- The signal opens the valve on the gas cylinder.
- The information is fed to a microcomputer.
- Gas is released until the sensor and computer detect that the carbon dioxide concentration in the air is in the correct range.
- The microcomputer compares the measurement with the required concentration which is stored in its memory.
- An infra-red sensor measures the concentration of carbon dioxide in the greenhouse air at regular intervals of time.
- If the carbon dioxide concentration is too low, the computer sends a signal to the control equipment on the gas cylinder.

Answer questions 4 to 6.

Questions

4 *Look at the steps involved in the automatic control of the carbon dioxide concentration listed (left) in the wrong order. Work out what you think is the correct order for these steps.*

5 *Now make a large copy of Figure 5. Write the steps involved in controlling the carbon dioxide concentration onto your diagram.*

6 *Now choose one of the other conditions shown in Figure 1. What sort of sensor could be used to detect changes in the condition and how could the sensor be connected to the computer? If the measurements show that the condition needs to be altered, how could this be done? Draw a diagram similar to Figure 5 to show the way in which your control system would work.*

Controlling several greenhouses

One microcomputer can control many different conditions at once. Each sensor is automatically checked every few seconds. A big market garden might have a central computer controlling several greenhouses.

The central computer is placed at a central station, as shown in Figure 6. It is connected to each of the outstations.

The central computer is connected to a weather station so that it can quickly respond to changing conditions. It also has a calendar clock and is programmed to make the necessary adjustments at sunrise and sunset.

The operator only has to visit the central station to see visual displays, or printouts, showing all the conditions in the various greenhouses.

Answer questions 7 and 8.

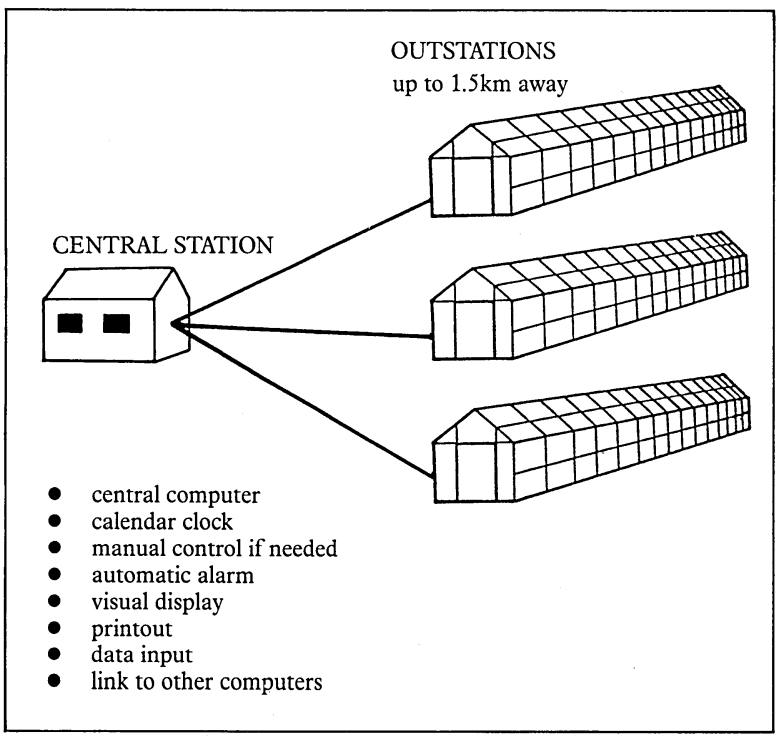

Figure 6 A central station controlling three outstations

Questions

7 *Look at Figure 6.*
(a) Why does the computer need to be connected to a clock?
(b) Why is the computer connected to a weather station?
(c) What is the purpose of having a visual display unit connected to the computer?
(d) What sort of alarm system is needed for a computer-operated greenhouse?
(e) The system is fully automatic but it needs human operators. Why?
(f) When might it be necessary for the market grower to give new data or programmes to the central computer?
(g) Make lists of what you think are the advantages and disadvantages of an automatic system of this type.

8 *Before the 1930s there were no automatic systems. People were employed to check and adjust the conditions. How would these workers have checked and adjusted:*
(a) temperature
(b) soil water?
Do you think this work was more or less skilled than operating the automatic system?