Contents

Words to Watch

account, account for State reasons for, report on, give an account of, narrate a series of events or transactions.

analyse Interpret data to reach conclusions.

annotate Add brief notes to a diagram or graph.

apply Use an idea, equation, principle, theory or law in a new situation.

assess Make a judgement of value, quality, outcomes, results or size.

calculate Find a numerical answer showing the relevant stages in the working (unless instructed not to do so).

clarify Make clear or plain.

classify Arrange into classes, groups or categories.

comment Give a judgement based on a given statement or result of a calculation.

compare Give an account of similarities and differences between two (or more) items, referring to both (all) of them throughout.

construct Represent or develop in graphical form.

contrast Show how things are different or opposite.

deduce Reach a conclusion from the information given.

define Give the precise meaning of a word, phrase or physical quantity.

demonstrate Show by example.

derive Manipulate a mathematical relationship(s) to give a new equation or relationship.

describe Give a detailed account.

design Produce a plan, simulation or model.

determine Find the only possible answer.

discuss Give an account including, where possible, a range of arguments for and against the relative importance of various factors, or comparisons of alternative hypotheses.

distinguish Give differences between two or more different items.

draw Represent by means of pencil lines.

estimate Find an approximate value for an unknown quantity.

evaluate Assess the implications and limitations.

examine Inquire into.

explain Give a detailed account of causes, reasons or mechanisms.

extract Choose relevant and/or appropriate details.

extrapolate Infer from what is known.

identify Find an answer from a given number of possibilities.

justify Support an argument or conclusion.

label Add labels to a diagram.

list Give a sequence of names or other brief answers with no explanation.

measure Find a value for a quantity.

outline Give a brief account or summary.

predict Give an expected result.

propose Put forward a point of view, idea, argument or suggestion for consideration or action.

recall Present remembered ideas, facts or experiences.

show Give the steps in a calculation or derivation.

sketch Represent by means of a graph showing a line and labelled but unscaled axes but with important features (for example, intercept) clearly indicated.

solve Obtain an answer using algebraic and/or numerical methods.

state Give a specific name, value or other brief answer without explanation or calculation.

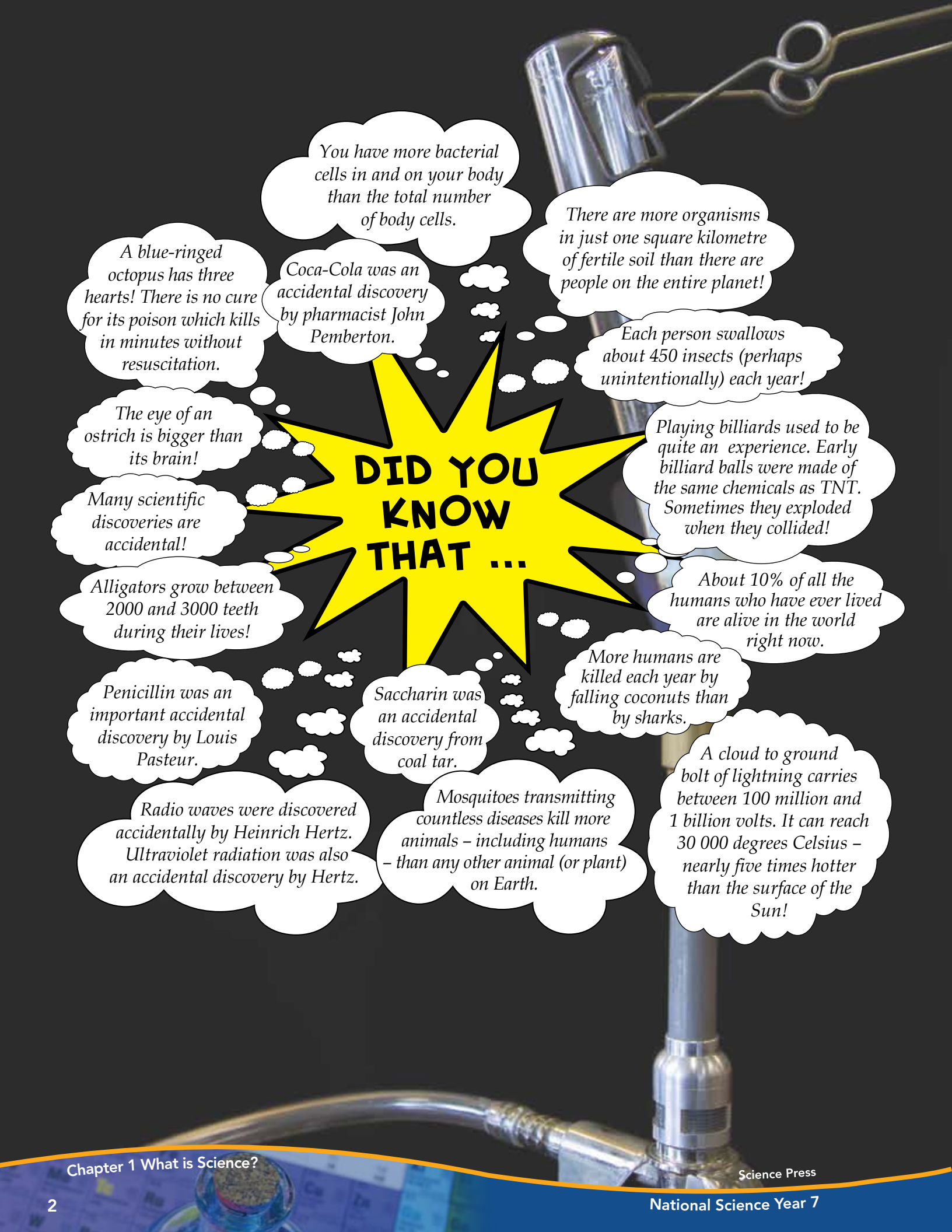
suggest Propose a hypothesis or other possible answer.

summarise Express concisely the relevant details.

synthesise Put together various elements to make a whole.

1 What is Science?

This chapter presents the introductory skills you will need for your study of science. The questions in each unit are only a few examples of the many that are integrated into the Science Understanding topics of the course.

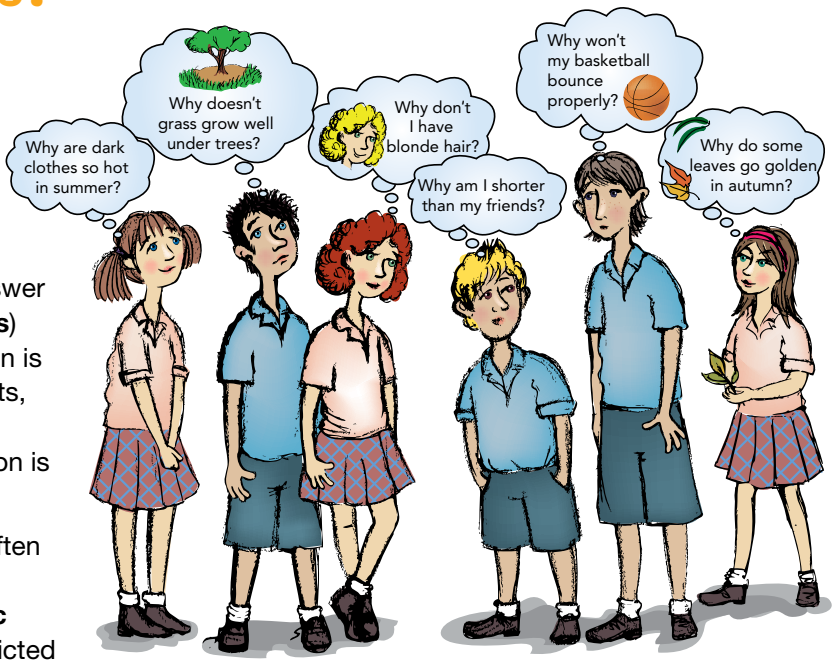

DID YOU KNOW THAT ...
You have more bacterial cells in and on your body than the total number of body cells.
There are more organisms in just one square kilometre of fertile soil than there are people on the entire planet!
A blue-ringed octopus has three hearts! There is no cure for its poison which kills in minutes without resuscitation.
Coca-Cola was an accidental discovery by pharmacist John Pemberton.
Each person swallows about 450 insects (perhaps unintentionally) each year!
The eye of an ostrich is bigger than its brain!
Playing billiards used to be quite an experience. Early billiard balls were made of the same chemicals as TNT. Sometimes they exploded when they collided!
Many scientific discoveries are accidental!
Alligators grow between 2000 and 3000 teeth during their lives!
About 10% of all the humans who have ever lived are alive in the world right now.
More humans are killed each year by falling coconuts than by sharks.
Penicillin was an important accidental discovery by Louis Pasteur.
Saccharin was an accidental discovery from coal tar.
A cloud to ground bolt of lightning carries between 100 million and 1 billion volts. It can reach 30 000 degrees Celsius – nearly five times hotter than the surface of the Sun!
Radio waves were discovered accidentally by Heinrich Hertz. Ultraviolet radiation was also an accidental discovery by Hertz.
Mosquitoes transmitting countless diseases kill more animals – including humans – than any other animal (or plant) on Earth.

1.1 Questioning and predicting

1.1.1 What is science?

Questioning

Science starts whenever someone asks a question. 'How can I do this?' 'How does this work?' What would happen if I ...?'



Predicting

Science continues if people predict an answer to their question (they make an **hypothesis**) and then set about finding if their prediction is correct in a logical way – doing experiments, making observations, writing down results then analysing them to see if their prediction is correct.

They may not know it, but what they are often doing is following a recipe for solving their problem which scientists call the **scientific method**. The scientific method is not restricted to problems in science. It can be used anywhere and in any subject.

1.1.1.1 Complete the sentences by writing one of the words below on each blank line. Your sentences will define science and describe some of its properties. Some words may be used more than once.

Words: analyse, answers, experiments, method, observations, problems, scientific, solving, results.

(a) Science, through the .... is a way of ..... problems.

(b) Scientists design ....., do these ....., making ..... along the way.

(c) They record these ....., often calling them the ..... of the experiments.

(d) They then ..... these results in order to find the ..... to the problems they are investigating.

(e) Sometimes, as well as the answers to the problem they have been seeking, the results of an experiment will cause them to recognise other ..... and these will direct the work they do later.

1.1.2 The scientific method

1.1.2.1 The boxes below contain the steps in the problem-solving process followed by scientists when they do experiments to solve problems. The boxes are not in the correct order.

Your tasks are as follows:

1. Read through the steps in the scientific method below carefully. They are not in the right order.
2. With your friends, predict the correct order and number them 1 to 12.
3. Check your order with that of at least one other group in the class.
4. Discuss any differences you might have, arguing the point until you all agree which is the best sequence.
5. When you all think that they are in the correct order copy them into the spaces on the next page.

A

The scientific method for solving problems.

B

Present the analysis of your results in the most appropriate way.

C

Write a conclusion for the experiment. This should state the answer to the original problem.

D

Analyse your observations to decide if you need to draw graphs or process them in another way.

E

Write down any other problems arising from the experiment which you might follow up later on with new experiments.

F

Observe what happens.

G

Discuss the problem with your co-workers to make sure you all understand the same thing.

H

Read the problem carefully to make sure you understand it.

I

Follow your plan.

J

Together, plan how you could solve the problem.

K

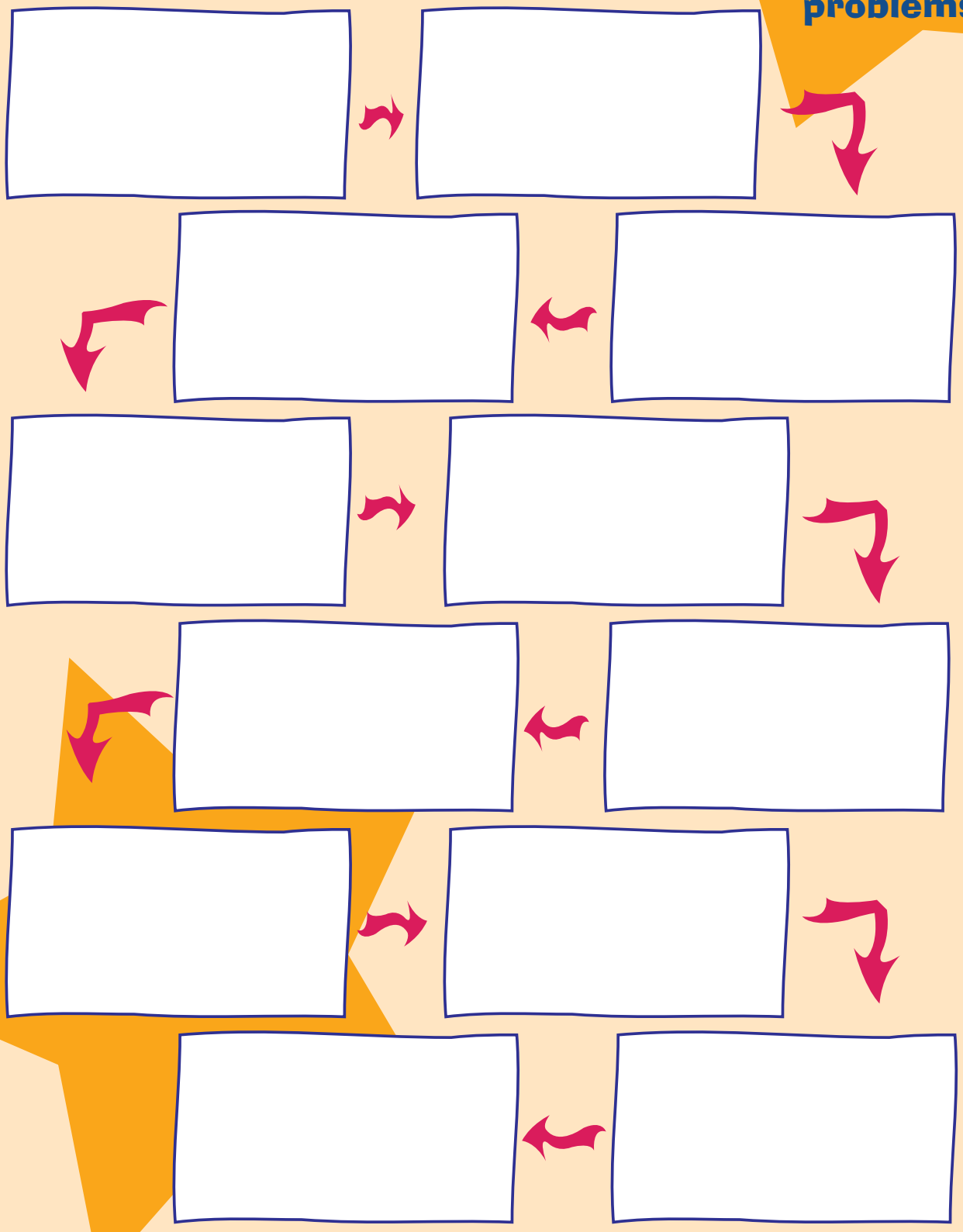
Record all your observations, even those you think might be incorrect.

L

List, and then collect any equipment you will need to do the experiment.

The scientific method for solving problems.

Rewrite the steps in the scientific method in the correct order here.



Chapter 1 What is Science?

1.1.1.1 (a) scientific method, solving
(b) experiments, experiments, observations
(c) observations, results
(d) analyse, answers
(e) problems

1.1.2.1 A, H, G, J, L, I, F, K, D, B, C, E

1.1.3.1 Answers will vary. Get a friend to read through yours to see if it all makes sense. You evaluate theirs in the same way. If you cannot solve any problems that arise, ask your teacher to help.

1.2.1 No questions.

1.2.2.1 Answers may vary, for example:
(a) think of new
(b) understand
(c) express
(d) listen to
(e) group
(f) share
(g) think, act
(h) plan
(i) mistakes

1.2.2.2 The picture shows a highly magnified view of an eggshell.

1.2.3 Discuss your findings with your family and in class with your teacher and friends.

1.3.1.1 Chemicals X and Y are different.

1.3.1.2 Experiment would not be a fair test because more chemical will take longer to dissolve than less chemical in the same amount of water. (Even though one may be more soluble, because more is used, it may take longer to dissolve and therefore give a misleading result.)

1.3.1.3 The more water used, the easier it is for a substance to dissolve, so again, having one with more water may give a misleading result.

1.3.1.4 Chemicals dissolve faster in warmer water, so again, it would not be a fair test.

1.3.2.1 (a) To determine if the blue or yellow flame of a Bunsen burner is hotter.
(b) and (c) Any of the following in either answer: How far the flame is from the water container; how much water is in the container; the size of the container; how far the gas taps are turned on; what the container is made of.
(d) Two each of Bunsen burner, beaker, tripod, gauze, and matches.

1.3.2.2 (a) To determine if salty water boils at a different temperature to pure water.
(b) and (c) Any of the following in either answer: How far the flame is from the water container; how much water is in the container; the size of the container; how far the gas taps are turned on; what the container is made of.
(d) Two each of Bunsen burner, beaker, tripod, gauze, thermometer, plus a spatula, salt and matches.

1.4.1.1 A No food or drink to be consumed in the laboratory.
B Wear safety goggles when doing experiments or do dangerous experiments in the fume cupboard.
C Do not touch hot objects.
D Do not smell chemicals directly. Use the proper method.
E Clean up all spillages immediately.
F Make sure long hair is tied back and/or covered.
G Do not taste chemicals.
H Be careful not to knock equipment over and wear covered-in shoes.
I For example, do not run in the laboratory.
J For example, do not do unauthorised experiments.

1.4.2.1 A Measuring cylinder.
B Beaker.
C Conical flask.
D Bunsen burner.
E Retort stand.
F Test tube.
G Round bottom flask.
H Tripod.
I Tongs.
J Clamp.