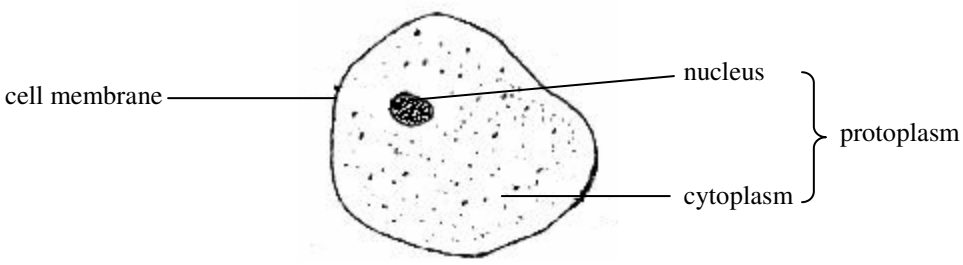
CHAPTER 1: SCIENTIFIC INVESTIGATION

Methods that are Commonly Used to Present the Results of a Scientific Investigation

The results of a scientific investigation must be presented so that people can be informed about the knowledge gained. The results may be presented in several ways.

1. Notes
   The observation may be written in the form of notes.
   Example:
   (a) The sterilized agar in culture dish 1 does not contain any bacteria colony.
   (b) The agar in culture dish 2 which is contaminated with well water has 4 colonies of bacteria.
   (c) The agar in culture dish 3 which is contaminated with river water has 12 colonies of bacteria.
2. Diagram
   An observation may be recorded in the form of a diagram. A pupil examining cheek cells under a microscope may draw and label a cheek cell. Each diagram should have a heading.

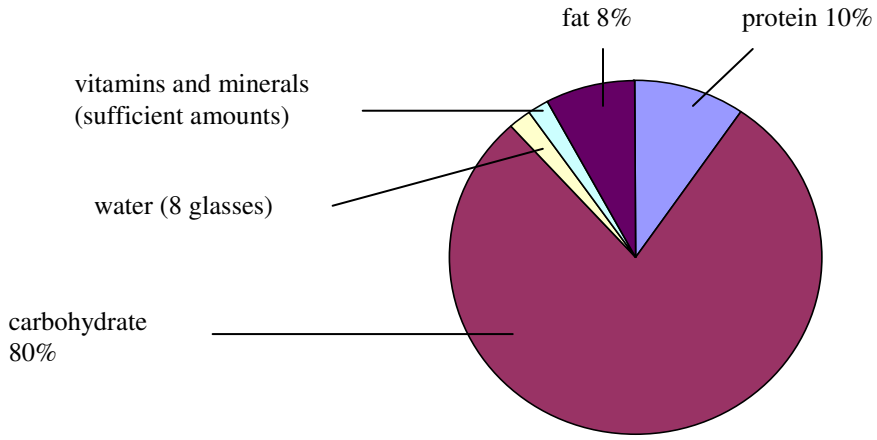


A cheek cell

3. Table
   The results may be presented in the form of a table. This enables the data to be clearly seen and easily analysed.
   An experiment to investigate how the length of a pendulum influences its time of swing may give the following results.

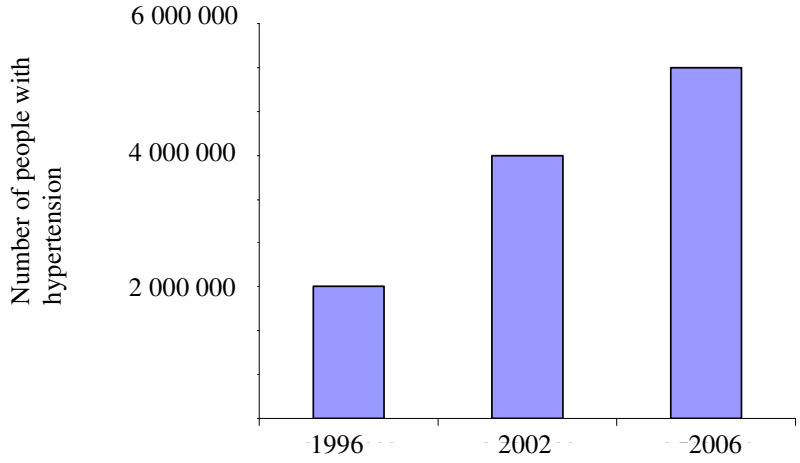
Length of pendulum (cm)	Time taken for 10 complete swings (s)	Average time taken for one complete swing (s)
100	20.1	2.0
80	18.0	1.8
60	16.4	1.6

4. Pie chart
A pie chart is sometimes used to give information in order to show the relative quantities clearly. The relative amounts of the classes of food in a balanced diet may be shown in a pie chart.



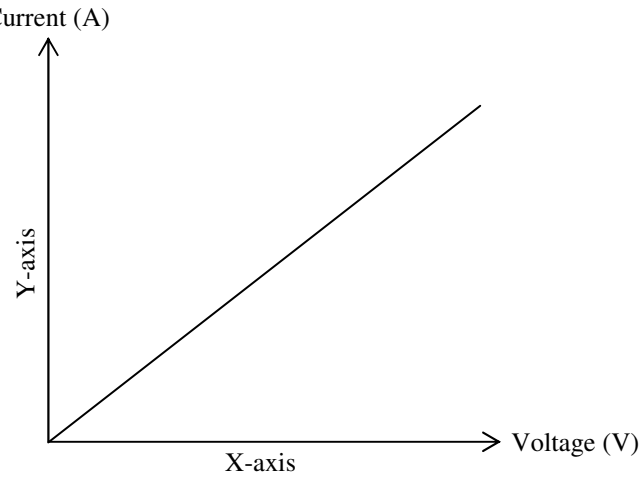
Constituents in a balanced diet

5. Bar chart
A bar chart is suitable if we wish to compare the data from a very large group of people over a very long period of time. For example, we can use it to compare the number of people suffering from hypertension in certain years in the country.



Prevalence of hypertension in Malaysia

6. Line graph
   A line graph is used if we wish to show how a manipulated variable affects the responding variable. The manipulated variable is represented on x-axis and the responding variable on the y-axis. Several values are obtained in order to plot the graph.



Relationship between voltage and current

Writing a Report

After a scientist has carried out an investigation, he must report his findings to the public. A scientific report may be written based on the following format.

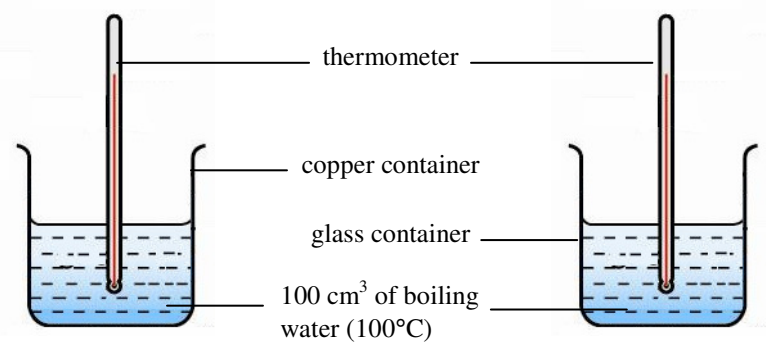
(a) Identify the problem
(b) State the suggested hypothesis for the problem
(c) State the aim of the investigation
(d) Identify the variables in the investigation
   i. Constant variables
   ii. Manipulated variables
   iii. Responding variables
(e) List the apparatus and materials required
(f) Describe the procedure carried out
(g) Present the observation/ data obtained
(h) Present an analysis of the results
(i) Form a rational conclusion

Problem:
How do a glass container and a copper container affect the rate of cooling of hot water kept in them?

Hypothesis:
A copper container allows the hot water in it to cool faster than a glass container.

Aim of the experiment:
To investigate how a copper container and a glass container influence the rate of cooling of hot water placed in them

Diagram:



Variables:
- Constant: Volume of water used in each container, initial temperature of water, size and thickness of containers, time allowed for cooling
- Manipulated: Type of material used for the containers
- Responding: Rate of cooling of the hot water

Procedure:
1. Set up the apparatus as shown in the diagram.
2. Keep the two containers at the same place.
3. Take the initial temperature of the hot water in each container.
4. Allow the water to cool for 10 minutes and then take the temperature of the water again.
5. Record the readings.

Observation:

Type of container	Temperature of water		Fall in temperature (°C)
	Initial (°C)	Final (°C)	
Copper	100	75	25
Glass	100	85	15

Conclusion:
The copper container allows hot water in it to cool faster than the glass container.

Explanation:
Copper, which is a metal, is a better conductor and radiator of heat than glass which is a non-metal.