

## **Applying Scientific Investigations**

1. We study science to discover information about our environment. Professional scientists are concerned with **investigations** and making **discoveries**. Students usually study and investigate theories and discoveries already done by scientists.
2. However, both students and professional scientists use the same methods for carrying out their investigations. One of the most important skills for scientific investigations is the ability to **obtain information** directly from the environment.
3. A scientific investigator must be able to **organize** and **record** information in an effective way.
4. Proper organization of information may reveal **relationships** and **trends**, some of which may have been unsuspected at the beginning of the investigation.
5. A scientific investigator must also be able to **draw conclusions** from the data collected.
6. An **observation** is an important aspect of a scientific investigation. A scientific investigator makes use of the five senses which are seeing, hearing, smelling, touching and tasting in his observation.
7. From the observation, an inference can be made. An **inference** is an initial interpretation or explanation concerning the observation. It is an initial conclusion concerning the observation, which may or may not be true. Further observations are required to confirm the inference.

### **EXAMPLE 1.21**

You probably would have observed that an ice cube melts faster in a glass of hot tea when there is more tea.

What inference can you make from this observation?

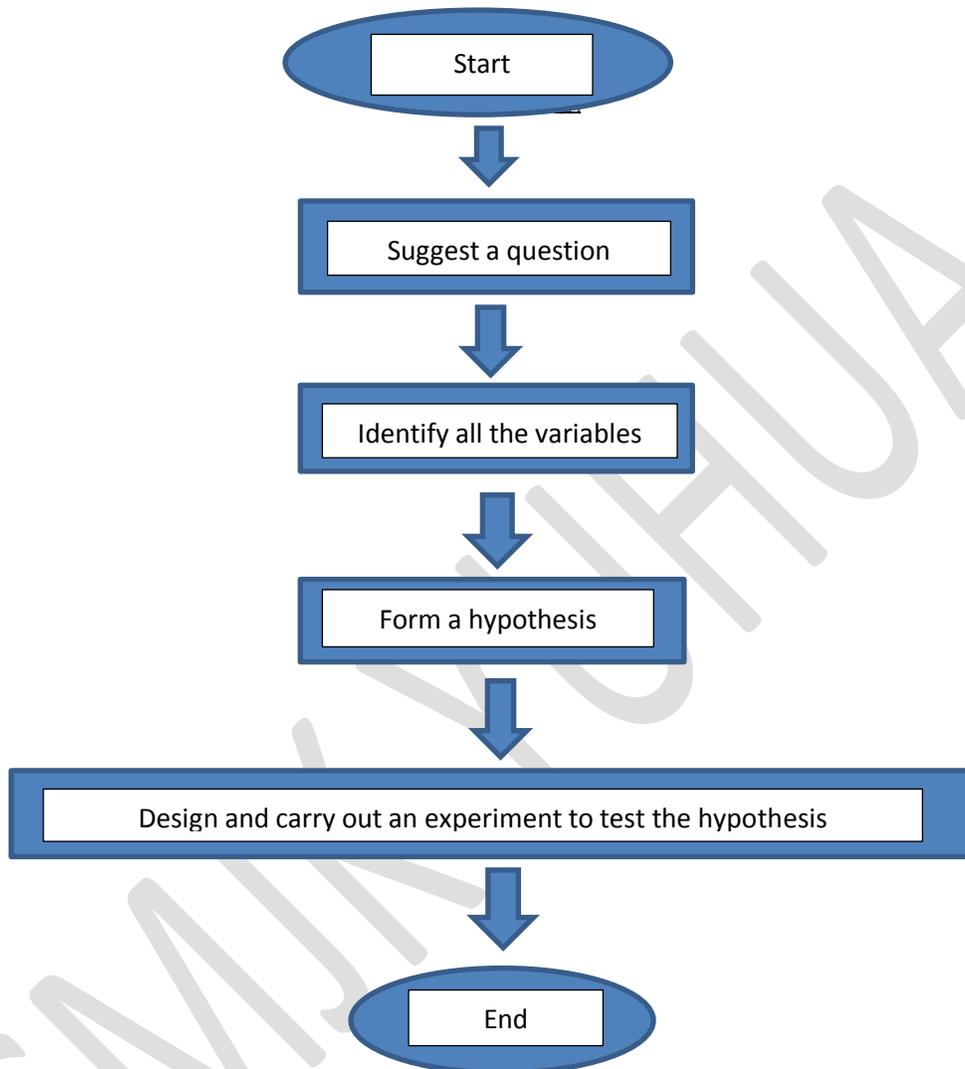
#### ***SOLUTION*** –

The time taken for the ice to melt depends on the volume of the tea.

(Or, the time taken for the ice to melt depends on the mass of the tea.)

## PROCESS IN A SCIENTIFIC INVESTIGATION

1. The flow chart indicates the process in a scientific investigation.



### Note

You can place the inference after the **question** suitable for scientific investigation.

- (a) When observing a certain situation, you may suggest a question suitable for scientific investigation. The **question** must be well defined, measurable and controllable.
- (b) To carry out a scientific investigation, you need to identify all the variables involved. A **variable** is a physical quantity that can be varied in an experiment. There are three types of variables.
- i. A **manipulated variable** is a physical quantity with values that are fixed by the experimenter before carrying out the experiment.
  - ii. A **responding variable** is a physical quantity that changes its value in response to the change in the manipulated variable.
  - iii. A **fixed variable** is a physical quantity that is set to remain constant throughout the experiment.
- (c) You then proceed to form a hypothesis. A **hypothesis** is a statement of an expected outcome that usually states the **relationship** between the manipulated and responding variables. The hypothesis must be brief and clear and can be tested by an **experiment**.
- (d) You will then need to design and carry out the experiment to test the hypothesis.