

## 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.

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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<sup>3</sup> ink to 200 cm<sup>3</sup>)
- 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<sup>3</sup>

2 measuring cylinders, 10 cm<sup>3</sup>

measuring cylinder, 100 cm<sup>3</sup>

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<sup>3</sup> 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<sup>3</sup> bleach (column 4) = **a** pence

Volume of ink reacting with 1 cm<sup>3</sup> bleach = **b** cm<sup>3</sup>

Cost of bleach reacting with 100 cm<sup>3</sup> ink =  $\frac{100}{b} \times a$  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:

<i>Brand</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>etc</i>
Bottle easy to handle if wet				
Bottle strong				
Cap well designed				
Clear hazard warning				
etc.				

*Acknowledgements*  
by J. Sainsbury.

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

## 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?

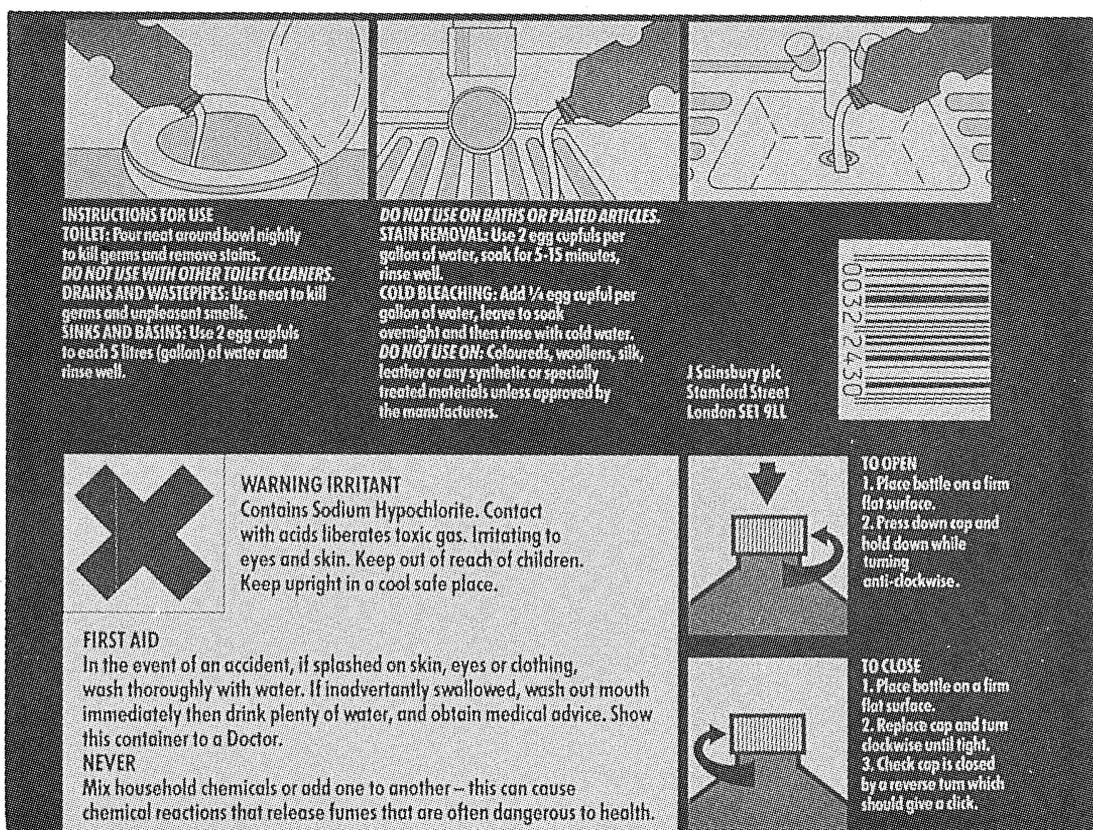


Figure 1

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.

### 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<sup>3</sup> 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.

### 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?

#### 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.*

#### 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?*

## 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  $5\text{ cm}^3$  of the bleach into a conical flask. Then add  $95\text{ cm}^3$  of distilled water from a large cylinder and mix well. This dilutes the bleach 20 times and gives you plenty for your experiment.

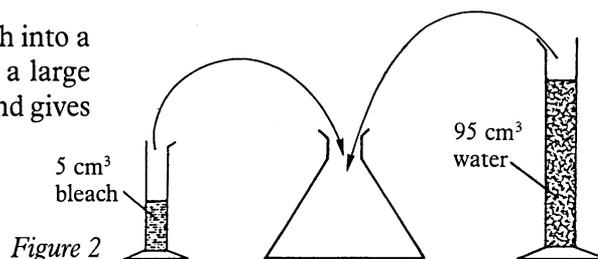


Figure 2

### 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  $5\text{ cm}^3$  mark. Use a dropping pipette to remove exactly  $1\text{ cm}^3$  bleach from the cylinder and transfer it to a test tube.

**B** Fill a second small measuring cylinder to the  $10\text{ cm}^3$  mark with ink. Use a dropper to add this ink drop by drop to the  $1\text{ cm}^3$  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  $1\text{ cm}^3$  sample.

## Results

Record your measurements in a table like Table 1 below.

Table 1

	<i>Volume of ink used/ cm<sup>3</sup></i>
Experiment 1	
Experiment 2	
Experiment 3	
Average value	

## Calculations and discussion

Make a copy of Table 2.

Table 2

<i>Name of bleach</i>	<i>Price paid</i>	<i>Volume of the container</i>	<i>Cost of 1 cm<sup>3</sup> bleach</i>	<i>Volume of ink reacting with 1 cm<sup>3</sup> bleach</i>	<i>Cost of bleach reacting with 100 cm<sup>3</sup> ink</i>
(1)	(2)	(3)	(4)	(5)	(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<sup>3</sup> 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.