

Prayoga worksheets: Biology

20 experiments · Predict, Measure, Observe, Explain · draft 16 October 2026

Prayoga in Biology at a glance

Class	Chapters	Board practicals	Prayoga experiments	What's new with Prayoga
Class 10	6	4	13 across 5 chapters	Phone becomes a microscope; respiration and photosynthesis shown as live data
Class 9	3	2	4 across 3 chapters	Cells and tissues photographed and labelled on the phone
Classes 6–8	Textbook topics	No board list	3	Plants, light and microbes observed and measured
Total			20 experiments	One kit + phone, by cable or Bluetooth, no battery inside; live graphs in Kannada; a worksheet for every experiment

Chapters: science chapters in that class's textbook. Board practicals: practicals the board prescribes. Prayoga experiments: every worksheet in this file for that class.

Prayoga experiments chapter by chapter

Class	Chapter or topic	Prayoga experiments (worksheet number)
10	Life Processes	1 Germinating seeds give off heat; 2 Carbon dioxide is given out in respiration; 10 Stomata on a leaf; 16 Yeast fermentation; 17 Photosynthesis and light; 18 Pulse rate before and after exercise
10	Control and Coordination	3 Reaction time; 19 Plants bend towards light
10	Sustainable Management of Natural Resources	4 Testing local soil and water
10	How do Organisms Reproduce	11 Pollen grains; 12 Binary fission and budding; 13 Parts of a dicot seed embryo
10	Our Environment	20 Compost heats up
9	Improvement in Food Resources	5 Soil for crops
9	The Fundamental Unit of Life	7 Onion peel cells; 8 Cheek cells
9	Tissues	9 Plant and animal tissues
6–8	Nutrition in Plants	6 Plants and sunlight
6–8	Microorganisms	14 Life in a drop of pond water; 15 Bread mould

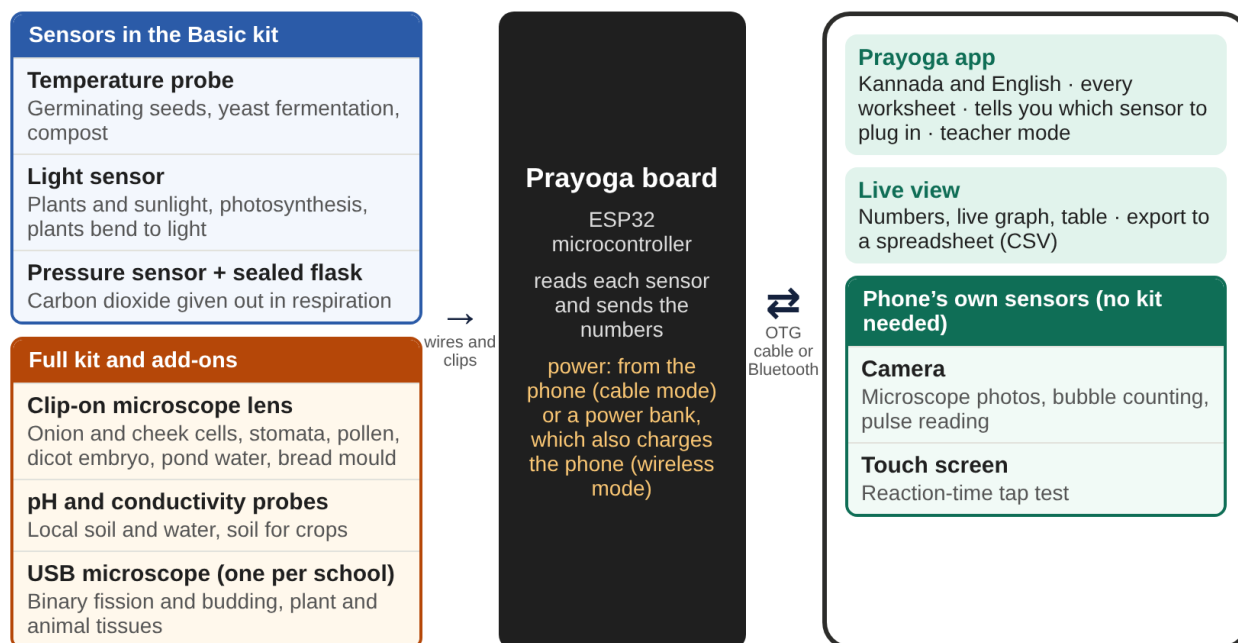
How to use these worksheets

1. **Print** each worksheet on both sides of one sheet. Front: a picture of the setup and every instrument, then predict, measure, set up and record. Back: the graph to plot and the questions.
2. **Before class**, the teacher tries the experiment once, charges the phones, and checks the label under the title. It says what the worksheet needs: the Basic kit, the Full kit, only the phone, by hand, or the shared USB microscope.
3. **In class**, groups of 5–6 work through the four steps in order: Predict, Measure by hand, Set up Prayoga and observe, Explain. Nobody opens the app until predictions are written.
4. **Students plot by hand first**, then compare with the app's live graph. The hand reading and hand graph keep the skills the exam tests.
5. **After class**, collect the sheets and mark them with the answer key at the end of this file.

Prayoga for Biology

Prayoga for Biology: how the parts work together

Sensors measure → the Prayoga board reads them five times a second → the phone shows live numbers and graphs. Cable mode: the phone powers the kit. Wireless mode: a power bank powers the kit and charges the phone, with data over Bluetooth.



By hand, alongside Prayoga: Ruler (reaction time), watch (pulse), pH paper, scale, protractor, lab thermometer. Students take these readings first, then check them against the sensor.

Setting up Prayoga (every experiment that uses the kit)

1. Plug the sensor or probe named on the worksheet into the kit (the "Set up Prayoga" box says which).
2. Connect the kit in one of two ways. **Cable mode:** plug the kit into the phone with the USB OTG cable; the phone powers the kit and the readings travel through the cable, so no other power is needed. **Wireless mode:** plug a power bank or 5 V charger into the kit's POWER IN port and connect by Bluetooth in the app; the phone can charge from the kit's CHARGE OUT port at the same time. Each kit has its own name (for example Prayoga-07), so groups connect to the right one.
3. Open the **Prayoga app** and choose the subject, class and experiment. The app shows which sensor to plug in and opens the right view.
4. Tap **Start** to record and **Stop** to finish, then **Save**. Saved readings can be shared as a spreadsheet. Experiments that use only the phone's own sensors (motion, sound, magnetism, camera) need no kit.

The four steps on every worksheet

Step	What students do
1 Predict	Write what they expect and why, and sketch the graph, before touching the kit.
2 Measure by hand	Use a thermometer, multimeter, scale, stopwatch or pH paper, and work out its least count. This keeps the instrument skills the exam tests.
3 Set up Prayoga and observe	Follow the “Set up Prayoga” box, run the experiment, fill the table, plot by hand, then compare with the app.
4 Explain	Compare with the prediction, explain differences, answer exam-style questions.

In class

- One kit per group of 5–6 students. Roles, rotated each time: **Builder**, **Reader** (plain instrument), **App operator**, **Recorder**, **Explainer**.
- A 40-minute period: predict 5 min · hand reading 5 min · observe and plot 15 min · explain 10 min · report back 5 min. Long experiments (over hours or days) are started in one period and finished later.
- The label under each title says what is needed. **Basic kit**: board, voltage/current sensor, temperature probe, light sensor, pressure sensor, buzzer and circuit parts. **Full kit**: adds pH and conductivity probes, clip-on microscope lens, coil and magnet, solar cell, grating film, IR sensors and the LED test-tube holder. **Lab add-on**: one USB microscope shared by the school.
- Teacher answers are at the end of this file.

Worksheets (20; 9 need only the Basic kit, the phone or hand methods)

No.	Worksheet	Class	Chapter	Status
1	Germinating seeds give off heat	Class 10	Life Processes	Basic kit
2	Carbon dioxide is given out in respiration	Class 10	Life Processes	Basic kit
3	Reaction time	Class 10	Control and Coordination	By hand + Prayoga app
4	Testing local soil and water	Class 10	Our Environment; Sustainable Management of Natural Resources	Full kit
5	Soil for crops	Class 9	Improvement in Food Resources	Full kit
6	Plants and sunlight	Class 7	Nutrition in Plants	Basic kit
7	Onion peel cells	Class 9	The Fundamental Unit of Life	Full kit
8	Cheek cells	Class 9	The Fundamental Unit of Life	Full kit
9	Plant and animal tissues	Class 9	Tissues	Lab add-on: USB microscope
10	Stomata on a leaf	Class 10	Life Processes	Full kit
11	Pollen grains	Class 10	How do Organisms Reproduce	Full kit
12	Binary fission and budding	Class 10	How do Organisms Reproduce	Lab add-on: USB microscope
13	Parts of a dicot seed embryo	Class 10	How do Organisms Reproduce	Full kit
14	Life in a drop of pond water	Class 8	Microorganisms	Full kit
15	Bread mould	Class 8 and Class 10	Microorganisms; How do Organisms Reproduce	Full kit
16	Yeast fermentation	Class 10 and Class 8	Life Processes; Microorganisms	Basic kit
17	Photosynthesis and light	Class 10	Life Processes	Basic kit
18	Pulse rate before and after exercise	Class 10	Life Processes (transportation)	By hand + Prayoga app
19	Plants bend towards light	Class 10	Control and Coordination	Basic kit
20	Compost heats up	Class 10	Our Environment	Basic kit

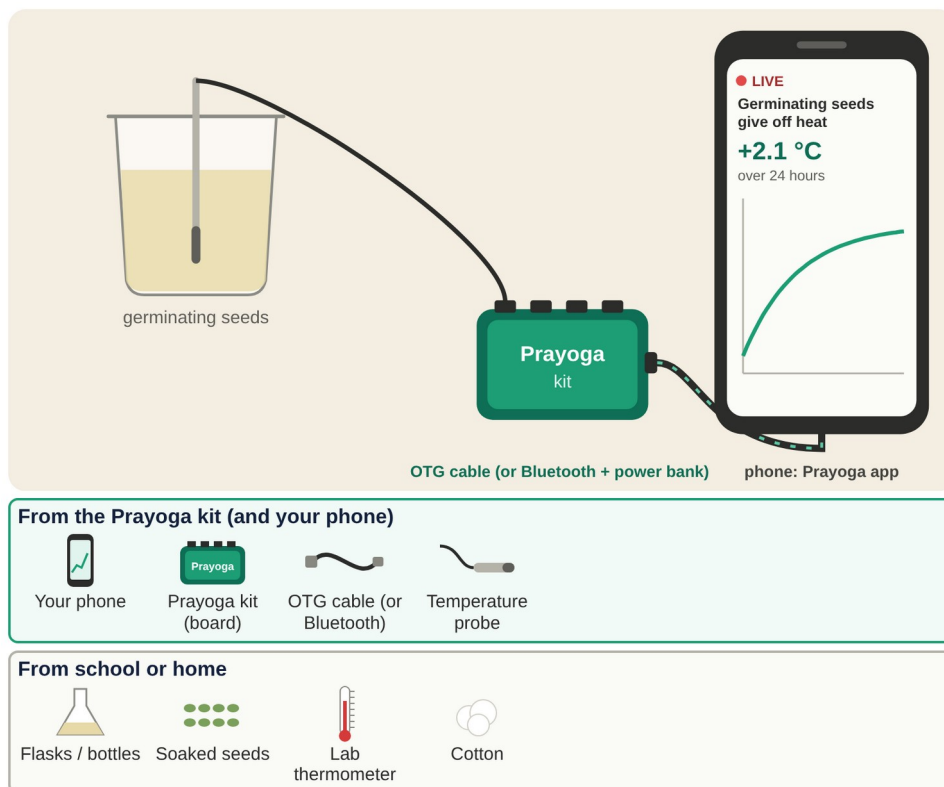
This page is left blank so each worksheet prints on the front and back of one sheet.

1. Germinating seeds give off heat

Class 10 • Life Processes **Basic kit**

Name _____ Class _____ Group _____ Date _____

You need: Prayoga kit (temperature probe), lab thermometer, two bottles or flasks wrapped in cloth, soaked germinating moong seeds, boiled (dead) seeds, cotton.

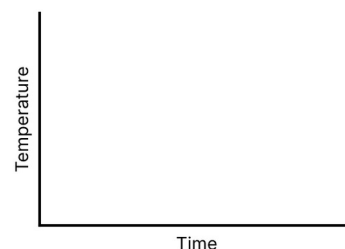


Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

After a day, compared with the boiled seeds, the germinating seeds will be: ☐ warmer ☐ cooler ☐ the same

Why do you think so?



Sketch the graph you expect

2 Measure by hand

1. Put the lab thermometer in the boiled-seed flask; read it each time you read the probe.

3 Set up Prayoga, then observe

Set up Prayoga

- Plug the temperature probe into the kit.
- Connect the kit: OTG cable to the phone (cable mode), or power bank in and Bluetooth on (wireless mode). Open the Prayoga app and choose this experiment. It opens the **Temperature** view and draws the live graph. Check it shows room temperature before you start.
- Tap Start to record and Stop to finish. Tap Save to keep the readings; they can be shared as a spreadsheet.

1. Fill one flask with germinating seeds and one with boiled seeds. Push the probe into the germinating seeds; plug both with cotton.
2. Record every hour during school and again the next morning.

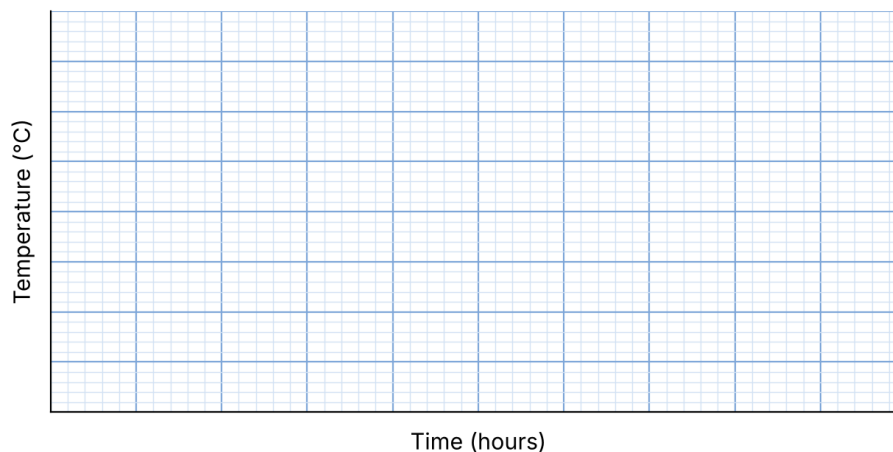
Write your readings in the table on the back.

3 Record your readings • Germinating seeds give off heat

Time	Germinating seeds (°C, sensor)	Boiled seeds (°C, thermometer)	Difference (°C)
Start			
1 hour			
2 hours			
3 hours			
Next morning			

3 Plot your results • Germinating seeds give off heat

Plot your points by hand and draw the best line or smooth curve. Choose a scale that uses most of the grid. Then compare with the app's graph.



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Why do we use boiled seeds?

c) Where does the heat come from?

Exam-style questions

1. Write the equation for aerobic respiration. (2 marks)

2. Why are boiled seeds used as a control in this experiment? (1 mark)

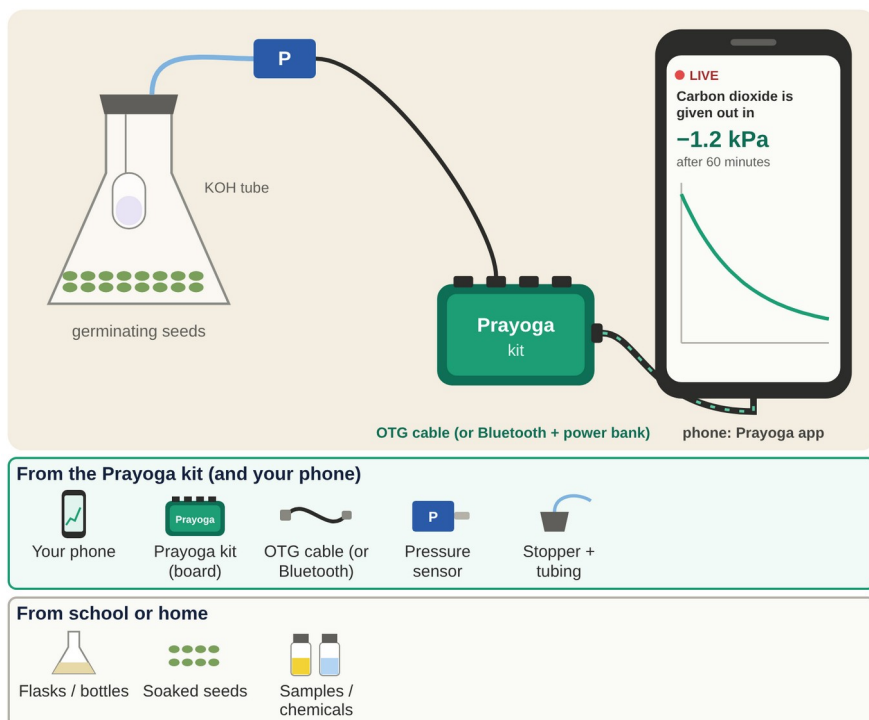
2. Carbon dioxide is given out in respiration

Class 10 • Life Processes **Basic kit**

Name _____ Class _____ Group _____ Date _____

You need: Prayoga kit (pressure sensor), conical flask with a one-hole stopper, germinating seeds, a small test tube of KOH solution (teacher), thread, petroleum jelly to seal; a second flask with boiled seeds if possible.

Safety: KOH is caustic: the teacher prepares and hangs the tube. Goggles on.

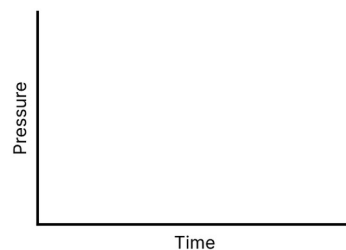


Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

In the sealed flask, KOH absorbs the carbon dioxide that the seeds give out. The pressure will: ☐ rise ☐ fall ☐ stay the same

Why do you think so?



Sketch the graph you expect

2 Measure by hand

1. If your school has the bent-tube set-up (tube dipping into water), mark the water level at the start and after one hour.

3 Set up Prayoga, then observe

Set up Prayoga

- Fit the stopper and tube onto the pressure sensor; check the seal by pressing gently on the tube end (the reading should rise).
- Connect the kit: OTG cable to the phone (cable mode), or power bank in and Bluetooth on (wireless mode). Open the Prayoga app and choose this experiment. It opens the **Pressure** view and draws the live graph.
- Tap Start to record and Stop to finish. Tap Save to keep the readings; they can be shared as a spreadsheet.

1. Put germinating seeds in the flask. The teacher hangs the KOH tube inside with thread. Fit the stopper joined to the pressure sensor and seal with petroleum jelly.
2. Keep the flask in the shade at a steady temperature and record for an hour.
3. Repeat with boiled seeds in a second flask, if you have one.

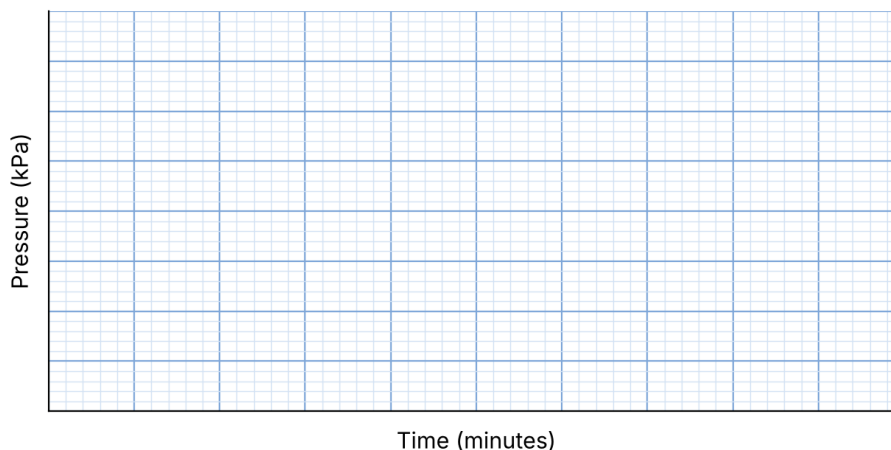
Write your readings in the table on the back.

3 Record your readings • Carbon dioxide is given out in respiration

Time (min)	Pressure, germinating seeds (kPa)	Pressure, boiled seeds (kPa)
0		
10		
20		
30		
40		
50		
60		

3 Plot your results • Carbon dioxide is given out in respiration

Plot your points by hand and draw the best line or smooth curve. Choose a scale that uses most of the grid. Then compare with the app's graph.



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Why does the pressure fall?

c) Why must the flask stay at a steady temperature?

Exam-style questions

1. Draw a labelled diagram of the experiment showing that CO_2 is given out during respiration. (3 marks)

2. What is the role of KOH in this experiment? (1 mark)

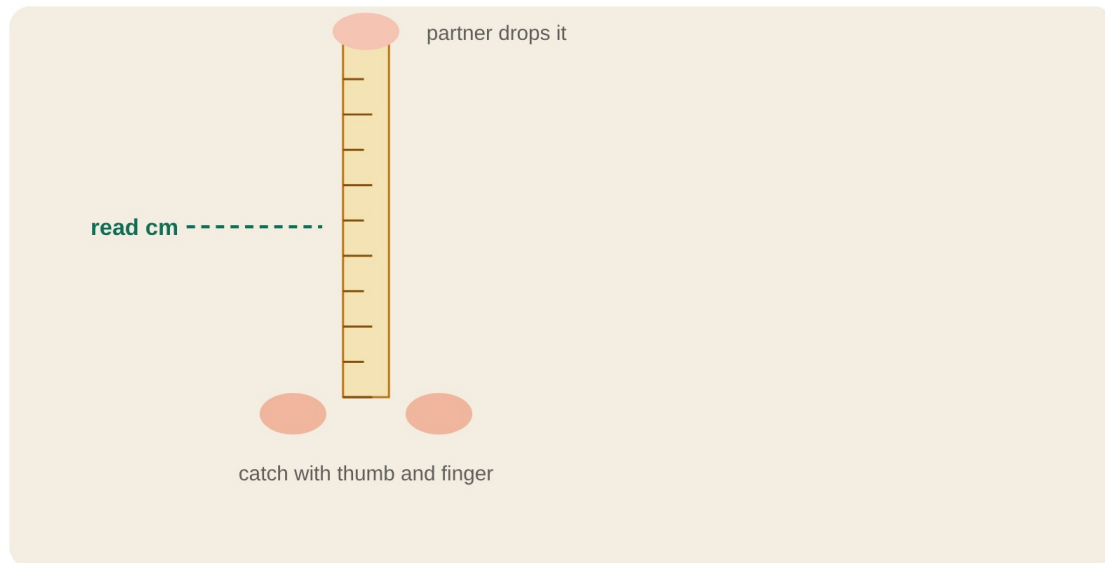
3. Reaction time

Class 10 • Control and Coordination

By hand + Prayoga app

Name _____ Class _____ Group _____ Date _____

You need: 30 cm scale, a partner.



From school or home



Scale / metre
rule

Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

When you count backwards while catching, your reaction time will: ☐ get faster ☐ get slower ☐ not change
Why do you think so?

2 Measure by hand

1. Your partner holds the scale with 0 cm between your open thumb and finger and drops it without warning. Read where you catch it (cm).

3 Set up Prayoga, then observe

Set up Prayoga

- The ruler-drop test is done by hand.
- Then open this experiment in the Prayoga app for the **Reaction time** tap test and compare the two results.

1. Do 5 catches normally.
2. Do 5 catches while counting backwards from 100 in sevens. Work out the average distance for each, then the time.

Write your readings in the table on the back.

3 Record your readings · Reaction time

Trial	Distance, normal (cm)	Distance, counting (cm)
1		
2		
3		
4		
5		
Average		
Time = $\sqrt{(2d \div 980)}$ s		

4 Explain

a) Was your prediction right? If not, what changed your mind?

b) How much slower were you while counting?

c) Why is it dangerous to use a phone while cycling or driving?

Exam-style questions

1. What is a reflex action? Give one example. (2 marks)

2. Trace the path of a reflex arc. (3 marks)

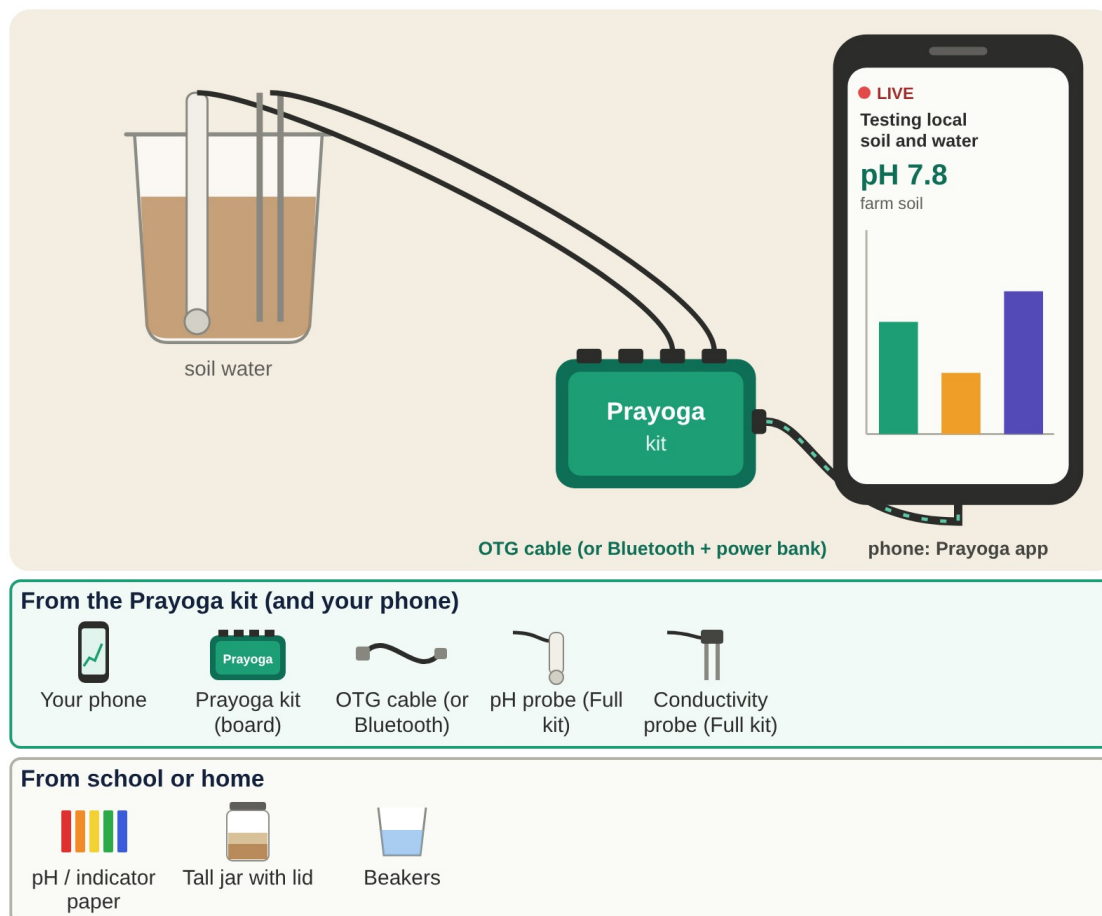
4. Testing local soil and water

Class 10 • Our Environment; Sustainable Management of Natural Resources **Full kit**

Name _____ Class _____ Group _____ Date _____

You need: pH probe, conductivity probe (or two nails in the kit circuit), pH paper, clean jars; farm soil, garden soil, borewell water, tap water, rainwater if available.

Safety: A learning activity, not a drinking-water test. Wash hands after handling soil.



Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

Which will have the most dissolved salts? ☐ rainwater ☐ tap water ☐ borewell water

Why do you think so?

2 Measure by hand

1. Test each sample with pH paper and match the colour chart.

3 Set up Prayoga, then observe

Set up Prayoga

- Plug the pH and conductivity probes into the kit; rinse both in clean water between samples.
- Connect the kit: OTG cable to the phone (cable mode), or power bank in and Bluetooth on (wireless mode). Open the Prayoga app and choose this experiment. It opens the **pH and conductivity** view and draws the live graph. Calibrate pH in pH 7 buffer when the app asks.
- Tap Start to record and Stop to finish. Tap Save to keep the readings; they can be shared as a spreadsheet.

1. Mix 1 part soil with 2 parts clean water; stir and let it settle for 30 minutes.
2. Measure pH and conductivity of the clear liquid and of each water sample. Rinse probes between samples.

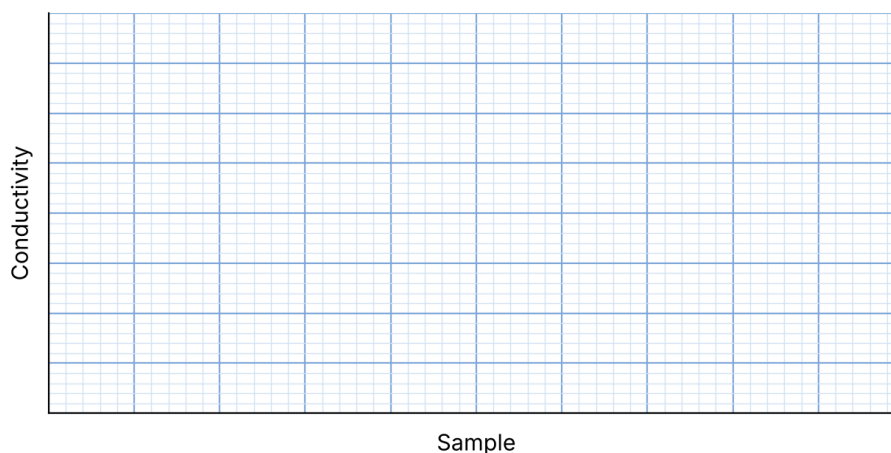
Write your readings in the table on the back.

3 Record your readings • Testing local soil and water

Sample	pH paper	pH probe	Conductivity (or current, mA)	Notes
Farm soil				
Garden soil				
Borewell water				
Tap water				
Rainwater				

3 Plot your results • Testing local soil and water

Draw a bar chart by hand. Choose a scale that uses most of the grid. Then compare with the app's graph.



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Which sample has the most dissolved salts? Where might they come from?

c) What could make farm soil too acidic or too salty?

Exam-style questions

1. Give two reasons why we should manage water resources carefully. (2 marks)

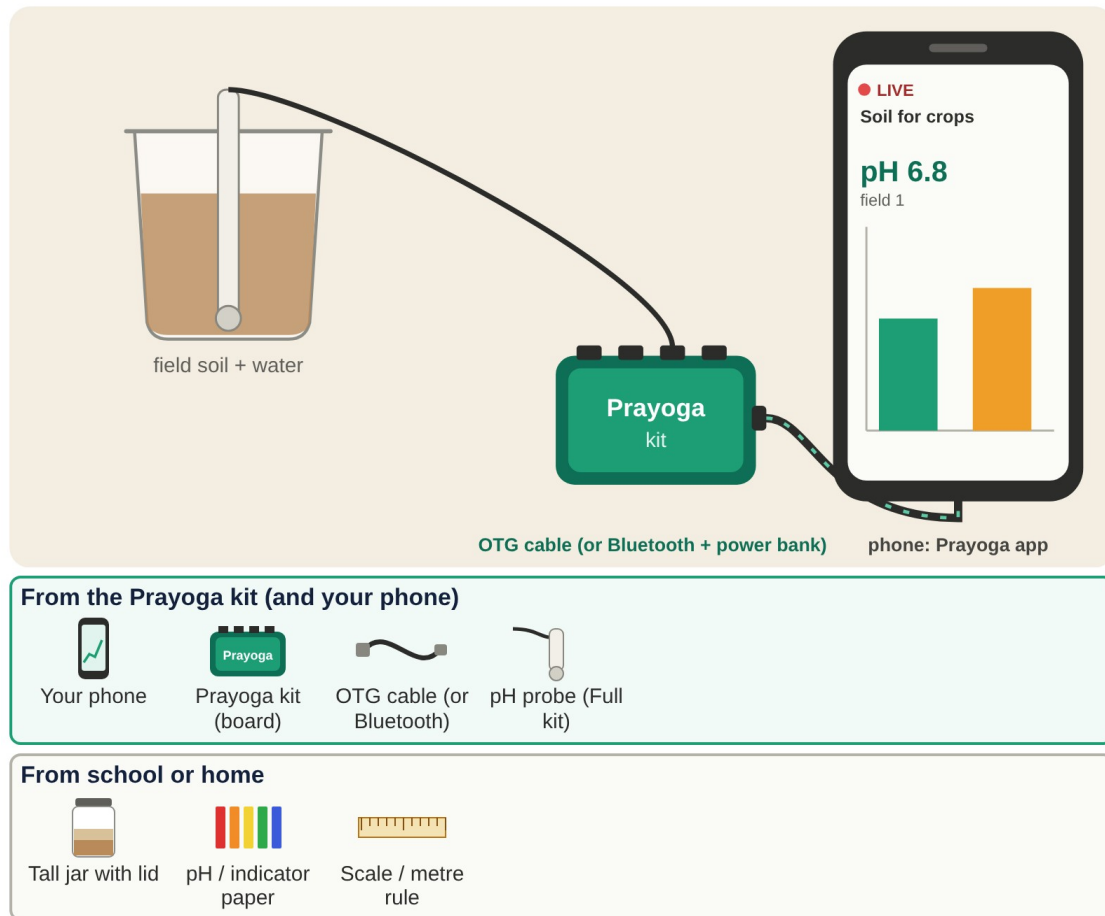
2. What is rainwater harvesting? (2 marks)

5. Soil for crops

Class 9 • Improvement in Food Resources **Full kit**

Name _____ Class _____ Group _____ Date _____

You need: Soil from two fields, pH probe or pH paper, two tall transparent jars with lids, water, scale.



Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

Which soil will hold more water? ☐ sandy soil ☐ clayey soil ☐ the same

Why do you think so?

2 Measure by hand

1. Jar test: fill a jar one-third with soil, add water, shake and leave a day. Measure the height of each layer: sand (bottom), silt, clay (top).

3 Set up Prayoga, then observe

Set up Prayoga

- Plug the pH probe into the kit; rinse it in clean water.
- Connect the kit: OTG cable to the phone (cable mode), or power bank in and Bluetooth on (wireless mode). Open the Prayoga app and choose this experiment. It opens the pH view and draws the live graph. Calibrate in pH 7 buffer when the app asks.
- Students also use pH paper, as the textbook asks.

1. Mix each soil with water (1:2); measure the pH.
2. Record the layer heights from the jar test.

Write your readings in the table on the back.

3 Record your readings · Soil for crops

Field	pH	Sand (cm)	Silt (cm)	Clay (cm)	Crop that may suit
Field 1					
Field 2					

4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Which soil will hold more water? How do you know?

c) How can a farmer correct acidic soil?

Exam-style questions

1. Give two differences between manure and fertiliser. (2 marks)

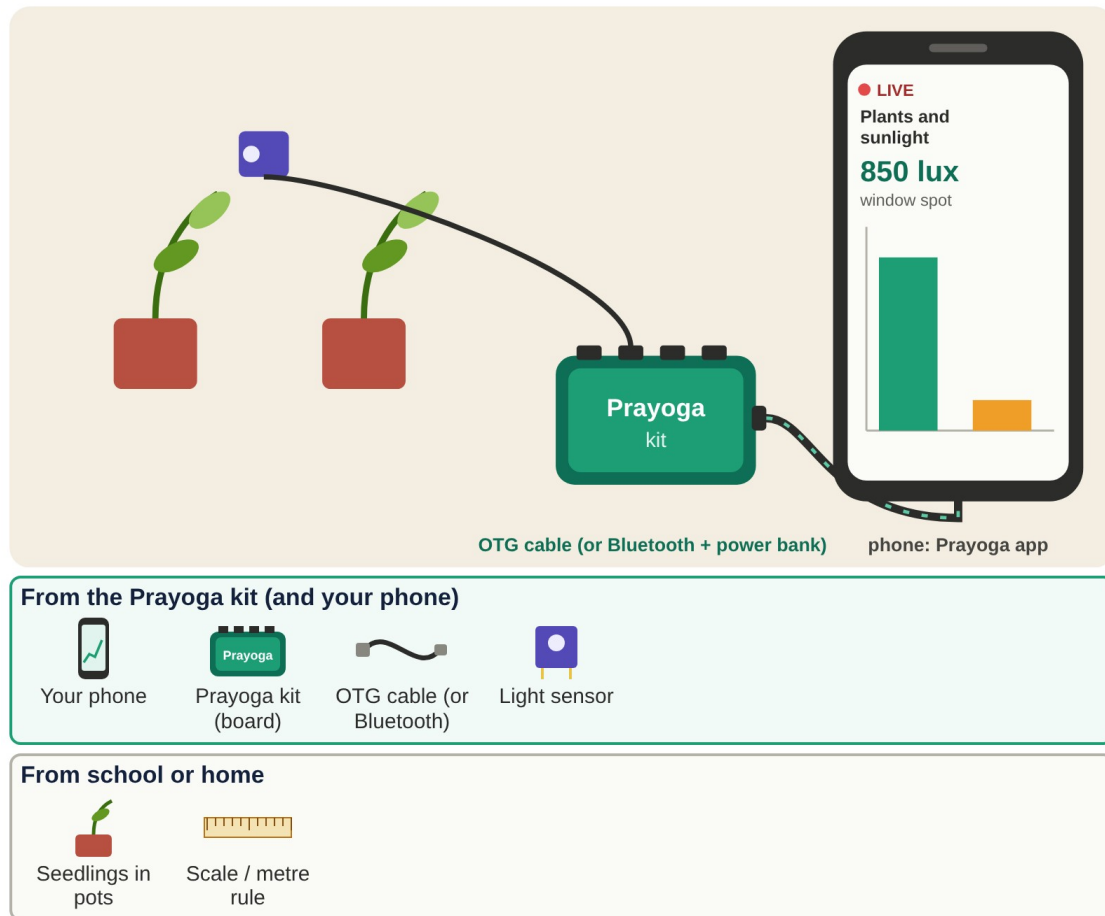
2. Name two ways to improve soil fertility. (2 marks)

6. Plants and sunlight

Class 7 • Nutrition in Plants **Basic kit**

Name _____ Class _____ Group _____ Date _____

You need: Prayoga kit (light sensor), two similar potted seedlings, scale, water.



Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

After two weeks, the plant in the dark corner will be: ☐ taller and green ☐ taller but pale ☐ shorter and greener
Why do you think so?

2 Measure by hand

1. Measure each plant's height with the scale every 3 days.

3 Set up Prayoga, then observe

Set up Prayoga

- Plug in the light sensor and point it at the light source.
- Connect the kit: OTG cable to the phone (cable mode), or power bank in and Bluetooth on (wireless mode). Open the Prayoga app and choose this experiment. It opens the **Light** view and draws the live graph.
- Tap Start to record and Stop to finish. Tap Save to keep the readings; they can be shared as a spreadsheet.

1. Keep one pot at a sunny window and one in a dark corner; water both the same.
2. Measure light at each spot at the same time of day.

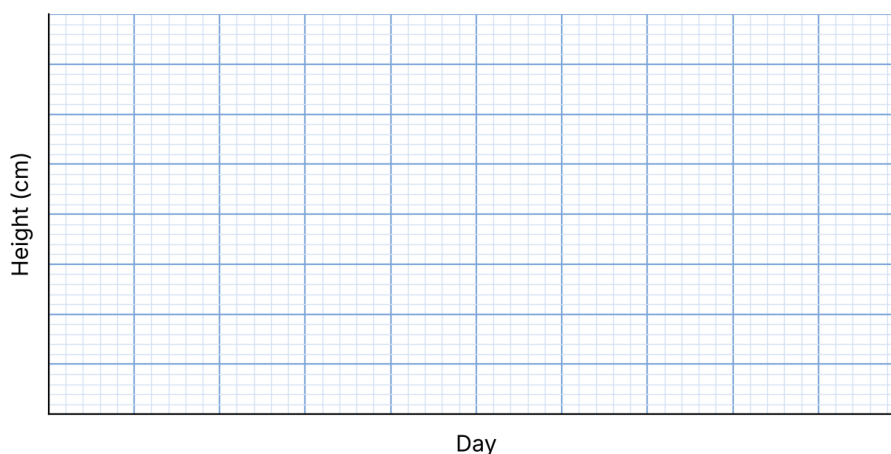
Write your readings in the table on the back.

3 Record your readings • Plants and sunlight

Day	Light at window (lux)	Light in corner (lux)	Height, window plant (cm)	Height, corner plant (cm)
1				
4				
7				
10				
14				

3 Plot your results • Plants and sunlight

Plot your points by hand and draw the best line or smooth curve. Choose a scale that uses most of the grid. Then compare with the app's graph.



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) How do the two plants differ in colour and shape?

c) Why do plants need light?

Exam-style questions

1. Write the word equation for photosynthesis. (2 marks)

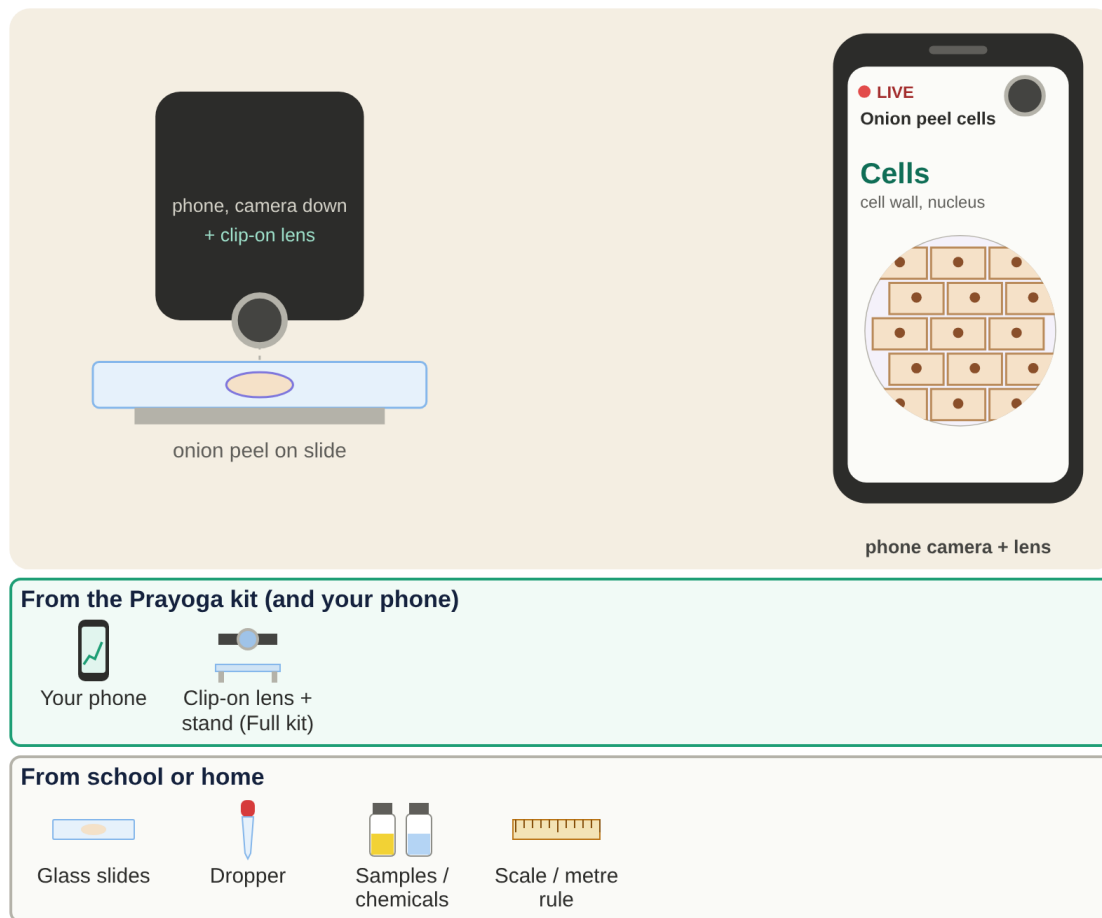
2. Why are leaves called the food factories of a plant? (1 mark)

7. Onion peel cells

Class 9 • The Fundamental Unit of Life **Full kit**

Name _____ Class _____ Group _____ Date _____

You need: Phone with clip-on lens, onion, glass slide (or clear plastic piece), water, iodine solution if available, forceps, needle.



Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

Will onion cells have a nucleus? ☐ yes ☐ no A cell wall? ☐ yes ☐ no

Why do you think so?

2 Measure by hand

- Place a ruler's millimetre marks under the lens. How wide is the view? _____ mm. Later, size of one cell $\approx$ view width $\div$ number of cells across.

3 Set up Prayoga, then observe

Set up Prayoga

- Clip the microscope lens exactly over the main camera.
- Open the Prayoga app and choose this experiment. The **Microscope** view zooms, focuses and lets you label the photo. Move the phone slowly up or down until the image is sharp.

- Peel the thin skin from the inside of an onion layer. Lay it flat on the slide with a drop of water (and a drop of iodine).
- Clip the lens on the camera, focus and photograph. Draw and label what you see.

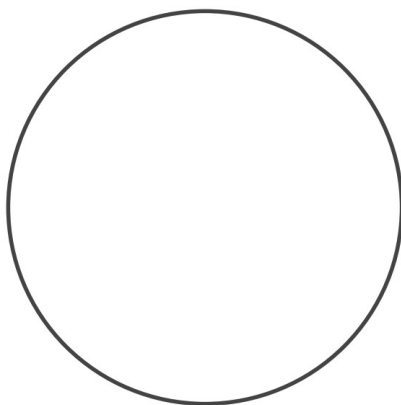
Write your readings in the table on the back.

3 Record your readings • Onion peel cells

Feature	Seen?	Notes
Cell wall		
Nucleus		
Shape of the cells		
Cells across the view (count)		
Size of one cell (mm)		

3 Draw what you see • Onion peel cells

Draw 3–4 cells and label cell wall, cytoplasm, nucleus:



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Why does iodine help?

c) How is an onion cell different from a cheek cell?

Exam-style questions

1. Draw a labelled diagram of an onion peel cell. (3 marks)

2. Which part gives a plant cell its fixed shape? (1 mark)

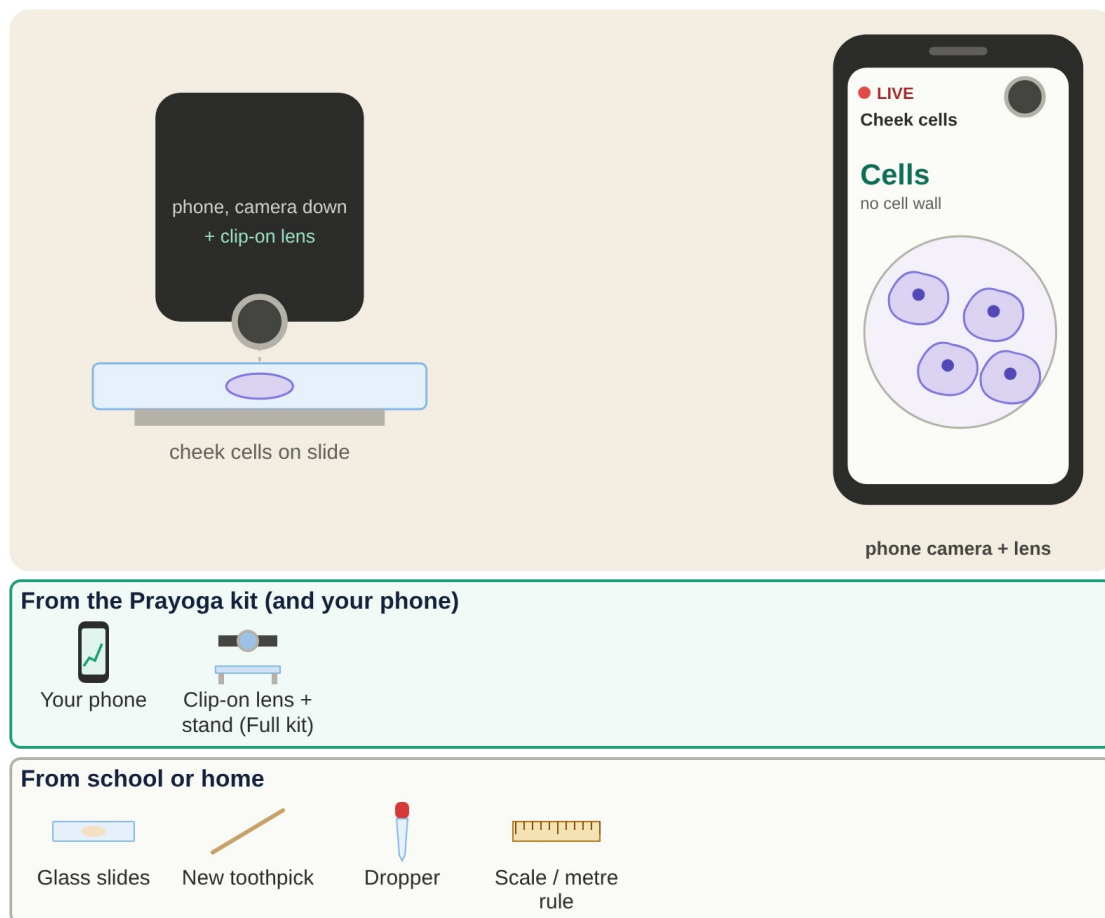
8. Cheek cells

Class 9 • The Fundamental Unit of Life **Full kit**

Name _____ Class _____ Group _____ Date _____

You need: Phone with clip-on lens, a new clean toothpick for each student, slide, water, methylene blue if available.

Safety: Use only your own new toothpick, scrape gently, and throw it away. Wash hands afterwards.



Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

Will cheek cells have a cell wall? ☐ yes ☐ no

Why do you think so?

2 Measure by hand

- Place a ruler's millimetre marks under the lens. How wide is the view? _____ mm. Later, size of one cell $\approx$ view width $\div$ number of cells across.

3 Set up Prayoga, then observe

Set up Prayoga

- Clip the microscope lens exactly over the main camera.
- Open the Prayoga app and choose this experiment. The **Microscope** view zooms, focuses and lets you label the photo. Move the phone slowly up or down until the image is sharp.

- Gently scrape the inside of your cheek with the flat end of the toothpick. Spread on the slide in a drop of water (and stain).
- Focus and photograph. Cheek cells are small: use the highest zoom and good light.

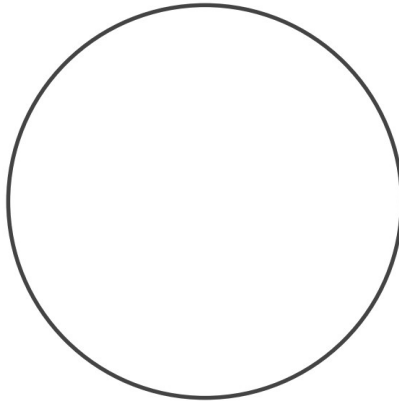
Write your readings in the table on the back.

3 Record your readings • Cheek cells

Feature	Seen?	Notes
Cell wall		
Nucleus		
Shape of the cells		
Cells in neat rows?		
Size of one cell (mm)		

3 Draw what you see • Cheek cells

Draw 2–3 cells and label cell membrane, cytoplasm, nucleus:



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Why are cheek cells irregular, not brick-shaped?

c) Compare with your onion drawing: what is missing here?

Exam-style questions

1. Write three differences between plant and animal cells. (3 marks)

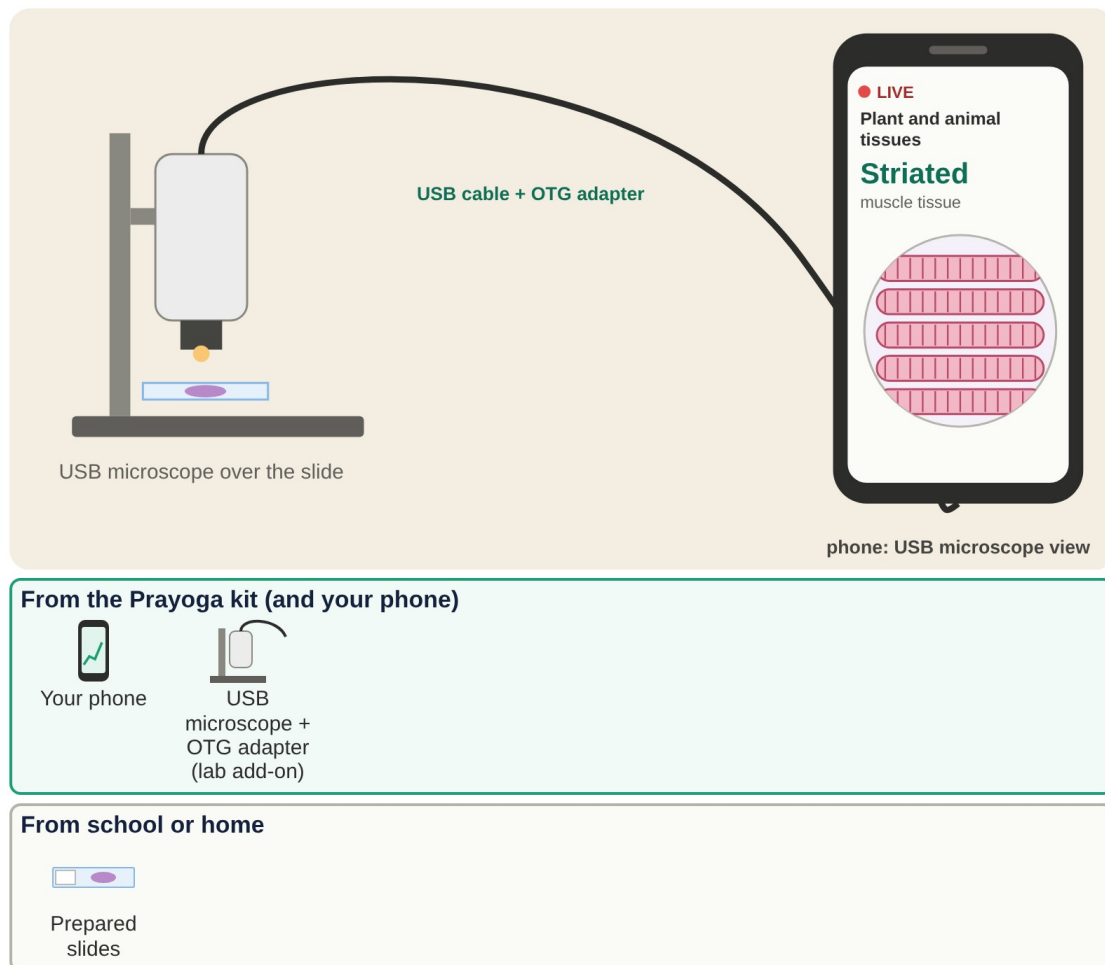
2. What is the outer covering of an animal cell called? (1 mark)

9. Plant and animal tissues

Class 9 • Tissues **Lab add-on: USB microscope**

Name _____ Class _____ Group _____ Date _____

You need: USB digital microscope (lab add-on), phone with the Prayoga app and OTG cable; prepared slides of parenchyma, collenchyma, sclerenchyma, striated, smooth and cardiac muscle, and a nerve cell.



Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

Which plant tissue has thick, dead cell walls? ☐ parenchyma ☐ collenchyma ☐ sclerenchyma

Why do you think so?

2 Measure by hand

1. Read the label on each slide, and note the magnification shown in the app: _____ ×.

3 Set up Prayoga, then observe

Set up Prayoga

- Plug the USB microscope into the phone with the OTG cable (no kit needed).
- Open the Prayoga app and choose this experiment. The **USB microscope** view shows the live image; focus with the microscope's wheel, then photograph and label.

1. Plug the USB microscope into the phone with the OTG cable. Focus on each slide.
2. Photograph each tissue and label one feature that identifies it (walls, spindle shape, stripes, branches).

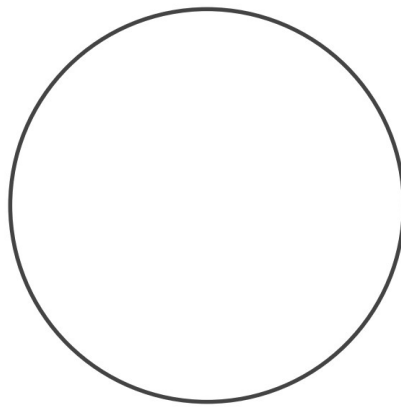
Write your readings in the table on the back.

3 Record your readings • Plant and animal tissues

Tissue	What identifies it	Plant or animal?
Parenchyma		
Collenchyma		
Sclerenchyma		
Striated muscle		
Smooth muscle		
Cardiac muscle		
Nerve cell		

3 Draw what you see • Plant and animal tissues

Draw one plant tissue and one muscle tissue:



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) How did you tell striated muscle from smooth muscle?

c) Which tissue makes coconut husk tough?

Exam-style questions

1. Draw a labelled diagram of a neuron. (3 marks)

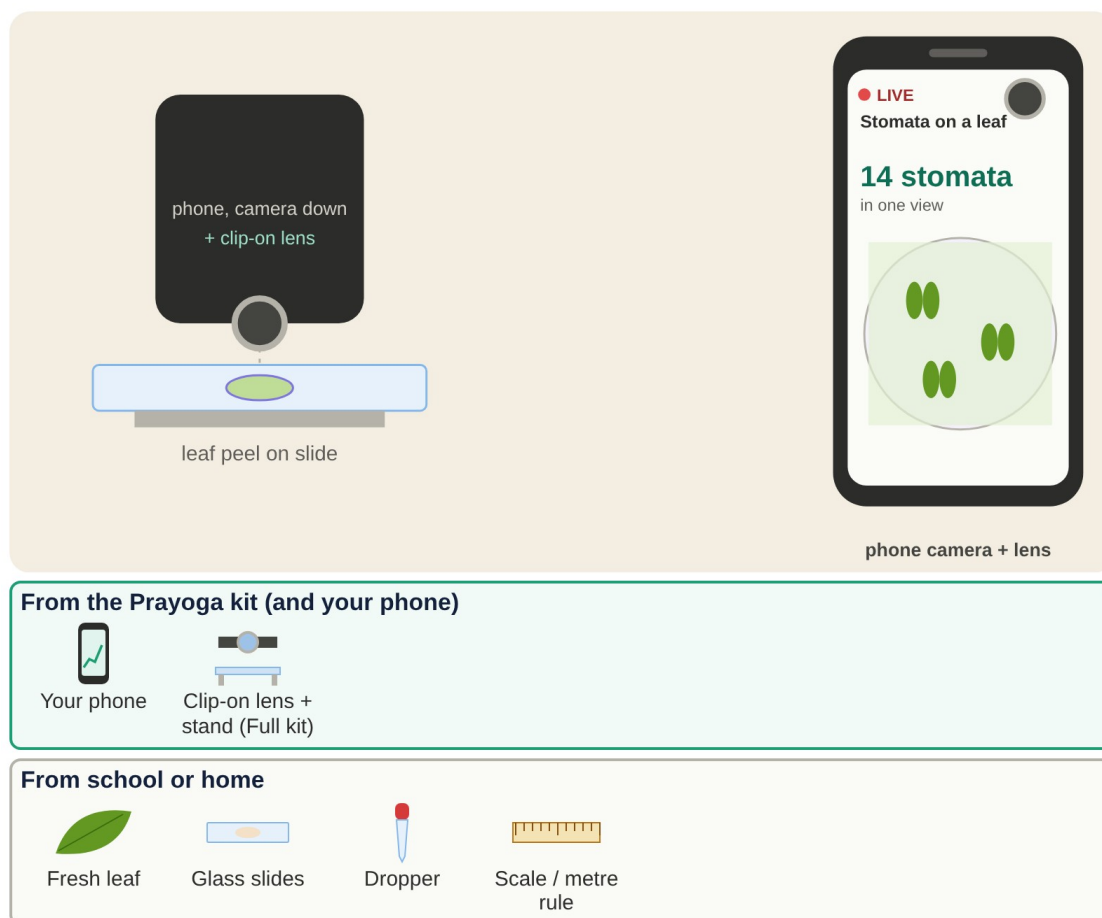
2. Give two differences between parenchyma and sclerenchyma. (2 marks)

10. Stomata on a leaf

Class 10 • Life Processes **Full kit**

Name _____ Class _____ Group _____ Date _____

You need: Phone with clip-on lens, a fresh leaf (balsam, Tradescantia or Rhoeo), slide, water, forceps.



Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

More stomata will be on the: ☐ upper side ☐ lower side ☐ both the same

Why do you think so?

2 Measure by hand

- Place a ruler's millimetre marks under the lens. How wide is the view? _____ mm. Later, size of one cell $\approx$ view width $\div$ number of cells across. View area $\approx 3.14 \times (\text{view width} \div 2)^2$.

3 Set up Prayoga, then observe

Set up Prayoga

- Clip the microscope lens exactly over the main camera.
- Open the Prayoga app and choose this experiment. The **Microscope** view zooms, focuses and lets you label the photo. Move the phone slowly up or down until the image is sharp.

- Fold the leaf and peel off a thin, clear layer of the lower skin. Mount it in water. Repeat with the upper skin.
- Count the stomata in one view for each.

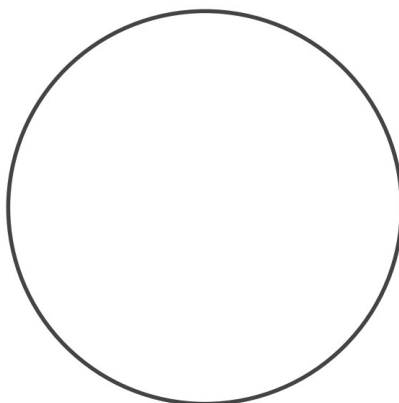
Write your readings in the table on the back.

3 Record your readings • Stomata on a leaf

Leaf side	Stomata in one view	View area (mm ²)	Stomata per mm ²
Lower skin			
Upper skin			

3 Draw what you see • Stomata on a leaf

Draw one stoma and label guard cells and pore:



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Why are there more stomata on the lower side?

c) Which gases pass through the stomata?

Exam-style questions

1. Draw a labelled diagram of an open stoma. (3 marks)

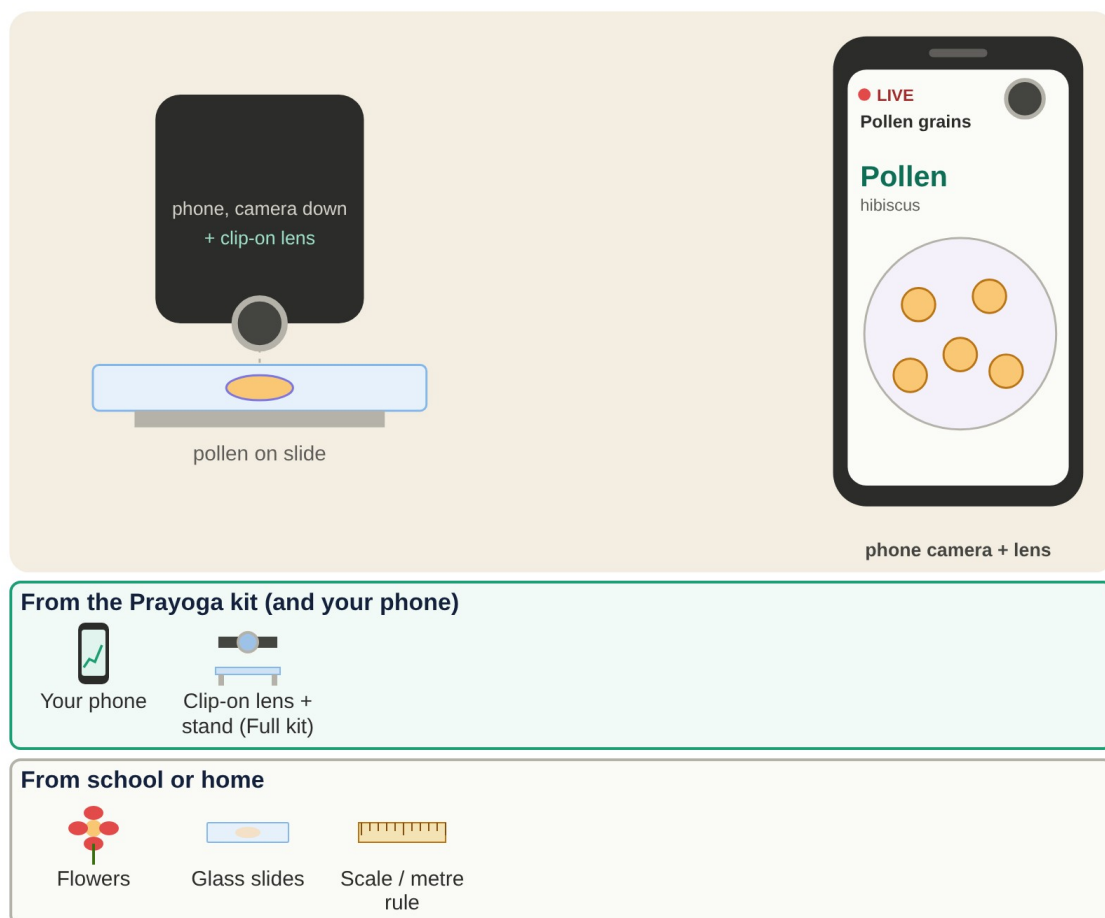
2. How do stomata open and close? (2 marks)

11. Pollen grains

Class 10 • How do Organisms Reproduce **Full kit**

Name _____ Class _____ Group _____ Date _____

You need: Phone with clip-on lens, two kinds of flowers (e.g. hibiscus and marigold), slides, small brush.



Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

Will pollen from two different flowers look the same? ☐ yes ☐ no

Why do you think so?

2 Measure by hand

- Place a ruler's millimetre marks under the lens. How wide is the view? _____ mm. Later, size of one cell $\approx$ view width $\div$ number of cells across.

3 Set up Prayoga, then observe

Set up Prayoga

- Clip the microscope lens exactly over the main camera.
- Open the Prayoga app and choose this experiment. The **Microscope** view zooms, focuses and lets you label the photo. Move the phone slowly up or down until the image is sharp.

- Tap or brush pollen from the anthers onto a slide.
- Photograph pollen from each flower at the same zoom.

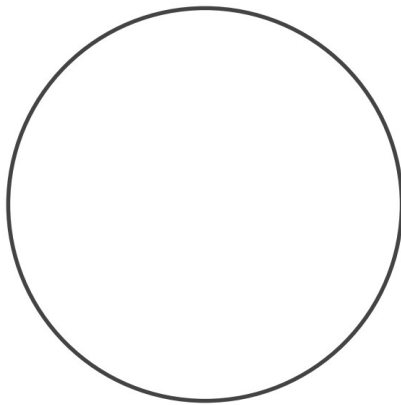
Write your readings in the table on the back.

3 Record your readings • Pollen grains

Flower	Shape	Surface (smooth / spiky)	Grains across the view	Size of one grain (mm)
Hibiscus				
Flower 2:				

3 Draw what you see • Pollen grains

Draw pollen from each flower:



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Why might pollen carried by insects be spiky or sticky?

c) Where must pollen land for a seed to form?

Exam-style questions

1. What is pollination? Name its two types. (2 marks)

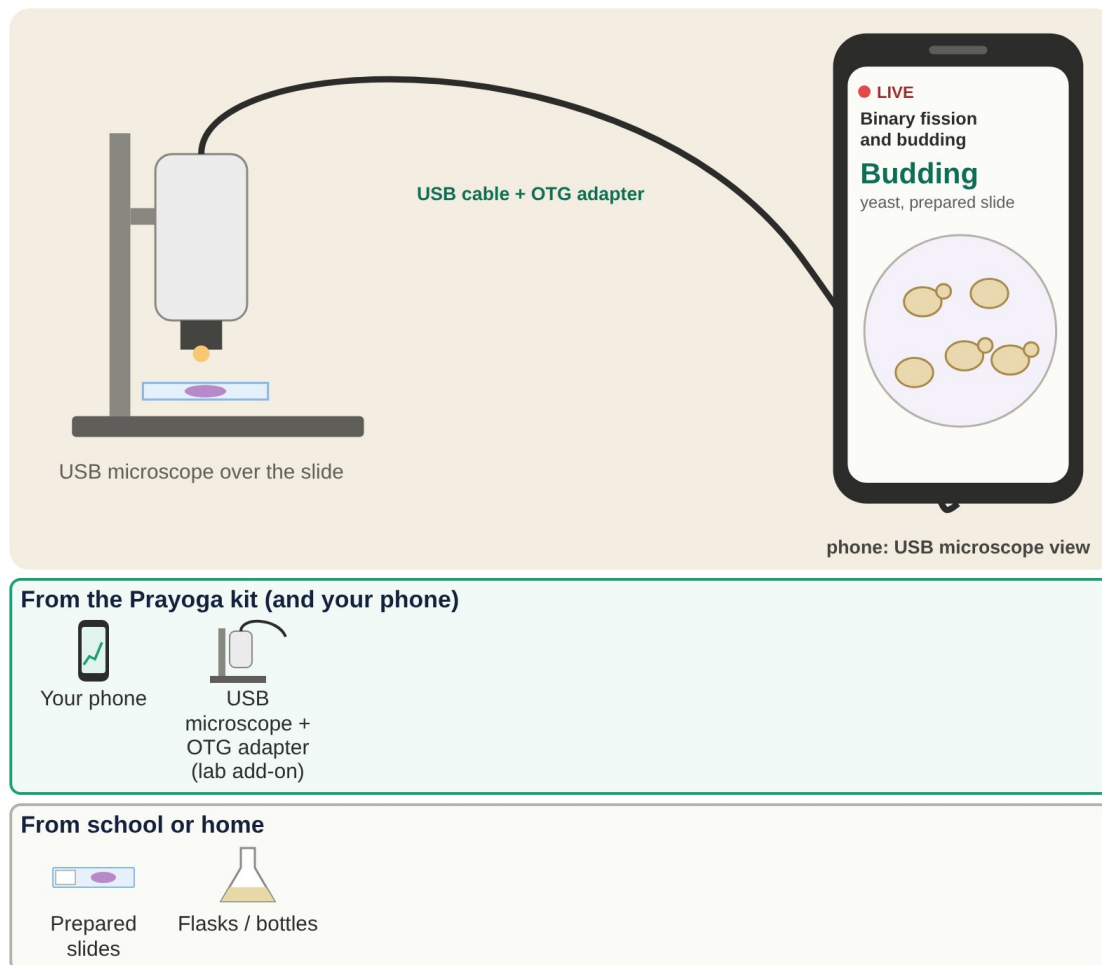
2. Give one difference between self-pollination and cross-pollination. (2 marks)

12. Binary fission and budding

Class 10 • How do Organisms Reproduce **Lab add-on: USB microscope**

Name _____ Class _____ Group _____ Date _____

You need: USB digital microscope (lab add-on), phone with the Prayoga app and OTG cable; prepared slides of Amoeba (binary fission), yeast (budding) and Hydra (budding); live yeast in warm sugar water (optional).



Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

In budding, the new organism: ☐ splits equally from the parent ☐ grows out as a small bump on the parent ☐ forms from a spore

Why do you think so?

2 Measure by hand

1. Look at the Hydra slide with a hand lens or by eye first. Can you see the bud?

3 Set up Prayoga, then observe

Set up Prayoga

- Plug the USB microscope into the phone with the OTG cable (no kit needed).
- Open the Prayoga app and choose this experiment. The **USB microscope** view shows the live image; focus with the microscope's wheel, then photograph and label.

1. Plug the USB microscope into the phone with the OTG cable. Place each slide under it and focus with the wheel.
2. Photograph Amoeba dividing, a yeast cell with a bud, and Hydra with a bud. Label each photo in the app.
3. Optional: put a drop of live yeast (fed with sugar water for 30 minutes) on a slide and look for buds.

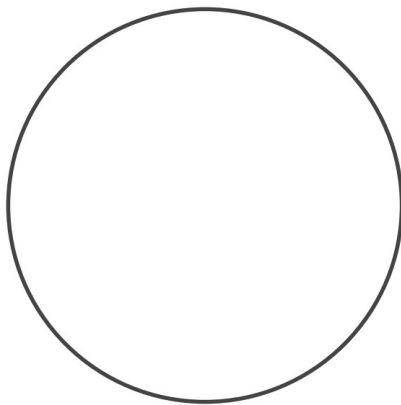
Write your readings in the table on the back.

3 Record your readings • Binary fission and budding

Organism	What you see	Binary fission or budding?
Amoeba		
Yeast		
Hydra		

3 Draw what you see • Binary fission and budding

Draw Amoeba dividing and a yeast cell with a bud:



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) How is binary fission different from budding?

c) Why are buds easier to find in yeast that has been fed sugar?

Exam-style questions

1. Draw the stages of binary fission in Amoeba. (3 marks)

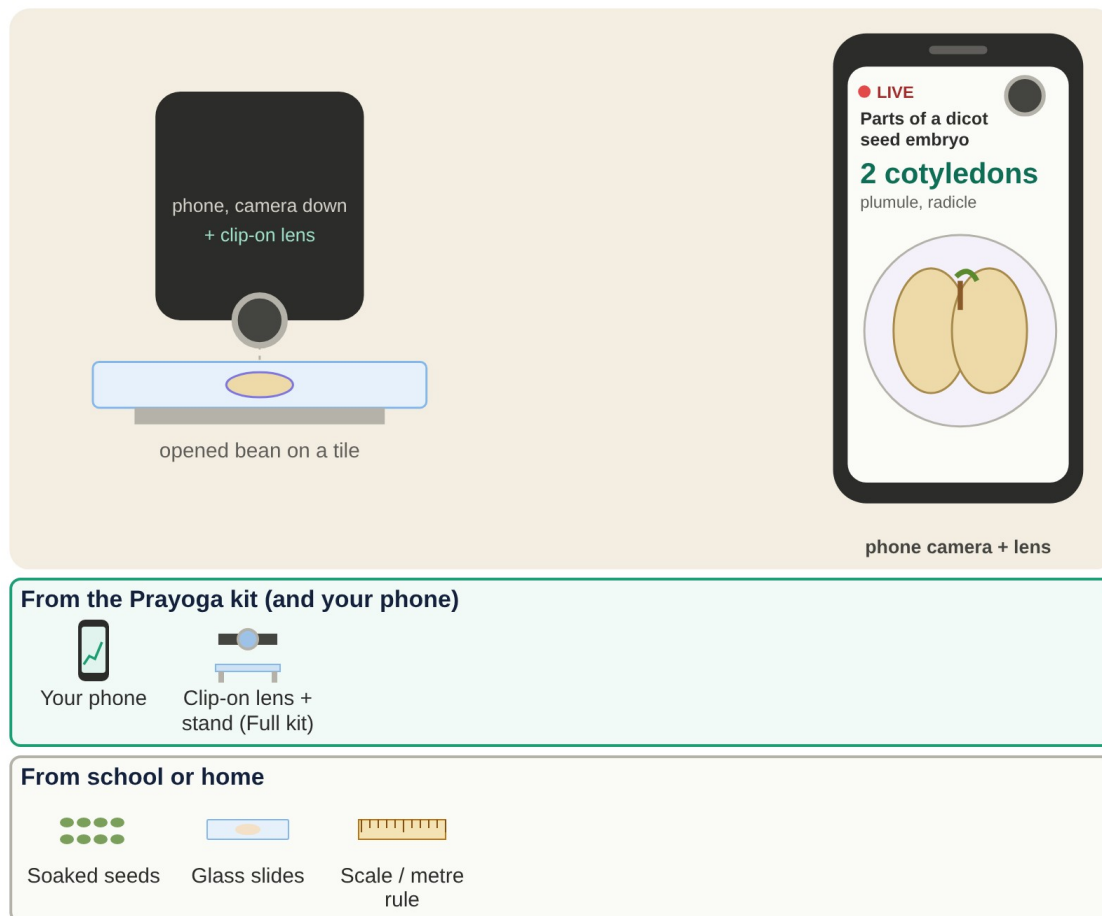
2. Name two organisms that reproduce by budding. (1 mark)

13. Parts of a dicot seed embryo

Class 10 • How do Organisms Reproduce **Full kit**

Name _____ Class _____ Group _____ Date _____

You need: Phone with clip-on lens (Full kit), pea, gram or red kidney bean seeds soaked overnight, a white tile or slide, needle.



Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

Inside a soaked bean you will find: ☐ one cotyledon ☐ two cotyledons ☐ no cotyledons

Why do you think so?

2 Measure by hand

1. Measure a soaked seed with a scale: _____ mm long. Peel off the seed coat by hand and gently split the seed into its two halves.

3 Set up Prayoga, then observe

Set up Prayoga

- Clip the microscope lens exactly over the main camera.
- Open the Prayoga app and choose this experiment. The **Microscope** view zooms, focuses and lets you label the photo. Move the phone slowly up or down until the image is sharp.

1. Lay the opened halves on the tile. Clip the lens on the camera and photograph the embryo.
2. Label the photo in the app: seed coat, cotyledons, plumule, radicle.

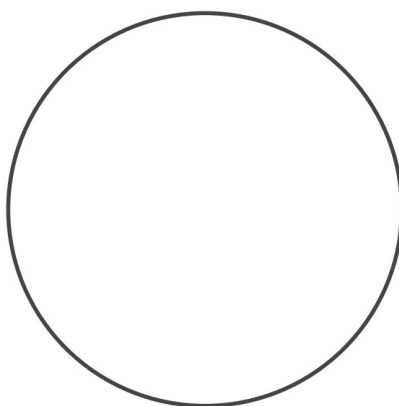
Write your readings in the table on the back.

3 Record your readings • Parts of a dicot seed embryo

Part	Seen?	Where it is	What it becomes or does
Seed coat			
Cotyledons			
Plumule			
Radicle			

3 Draw what you see • Parts of a dicot seed embryo

Draw the opened seed and label its parts:



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Why are the cotyledons large and thick?

c) Why are the seeds soaked overnight?

Exam-style questions

1. Draw a labelled diagram of the embryo of a dicot seed. (3 marks)

2. What do the plumule and the radicle grow into? (1 mark)

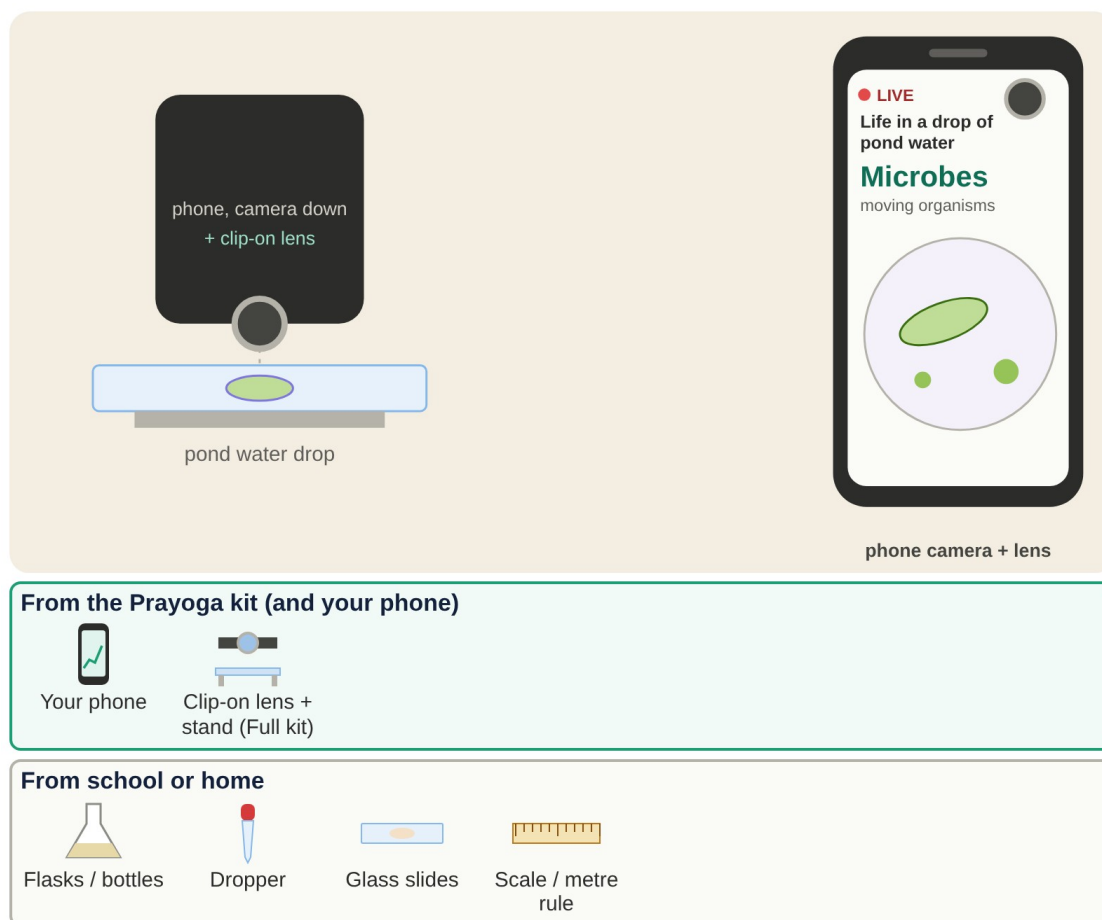
14. Life in a drop of pond water

Class 8 • Microorganisms **Full kit**

Name _____ Class _____ Group _____ Date _____

You need: Phone with clip-on lens, pond water with some weeds in a clean bottle, dropper, slides.

Safety: Wash hands after handling pond water.



Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

Will you see living things in one drop of pond water? ☐ yes ☐ no

Why do you think so?

2 Measure by hand

- Place a ruler's millimetre marks under the lens. How wide is the view? _____ mm. Later, size of one cell $\approx$ view width $\div$ number of cells across.

3 Set up Prayoga, then observe

Set up Prayoga

- Clip the microscope lens exactly over the main camera.
- Open the Prayoga app and choose this experiment. The **Microscope** view zooms, focuses and lets you label the photo. Move the phone slowly up or down until the image is sharp.

- Put a drop of pond water (from near the weeds) on a slide.
- Record a short video through the lens. Look for things that move and things that are green.

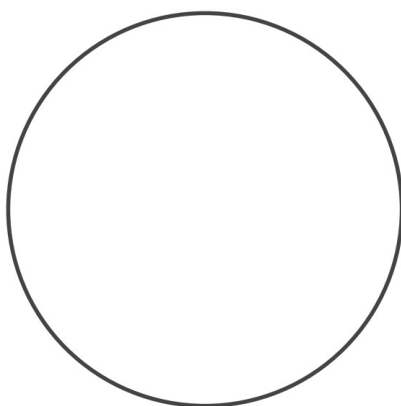
Write your readings in the table on the back.

3 Record your readings • Life in a drop of pond water

Organism (describe or name)	Moving?	Green?	Size (mm)
1			
2			
3			
4			

3 Draw what you see • Life in a drop of pond water

Draw two organisms you saw:



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) How did you decide whether something was alive?

c) The green ones: how do they get their food?

Exam-style questions

1. Name the major groups of microorganisms. (2 marks)

2. Give two uses of microorganisms. (2 marks)

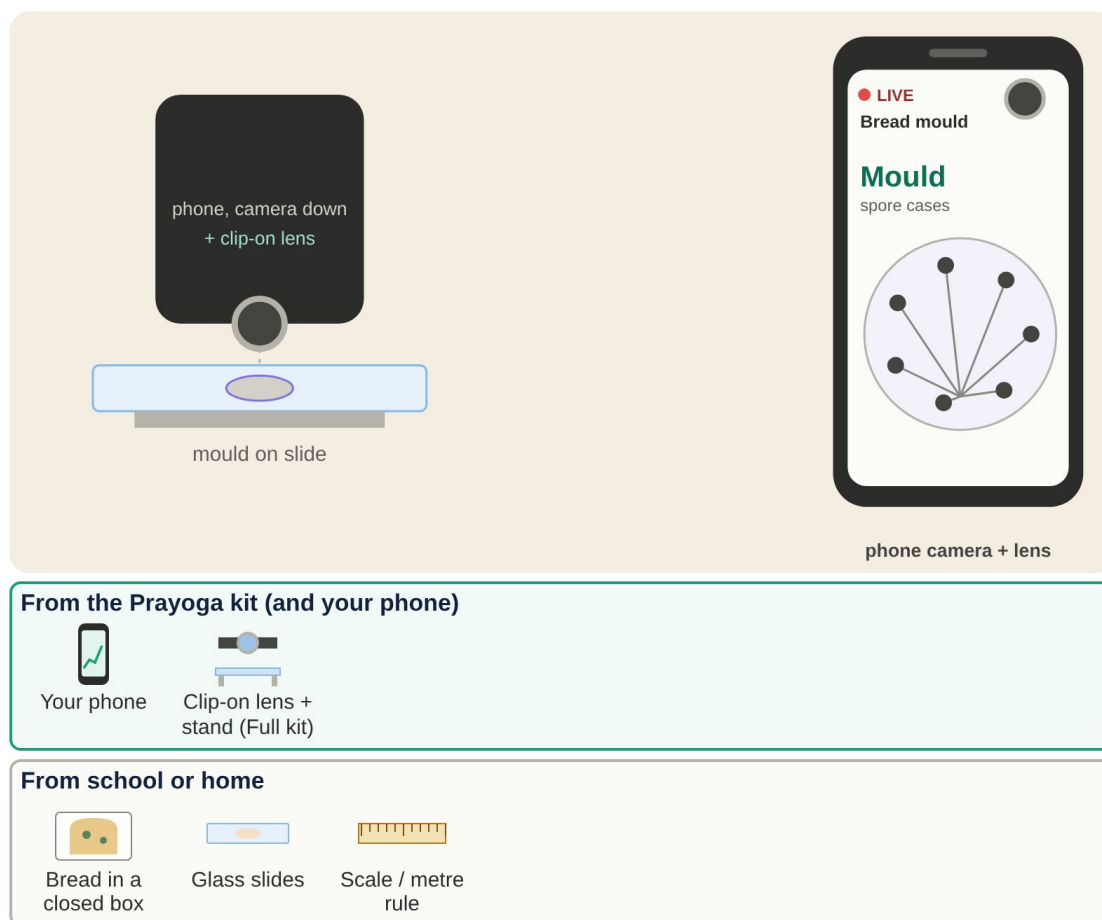
15. Bread mould

Class 8 and Class 10 • Microorganisms; How do Organisms Reproduce **Full kit**

Name _____ Class _____ Group _____ Date _____

You need: Phone with clip-on lens, a slice of bread, a closed box, a few drops of water, slide, needle.

Safety: Do not smell or breathe in the mould. Keep the box closed; throw it away sealed. Wash hands.



Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

Where will mould grow fastest? ☐ dry bread in the open ☐ moist bread in a closed box ☐ bread in a fridge
Why do you think so?

2 Measure by hand

- Place a ruler's millimetre marks under the lens. How wide is the view? _____ mm. Later, size of one cell $\approx$ view width $\div$ number of cells across.

3 Set up Prayoga, then observe

Set up Prayoga

- Clip the microscope lens exactly over the main camera.
- Open the Prayoga app and choose this experiment. The **Microscope** view zooms, focuses and lets you label the photo. Move the phone slowly up or down until the image is sharp.

- Sprinkle water on the bread, close the box and keep it in a warm place for 3–4 days.
- Lift a little mould onto a slide with the needle and view it.

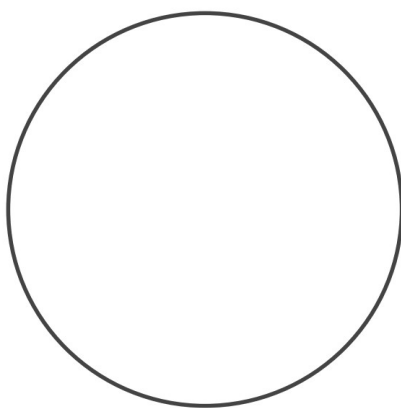
Write your readings in the table on the back.

3 Record your readings • Bread mould

Day	What you see by eye	What you see with the lens
1		
2		
3		
4		

3 Draw what you see • Bread mould

Draw the threads and spore cases; label hyphae and sporangia:



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Why does mould grow faster on moist bread in a closed box?

c) What are the black dots?

Exam-style questions

1. What is spore formation? Give an example. (2 marks)

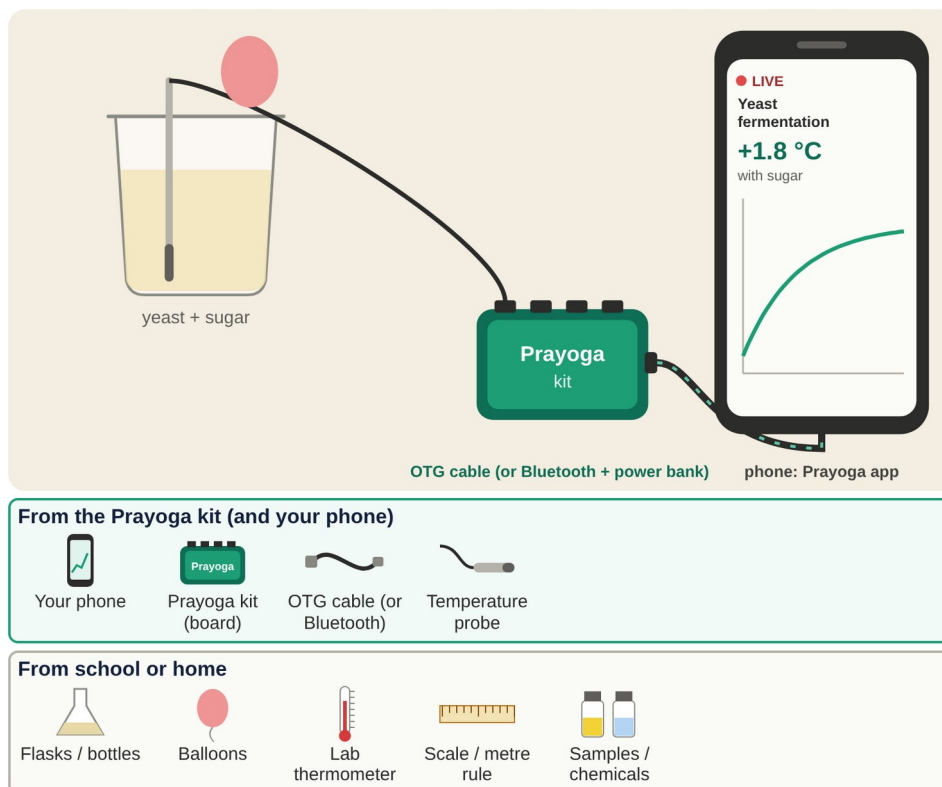
2. Draw Rhizopus and label hyphae and sporangia. (2 marks)

16. Yeast fermentation

Class 10 and Class 8 • Life Processes; Microorganisms **Basic kit**

Name _____ Class _____ Group _____ Date _____

You need: Prayoga kit (temperature probe), lab thermometer, two bottles, dry yeast, sugar, warm water (about 35 °C), two balloons, thread, scale.

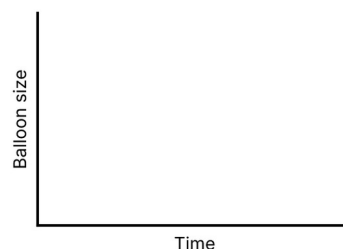


Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

The balloon will grow more on the bottle: ☐ with sugar ☐ without sugar ☐ the same

Why do you think so?



Sketch the graph you expect

2 Measure by hand

1. Measure each balloon's distance around (circumference) with thread and scale every 10 minutes.

3 Set up Prayoga, then observe

Set up Prayoga

- Plug the temperature probe into the kit.
- Connect the kit: OTG cable to the phone (cable mode), or power bank in and Bluetooth on (wireless mode). Open the Prayoga app and choose this experiment. It opens the **Temperature** view and draws the live graph. Check it shows room temperature before you start.
- Tap Start to record and Stop to finish. Tap Save to keep the readings; they can be shared as a spreadsheet.

1. Bottle A: yeast + sugar + warm water. Bottle B: yeast + warm water only. Put the probe in A and the thermometer in B; fit the balloons.
2. Record every 10 minutes for 30 minutes.

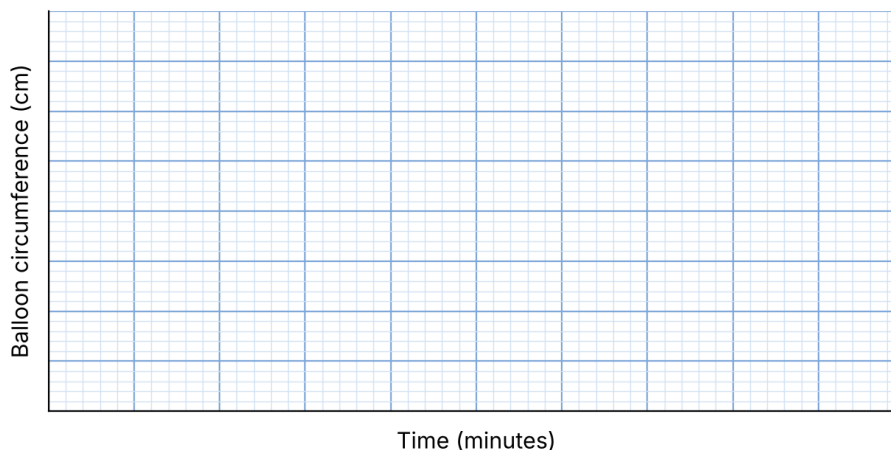
Write your readings in the table on the back.

3 Record your readings • Yeast fermentation

Time (min)	A: temp (°C, sensor)	B: temp (°C, thermometer)	A: balloon (cm)	B: balloon (cm)
0				
10				
20				
30				

3 Plot your results • Yeast fermentation

Plot your points by hand and draw the best line or smooth curve. Choose a scale that uses most of the grid. Then compare with the app's graph.



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Which gas fills the balloon? How could you test it?

c) Where is fermentation used in Karnataka kitchens?

Exam-style questions

1. Write the word equation for anaerobic respiration in yeast. (2 marks)

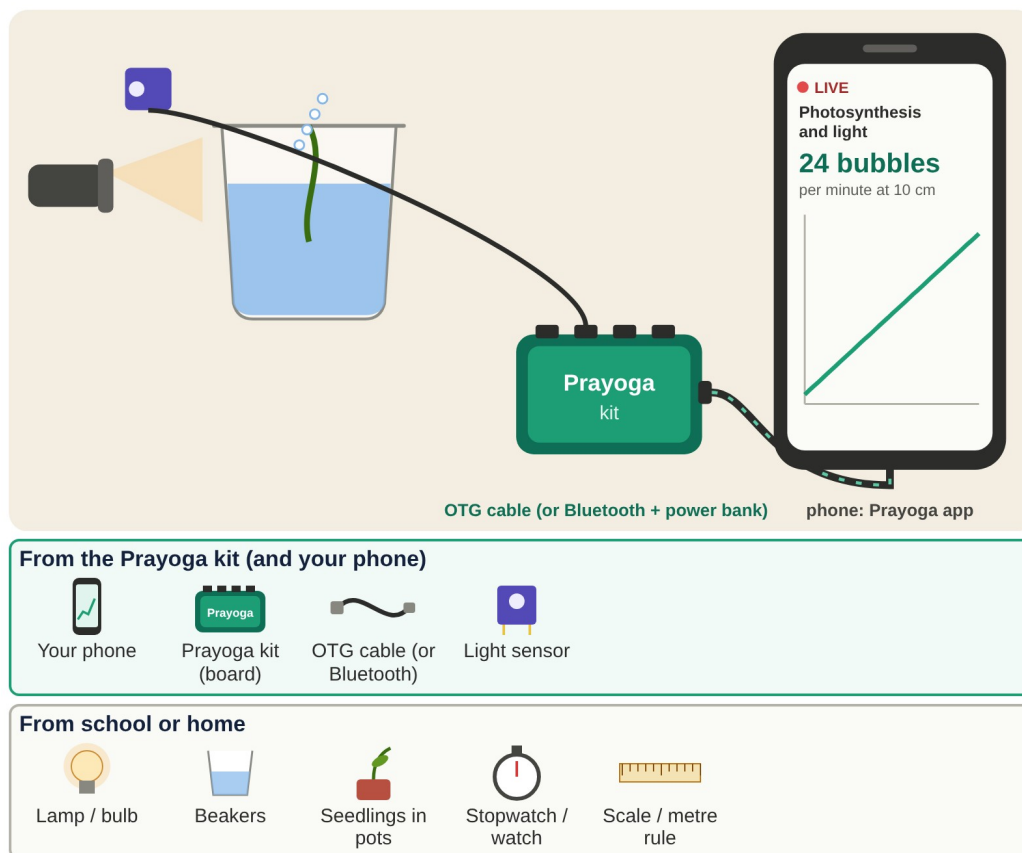
2. Name the process that makes idli batter rise. (1 mark)

17. Photosynthesis and light

Class 10 • Life Processes **Basic kit**

Name _____ Class _____ Group _____ Date _____

You need: Prayoga kit (light sensor), Hydrilla sprig, beaker of water with a pinch of baking soda, lamp or torch, scale, stopwatch.



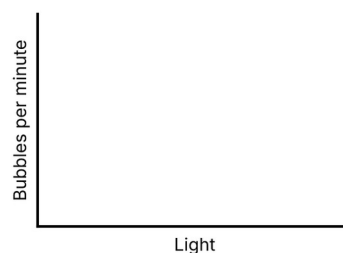
Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

Moving the lamp closer to the plant will make the bubbles: ☐ faster

☐ slower ☐ no change

Why do you think so?



Sketch the graph you expect

2 Measure by hand

- Count bubbles from the cut stem for one minute by eye, using a stopwatch. Count twice.

3 Set up Prayoga, then observe

Set up Prayoga

- Place the light sensor where the plant is.
- Connect the kit: OTG cable to the phone (cable mode), or power bank in and Bluetooth on (wireless mode). Open the Prayoga app and choose this experiment. It opens the **Light** view and draws the live graph. Note the reading for each lamp position.
- Count bubbles by eye, or film one minute with the app's camera and count while playing it back slowly.

- Place the lamp 10 cm from the beaker. Put the light sensor where the plant is and read it.
- Wait 2 minutes, then count bubbles. Repeat at 20 and 30 cm, and with the lamp off.

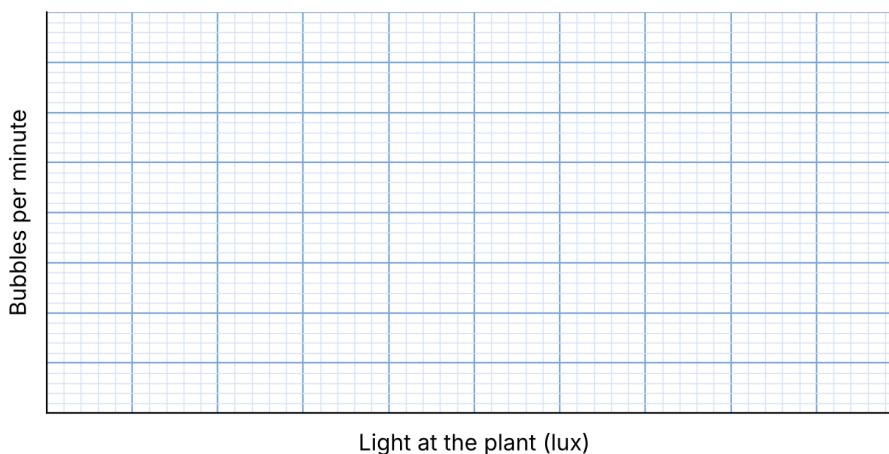
Write your readings in the table on the back.

3 Record your readings • Photosynthesis and light

Lamp distance (cm)	Light at plant (lux)	Bubbles, count 1	Bubbles, count 2	Average per minute
10				
20				
30				
Lamp off				

3 Plot your results • Photosynthesis and light

Plot your points by hand and draw the best line or smooth curve. Choose a scale that uses most of the grid. Then compare with the app's graph.



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Which gas is in the bubbles?

c) Why do we add a pinch of baking soda to the water?

Exam-style questions

1. List the raw materials and the products of photosynthesis. (2 marks)

2. What is the role of chlorophyll? (1 mark)

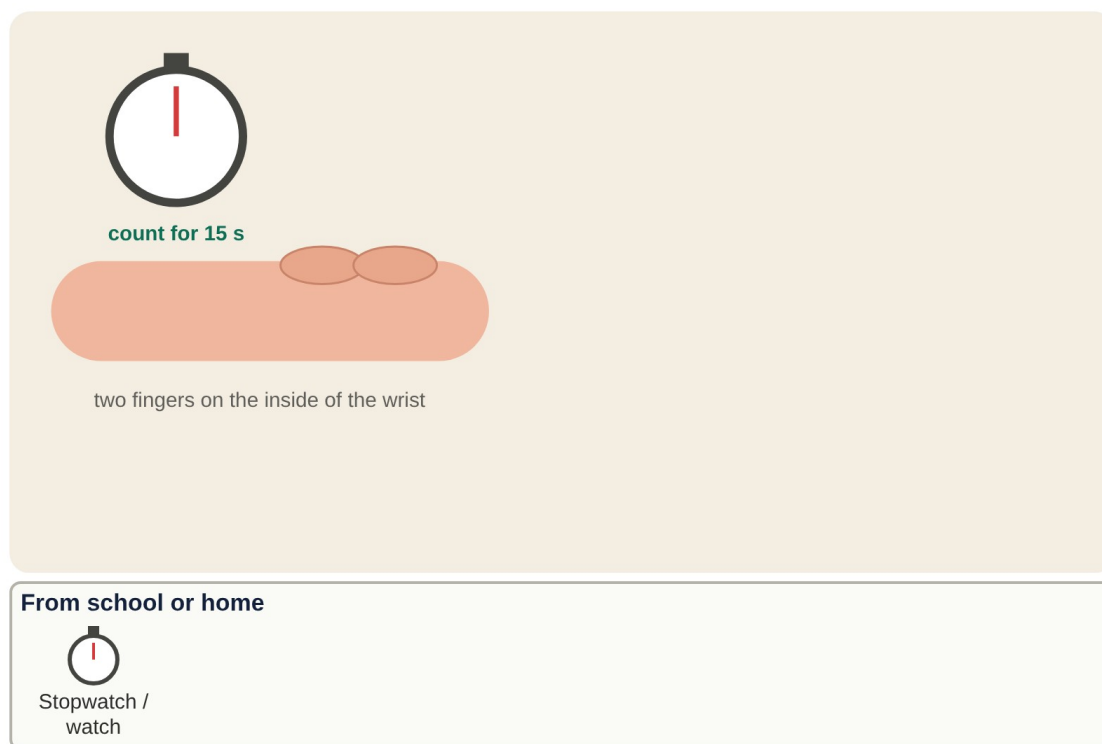
18. Pulse rate before and after exercise

Class 10 • Life Processes (transportation) **By hand + Prayoga app**

Name _____ Class _____ Group _____ Date _____

You need: Watch or phone stopwatch, a partner.

Safety: A learning activity, not a medical test. Anyone with a heart or breathing problem sits out and acts as timekeeper.

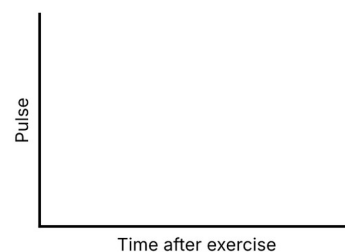


Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

After 20 jumps, your pulse will return to normal in: ☐ under 1 minute ☐ 1-3 minutes ☐ more than 5 minutes

Why do you think so?



Sketch the graph you expect

2 Measure by hand

1. Find the pulse on the inside of the wrist with two fingers (not the thumb). Count beats for 15 seconds and multiply by 4.

3 Set up Prayoga, then observe

Set up Prayoga

- Count the pulse by hand first.
- Then open this experiment in the Prayoga app: the **Pulse** view reads it from a fingertip on the camera. A learning activity only, not a medical test.

1. Sit quietly for 2 minutes and take your resting pulse.
2. Do 20 jumps on the spot. Take your pulse straight away and after 1, 2 and 3 minutes.

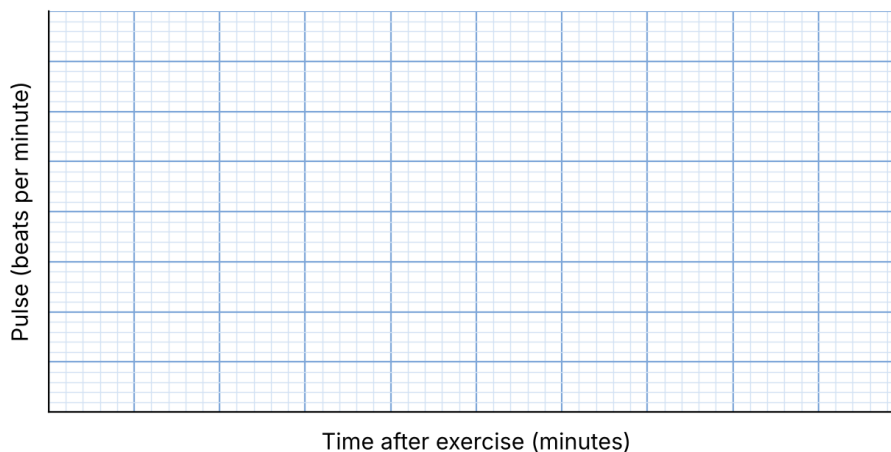
Write your readings in the table on the back.

3 Record your readings • Pulse rate before and after exercise

When	Beats in 15 s	Beats per minute ($\times 4$)
Resting		
Just after 20 jumps		
After 1 minute		
After 2 minutes		
After 3 minutes		

3 Plot your results • Pulse rate before and after exercise

Plot your points by hand and draw the best line or smooth curve. Choose a scale that uses most of the grid. Then compare with the app's graph.



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Why does the heart beat faster during exercise?

c) What in the blood carries oxygen?

Exam-style questions

1. What is double circulation? (2 marks)

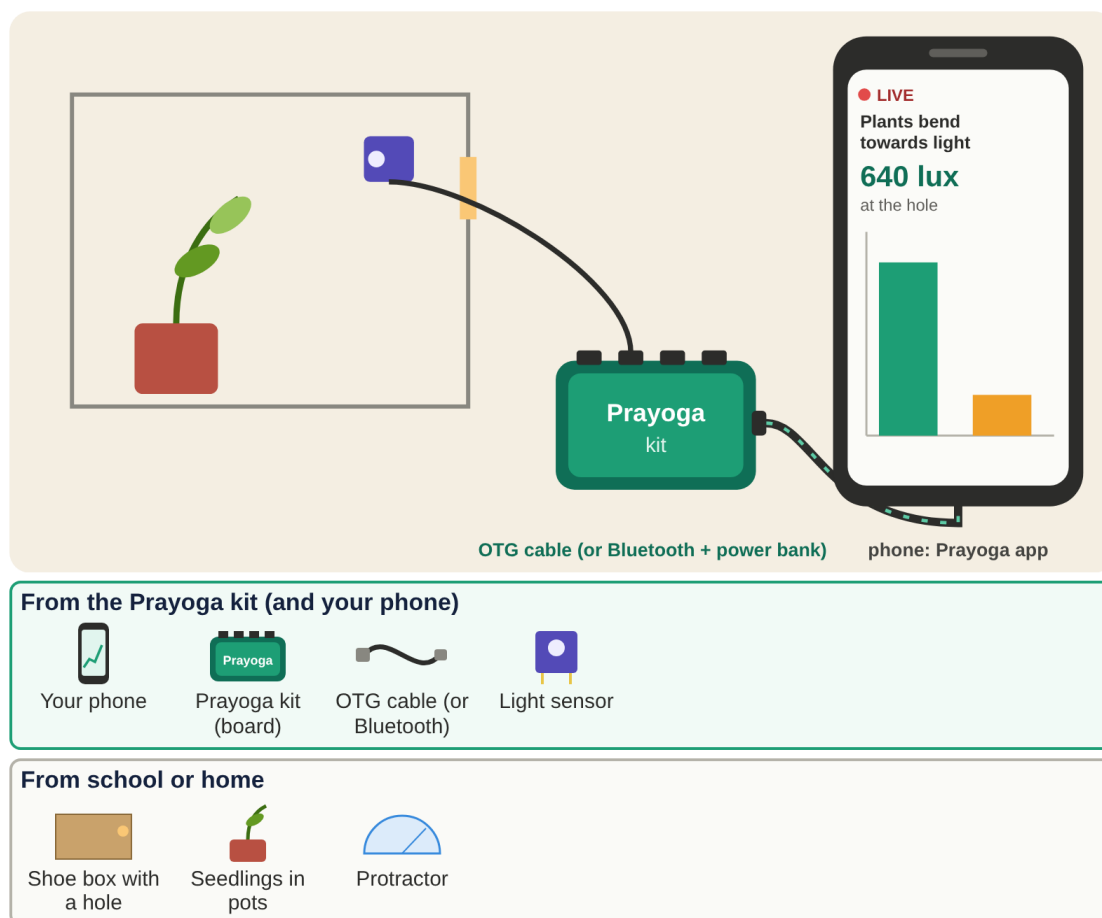
2. Why is it useful for mammals to have a four-chambered heart? (2 marks)

19. Plants bend towards light

Class 10 • Control and Coordination **Basic kit**

Name _____ Class _____ Group _____ Date _____

You need: Prayoga kit (light sensor), bean or maize seedlings in a pot, a shoe box with a hole cut in one side, protractor.



Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

After 3–4 days the shoot will: ☐ grow straight up ☐ bend towards the hole ☐ bend away from the hole

Why do you think so?

2 Measure by hand

1. Measure how far the shoot leans from vertical with a protractor each day.

3 Set up Prayoga, then observe

Set up Prayoga

- Plug in the light sensor and point it at the light source.
- Connect the kit: OTG cable to the phone (cable mode), or power bank in and Bluetooth on (wireless mode). Open the Prayoga app and choose this experiment. It opens the **Light** view and draws the live graph.
- Tap Start to record and Stop to finish. Tap Save to keep the readings; they can be shared as a spreadsheet.

1. Put the pot in the box and close the lid; keep the box near a window with the hole facing the light.
2. Each day, measure the light at the hole and beside the plant, and the bending angle.

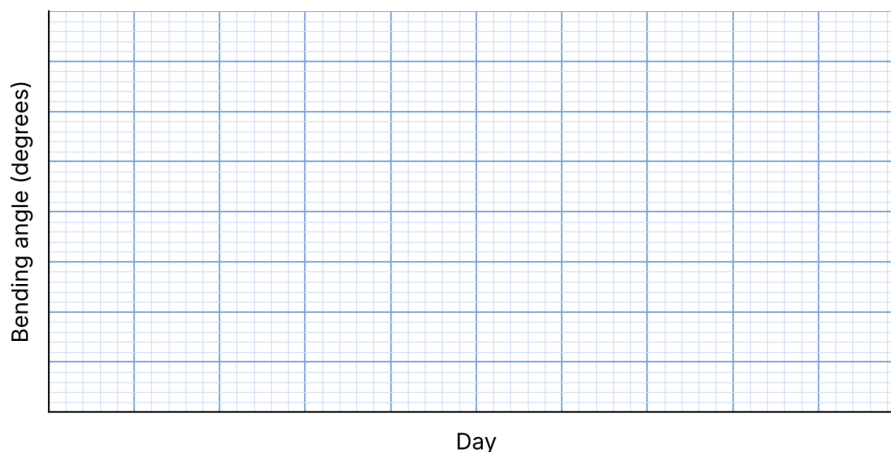
Write your readings in the table on the back.

3 Record your readings • Plants bend towards light

Day	Light at the hole (lux)	Light at the plant (lux)	Bending angle (°)
1			
2			
3			
4			
5			

3 Plot your results • Plants bend towards light

Plot your points by hand and draw the best line or smooth curve. Choose a scale that uses most of the grid. Then compare with the app's graph.



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) Which part of the plant bends? Which hormone causes it?

c) Roots grow downwards. What is this response called?

Exam-style questions

1. What is phototropism? (1 mark)

2. How does auxin make a shoot bend towards light? (2 marks)

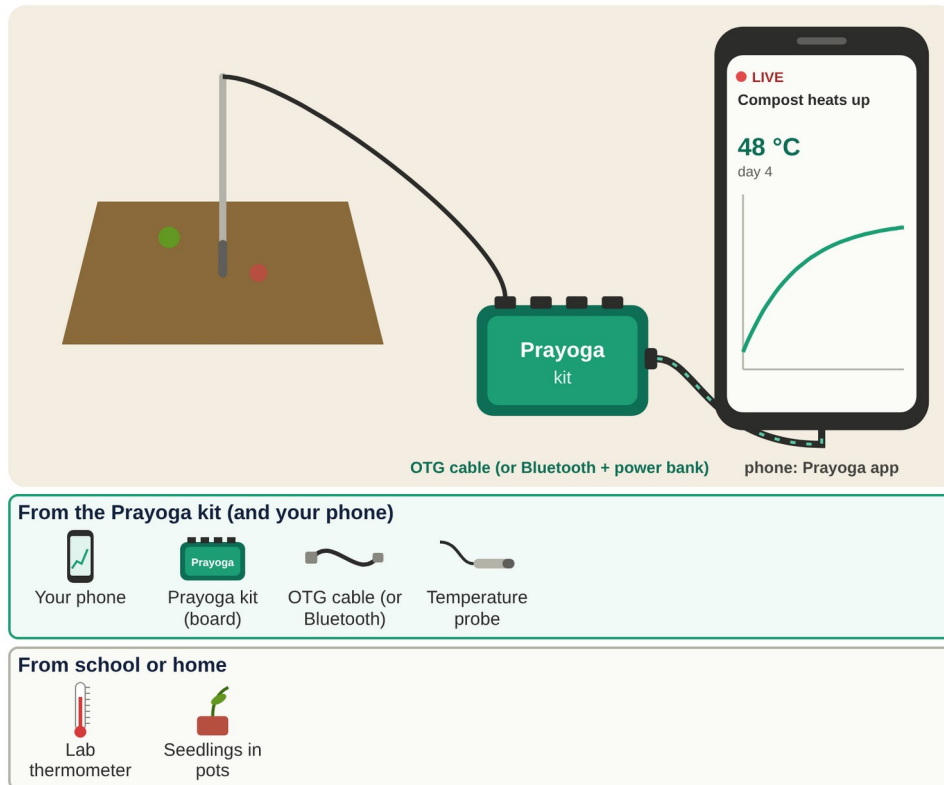
20. Compost heats up

Class 10 • Our Environment **Basic kit**

Name _____ Class _____ Group _____ Date _____

You need: Prayoga kit (temperature probe), lab thermometer, a compost pit or a pot filled with dry leaves, vegetable peels and a little soil, water.

Safety: Wash hands after handling compost.

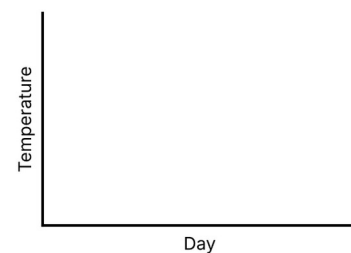


Above: how the parts connect, and every instrument you need. The animated version is on the Prayoga setup page.

1 Predict (before you touch the kit)

Compared with nearby soil, the compost will be: ☐ warmer ☐ cooler ☐ the same

Why do you think so?



Sketch the graph you expect

2 Measure by hand

1. Push the lab thermometer into the nearby soil to the same depth and read it each day.

3 Set up Prayoga, then observe

Set up Prayoga

- Plug the temperature probe into the kit.
- Connect the kit: OTG cable to the phone (cable mode), or power bank in and Bluetooth on (wireless mode). Open the Prayoga app and choose this experiment. It opens the **Temperature** view and draws the live graph. Check it shows room temperature before you start.
- Tap Start to record and Stop to finish. Tap Save to keep the readings; they can be shared as a spreadsheet.

1. Push the probe into the middle of the compost.
2. Record both temperatures at the same time each day for a week; keep the compost damp.

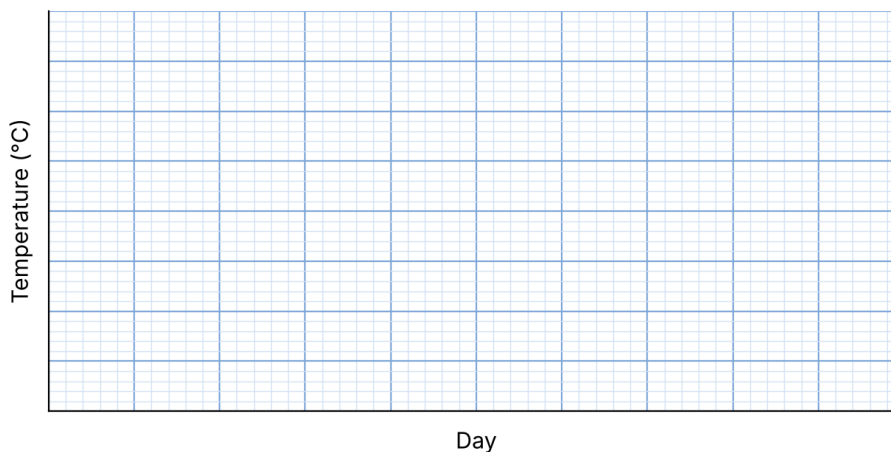
Write your readings in the table on the back.

3 Record your readings · Compost heats up

Day	Compost (°C, sensor)	Nearby soil (°C, thermometer)	Difference (°C)
1			
2			
3			
4			
5			
6			
7			

3 Plot your results · Compost heats up

Plot your points by hand and draw the best line or smooth curve. Choose a scale that uses most of the grid. Then compare with the app's graph.



4 Explain

a) Was your prediction right? If not, what changed your mind?

b) What makes the compost warm?

c) Which kinds of waste cannot be composted? Why?

Exam-style questions

1. What are biodegradable and non-biodegradable substances? Give one example of each. (2 marks)

2. What are decomposers? Why are they important? (2 marks)

Teacher answer key

1. Germinating seeds give off heat

- Germinating seeds become about 1–3 °C warmer than the boiled seeds.
- Living seeds respire and release energy as heat; boiled seeds are dead.
- Glucose + oxygen → carbon dioxide + water + energy ($C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{energy}$).
- The control shows the heat comes from living seeds, not the room.

2. Carbon dioxide is given out in respiration

- Pressure falls slowly with germinating seeds (often a fraction of a kPa to about 1–2 kPa in an hour); little change with boiled seeds.
- Seeds use oxygen and give out CO_2 ; KOH absorbs the CO_2 , so the amount of gas falls. Warming the flask would raise the pressure and hide the effect.
- KOH absorbs carbon dioxide.

3. Reaction time

- Typical catch 15–30 cm, about 0.17–0.25 s; slower while counting.
- Catching is a voluntary action through the brain, which is why distraction slows it; a reflex goes through the spinal cord and is faster.
- Reflex action: a quick, automatic response, e.g. pulling the hand away from a hot object.
- Receptor → sensory neuron → spinal cord (relay neuron) → motor neuron → effector (muscle).

4. Testing local soil and water

- Borewell water usually has higher conductivity than tap water or rainwater. Many Karnataka farm soils are about pH 6–8.5.
- Salts come from rocks the water passes through, fertilisers and over-irrigation; acid from some fertilisers and heavy rain washing out bases.
- Water is limited; groundwater is falling; it is needed for farming, industry and living things.
- Rainwater harvesting: collecting and storing rainwater, or letting it soak into the ground to recharge groundwater.

5. Soil for crops

- Most crops prefer pH about 6–7.5. More clay means more water held.
- Acidic soil: add lime. Alkaline soil: add gypsum or organic matter.
- Manure: organic, bulky, releases nutrients slowly, improves soil texture. Fertiliser: chemical, gives specific nutrients quickly.
- Crop rotation, mixed cropping, green manure, compost.

6. Plants and sunlight

- The corner plant grows tall, thin and pale; the window plant is green and sturdy.
- Light is needed to make food (photosynthesis).
- Carbon dioxide + water → (sunlight, chlorophyll) → glucose + oxygen.
- Leaves make food by photosynthesis.

7. Onion peel cells

- Brick-shaped cells in rows with clear walls; nucleus dark with iodine; cells about 0.2–0.3 mm long.
- Iodine stains the nucleus so it shows up.
- The cell wall.

8. Cheek cells

- Flat, irregular cells about 0.05 mm across with a nucleus and no cell wall; they may overlap.
- No cell wall, so the shape is not fixed.
- Plant cells have a cell wall, a large vacuole and plastids (chloroplasts); animal cells do not.
- Cell (plasma) membrane.

9. Plant and animal tissues

- Parenchyma: thin walls, loosely packed. Collenchyma: walls thickened at the corners. Sclerenchyma: thick, lignified, dead cells.
- Striated: stripes, long cylindrical, several nuclei. Smooth: spindle-shaped, one nucleus, no stripes. Cardiac: branched with one nucleus per cell. Nerve cell: cell body, dendrites, long axon.
- Coconut husk: sclerenchyma.

10. Stomata on a leaf

- Many more stomata on the lower side; it is shaded, so less water is lost.
- Carbon dioxide in, oxygen out, and water vapour out (transpiration).
- Guard cells swell with water and the pore opens; they lose water and it closes.

11. Pollen grains

- Hibiscus pollen is large (about 0.1–0.15 mm), round and spiky; pollen differs between flowers.
- Spikes and stickiness help pollen hold onto insects. It must land on the stigma.
- Pollination: transfer of pollen from anther to stigma. Self (same flower or plant) and cross (another plant of the same kind).

12. Binary fission and budding

- Amoeba divides into two equal daughter cells; a yeast cell has a small bud on one side; Hydra has a bud growing from its body wall.
- Binary fission: the parent splits into two equal parts. Budding: a small outgrowth grows and then separates. Fed yeast grows actively, so more cells are budding.
- Yeast and Hydra.

13. Parts of a dicot seed embryo

- Two cotyledons (dicot). Plumule (tiny shoot) and radicle (tiny root) lie between them at one end.
- Cotyledons store food for the young plant. Soaking softens the seed coat and swells the seed so it opens easily.
- Plumule: shoot. Radicle: root.

14. Life in a drop of pond water

- Commonly seen: Paramecium and other protozoa, green algae (Spirogyra threads, diatoms), small animals such as rotifers.
- Green organisms make food by photosynthesis.
- Bacteria, fungi, protozoa, algae (and viruses).
- Making curd and bread, medicines (antibiotics), composting.

15. Bread mould

- White threads (hyphae) with tiny black round spore cases (sporangia) on top.
- Mould needs moisture and warmth; spores from the air settle on the bread.
- Spore formation: asexual reproduction in which spores released from sporangia grow into new organisms, e.g. Rhizopus (bread mould).

16. Yeast fermentation

- Bottle A's balloon grows and its temperature rises by about 1–2 °C; little change in B.
- Carbon dioxide: it turns limewater milky. Idli and dosa batter.
- Glucose → ethanol + carbon dioxide + energy (in the absence of oxygen).
- Fermentation.

17. Photosynthesis and light

- More light, more bubbles; very few with the lamp off.
- Oxygen (relights a glowing splinter). Baking soda supplies carbon dioxide. A lamp very close also heats the water, which is worth discussing.
- Raw materials: carbon dioxide and water (with sunlight). Products: glucose and oxygen.
- Chlorophyll absorbs light energy.

18. Pulse rate before and after exercise

- Resting pulse for teenagers is often 60–100; it rises after exercise and returns over a few minutes. Results vary; do not compare students.
- Muscles need more oxygen and glucose. Haemoglobin in red blood cells carries oxygen.
- Double circulation: blood passes through the heart twice in one complete circuit of the body.
- Oxygen-rich and oxygen-poor blood are kept separate, giving an efficient oxygen supply for high energy needs.

19. Plants bend towards light

- The shoot bends more each day towards the light.
- The shoot tip; auxin. Roots: geotropism (gravitropism).
- Phototropism: growth movement in response to light.
- Auxin collects on the shaded side; cells there grow longer, so the shoot bends towards the light.

20. Compost heats up

- Compost is warmer than the soil, often by 5–30 °C, peaking after a few days.
- Microorganisms breaking down waste release heat as they respire. Plastic, glass and metal cannot be broken down by microbes.
- Biodegradable: broken down by microbes (peels, paper). Non-biodegradable: not broken down (plastic).
- Decomposers (bacteria, fungi) break down dead matter and return nutrients to the soil.