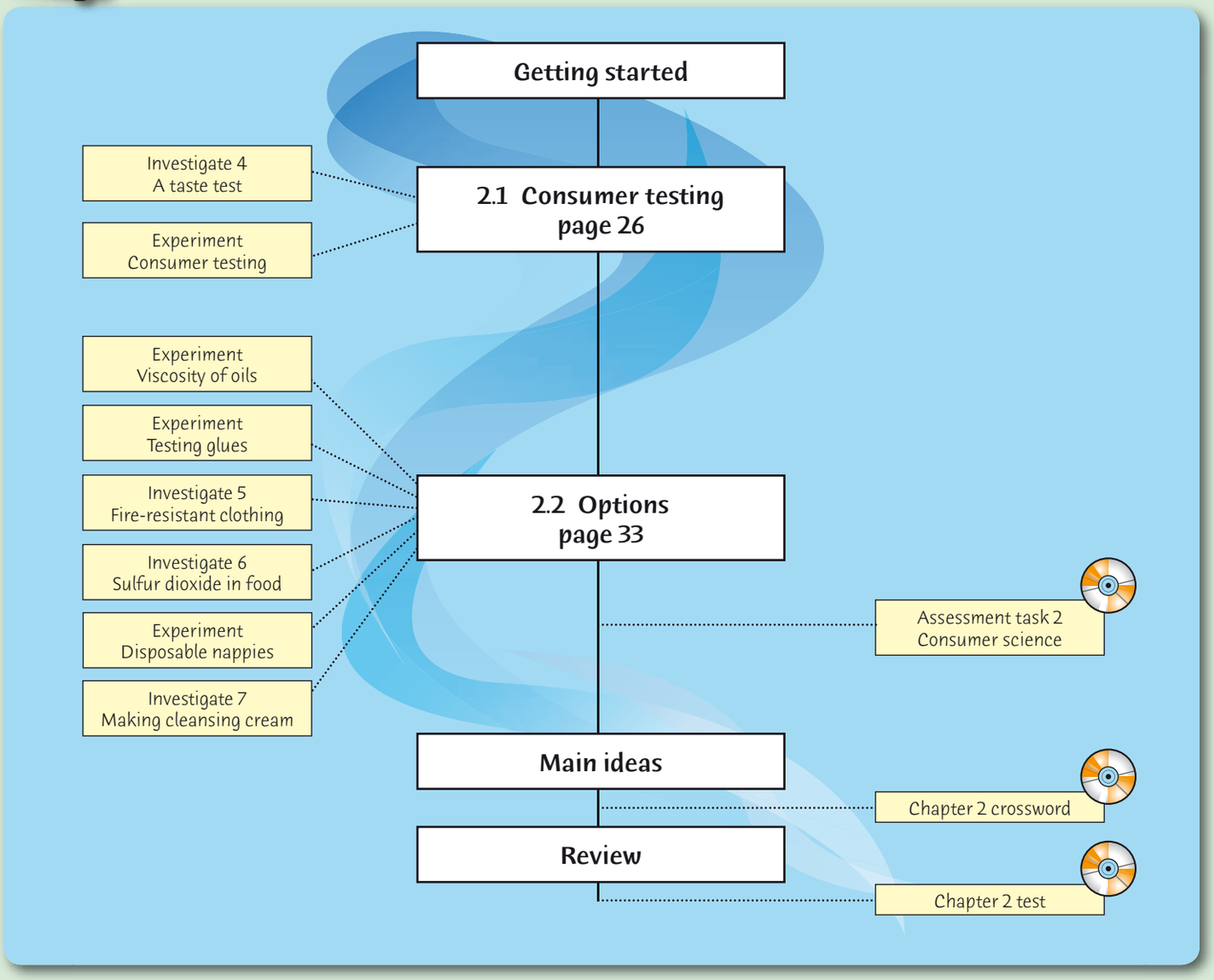
2 Consumer science

Planning page



Essential Learnings for Chapter 2

Essential Learnings	References		
	Student book (page number)	Workbook (page number)	Teacher Edition CD (Assessment task)
Ways of working Select and use scientific equipment and technologies to enhance the reliability and accuracy of data collected in investigations	Experiments pp. 34, 36 Investigate 5 p. 38 Investigate 7 p. 44		
Communicate scientific ideas, explanations, conclusions, decisions and data, using scientific argument and terminology, in appropriate formats	Tables and graphs pp. 26–32		
Plan investigations guided by scientific concepts and design and carry out fair tests	Investigate 4 p. 29 Investigate 5 p. 38 Investigate 7 p. 44 Experiments pp. 30, 34, 36, 42		Assessment task 2 Consumer science
Research and analyse data, information and evidence	pp. 26–32	pp. 12–14 Exercise 6 pp. 15–16	
Reflect on different perspectives and evaluate the influence of people's values and culture on the applications of science		Exercise 5 p. 15	

QSA Science Essential Learnings by the end of Year 9

Vocabulary

additives
antioxidants
consumer
cosmetics
disposable
emulsifier
emulsion
feature
flammable
ingredients
objective
preservatives
processed
questionnaire
retardant
subjective
sulfur dioxide
viscosity

Focus for learning

Order the steps involved in deciding on the best mobile phone (page 25).

Equipment and chemicals (per group)

Investigate 4 page 29 different brands of a particular product (eg orange juice, lemonade, sandwich spread, yoghurt or hamburgers), blindfolds

Experiment page 30* different brands of a particular product (eg soft drinks or fruit juices, stain removers, chewing gums, biros, breakfast cereals)

Experiment page 34* cooking oil, ball bearing (or marble), stopwatch, magnet, metal tray, large measuring cylinder or long tube, refrigerator, hotplate, beaker

Experiment page 36* various types of glue, various materials to test, mass hanger and standard masses, brick, metal hook, spring balance

Investigate 5 page 38 samples of two different fabrics, metal tongs, heatproof mat or tray of sand, Bunsen burner, stopwatch, metal can, scissors, alum, borax, boric acid, balance, 250 mL beaker, washing powder

Investigate 6 page 41 selection of foods (eg dried apricots, wine), dilute iodine-potassium iodide solution (5 g iodine and 10 g potassium iodide per litre of water), mortar and pestle (or blender), beaker, 1% starch suspension, balance, measuring cylinder

Experiment page 42* different brands of disposable nappies

Investigate 7 page 44 100 g liquid paraffin, 30 g white beeswax, 2 g borax, 2 beakers (250 mL), measuring cylinder (100 mL), balance, water bath, heatproof mat, 2 stirring rods, 2 thermometers, small storage bottle, make-up, several commercial cleansing creams, soap

Special preparations

Investigate 6 page 41 To make 1% starch suspension, add a small amount of cold water to 5 g of starch powder and stir until a smooth paste. Pour this paste into 500 mL of boiling water and stir rapidly.

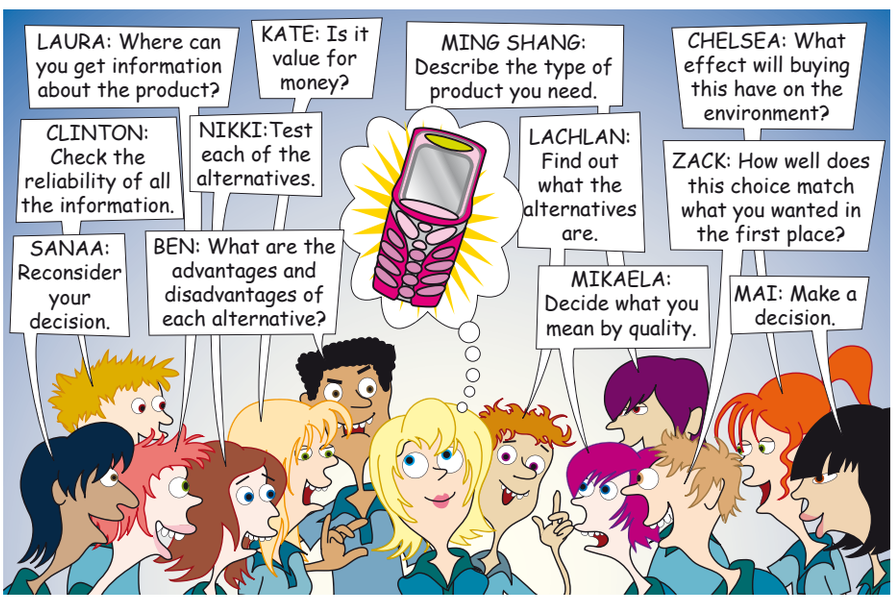
* Students to list the equipment they will need, which may be different from what is listed here.

2 Consumer science

Getting Started

Ella is planning to buy a mobile phone. This will make a large hole in her savings, so she wants to make the correct choice. Her friends have plenty of suggestions, but how can she sort out this advice?

- Arrange the advice in the cartoon into a flow chart that shows the order of the steps Ella should take in deciding which phone to buy.
- Compare your flow chart with other people's. Discuss any differences.



Starting point

1 The students could come up with their own cartoon for another product that they have recently acquired or would like to, such as an iPod, digital camera or MP4 player. They could get a classmate to draw a flow chart for it.

2 Give the students time to recall and list any 'product claims' made by manufacturers saying why their brand is better than their competitors' brands, eg:

- the strongest and most absorbent paper towel
- vitamin C content in a fruit drink or cough lozenge
- potting soil with the best water retention
- batteries lasting the longest
- best fabric stain remover.

Can any of these be tested at school or at home? Discussing these claims here will help the students prepare for their own consumer testing in the experiment on page 30.

3 Ask the class why they think many products in today's market are similar to each other yet have some different features. For example, many technological items such as mobile phones and iPods have the same purpose but can have very different features. Is it good to have such a choice? How can consumer products be grouped together? Why? (For example, 'food products' might be grouped together.) How is the quality of consumables tested and controlled? Are only products that are eaten regarded as consumables? Explain. These discussion points could be turned into a Round Table activity (where a group of students is given a set time to brainstorm together before reporting their conclusions to the whole class) or a Think/Pair/Share activity (where students individually think about the posed question, discuss their answer with a partner and share their conclusion with the class). This encourages cooperative learning, creativity and deeper thinking.

Hints and tips

It would be a good idea here to review:

- the difference between quantitative and qualitative data
- how to conduct a fair test
- the concept of controlling variables.

2.1 Consumer testing

We are all consumers because we eat food and belong in a food web. However, the word 'consumer' is used with another meaning: it is used to describe someone who buys something. Every time you go to the shops and buy something, you are a *consumer*. It does not have to be food. It could be clothes, electrical goods, sporting equipment or even electricity.

Testing mobile phones

There are many articles published in newspapers and magazines to help consumers choose which products to buy. *Choice* magazine is one such publication, and their investigators recently tested mobile phones. The six steps used in their investigation are shown on the right and on page 28.

STEP 1: Decide which product you want to test

Mobile phones are very popular with all ages of people. They are packed with features and functions you may love—or never use. The *Choice* investigators tested 45 GSM models.

STEP 2: List the features you want to test

Choice decided to test the 10 features listed below.

STEP 3: Design a fair test for each feature

To check for durability the testers put the phones in an 80 cm barrel that was then turned, simulating falls from a table or out of a shirt pocket. After 5, 15 and 25 turns the phones were checked for damage.

STEP 4: Do the tests and record the results

See the table on the next page.

1. How good is the battery?
2. Sensitivity—how well does the phone deal with a weak signal?
3. How easy is it to use the basic functions?
4. How easy is the keypad to use (ergonomics)?
5. How good is it for SMSing?
6. What is the sound quality?
7. What is the quality of the digital camera pictures?
8. How many different features does it have (versatility)?
9. How big is it? How heavy is it (portability)?
10. How tough is it (durability)?

Learning experience

Obtain a current set of *Choice* magazines for pairs or small groups to view. Ask the students to make a table listing products tested (quantitative and qualitative). Get them to choose a product from the list and examine the testing method more closely. They should construct a flow chart of the sequence of the method and then work out how it fits into the consumer testing steps listed on pages 26–28. A fun way of doing this is to allow the students to photocopy the relevant pages then cut and paste the information, placing it under the correct consumer testing step (1–6). Ask the following questions:

- Was the test a fair test? Explain.
- What type of data was collected?
- Was the test subjective or objective? Explain.
- Do you think the tester missed any testing criteria/variables? Explain.
- What conclusion(s) did they make about the product?
- Which product would you recommend to the class to buy and why?

Brand/model (in rank order)	A	B	C	D	E	F	G	H
Overall score*	68	68	63	63	61	60	59	55
1 Battery score	63	62	78	49	55	76	49	39
2 Sensitivity	80	75	69	72	70	66	74	66
3 Everyday use	76	89	81	65	73	56	47	62
4 Ergonomics	63	59	54	69	46	45	51	63
5 SMS	74	70	61	76	68	63	58	67
6 Sound	62	67	51	61	53	54	47	52
7 Picture	50	54	47	51	52	43	60	37
8 Versatility	73	68	62	63	64	49	84	57
9 Portability	59	66	41	70	67	65	49	71
10 Durability	75	65	68#	61	59#	61	78#	53
Battery life (h)†	5.1	6.0	7.7	3.9	4.8	7.6	3.8	3.0
Charge time (min)	171	120	132	120	118	158	77	94
Voice dialling	✓		✓		✓		✓	
Voice recording	✓	✓	✓	✓	✓		✓	✓
Email	✓	✓		✓	✓	✓	✓	
Weight (g)	123	99	126	92	97	99	130	87
Dimensions (mm)	88x47x23	93x47x25	98x48x27	108x47x20	98x53x15	107x46x19	102x50x23	105x47x19
Price ($)	639	999	649	399	999	179	619	349

Reprinted from the June 2005 edition of *Choice* with the permission of the Australian Consumers' Association (ACA).

* Combined score for features 1–10
\# Defective after tumble test
† An average for different use patterns

Hints and tips

Don't assume the students understand the information presented in the table. Check how much they do by quizzing them. Ask them to decide which phone (A–H) they would recommend and give reasons why. From the information in the table, is there a clear choice of phone that is recommended? Explain.

Research

Students may not really have thought about product testing and its importance before. Consumer safety is usually the main reason products are tested. Divide the class into groups and give them some time to research the following questions:

- Are there any government or independent consumer 'watchdogs' that check manufacturers' claims or test for product quality?
- Why is it important to have products tested to check they meet the Australian standards?
- What is a 'recall' of an item?

Students can then present the results of their research to the class.

STEP 5: Interpret the results and write a report

Most mobile phones can take digital photos and send them to someone else. However, the quality is poor compared with digital cameras. While phone A was rated the best overall, it may not be the best on a particular feature, eg weight. So if a particular feature is essential to you, a model further down the table, which doesn't have a major weakness, may be the one for you.

STEP 6: Decide on the best product

Value for money

When deciding which product to buy, you should consider *value for money*. With the mobile phones tested by *Choice*, A and B had the same overall score, but A was cheaper.

To find value for money for products in containers, you can divide the cost by the net mass, as shown below, to calculate the cost per gram or per millilitre. With solutions, you may need to consider the concentration of the solution as well as the volume. For example, 500 mL of a 10% bleach solution should last longer than 500 mL of a 5% solution, since you need to use only half the amount each time.

You also need to consider the lifetime of the product. For example, an alkaline battery that lasts twice as long but costs three times as much is not the best value for money.

Rating panels and surveys

It is easy to compare products when you have tested them by measuring something, for example the weight of a mobile phone, or by noting whether or not it has a particular feature. Such tests are said to be **objective tests**.

In other tests you cannot be as objective. For example, the performance of a mobile phone, eg ease of use, is based on opinion—what one particular person thinks. Such tests are said to be **subjective tests**. To make the results of such tests easier to compare you can ask people to give the product a *rating*. For example:

or

For this sort of test you need a number of people (a *panel*). If you want an overall rating you can then average the results.

Another method used to collect consumer information is a **survey**. For example, you might want to do a survey on the reliability of various makes of cars. When carrying out such a survey you obviously cannot ask *all* users of the make you choose (eg Holdens).

Fig 3 Which is the best value for money here?

Hints and tips

Make sure to emphasise the difference between an objective and a subjective test. Why are most of the tests in *Choice* magazine objective? What would you think if all products of the same type were exactly the same? What if all brands of chocolate or all types of cars were identical? How would you feel? Why is it good to have a choice of similar products? Generate a class discussion around these questions.

Homework

Ask students to go to a supermarket or hardware store and conduct a price survey of products such as jams and spreads, bread, milk, nails, paint, and so on. Which brand (based on price) would they recommend? Which brand based on a different criterion would they recommend? Explain. What other criteria do they think are worth considering? What advice would they give to shoppers?

Learning experience

You could ask the class to bring in some food catalogues from home, or get the students to look on the internet under home shopping, to evaluate different brands of similar products for *value for money*. You may even like to take a short excursion to the local supermarket or design a homework task getting them to evaluate a range of specified products and decide which is the best value for money. Does buying in bulk always save money? For example, is a 2 L carton of milk cheaper than two 1 L cartons? Ask the class to devise a quick method for checking.

Instead you use a **sample**—in this case, only selected car users. You need to choose this sample carefully so that it represents the whole group and not just a part of it. For example, you would need to sample car users of different ages from different areas of Australia. Making the sample size as large as possible improves the results, and helps to overcome prejudice or bias.

To conduct the survey you can either interview people or send them a printed list of questions called a *questionnaire*. These questions must be worded in a way that will make the results as objective as possible. For example, instead of asking *How reliable is your car?* it would be better to ask *How many times did your car break down in the last year?*

Fig 4 Taste is a subjective test. When comparing wines, judges rate the wines on criteria such as taste, colour and aroma.

Investigate 4 A TASTE TEST

Aim

To use a panel to assess the quality of a type of drink or food.

Method

1. Select about three different brands of a particular product, eg orange juice, lemonade, sandwich spread, yoghurt or hamburgers.
2. Decide on the criteria you will use to assess the product, eg flavour, colour, texture, sweetness, smell.
3. Design a data table to record your results.
4. Set up a tasting panel of at least four people. Blindfold them.
5. Have two samples of each product. This lets you compare people's ratings of the same product to see if they are 'reliable' tasters.
6. Give the samples to the tasters in a mixed order, and ask them to rate each on a scale of 1 to 10, using the criteria from Step 2.
7. Record the ratings in your data table and analyse them.

Discussion

1. Why were the testers blindfolded?
2. Which product did each person give the highest rating? Which did they give the lowest rating?
3. Did all tasters give their highest rating to the same product?
4. What is the average rating for each product?
5. Can you suggest any improvements to your test? Explain.

Conclusion

Write a brief conclusion for your test.

Hints and tips

Some manufacturers claim that a high percentage of people would purchase their product again, however, the samples they base these claims on are extremely small. How do you think this skews the data? Are the conclusions made based on the sample size a fair representation of the population? Why? What sample size(s) gives you a fair representation of the population?

The students should be thinking about these sorts of questions when manufacturers make product claims based on surveys. Encourage them to do so and ask them to write down a 'claim' they have heard or seen in the media about a product with results based on a survey. Were the students able to find out what sample size was used and which types of people were asked questions in the sample? What were the question(s) asked? Encourage critical thinking.

Lab notes

- There is potential here for misbehaviour with blindfolds and tasting, so be well prepared and give the class clear rules.
- It's a good idea to hide brand names and prices if students are not blindfolded.
- Remind students about hygiene and be aware of those with food allergies or intolerances.
- This is an excellent opportunity to pool class data and use it as a basis for discussion, either as a whole class or in smaller groups.
- Potato chips or chocolate buttons work well and are generally more cost-effective. A healthier alternative might be to test brands of sultanas or wholemeal bread.
- Remind the students that this type of testing is subjective.

Experiment

CONSUMER TESTING

Imagine you work for a consumer magazine. Your boss has asked you to choose a consumer product and apply the six steps below to compare different brands. She wants you to write up your findings for the next issue of the magazine.

STEP 1: Decide which product you want to test

There are lots of products to choose from, and here are some suggested research questions.

- Which drink contains the most sugar or the most vitamin C?
- Which stain remover works best?
- Which chewing gum keeps its flavour the longest?
- Does a fine point biro last longer than a medium point one?
- Believe it or not, breakfast cereal contains tiny particles of iron, but which brand contains the most?

STEP 2: List the features you want to test

You can get further ideas from *Choice* magazine. You could also go to www.scienceworld.net.au and follow the links to the websites below:

Choice

Science Fair Project Ideas

STEP 3: Design a fair test for each feature

Remember to apply what you have learnt about working scientifically and doing projects.

- Write an aim that makes it clear what it is that you are investigating. This is usually in the form of a research question like the ones in Step 1.
- Write a plan that outlines what you intend doing and how you will make any tests fair. It is a good idea to test each product three times and average your results.
- List the equipment you will need.
- Before starting your experiment check with your teacher whether the equipment is available and whether what you are planning to do is safe.

STEP 4: Do the tests and record the results

Present your data in a way which helps show any patterns or trends in it.

STEP 5: Interpret the results and write a report

- What is the answer to your research question?
- Are your results what you expected? Did you control the variables properly? Could you improve your results by changing your method or repeating measurements?

STEP 6: Make a decision on the best product

Your findings should be *reliable*. For instance, you should be able to defend your tests if a manufacturer says your results are inaccurate. If someone else repeats your tests, would they obtain similar results?

Lab notes

- To do this properly will require about four lessons, and some clear guidelines will be needed. Part of the planning of this experiment could be done as a homework activity.
- Students need to have two or three possibilities which they can negotiate with you depending on cost, safety and how many other students want to do it.
- One way to test the amount of iron in breakfast cereals is to crush a measured amount in a plastic snap bag and then use a strong magnet (eg neodymium) to attract the iron.

Check!

1 Use the table on page 27 to answer these questions about the mobile phone investigation done by *Choice*.

- **a** Which is the heaviest of the phones tested by *Choice*?
- **b** Which do you think would be the best phone if you do a lot of SMSing?
- **c** Which phone would take the best photos?
- **d** Which phone would be the best where there is a poor signal?
- **e** Which phones failed the tumble test?
- **f** What similarities and differences are there between the Brand A and Brand B phones? Which would you buy? Why?
- **g** According to the *Choice* results, are the most expensive phones the best?
- **h** What is meant by the ergonomics of a phone?
- **i** On average, how long do mobile phone batteries last?
- **j** Which of the *Choice* tests do you think would be subjective? Explain your answer.
- **k** Which of the phones is the smallest? Explain your answer.

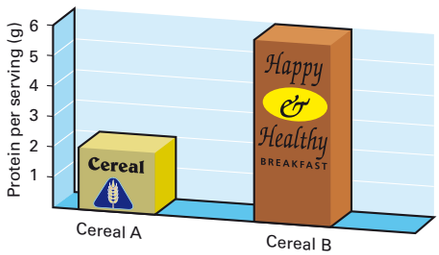
2 Margarita was worried that there was too much juice and not enough fruit in a certain brand of tinned fruit, so she did a test. Here are her results.

mass of unopened can	= 550 g
mass of opened can after juice has been drained off	= 400 g
mass of empty can	= 50 g

- **a** What is the total mass of the contents of the can? (This is the *net* mass.)
- **b** What is the mass of juice in the can?
- **c** What is the mass of solid fruit in the can?
- **d** What percentage of the can's contents is solid fruit?

3 List four tests you could use to decide which brand of correction fluid to buy.

4 Look at the bar graph below showing the amount of protein in an average serving of two breakfast cereals.



- **a** Based on this graph, which cereal do you think is better for your health? Explain.
- **b** The recommended daily amount of protein is 50–100 g. Does this change your answer to a? Explain.

5 Kyra asked three people to do some tests on hamburgers using this five-point scale:

5 Yummy
4 Not bad
3 Nothing special
2 Not very nice at all
1 Yuk! I'd rather starve

Each person tested each hamburger twice. The results are shown below.

- **a** Calculate the average rating for each of the hamburgers.
- **b** Rate the four hamburgers in order of popularity.
- **c** Who was the most reliable taster—that is, the person whose ratings for the same hamburger are the closest?

	Yasmin	Felicity	Kelly
Fast food chain A	3 2	3 1	3 3
Fast food chain B	5 4	4 3	4 4
Homemade	3 4	3 5	4 3
Corner store	5 5	4 2	5 4

Check! solutions

1 Using the table on page 27:

- **a** Phone G was the heaviest of the phones tested.
- **b** Phone D was the most highly rated for 'SMSing'.
- **c** Phone G was most highly rated for pictures and would take the best photos.
- **d** Phone A was rated most highly for sensitivity and would be best to use where there is a poor signal.
- **e** Phones C, E and G were found to be defective after the 'tumble test'.
- **f** Phone A was significantly (ie > 10%) better than phone B in the areas of durability, size and price. Phone B was significantly (ie > 10%) better than phone A in the areas of everyday use, battery life, charging time and weight (ie it was lighter).
- **g** Taking the overall score and price into account we would say this is generally true. Three out of four of the most expensive phones are ranked in the top three according to the overall score.
- **h** 'Ergonomics' means how comfortable, convenient and therefore efficient it is to use. You may need to check a dictionary.
- **i** On average, batteries last 5.2 hours.
- **j** The tests which are more subjective are 'everyday use', ergonomics and versatility because they depend on someone's opinion and will therefore vary somewhat from person to person.
- **k** The size of the phone can be calculated by multiplying the dimensions. The smallest is phone E which has a volume of 77 910 mm^3.

2 Using Margarita's measurements:

- **a** The mass of the contents of the can is 550 g − 50 g = 500 g.
- **b** The mass of the juice in the can is 550 g − 400 g = 150 g.
- **c** The mass of solid fruit in the can is 400 g − 50 g = 350 g.
- **d** The percentage of solid fruit = 70%.

3 Tests you could do on correction fluid are:

- how well it works in covering up errors
- the cost per mL
- the type of solvent and how quickly it dries
- whether it needs to be shaken every time before use
- whether it has an applicator which is easy and clean to use
- whether it can be harmful if misused by children.

4 Using the information in the graph:

- **a** Based on the graph, Cereal B is better because it contains three times more protein per serve than Cereal A.
- **b** You can probably infer that Cereal B is better for you than Cereal A because it provides a larger proportion of your daily requirements. However, other factors including what else you eat and your activity patterns are also relevant.

5 Using the results of Kyra's tests:

- **a** The averages for each hamburger are:

Fast food chain A	2.5
Fast food chain B	4
Homemade	3.7
Corner store	4.2

- **b** In order of popularity they are:
  Corner store
  Fast food chain B
  Homemade
  Fast food chain A
- **c** The most reliable taster is Kelly.

challenge

1 You want to test how effective various sunscreens are. What variables could affect the results of your test?

2 Blake is looking for a new boogie board.
- **a** What features do you think he should be looking for?
- **b** What tests could he do?

3 Choose a test report that interests you from *Choice* magazine and write a summary of it. In your summary, make sure you give the aim of the investigation, what tests were done, the results and the conclusions.

4 How would you test which of four different science textbooks was the best?

5 There are three options for providing nappies for a baby. List at least three advantages and three disadvantages of each option. Then, as a group, decide which you consider the best option and why.

Option 1: Use re-usable cloth nappies. Parents who use this method buy about 30 nappies (about $2.50 each) and wash them at home after use. Remember there are costs (about $6.50 per week) for washing powder, disinfectant, hot water and electricity to run the washing machine and perhaps the clothes dryer. Assume the cloth nappies last about a year.

Option 2: Use re-usable cloth nappies and pay a nappy service to collect the dirty nappies and replace them with clean ones. The nappy service washes the nappies for you. Nappy services charge about 44 cents per nappy, and about 60 nappies are required each week.

Option 3: Use disposable nappies. These cost about 31 cents each.

6 Examine the advertisement below and answer the following questions.
- **a** Why is the person in the advertisement a middle-aged male with a white coat and glasses? What is he meant to represent?
  Do consumers trust this sort of person more than others?
- **b** There are many products whose names suggest they are 'green', like *Eco-gentle*. What advantages do the manufacturers expect to gain from this?
- **c** Is it realistic to say the product has no effect on the environment?
- **d** Can experiments prove the safety and effectiveness of the product? Explain.
- **e** Is there anything special about tests carried out in universities? Why might advertisers include this type of statement?
- **f** What does the word 'hypo-allergenic' mean? Do you think many consumers would know? Why do you think this word was used in the advertisement?

Challenge solutions

1 Variables that would affect the results of your test include individual differences between people, different light intensities, different areas of the body, exposure to water and time.

2 **a** Blake would look for size, the material used on the bottom surface (the rocker) and the foam used on the top surface. He would also check the rails (the angles on the side edges), test whether it is sturdy and yet flexible and is reasonably priced.

b To test the board Blake could:
- Measure the size by holding the board vertically on the ground. The correct size is up to his belly button.
- Test the sturdiness of the board by placing his knee in the foam and pushing. The board should be stiff yet slightly flexible.
- Test the 'slick' (the smooth bottom surface) by depressing it with his thumb. Good-quality slicks are smooth and firm but hard.
- Observe the curve on the bottom surface (the rocker). It should have a slight convex curve.

3 Your teacher or school resource centre will be able to help you with past magazines, or you can access the website at <www.choice.com.au>.

4 You would decide on a certain number of important points or criteria and then rate the books on each criterion, perhaps using a scale of 1–5 where 1 is hopeless and 5 is excellent. The data could then be collected and displayed in the form of a table. It would be useful to include some students and some teachers on the rating panel. Suitable criteria might be:

i Does it have a sturdy and attractive cover?

ii Is it set out neatly and clearly printed on good-quality paper?

iii Does it contain interesting and current topics and activities?

iv Does it include references to the internet?

v Does it cover the required science curriculum guidelines?

vi Does it also have useful support materials like workbooks, teacher resource books and these 'Solutions' and 'Tests'?!

5 For **Option 1**:
Three advantages of cloth nappies are:
- they last longer
- they can be reused
- it works out much cheaper ($413 per year).

Three disadvantages of cloth nappies are:
- they require washing powder
- they require energy to wash
- they take up a parent's time.

For **Option 2**:
Three advantages of a laundry service are:
- much less work for parents
- no washing costs
- no waste to dispose of.

Three disadvantages of a laundry service are:
- fresh nappies may not always be available
- it is very costly compared to Option 1 ($1373 per year)
- there could be problems on weekends or holidays.

For **Option 3**:
Three advantages of disposable nappies are:
- they are always readily available
- they are always clean and fresh
- there is no need or expense for washing.

Three disadvantages of disposable nappies are:
- they are quite costly compared to Option 1 ($967 per year)
- very wasteful of resources
- create problems in hygienic disposal.

The final decision about the best option is a matter of personal preference and will be different for different people.

2.2 Options

There are six options for you to choose from. Each one has something to do with making decisions about which product to buy or about safety aspects of a product. You can use these summaries to help you decide which options to do.

OPTION 1

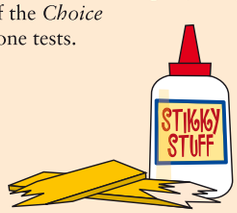
VISCOSITY OF OILS page 34

You find out about the viscosity of oils, and conduct an experiment to find out how the viscosity changes as the temperature changes.

OPTION 2

TESTING GLUES page 36

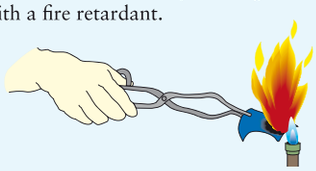
You plan and conduct various consumer tests on different brands of glue, along the lines of the *Choice* mobile phone tests.



OPTION 3

FIRE DANGER page 37

You investigate whether fabrics can be made less flammable by treating them with a fire retardant.



OPTION 4

FOOD ADDITIVES page 39

You learn about food labels and the different types of food additives, then test for sulfur dioxide in foods.

OPTION 5

DISPOSABLE NAPPIES page 42

You compare the effectiveness of different brands of disposable nappies.

OPTION 6

COSMETICS page 43

First you find out what an emulsion is, then you make your own cleansing cream and compare it with commercial cleansing creams.

Hints and tips

- The students might like to come up with their own options to test. If they do, make sure their test has something to do with making a decision about which product to buy or the safety aspects of the product.
- As a teacher, you might decide which products the class will investigate. Options 1, 2, 4 and 6 lend themselves well to a whole class activity. Option 3 may be better performed as a teacher demonstration and Option 5 is suitable for a group activity. If you choose to get the students to investigate only one option, limit the group sizes and be vigilant when they are testing safety aspects.

Learning experience

The students could present their option findings in poster form or as an article similar to one found in *Choice* magazine. For their final conclusion they may like to write their own product advertisement highlighting their key findings. Students should write their report using the appropriate language used in this chapter.

6 After examining the advertisement:

a This person is meant to represent a scientist. Consumers will trust this person because they think he has tested the product fairly and objectively.

b Manufacturers hope to appeal to those people who would like to do what they can to save the planet. They do it because they hope to sell more of their products.

c No, this is not realistic because every product will have some effect on the environment.

d Experiments will provide some evidence but there are a lot of variables when the product is actually used in the home laundry. For example there may be different people using the product and even though it may usually be effective it will not always be safe.

e Universities have laboratories where proper scientific experiments can be conducted by qualified people. Advertisers include this because they hope that consumers will trust them and their product and that as a result they will sell more.

f 'Hypo-allergenic' means that it will not cause an allergic reaction in most people. Most consumers would probably guess this because they would think that all of the ingredients that could cause allergies have been removed. The word 'hypo-allergenic' is used because it is of concern to some people who could react to clothes washed in detergent.

OPTION 1

Experiment

VISCOSITY OF OILS

Research question

How does the viscosity (thickness) of oil change as the temperature is changed?

Designing your experiment

Read through the Planning hints, then work in a small group to design your experiment. Make a list of the materials you will need.

Include in your design an assessment of the safety issues you will address when you do the experiment.

Show your draft design, materials and risk assessment to your teacher for approval. Do not start your experiment without a signed approval from your teacher.

Planning hints

1 Write a testable hypothesis linking the viscosity of the oil to its temperature.

2 You can measure the viscosity of the oil by dropping a ball bearing through it. The longer it takes to fall, the more viscous the oil is.

3 You can use a magnet to retrieve the ball bearing from the bottom of the cylinder.

4 You don't want the fall time to be too short, so you need a tall measuring cylinder. You could experiment with a long tube, eg an old burette works well. You could also use a marble or something similar instead of a ball bearing.

5 Another method is to put the oil in a long tube, leaving an air bubble. When you tip the tube upside down you can measure how long the bubble takes to move *up* the tube.

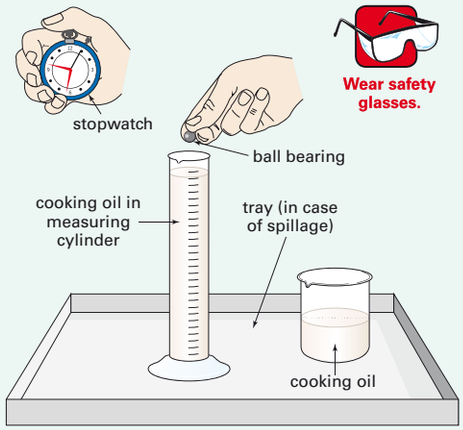
6 You should do each measurement three times, then calculate an average fall time.

7 To cool the oil, put it in a refrigerator.

8 To warm the oil, heat it in a beaker on a hotplate, but **do not heat the oil above 50°C**.

9 Remember to control all variables except the temperature of the oil.

10 Graph your results and draw a line of best fit through the points. (It may be curved.)



You need to be very careful with the warm oil. Hold the beaker with a paper towel or a cloth when pouring, and take care not to splash it. In case of spillage, it is best to work on a tray. If you spill warm oil on yourself, wipe it off quickly with a paper towel or cloth, then wash well with cold water and detergent.

Discussion

1 Which is the independent variable in this experiment? Which is the dependent variable?

2 How does the fall time change as the temperature increases?

3 At which temperature is the oil most viscous? How do you know?

4 Use your graph to predict the viscosity of the oil at 35°C, 0°C and 60°C.

5 How accurate do you think your results are? Suggest ways of improving the experiment.

Conclusion

Is your hypothesis supported by the results? If not, rewrite it.

Lab notes

- Insist on the students wearing safety glasses to avoid any oil splashes into the eyes.
- In Planning hint 3, neodymium magnets work most effectively. Alternatively, you could put the magnet on a string and go 'fishing' for the ball.
- Make sure you get someone responsible to heat the oil.
- A large tray is a vital precaution.
- Washing the cylinders is a big job and will need a lot of detergent and some long brushes.

Learning experience

Consider doing a teacher demonstration showing the viscosity of some different oils at room temperature. Alternatively, the students could devise their own experiment and test the viscosity of different oils, as in the experiment.

OPTION 1

Thick and thin oils

Did you find in the experiment that cooking oil becomes less viscous (thinner) at higher temperatures? The oil used in the engine of a car behaves in much the same way.

Engine oil is a lubricant that reduces friction between the moving parts of a car's engine, especially on the pistons as they move up and down inside the cylinders. For good lubrication the oil must have the right **viscosity**. 'Thick' liquids like honey have a high viscosity, and flow slowly. 'Thin' liquids like water have a low viscosity, and flow quickly.

Oil must work over a wide range of temperatures. On a cold winter morning the temperature may be as low as 0°C, and when the engine is running its temperature will be between 90°C and 100°C. Technologists have developed special oils, called multigrade oils, by including special additives. The viscosity of a multigrade oil does not decrease much as the temperature rises. At low temperatures the oil is thin enough for the engine to start easily; and at high temperatures it is thick enough to lubricate the engine properly.

Look at a container of oil. The viscosity of the oil is usually given by an SAE number.

Fig 17 What do you know about engine oil? You probably know that it is usually changed when the car is serviced, and sometimes needs 'topping up'.

Single-grade oils have only one number, from 5 to 50. The higher the number the thicker the oil. Multigrade oils have two numbers, eg 20W/50. This means that the oil acts like 20 oil at low temperatures (the W stands for winter), and like 50 oil at higher temperatures.

Check!

1. What is meant by the viscosity of oil?
2. What happens to the viscosity of oil when it is heated? How can you explain this in terms of the forces between the long hydrocarbon molecules in oil?
3. Explain the differences between the following oils:

   SAE 20W/40 SAE 20W/50 SAE 40
4. Suggest why an engine is easier to start if you use a thinner oil.
5. Suggest why engines last longer if you use thicker oils.
6. Joe filled a burette with a liquid and put a cork in the top, leaving an air bubble. He then turned the burette upside down and measured how long the air bubble took to move up the burette. He did this for four different liquids, and recorded his results.

Liquid	Air bubble time (s)
A	12
B	20
C	16
D	5

   a In which liquid did the air bubble rise most quickly?
   b Which one of the four liquids is the most viscous?
   c If liquid C is heated, its viscosity will change. Which of the other liquids will it probably become most like in viscosity?

Hints and tips

When discussing quality control and product testing, consider getting a food technologist or scientific quality controller to come out and give a presentation to the class. Ask them to explain what their work involves, the science they use and what happens to the data they collect. How are new products developed or modified? Do they make recommendations, and what happens if the product they tested fails? It may even be possible to organise a tour of a manufacturing company to see quality control. If it is not possible to have someone visit the school, ask the students to prepare a list of interview questions they can ask a scientist working in this field over the phone or online.

Homework

Ask students to investigate different types of motor oils or cooking oils. If possible, they should write down the SAE (Society of Automotive Engineers) number of the oil and whether it is single or multigrade. Other tasks/questions could include the following:

- Order the oils according to their viscosities and uses.
- What temperatures are they best used at? For example, olive oil should not be heated to temperatures greater than 50°C, while peanut oil is very versatile and can be heated to very high cooking temperatures like those when using a wok.
- What other interesting information or facts did they discover?

Students should present the information as a pamphlet with its target audience being motor mechanics or chefs.

Check! solutions

1 The viscosity of oil means how easily it will flow. Less viscous oils have lower numbers and flow easily, whereas more viscous oils have higher numbers and flow more slowly.

2 As an oil is heated its viscosity decreases. This occurs because as the molecules begin to move about more rapidly the forces attracting them together are reduced.

3 These numbers refer to the viscosity of the oils.
- SAE 20W/40 means that this oil has a viscosity of 20 at low temperatures (W stands for Winter) and 40 at higher temperatures. It is a multigrade oil.
- SAE 20W/50 means that this oil has a viscosity of 20 at low temperatures and 50 at higher temperatures. It is also a multigrade oil.
- SAE 40 is a moderately viscous, single-grade oil and its viscosity will decrease as the temperature increases.

4 A thinner oil will mean that there is less resistance to movement (friction) as the parts of the motor start moving when the engine is being started.

5 Engines will last longer if a thicker oil is used because it will provide a thicker film and better protection for the moving parts of the motor.

6 a The air bubble rose most quickly in liquid A.
b The most viscous liquid is B because it took the longest time for the air bubble to rise to the surface.
c Generally, when heated, oils will become thinner with less viscosity. This will mean that it will become more like oil A.

OPTION 2

Experiment
TESTING GLUES

Aim

To do some consumer testing of glues, using the six steps from pages 26 and 28.

Planning hints

1 Some features of glues which you could investigate are:
- the strength of the bond formed
- the type of glue, eg paper, wood or plastic, one-part or two-part
- the unit cost (how much does 1 g or 1 mL of glue cost?)
- whether the instructions are simple and clear
- whether the safety precautions are adequate.

2 You could investigate how well the glues bond to different materials, for example: wood to wood, paper to paper, plastic to plastic or plastic to metal?

3 You will need to work out a way of testing the strength of the bonds formed. Two possible methods are illustrated below.

4 You could also investigate how the strength of a bond increases with time.

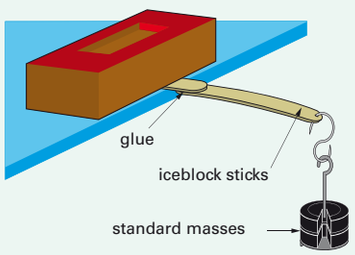
5 **All glues must be handled with great care.** Avoid contact with skin and eyes, and use gloves if possible. Wipe any glue off your skin immediately with a clean cloth. Work in a well-ventilated area, and do not inhale the vapour. Before using a glue read the instructions carefully.

6 In your opinion, how easy is the glue to use? Are the nozzle and cap well designed? Does the container leak? Does it stand up to repeated use? You could use a rating scale here.

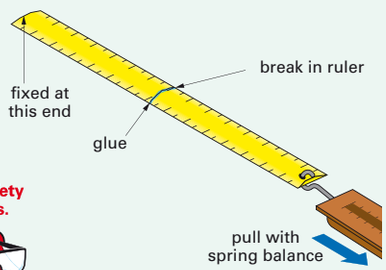
7 Consider the best way to display your findings. One way is to use a data table similar to the one below. The details will depend on which tests you do.

8 Once you have completed your tests, you need to interpret the results and write a report, advising consumers about the best types of glues to buy.

Method A



Method B



Wear safety glasses.

Glue brand	Price paid	Net contents	Cost per g or mL	Instructions	Safety labelling	Ease of use	Strength

Lab notes

- Make sure to stress the danger of students getting glue on their skin. Avoid using superglue.
- It's a good idea to have a newspaper or something similar to cushion the weights if they fall.
- Try to quantify properties (eg ease of use) using a scale of 1–10.
- Emphasise the importance of writing the results into a table, as shown at the bottom of the page.

OPTION 3

Fire danger

The photo below shows scars on a young girl from burns received when her dress caught on fire. Most burns children suffer occur when clothing catches fire from heaters and open fires or from them playing with matches and flammable liquids such as petrol and kerosene. Scalding from boiling water is also common.

Some fabrics are more flammable than others. Some synthetic fabrics also melt when they burn, and the hot molten fabric can stick to the skin, causing severe burning. For these reasons most manufacturers of children's sleepwear now use fire-resistant materials or close-fitting styles (see Fig 21). When buying fabrics or clothes you can check whether they are fire-resistant or of low flammability by looking for the label LOW FIRE DANGER (Fig 22).

To make clothing fire resistant manufacturers use a *flame retardant*. One type of retardant is a mixture of chemicals in which the cloth is soaked.

Fig 21 These tracksuit-style pyjamas are close-fitting so that the sleeves and legs are less likely to catch fire in heaters and open fires.

Fig 22 When buying children's nightwear look for the label LOW FIRE DANGER.

Hints and tips

Try to organise a representative from the local fire department to come out and give a safety talk to the class, particularly addressing the issues relating to clothing. If possible, organise for a burns specialist from a hospital to give a presentation on how to treat burns.

Learning experience

Ask the students to give reasons why clothing made from synthetic fabrics is generally considered more harmful if it catches alight than clothing made from natural fibres. (The synthetic fabrics tend to melt and stick to skin, causing more severe burning.) Get the class to make some 'Fabric Fact Sheets' detailing information about each fabric and relating it to this chapter. Their target audience should be parents. As well as clothing, they could also consider bedding.

Learning experience

Students could develop a one-page fire safety or first aid sheet outlining the key points from this option to put into the school newsletter. Each sheet could be posted on the school intranet and the class asked to rate them. The sheet with the best rating could then be put into the school newsletter, printed as flyers and displayed around the school to alert others of the dangers. A task like this encourages creativity and care for others, and shows science at work.

OPTION 3

Investigate

5 FIRE-RESISTANT CLOTHING

Aim

To compare the flammability of fabric samples before and after treatment with a flame retardant.

Materials

- samples of two different fabrics, eg cotton or wool and a synthetic
- metal tongs
- heatproof mat or tray of sand
- Bunsen burner
- stopwatch
- metal can
- scissors
- alum
- borax
- boric (boracic) acid
- balance
- 250 mL beaker
- washing powder

Wear safety glasses.

Planning and Safety Check

- This investigation may take more than one day. So that you will know exactly what to do, and in what order, draw up a flowchart summarising the steps in the Method.
- Because some fabrics give off toxic fumes when they burn, it is best to do this investigation in a fume cupboard. Discuss this with your teacher.

Method

1 Cut out three 3 cm squares of each fabric.

2 Make the flame retardant solution using the following:

13 g alum	0.5 g boric acid
1.5 g borax	100 mL water

3 Saturate two samples of each fabric in this solution, then dry them thoroughly.

4 Wash one sample of each treated fabric using a small amount of washing powder in warm water, then dry it.

5 Using the metal tongs, hold one of the untreated fabric samples close to the burner flame until it ignites. Hold the burning fabric over the metal can.

Measure the time taken for the sample to: **a** catch alight and **b** burn completely.

If the flame goes out before the burning has been completed, relight the sample immediately and keep it alight until it has all burnt.

6 Repeat the burning test for:
- the other untreated sample
- the two treated samples
- the two treated and washed samples.

Remember to control variables.

Record your results in a data table.

Discussion

1 Which is more flammable—the cotton or the synthetic fabric?

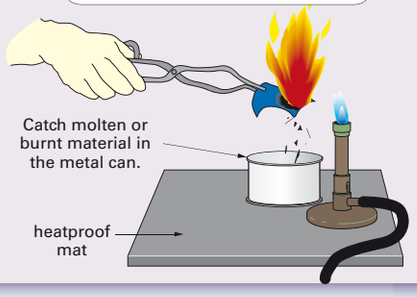
2 What effect did the flame retardant solution have on the flammability of the fabrics?

3 Does the flame retardant work better on the cotton or on the synthetic fabric?

4 Does the flame retardant work as well after the fabric has been washed?

5 What extra information would you need before you could write a full consumer report on flame retardants?

Note: Do this in a fume cupboard.



Lab notes

- It is obviously important to make sure that the samples are the same size if the burning time is to be compared.
- Make sure that these tests are done in a fume hood or a well-ventilated area.
- Try to get to the end of step 4 in one lesson, and let the fabrics dry between lessons.
- A hair dryer will help speed up drying if necessary.
- Because of its hazardous aspects, you may find this investigation is better done as a teacher demonstration.

OPTION 4

Food additives

Some of the food we eat is fresh, like apples and tomatoes. But most of it has been *processed* in some way—to make it look better, to change its flavour, or to make it last longer. When food is processed, the chemicals in it are altered or extra chemicals, called *food additives*, are added to it. There are laws about the labelling of foods. Fresh food does not have to be labelled, but most processed food does. The illustration below shows the information the label must show.

Datemark

Most foods 'go off' eventually, but some last longer than others. The datemark helps consumers and shops make sure the food is in good condition.

Name

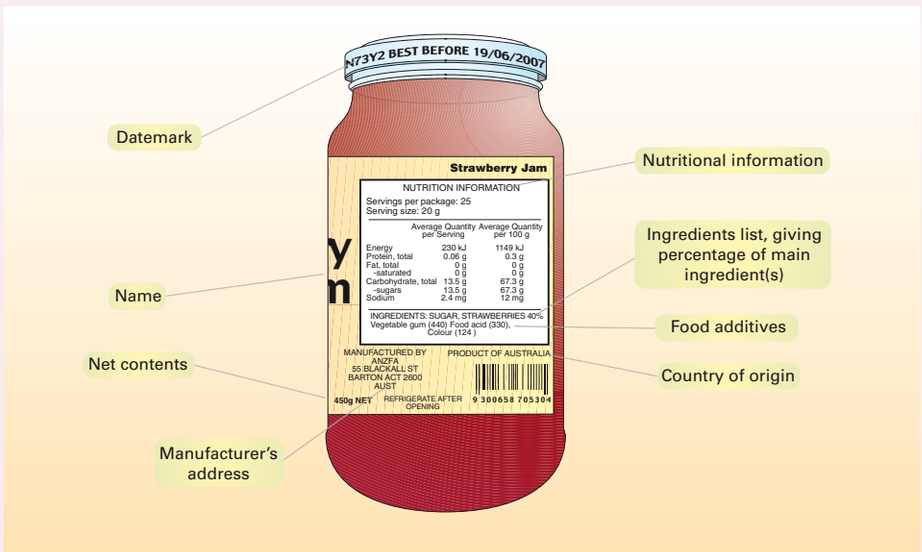
The name should give honest information about what the food actually contains. For example, a product called 'strawberry jam' must contain strawberries.

Ingredients

Most packaged food has to have a list of ingredients, showing what is in the food. The ingredients are listed in order of decreasing mass, that is, the main ingredients are listed first, and the additives at the end. The main ingredient must also be given as a percentage of the product. For example, the percentage of strawberries in the jam below is 40% of the total mass. The additives are food acid (to give it a 'tang'), preservatives (to stop it 'going off') and red colouring.

Additives have to be approved by the government, and most of them have a number. This number tells you what the additive is. For example, 160a is carotene, the colour found in carrots and pumpkins and often used to colour fruit drinks and margarine. The table on the next page lists the main types of food additives. For a more complete list, see the Australia New Zealand Food Authority website.

Most processed food is also required to have basic nutritional information about fat (including saturated fat), protein, carbohydrate (including sugars) and sodium (sodium chloride or salt).



Hints and tips

- Class discussions are a great way of finding out more about your students. They can reveal information about students' misconceptions or preconceived ideas. Have a discussion about food additives. Are there any students in the class who have food allergies or intolerances? If so, what are their symptoms and what treatment is needed? Do they know of anyone who has had a severe allergic reaction to a food? Encourage sensitivity and compassion, as not all students with food allergies or intolerances are willing to share their experiences.
- What is the difference between an allergy and an intolerance? Consider asking the school nurse to give a short presentation outlining the difference. Ask them to explain what first aid procedures need to be taken for severe cases.

Homework

Ask students to investigate the contents of their pantry at home. They should choose five food items and, for each one, list the information outlined in the diagram on this page. They could even draw their own pictures to display the product information. Students should then answer the following questions:

1 What is the main ingredient in the food?
2 Are there any artificial flavours or colours, or is the food considered 'all-natural'?
3 Has a preservative been used? If so, what is it?
4 Would you consider this food to be healthy? Why or why not?

Learning experience

Are artificial ingredients just as good as natural ingredients? Get the class to investigate different types of artificial flavours and colours and compare them to their natural equivalents. Why are more people allergic to red food colouring than any other colour? What purpose do food colours have? Why are more and more people these days opting for naturally flavoured or coloured foods? What information do food manufacturers have to display on their product labels? Divide the class into small groups, ask students to brainstorm a series of questions about food additives, and then give them time to research the answers. They could present their findings in a poster, a multimedia presentation or an oral presentation.

OPTION 4

Additive	Why it is added	Some examples	Code number	Found in . . .
flavours	to give food more taste	usually complex mixtures	no number	sweets, sauces, soups, soft drinks, cordials, potato crisps
colours	to make food more attractive	tartrazine 102 (yellow), cochineal 120 (red), chlorophyll 140 (green), carotene 160a (orange)	numbers beginning with 1	soft drinks, ice-cream, snack foods, soups, sauces, biscuits, cakes, margarine, sweets
preservatives	to stop bacteria and fungi growing in food and making it 'go off'	salt, sugar, sodium benzoate 211, sodium nitrite 250, sulfur dioxide 220	numbers beginning with 2	soft drinks, fruit drinks, wine, pickles, cheese spreads, sausage meat, ham, bacon, dried fruits
antioxidants	to help stop fats and oils going rancid (bad taste and smell)	ascorbic acid 300 (vitamin C), tocopherol 306–309 (vitamin E)	numbers beginning with 3	chewing gum, instant soups, cake mixes, potato crisps, margarine
flavour enhancers	to improve the flavour	monosodium glutamate 621 (MSG)	numbers beginning with 6	Asian food, potato crisps, biscuits
emulsifiers	so that oil and water mixtures do not separate into layers	lecithin (from soya beans)	various numbers	salad dressings, mayonnaise, margarine, ice-cream, chocolate
food acids	to give food a 'tang' and keep acid level constant	acetic acid 260, citric acid 330		lemon soft drink, canned tomatoes
vegetable gums	to thicken and set foods	alginates 400–405 (from seaweed)		ice-cream, flavoured milk drinks, desserts, pie fillings
humectants	to stop foods from drying out	glycerin 422		cakes, biscuits, muesli bars, pie fillings, some pet foods

Additives improve the appearance, texture, flavour, keeping quality or nutritional value of processed foods. On the other hand, some people are allergic to certain additives, especially preservatives and artificial colours, which may cause hay fever, skin rashes, headaches, stomach upsets or hyperactivity. It is also possible that some additives could cause cancer if eaten in large amounts for many years.

Food additives are tested before they can be used. These tests are usually done on animals. Any additives that are shown to cause health problems are banned.

Hints and tips

You can obtain lists of food additives and their numbers from the internet. The students might like to find their own if they have access to computers at school. Print some lists out for them to view. You will find the class fascinated with them, and they will want to find out about their lunch, or items they eat at home.

Learning experience

Does the school canteen cater for people with food allergies or intolerances? How healthy is the food being sold? Get the students to do a survey of the school food and rate the foods according to their nutritional qualities. The class could be divided up into groups; each group could investigate a different type of food, such as snack foods, hot lunch items, sandwiches, drinks and so on. They can present their findings as a poster which could be displayed near the canteen.

OPTION 4

Investigate

6 SULFUR DIOXIDE IN FOOD

Aim

To test various foods to determine whether they contain sulfur dioxide preservative.

Materials

- selection of foods such as dried apricots, desiccated coconut, raisins, wine
- dilute **iodine–potassium iodide** solution (5 g iodine and 10 g potassium iodide per litre of water) Toxic
- mortar and pestle (or blender)
- beaker
- 1% starch suspension
- balance
- measuring cylinder

Method

1 Weigh out about 10 g of the food.

2 Mix the food with about 100 mL of water in a mortar or blender. Decant the solution into a beaker. With liquids you can omit this step. Simply use 100 mL of the liquid.

3 Add 10 mL of iodine–potassium iodide solution to the beaker.

If the food contains sulfur dioxide, it reacts with the iodine, removing it from the solution. So, when the starch suspension is added in the next step, no blue-black colour is seen. If the food does not contain sulfur dioxide, the iodine remains and reacts with the starch to produce a blue-black colour.

4 Add about 2 mL of starch suspension.

Does the food contain sulfur dioxide?

5 Try other foods.

Record your data in a data table.

Discussion

1 Which foods contained sulfur dioxide?

2 Can you tell which foods contained the *most* sulfur dioxide? How could you modify the investigation to find out?

Check!

1 Why do most foods have a datemark?

2 Why do you think it is important to know the percentage of fruit juice in a drink?

3 Look at the list of ingredients below.
- **a** Which is the main ingredient?
- **b** List the additives and say why you think each has been added.
- **c** What do you think the product is?

CARBONATED WATER, SUGAR, LEMON JUICE (5%) FLAVOURS, FOOD ACID (330), PRESERVATIVE (211), COLOUR (102)

4 Use the table of food additives on the previous page to answer these questions.
- **a** A food item has an additive with the number 210. What would the purpose of this additive be?
- **b** What does an emulsifier do?
- **c** Why are vegetable gums added to some foods?
- **d** Why is citric acid added to some soft drinks and fruit drinks?
- **e** How are preservatives and antioxidants similar?
- **f** Which additives would you expect to find in margarine?

5 The jelly beans in a packet come in eight different colours, yet there are only five different colours in the ingredients list. How can this be?

6 Can you tell the difference between sugar and artificial sweetener? Design a fair test to find out.

7 What is hyperactivity? How is it related to what we eat? What can be done about it?

Lab notes

- Remind students that the laboratory is a place for scientific testing and not eating, so do not allow them to nibble any food item. Reinforce that hazardous chemicals are being used in this investigation.
- This is a simple and safe investigation, with opportunity for extension.
- If students finish early they could do some internet research about when and where this method is used in the food industry and also any problems that might arise, eg allergy to sulfur dioxide.

Check! solutions

1 Most processed foods have a datemark so that both the shopkeepers and the consumers can be confident that it has not started to decompose or 'go off'.

2 Fruit juice must be made up of at least 50% the juice of fruit, whereas fruit drink can contain much less juice and usually more additives.

3 After looking at the list:
- **a** The main ingredient is carbonated water.
- **b** The ingredients have been added for the following reasons:
  - sugar for taste
  - lemon juice for taste and as a preservative
  - flavours to add flavour (obviously)
  - food acid (330) for a tangy taste
  - preservative to stop it 'going off'
  - colour to make it more attractive.
- **c** You would infer from the yellow colour that this product is a lemon-flavoured soft drink.

4 Using the table on page 40:
- **a** The purpose of this additive would be as a preservative because it begins with 2.
- **b** An emulsifier allows oils and water to mix without separating into layers.
- **c** Vegetable gums are added to some foods to help thicken and set them.
- **d** Citric acid gives food and drinks a tangy 'citrus' flavour.
- **e** Both groups help to prevent foods 'going off' or starting to decompose.
- **f** In margarine you would expect to find antioxidant, colour (eg 102) and emulsifier.

5 This is possible because the other three colours are made by mixing some of the five colours.

6 A fair test would involve you having a 'blind' test using two unlabelled glasses containing identical drinks except for the sugar or sweetener (eg 'Pepsi' and 'Pepsi Max', or sugar and sweetener simply dissolved in water) and repeating it several times. It would be a good idea to wash your mouth out with plain water after each tasting.

7 Hyperactivity is when some people, especially children, become too active. This can affect their behaviour and learning at school. Research has shown that with some people it becomes worse after they have eaten certain food additives (eg in raspberry cordial). One way to manage 'hyperactivity' is to restrict what these people eat and drink.

OPTION 5

Experiment

DISPOSABLE NAPPIES

Aim

To apply the six steps on pages 26 and 28 to compare the effectiveness of different brands of disposable nappies.

A typical disposable nappy is shown below. It should have the following important features:

- absorbent—to soak up lots of liquid
- leakproof—so liquid cannot leak out around the legs and waistband
- comfortable for the baby to wear
- disposable—as much of the nappy as possible should be biodegradable.

Planning hints

This experiment is open-ended and you will need to decide what you are going to test and how you will do it. Before you start, read through the following suggestions.

1 You could test the absorbent padding to see how much liquid it will soak up. Note that most disposable nappies contain a special white powder called sodium polyacrylate. It is a polymer that swells to form a gel (a kind of jelly) on contact with water.

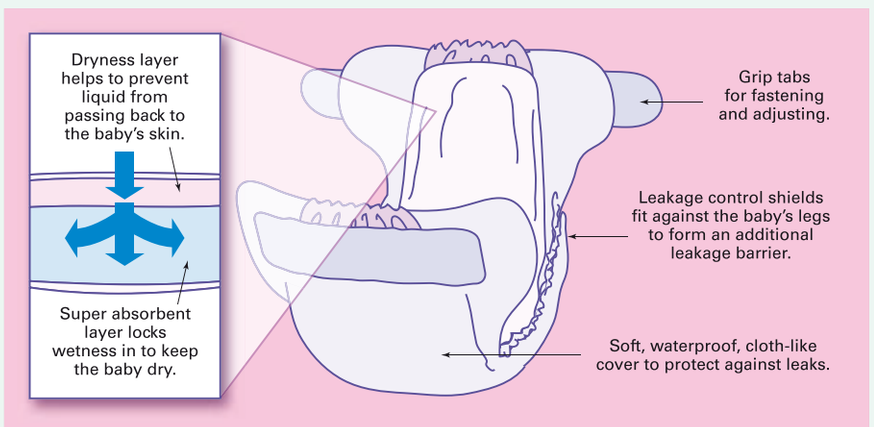
2 Most manufacturers claim that their nappies have one-way liners. This means they allow liquid to pass through them to the absorbent padding, but do not allow liquid to flow back the other way. This means the baby's skin stays reasonably dry. You could test some one-way liners to see if this claim is true.

3 How strong are the tapes used to fasten the nappy? Are they strong enough to hold the nappy on an active baby? Do they still work when the nappy is wet?

4 You could do a survey of nappy users to see which brands they use, how easy they are to use etc. You could interview neighbours, friends and relatives, or you could design a questionnaire.

5 Remember your tests must be fair, so make sure each brand of nappy is tested in the same way. Also, your findings must be reliable. If someone else repeats your tests, they should get the same results.

6 Write a detailed report describing what you did and what you found out. The intended audience for your report should be people who buy disposable nappies.



Lab notes

- This task lends itself to work in groups or pairs.
- Be careful how many nappies your class uses. Nappies are expensive and there is also an environmental impact.
- Labels or manufacturers' internet sites will have information about the chemicals in the nappies.
- Make sure to emphasise Planning hint 6, as this will form the majority of any assessment.

OPTION 6

Cosmetics

One of the most common cosmetics used today is cleansing cream. It moisturises as well as soothes the skin. It is also used to remove make-up and to clean the skin. The use of cleansing cream avoids having to use large amounts of soap that extract the natural oils from the skin and can have a damaging effect.

Cleansing cream is an emulsion consisting of tiny droplets of oil and wax suspended in water. Normally water and oil do not mix, because water molecules are polar (contain electric charges) and oil molecules are non-polar. Each prefers to stay with its own kind, rather than getting mixed up with the other.

If you mix oil with water, the oil floats on top as a separate layer. If you shake the mixture vigorously, the oil is broken up into tiny droplets. But when you let the mixture stand, the oil separates out again. What is needed is a 'go-between' to bring the two liquids together. These 'go-between' molecules are called **emulsifiers**. They have a polar end and a non-polar end and are therefore attracted to both oil and water molecules, as shown in Fig 28.

Cleansing cream is called an oil-in-water emulsion, and it can be rubbed onto your skin without leaving it feeling greasy. When it is applied to your skin, the water evaporates, producing a cooling effect. This is why it is sometimes called *cold* cream. The oily ingredients in the cream are left as a thin film on your skin. They can be washed off easily with water.

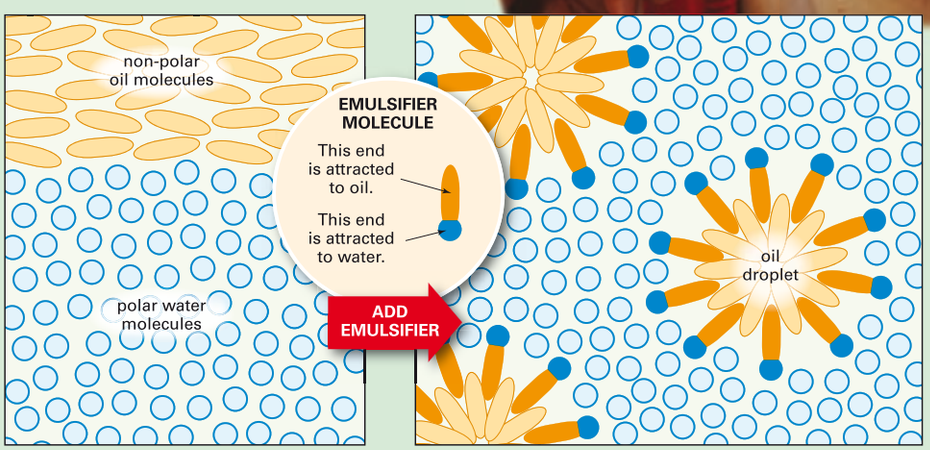


Fig 28 How an emulsifier helps oil and water mix. Emulsifiers work in the same way as soaps and detergents.

Hints and tips

Revise what an emulsion is—a colloid with tiny droplets of one liquid spread through a second liquid.

Issues

Some cosmetics, including cleansing creams, are tested on animals.

- Why do students think this is? Which animal species is most often subjected to animal testing (rabbits)? Ask them to suggest why.
- Products that have not been tested on animals usually contain a symbol of a rabbit accompanied by the words 'no animal testing'. Ask the class to list cosmetic companies/brands that test their products on animals and those that do not. How do they feel about this? Was the information difficult to obtain? Should the public be made aware of brands that use animal testing? Based on this information, would students change their minds about which brands they choose to use?
- This issue could be debated as a class or in groups. Students should respond to the questions using the type of language found in this chapter. Alternatively, individual students could make their own multimedia advertisements presenting their findings.

Homework

Write down the ingredients listed for a particular brand of cleansing cream. How do they compare with those listed in the investigation on page 44? Why do there seem to be so many more ingredients in commercially produced creams? Infer what some of the added ingredients are for (colours, preservatives and perfumes).

Lab notes

- There are obvious safety hazards in this investigation, especially in the use of the hotplate.
- It is very important to allow the creams to cool down properly before testing them.
- Students could use their cleansing cream to remove lipstick and foundation.
- It is better not to let students use the cream on their faces in case of an allergic reaction. When they are testing them to remove make-up, make sure they only apply it to the backs of their hands.
- It is a good idea to use a table to collate and compare students' observations.

OPTION 6

Investigate

7 MAKING CLEANSING CREAM

Aim

To make cleansing cream and compare it with commercial cleansing creams.

Materials

- **liquid paraffin** (100 g)
- **white beeswax** (30 g)

Flammable

- borax (2 g)
- 2 beakers (250 mL)
- measuring cylinder (100 mL)
- balance
- water bath (see Planning and Safety Check)
- heatproof mat
- 2 stirring rods
- 2 thermometers
- small storage bottle
- make-up
- several commercial cleansing creams
- soap

Planning and Safety Check

Read the Materials and Method carefully and note any safety hazards. The beakers and storage bottle you use must be perfectly clean, since you will be putting the cleansing cream you make on your skin .

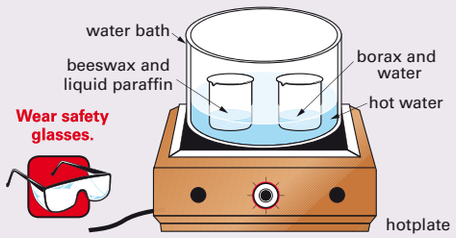
Discuss with your teacher what you will use for a water bath and how you will lift the beakers out of it in Step 4. You could use a large beaker, flat tray or large aluminium pot on a hot plate. Alternatively you could use an electric frypan.

Method

1 Add water to your water bath and heat it until the water temperature is about 75°C.

2 Weigh out 30 g of white beeswax, break it into small pieces and put it in a small beaker. Then add 100 g of liquid paraffin while stirring gently. Place the beaker in the water bath.

3 Dissolve 2 g of borax in 70 mL of water in a second beaker and put it in the water bath too.



4 When both beakers have reached 75°C, remove them from the water bath and stand them on a heatproof mat.

5 Pour the borax solution slowly into the beaker of beeswax and paraffin, while stirring. Continue to stir until the mixture has cooled to 35°C.

6 Allow the cream to cool to room temperature, then put it in the storage bottle.

7 Apply some make-up to your hand, then use your cream to remove it.
Apply some make-up to your other hand and this time try to wash it off with soap and water.
Describe the results of your tests.

8 Compare the properties of your home-made cream with those of several commercial cleansing creams.
Record your results.

Discussion

1 What are the ingredients in your home-made cleansing cream? What are the ingredients in the commercial cleansing creams?

2 You used two different oils? What are they?

3 Suggest why beeswax dissolves in paraffin but not in water.

4 Using what you learnt on the previous page, suggest why borax was added to the mixture.

5 Why do you think you heated the ingredients to 75°C?

6 Suggest ways you could improve your cleansing cream.

MAIN IDEAS

Copy and complete these statements to make a summary of this chapter. The missing words are on the right.

fair tests
features
objective
sample
subjective
survey

1 To test a consumer product you first identify the _____ you consider important, then design _____ for each of these.

2 Tests where you count or measure something are _____. Tests based on people's opinions are _____.

3 A _____ is a method of obtaining information when you can't do a fair test. You use a _____ from a larger group.

Try doing the Chapter 2 crossword on the CD. Working with technology

REVIEW

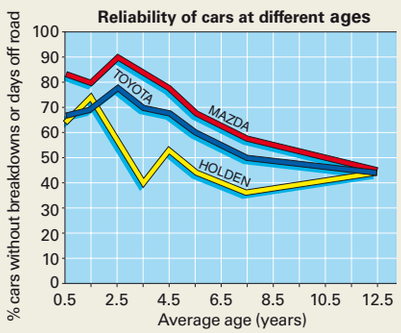
1 For each question below, decide whether the answer will be objective or subjective.
- **a** How much does the mobile phone weigh?
- **b** Are the yellow shopping bags as strong as the white ones?
- **c** Which potato chips are the crispiest?
- **d** Which brand of sunscreen blocks most UV radiation?
- **e** Which bed is the most comfortable?
- **f** Which stroller is the easiest to use?
- **g** Does this cot meet the Australian standard?

2 The manufacturer of a skin care lotion claims that its product 'holds its moisture longer'. A scientist decided to test this claim by placing a sample on a sensitive balance in a very dry atmosphere. Each day she recorded the mass of the sample.

Day	Mass(g)
0	15.006
1	14.562
2	14.189
3	13.873
4	13.587
5	13.330

- **a** How much mass did the lotion lose over 5 days?
- **b** Suggest a reason for this loss of mass.
- **c** Was the rate of moisture loss increasing or decreasing?
- **d** Does the experiment 'prove' anything about the claim made by the manufacturer? Explain.

3 Use the graph below to answer these questions.
- **a** How was the reliability of the cars measured?
- **b** Which was the most reliable make of car tested?
- **c** At what age are Holdens slightly more reliable than Toyotas?
- **d** For how many years is the reliability of Mazdas more than 70%?
- **e** What happens to the reliability of all three cars after about 12 years?



Main ideas solutions

1 features, fair tests
2 objective, subjective
3 survey, sample

Review solutions

1 **a** objective **e** subjective
b objective **f** subjective
c subjective **g** objective
d objective
Whether the answer is objective or subjective depends on the details of the test. For example, it is possible to obtain objective results for question **c**.

2 **a** loss of mass = 1.676 g
b Evaporation of some of the liquid ingredients in the lotion would explain the loss of mass.
c The rate of moisture loss was decreasing. On the first day the loss was 0.444 g but on the last day the loss was only 0.257 g.
d Unless the moisture loss for the lotion is compared with that for other lotions, the experiment does not prove that the lotion 'holds its moisture longer'.

3 **a** The reliability of the cars was measured by counting the number of cars which did not have breakdowns or days off the road, and converting this to a percentage of the total number of cars of that make.
b Mazda
c about 1.5 years old
d about 5 years
e After about 12 years the reliability is about the same for all three cars.

REVIEW

4 Some students conducted a survey by asking people the following question: *What do you think about the use of cigarettes, alcohol and marijuana by adults?* Here are their results.

	What people thought		
	acceptable	unacceptable	undecided
Cigarettes male %	14	45	41
female %	10	48	42
Alcohol male %	32	25	43
female %	20	38	42
Marijuana male %	15	81	4
female %	11	83	6

a What percentage of females thought smoking cigarettes was acceptable?
b What differences were there between the opinions of males and females on the drinking of alcohol?
c On which issue did people have the most definite opinion?
d Write a short paragraph summarising the students' results.

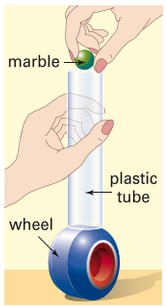
5 Read the following article from a sports magazine and answer the questions below.

Skateboard parts

The *deck* or *board* is the part you stand on. Most decks are made from a special type of wood called Canadian rock maple. Decks vary in size, so choose one that suits you and feels comfortable when skateboarding. Try out some friends' boards or ask to try some from the shop to find the one you like the best. Replacing the deck on your board will cost between $65 and $140.

The *trucks* are the parts that hold the wheels on. Basic skateboards have 'pressure cast' trucks, which cost about $25 each. (You need two of these of course.) The best trucks are 'sand cast' and can cost up to $50 each. They can be loosened for greater manoeuvrability, so you can turn more easily. You can also buy 'lappers' and 'copers'. These are plastic fittings which fit over the trucks to protect them if you ride over curbs and other obstacles.

Wheels are made from a special rubbery type of material. The best ones have what is called a 'high rebound factor'. One way to test for this is to put a clear plastic tube on the surface of the wheel and drop a marble into it as shown. The higher the marble bounces, the better the wheel. If the wheels wear out (or you don't like the colour), they cost between $25 and $70 for a set.



Bearings are the tiny steel balls which fit inside the wheels to make them turn freely. If you look after your skateboard, you may not have to replace them. However, if they become worn or rusty, your skateboard won't run smoothly. A set of bearings for four wheels costs between $20 and $50.

Skidpads and *noseguards* are plastic fittings which can be attached to the front and back of the skateboard so you don't break or wear out the deck.

a What are the five main skateboard parts?
b What is the purpose of the bearings?
c Why are some wheels better than others? How can you test them?
d Which variables would you need to control in this wheel test?
e Suppose you built a skateboard from parts. What would be the cheapest board? What would be the most expensive?

6 Design an experiment to test which type of correcting fluid dries most quickly.
a Which is the independent variable in this experiment?
b Which is the dependent variable?
c Which variables will you need to control?
d Write down the steps in the experiment.

Check your answers on pages 331–332.

4 **a** 10%
b 32% of males thought the drinking of alcohol was acceptable, whereas only 20% of females thought it was acceptable.
c Most people had a definite opinion on marijuana (only 4% and 6% undecided).
d There were more people who thought drinking alcohol and smoking cigarettes and marijuana was unacceptable than there were who thought it was acceptable. Drinking alcohol was thought to be more acceptable than smoking cigarettes or marijuana. There were no large differences between males and females, although drinking alcohol was more acceptable to males than to females.

5 **a** deck, trucks, wheels, bearings and skidpads/noseguards
b The bearings are to help the wheels turn freely (by reducing friction).
c The best wheels have a 'high rebound factor'. You can test a wheel by dropping a marble onto it and measuring how high it bounces.
d The variables you need to control are the plastic tube, the marble and how you dropped the marble.
e The cheapest skateboard would be $160. The most expensive would be $365 (or more).

6 **a** The independent variable (the one you vary) is the brand of correcting fluid.
b The dependent variable is the drying time.
c You will need to control how you apply the correcting fluid to the paper, eg one small drop. All drops need to be tested on the same paper, under the same conditions (eg no blowing, same day).
d 1 Put a drop of correcting fluid on a piece of paper.
2 Measure how long it takes to dry. (You need to decide how you will tell when it is dry.)
3 Test drops of other types of correcting fluid in exactly the same way.
4 Record all results and decide which type dries most quickly.