THEME 1

FOOD

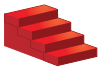
ACTIVITY 1

What we have to do?

Germinate seeds to observe how plants grow from seeds.

What do we need?

Dry whole seeds of gram or moong (green gram), Petri dish, cotton cloth, water.



How do we proceed?

1. Soak 20-25 dry whole seeds of gram or moong in a Petri dish or container filled with water.
2. Next day, drain the excess water and cover the seeds with wet cotton cloth.
3. Keep the cotton cloth moist for 2-3 days by soaking them in water at regular intervals. Seeds may be washed or rinsed each day to prevent rotting.
4. Observe the seeds each day.

(a) (b)

Figure 1.1 Gram (chana) seeds (a) dry (b) sprouted

What do we observe?

The seeds swell or increase in size on Day 1. Next day, a small white structure emerges from each seed. It gradually elongates during the next 2-3 days and small hair like outgrowths appear around it just behind it's tips.

What do we conclude?

- Seeds germinate in the presence of water. Germination is the process of growth of plants from the seeds.
- During germination, the white structure that appears first develops into root.
- The small hair-like outgrowths formed later are root hairs.
- If seeds are kept moist for a few more days, another whitish structure emerges from the same point of the seed, which later develops into a shoot (Fig. 1.2).

a *b*

Fig. 1.2
Young plants emerging from seeds

Let us answer

1. Why don't pulses stored in containers in the kitchen at home germinate?
2. Name the part of plant where seeds are located.
3. Do seeds ever germinate on the mother plant? Give reasons for your answer.
4. Do all plants produce seeds? Justify your answer with examples.
5. What are the other methods by which plants can reproduce?

What more can we do?

- Repeat the above activity at home with different seed samples. Observe and report to the teacher after 2-3 days.
- Sow 1-2 germinated seeds in soil or sand in a pot and water them daily. You will observe that seeds develop into a small plant which gradually increases in size. Make observations about the height of the plant each day. Also note down the number of days it takes to produce the first leaf. Draw a figure of the young plant with leaves and roots.

Note for the teacher

Before the start of the activity, the teacher should explain the concept of seed germination. This activity can be given as a home assignment. The teacher must help the students in observing the process of germination daily.

Notes _____

ACTIVITY 2

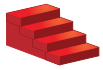
What we have to do?

Test the presence of carbohydrates, proteins and fats in food items.

2A Test the presence of carbohydrates in food items.

What do we need?

Bread slice, potato slice, soaked chickpea seeds, Petri plates, 3% iodine solution, dropper.



How do we proceed?

1. Place a bread slice, a potato slice and a few chickpea seeds (with seed coat removed) in separate and clean Petri plates.
2. With the help of a dropper, place 2-3 drops of iodine solution on each item (Fig. 2.1).
3. Note the change in colour and record your observations.

Figure 2.1
Testing for starch

What do we observe?

Blue-black colour appears on bread slice and potato slice, whereas, chickpea seeds do not show any change in colour.

What do we conclude?

- Bread and potato contain starch which gives blue-black in colour on addition of iodine solution. Whereas, chickpea seeds do not contain starch and thus do not show any change in colour.
- Starch is a type of carbohydrate present in many of our food items. Carbohydrates are energy-yielding components of food.

What we have to do?

2B Test the presence of proteins in food items.

What do we need?

Gram or pea seeds, one banana, test tubes, water, copper sulphate solution, caustic soda, dropper.

How do we proceed?

1. Grind 10-15 seeds of gram or pea into powder form; and mash a piece of banana separately to form a paste.
2. Take a small quantity of these food items in the separate test tubes and label them 'A' and 'B'.
3. Add 10-15 drops of water to each test tube.
4. With the help of droppers, add 2-3 drops of copper sulphate solution and 10 drops of caustic soda to each test tube (Fig. 2.2).
5. Shake well and keep the test tubes aside for a few minutes.
6. Note the change in colour and record your observations.

Figure 2.2
Testing for proteins

What do we observe?

Contents of test tube 'A' containing powered seeds of gram or pea turn violet in colour whereas test tube 'B' containing mashed banana does not show colour change.

What do we conclude?

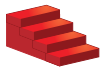
- Appearance of violet colour in test tube 'A' confirms that gram or pea seeds contain proteins. As banana does not contain proteins, the test tube 'B' does not show violet colour.
- Protein is another food component present in many of our food items. These are body-building components of the food.

What we have to do?

2C Test the presence of fats in food items.

What do we need?

Peanuts, dry coconut, rice grains, white paper



How do we proceed?

1. Take three sheets of white paper.
2. Place a few peanuts, pieces of dry coconut (*Khopra*) and rice grains on separate sheets of papers.
3. Fold the paper in such a way that the materials are wrapped in the paper from all the sides.
4. Crush the food items taking care that the paper does not tear.
5. Unfold the papers and remove the food items.
6. Let the papers dry and note the change in texture of paper.
7. Now hold the papers against a source of light and record your observations.

What do we observe?

The papers wrapped around peanuts and dry coconut pieces show oily patches while that containing rice grains does not show such patches. When we hold the paper in front of a light source, the oily patches appear translucent.

What do we conclude?

- Appearance of oily patch on the paper indicates the presence of fats in peanuts and dry coconut. Rice grains do not change the texture of paper as they do not contain fats. Oily patches become translucent because paper has a tendency to absorb oil.
- Fat is another food component present in many of our food items. Like carbohydrates, these are also energy-yielding components of the food.

Let us answer

1. Name the major components of food and at least two food items rich in each food component.
2. What would happen if we eat only carbohydrate-rich food?
3. Match the nutrients in Column 'A' with the food items rich in that nutrient in Column 'B'.

Column 'A'		Column 'B'	
a)	Protein	i)	Sesame and mustard seeds
b)	Carbohydrate	ii)	Leafy vegetables
c)	Fat	iii)	Fish and eggs
d)	Vitamins	iv)	Wheat and rice

4. Pick the odd one out and give reasons for choosing that option.
   a) Nuts, *ghee*, banana, sunflower
   b) Pea, wheat, egg white, gram
   c) Mango, potato, sweet potato, sesame
5. Choose the correct option.
   a) Energy-yielding components of food are
      (i) carbohydrates and proteins (ii) proteins and fats
      (iii) carbohydrates and fats (iv) fats and vitamins

b) Yolk of egg is rich in

(i) carbohydrates (ii) vitamins (iii) proteins (iv) fats

What more can we do?

Different food items contain different types of nutrients – carbohydrates, proteins, fats, vitamins and minerals.

- Perform the above tests on the food items you eat everyday to find out the type of nutrients contained in them. Analyse whether you are taking a balance diet or not. Visit a nutritionist and consult him/her for a balanced meal for yourself. Modify your meals accordingly to be strong and healthy.
- Take a small piece of banana. Mash it properly and place in a test tube. Add 5-10 drops of Benedict's solution to it. Place the test tube for 2-3 minutes in a water bath containing boiling water. The appearance of reddish-orange colour confirms the presence of carbohydrates in banana.
- Take the white of an egg in a test tube and add few drops of diluted nitric acid to it. Place the test tube in a water bath containing boiling water till a yellow colour appears. Cool the solution and add a few drops of ammonium hydroxide. A bright orange colour confirms the presence of proteins in egg white.
- Find out the various types of food items consumed in different regions of the country. Enlist them and categorise according to the major food components present in them.
- Read about the effects of excess and deficiency of nutrients present in the food. Have a discussion in the class about the effects.

Note for the Teacher

Before performing the activity, the teacher should explain the need and importance of food. The students must be familiar with different components of food and the concept of balanced diet. Teacher should also discuss the importance of each component. Myths about the eating habits may be clarified. A few are as follows:

- Skipping meals is a good way to lose weight.
- All carbohydrate-rich foods are fattening.

Teacher may give the following project to the students. Students may be asked to bring a variety of food items. The students may be divided into three groups. Each group may perform the test for a particular component of food and fill the following table.

Note: Some of the items are listed below. Students can bring these or other food items for performing the test.

Food Item	Carbohydrate	Protein	Fat
Banana			
Boiled rice			
Curd			
Butter			
Milk			
Sweet potato			
Apple slice			
Soyabean			

Notes

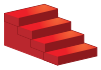
ACTIVITY 3

What we have to do?

Observe stomata in leaves.

What do we need?

Leaves of mango/banyan/bougainvillea/*Salvia*/*Petunia*/balsam, micro-slide, forceps, water, cover glass, needle, Compound microscope.



How do we proceed?

1. Take a mature leaf from any of the plants listed above.
2. Tear the lower epidermis and you will notice a thin, peel on the edges of the torn portions of the leaf.
3. Carefully remove a small peel with the help of forceps and place it on a micro-slide in a few drops of water.
4. Place a cover glass on it without allowing any air bubbles beneath.
5. Observe the peel under the low power of the microscope and note the different types of cells (Fig. 3.1).
6. Locate the pores in the cells and with the help of your teacher, observe it under high power.
7. Draw the figure of a pore along with its surrounding structure.
8. Repeat the same procedure for the upper epidermis.

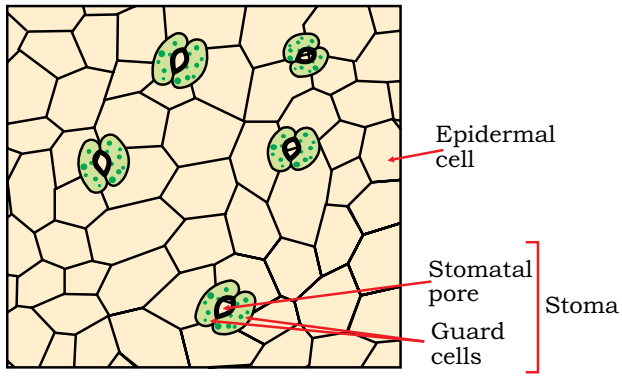


Figure 3.1
Lower epidermal peel of a leaf

What do we observe?

- We observe a number of compactly arranged cells.
- In between the cells we see a number of tiny pores.

- Each pore is surrounded by two specialised bean-shaped cells.
- There are several pores scattered in the peel with no specific arrangement.

What do we conclude?

- The leaf peels comprise of a number of cells which are more or less identical in shape and size. They are epidermal cells.
- Tiny pores along with their bean-shaped cells (guard cells) are called stomata (Singular-stoma).

Let us answer

1. Which surface of the leaf has more number of stomata?
2. Name the bean-shaped cells of stoma.
3. What are the functions of stomata?
4. Are stomata present in submerged water plants?
5. What is the function of the pore in stomata?

What more can we do?

Leaf samples of different plants can be brought to the class and students may be asked to peel their upper and lower surfaces and mount them. They may be asked to count the number of stomata in the microscopic field and compare the number with two or three other plants.

Note for the teacher

- Teacher should demonstrate the process of removal of peel and its mounting. Students can perform the activity using other leaf materials. Focusing the peel under low power and later under high power lens must be done under the supervision of the teacher.
- Teacher should discuss the importance of stomata – for gaseous exchange during respiration and photosynthesis; and transpiration.

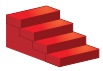
ACTIVITY 4

What we have to do?

Study that leaves prepare starch by the process of photosynthesis.

What do we need?

A leaf of any plant, spirit, a beaker, test tube, burner, tripod stand, water, Petri plate, iodine solution, dropper, forceps.



How do we proceed?

1. Insert a leaf into a test tube gently with the help of forceps.
2. Pour spirit into the test tube so that the leaf completely dips in it.
3. Keep the test tube in a beaker half-filled with water.
4. Place the beaker on a tripod stand as shown in the figure 4.1.
5. Boil the water till the spirit becomes green in colour and the leaf becomes colourless.
6. Take out the leaf carefully from the test tube and wash it with water.
7. Place it in a Petri plate and add a few drops of iodine solution.

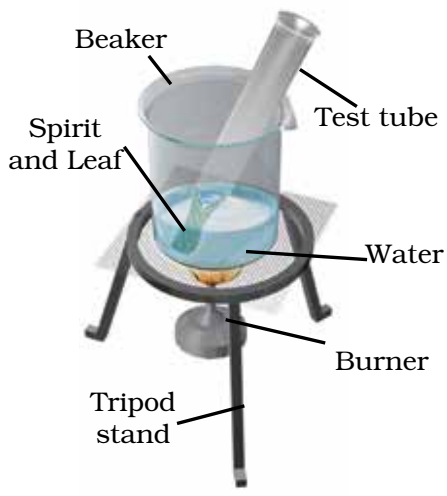


Figure 4.1
Set-up for extraction of chlorophyll

What do we observe?

As we add iodine solution on the colourless leaf, it turns blue-black.

What do we conclude?

- When we boil the leaves in spirit they become colourless because chlorophyll pigments leach out.
- Leaves contain starch which gives blue-black colour with iodine solution.
- Starch is synthesised in the green leaves in the presence of sunlight by the process of photosynthesis.
- Starch gets stored in leaves or gets transported to other parts of the plant.

Let us answer

1. Why do leaves become colourless after boiling in spirit?
2. Why is the test tube containing leaf with spirit boiled in a water bath?
3. What would happen if:
   a) a fresh green leaf of a plant receiving enough sun light is treated with iodine solution?
   b) a fresh green leaf of a plant placed in dark for 2-3 days is treated with iodine solution?
   c) variegated leaves (leaves with some green portions and some non-green portions) are treated with iodine solution?
4. Why is photosynthesis essential for survival of all organisms on earth?
5. Keep a potted plant having leaves of different colours in dark for 2-3 days and perform the iodine test. Now, keep the same plant in sunlight for 3-4 hours and repeat the iodine test. Record your observations and give reasons.

What more can we do?

- Separate non-green and green parts of the variegated leaves. Follow the procedure as discussed in the above activity. Note down the difference in colour of spirit.

- Place a potted plant with green leaves in a dark room for 1-2 days. Pluck a leaf and perform the iodine test. You will observe that leaves do not turn blue-black in colour. This is because of utilisation of starch stored in the leaves and lack of photosynthesis in the absence of sunlight.
- Select a healthy green leaf of a potted plant. Cover a portion of the leaf completely with the black paper and leave it undisturbed for 1-2 days. Now pluck the leaf, remove the black paper and perform the iodine test. You will observe that the uncovered portion of the leaf turns blue-black colour because of the presence of the starch, while, the covered portion of leaf does not become blue-black. Can you give reasons for the results obtained?

NOTE FOR THE TEACHER

- Before the activity, the teacher may discuss the concept of photosynthesis in the class. Since the activity involves use of spirit and heating, it may be demonstrated by the teacher or can be done by the students under the supervision of teacher.
- After the activity, the teacher may relate the presence of starch in the leaves with the presence of starch in various food items. This will clarify the concept of transportation of food from the leaves to other parts of the plants.

NOTES

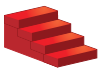
ACTIVITY 5

What we have to do?

Study how insect pests spoil food grains.

What do we need?

A few infected/infested/spoiled grains/seeds of wheat/rice/pulses, three plastic containers with lids, hand lens, micro-slides, brush and forceps.



How do we proceed?

1. Collect three different kinds of spoiled grains (contaminated) of seeds—any pulse, rice and wheat.
2. Keep a fistful of each type of seeds in a container and mark the containers, A, B and C.
3. Carefully observe the following in the seeds
   - Are there small holes in some seeds?
   - Is there a powdery material at the bottom of the container?
   - Are there net-like threads around the grains?
   - Do the seeds emit a foul/sour smell?
4. Now observe if there are any kind of organisms—worms/insects—in the container? In case they are present, observe if there is only one kind of organism or do you find different types of worms/insects in the container? Note the colour, shapes and structure of the insects/worms (Fig. 5.1 & Fig 5.2)

   Try to break hollow grain and observe the presence of any organism inside the grain.
5. Draw sketches of the observed creatures in your notebook.
6. Observe if all the seeds are infected/spoiled or only a few.
7. With the help of forceps or a brush pick up these organisms and place in a drop of water on a slide.
8. Observe them by using a hand lens.
9. Leave the grains in the containers and observe them again after a few days.

Figure 5.1
Grains infected with insect pests

Figure 5.2
Grains infected with microorganisms

What do we observe?

- The number of infected/spoiled grains varies in different samples.
- There are a number of worm–like creatures which may be seen crawling within the spaces or inside the grains (if you break open the seeds).
- The infected grains will have holes and may have become hollow leaving only the seed coat.
- Some of the grains may have been reduced to a powdery material.
- The rice grains may also show webbing between them.
- After a few days, many more grains would have got converted into powdery material. There may be a whitish covering over grains and also a sour and musty odour.

What do we conclude?

- The stored grains are attacked by different insect pests. Different life stages of insects, such as larvae (seen as worm–like creatures) and adults (reddish-brown organisms) make holes in the grains and damage them.
- The infected grains become hollow and a powdery material is seen at the bottom of the container.
- The seeds may be infected by micro-organisms resulting in the musty odour.
- The infected grains are unfit for human consumption. They will cause illness, nausea and vomiting. These seeds are dead and hence they cannot germinate.

Let us answer

1. What are the different ways in which seeds can get spoilt?
2. What will happen to the seeds if we do not store them properly?
3. Name a few storage structures used in your house. Find out if they are safe for storage?
4. Have you observed how grains are stored in huge godowns?
5. Sometimes when we soak chick pea seeds in water, a few of them float, whereas other seeds sink to the bottom. Give reasons.

What more can we do?

- Take a few healthy and a few contaminated gram seeds. Wash them and soak them in water in separate containers for a day. Now try to sprout the seeds as you did in the seed germination experiment. Share your observations with your classmates.
- Study the preserved specimens of insect pests which infect seeds. Learn their features with the help of your teacher. Try to understand the different stages in their life cycle. Find out which stage of their life cycle infects the seeds.
- Find out the methods of storage in rural areas. Collect information about the different methods of storage and prepare a report.

Note for the teacher

- This can be a group activity of 4-5 students.
- The task of collecting infected seeds may be assigned to students a few days in advance.
- Teacher may help students in identifying infected/spoiled seeds and collecting pests from them.
- Students may also read about the different insect pests that damage our crop plants leading to extensive losses.
- Students may be encouraged to suggest suitable storage methods for preventing contamination.

Notes _____

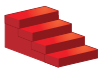
ACTIVITY 6

What we have to do?

Observation of pond water for presence of micro-organisms.

What do we need?

A glass tumbler, pond/stagnant water samples, muslin cloth, dropper, micro-slide, cover glass, Petri plate, Compound microscope.

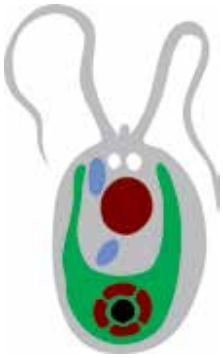


How do we proceed?

1. Collect water in a glass tumbler from a clean pond or stagnant pool.
2. If water is turbid, filter it through muslin cloth.
3. With the help of a dropper, place a drop of filtered water on a clean micro-slide.
4. Place a cover glass on the drop of water without letting in any air bubbles.
5. Observe under the Compound microscope.

What do we observe?

Though water appears clean to the naked eye, different kinds of minute organisms can be observed under the microscope. Figures of some common micro-organisms are given below. Identify the organisms observed in the slide by comparing with these figures (Fig. 6.1 & 6.2).

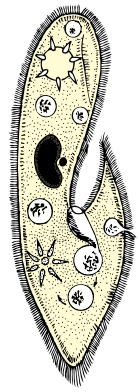


Chlamydomonas

Spirogyra

Figure 6.1 Algae

Amoeba



Paramecium

Figure 6.2 Protozoa

What do we conclude?

Water contains several kinds of small organisms which are not visible to the naked eye but can be seen with the help of a Compound microscope. These organisms are called micro-organisms. Water, however, may also contain several organisms which are visible to the naked eye. They cannot be called micro-organisms.

Let us answer

1. Why are micro-organisms so called?
2. Is pond water fit for drinking? Give reason for your answer.
3. How do our ponds get polluted?
4. Name the four major groups of micro-organisms. Give two examples for each group.
5. Match the organisms given in Column 'A' with the group to which they belong given in Column 'B'.

Column 'A'		Column 'B'	
a)	*Spirogyra*	i)	Fungi
b)	*Staphylococcus*	ii)	Protozoa
c)	*Paramecium*	iii)	Algae
d)	*Rhizopus*	iv)	Bacteria

6. Pick the odd one out and give reasons.
   a) *Amoeba, Euglena, Paramecium, Chlamydomonas*
   b) *Penicillium, Aspergillus, Spirogyra*, Yeast
   c) *Lactobacillus, Rhizopus, Staphylococcus, Rhizobium*
7. State whether the following statements are *true* or *false*. If false, correct the statement.
   a) Fungi are autotrophs while protozoa can be autotrophs or heterotrophs.
   b) *Rhizopus* lives in the root nodules of leguminous plants and helps in nitrogen fixation.
   c) Water may contain certain bacteria which cause harmful diseases.

What more can we do?

Micro-organisms thrive in almost every kind of environment– soil, water, air, hot springs, etc. Different habitats have different kinds of micro-organisms. To understand the concept, the following activities can be performed.

- Collect some moist soil from the field in a beaker. Half-fill the beaker with water. Keep the beaker aside till the soil particles settle down. Take a drop of water on a micro-slide and observe under the microscope. You will observe some organisms which will be different from those observed in pond water.
- Place a drop of curd on a glass slide and observe under the Compound microscope. Curd contains a few bacteria, such as *Lactobacillus and Staphylococcus*.

Note for the teacher

- Teacher should introduce the concept of micro-organisms before performing the activity. Four major groups of micro-organisms should be explained along with their characteristic features.
- Students should be asked to collect samples of water from different places. They should be asked to draw the outline structure of organisms observed under the microscope. Organisms observed in different water samples may be compared and identified by the teacher. This would clarify the concept of the diversity of micro-organisms present in water.
- Teacher should also discuss the threats and benefits of micro-organisms. Students should not be averse to eating curd after observing the bacteria present in it. The benefits of bacteria in curds must be discussed.
- Teacher may give the following project to students. Students may be divided into four groups. Each group may select a particular micro-organism/group of micro-organisms, gather information about the microorganism and fill the following table.

S.No.	Name of the micro-organism	Where it lives	Harmful or useful	Figure