

A large, circular, blue-tinted image showing a microscopic view of numerous cells, likely animal cells, with prominent nuclei. The cells are arranged in a dense cluster, and the image is framed by a thick blue border.

Saraswati
LAB MANUAL
BIOLOGY

Strictly according to the latest syllabus

Saraswati
LAB MANUAL
BIOLOGY
FOR CLASS XII

By
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SYLLABUS

Evaluation Scheme	Maximum Marks: 30
One Major Experiment	5 Marks
One Minor Experiment	4 Marks
Slide Preparation	5 Marks
Spotting	7 Marks
Practical Record + Viva Voce	4 Marks
Project Record + Viva Voce	5 Marks
Total	30 Marks

A. List of Experiments

1. Study pollen germination on a slide.
2. Collect and study soil from at least two different sites and study them for texture, moisture content, pH and water holding capacity. Correlate with the kinds of plants found in them.
3. Collect water from two different water bodies around you and study them for pH, clarity and presence of any living organisms.
4. Study the presence of suspended particulate matter in air at the two widely different sites.
5. Study of plant population density by quadrat method.
6. Study of plant population frequency by quadrat method.
7. Prepare a temporary mount of onion root tip to study mitosis.
8. Study the effect of the different temperatures and three different pH on the activity of salivary amylase on starch.
9. Isolation of DNA from available plant material such as spinach, green pea seeds, papaya, etc.

A. Study/observation of the following (Spotting)

1. Flowers adapted to pollination by different agencies (wind, insect, bird).
2. Pollen germination on stigma through a permanent slide.
3. Identification of stages of gamete development, *i.e.*, T.S. of testis and T.S. of ovary through permanent slides (from grasshopper/ mice).
4. Meiosis in onion bud cell or grasshopper testis through permanent slide.
5. T.S. of blastula through permanent slide.
6. Mendelian inheritance using seeds of different colour/size of any plant.
7. Prepared pedigree charts of any one of genetic traits such as rolling of tongue, blood groups, ear lobes, widow's peak, colour blindness.
8. Controlled pollination—emasculation, tagging and bagging.
9. Common disease-causing organisms like *Ascaris*, *Entamoeba*, *Plasmodium*, Roundworm through permanent slide or specimens. Comment on symptoms of diseases that they cause.
10. Two plants and two animals (models/virtual images) found in xeric conditions. Comment upon their morphological adaptations.
11. Two plants and two animals (models/virtual images) found in aquatic conditions. Comment upon their morphological adaptations.

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INTRODUCTION

YOUR BIOLOGY LABORATORY

Laboratory is a place where the necessary equipments, chemicals and required facilities are available needed by a science student and teacher to perform the experiments.

It is the place where one tests his theoretical knowledge practically for its validity or truthfulness. One gets opportunity to learn the science by performing practicals. A science student cannot do or learn without a laboratory. It is a very significant place as many discoveries, inventions, theories have emerged out of this place.

WHAT YOU NEED

Before going into laboratory you need certain things that will help you to study or perform the experiment.

1. A *laboratory note book* for taking down instructions given by the teacher for an experiment. For noting the observations made by you and for sketching the rough diagrams.
2. *Practical book* for comparing the information, observation, sketches and it guides you how to proceed with the experiment.
3. *Pen, pencils (HB), eraser, razor blade, scale etc.*
4. During section cuttings or slide making you need *various instruments*, such as—scissors, a bone cutter, forceps (00), big forceps, scalpel, dissecting needles, brush, dropper, a piece of cloth etc.

Always you can carry along with you in for geometry box a set of forceps, blade, brush, dropper and a piece of cloth.

5. A *practical record file*. (To be submitted for signature of teacher and later to examiner during final practical exams. It carries 3 marks + 2 marks for Viva Voce = 5 marks).

Always reach to the laboratory in time. You should carry the above listed materials along with you, whenever you go to lab for work. Enquire from the teacher in advance what is to be done or which experiment is to be performed. Read it from the practical book and ask questions to remove the doubts if any, you have.

Take your allotted seat.

Do not waste time in roaming around in laboratory, disturbing classmates and avoiding teacher's instructions.

Remember a well behaved and sincere (science) student is always benefitted and liked by the teacher.

1. WHILE WORKING IN LABORATORY

1. Occupy your seat.
2. Carefully listen or note down the instruction given by the teacher. Always be attentive.
3. Read the experiment to be done before you start the work/experiment.
4. Ask or collect the materials from the laboratory attendant or rack.
5. Carry on the work without disturbing others. However, you should take guidance from the teacher and at the end of experiment show your result or work whether it is correct or not.
6. Take care of instruments, glasswares and chemicals. Use them carefully.
7. Keep your table clean.

2. MAKING A PRACTICAL RECORD FILE

1. Importance of Records. There are two records to be submitted at the end of exams :

- (a) A **practical record file** is important record. As it carries 2 marks for maintenance and 2 marks (Total 4 marks) for Viva Voce based on the contents or work recorded.

On the day of final practical examination, it has to be submitted to the examiner. Use a good file.

- (b) Other record is maintained for project work. It is called **project file** or **report record**. It carries 5 marks. (3 for record + 2 for Viva Voce based on it).

2. Maintenance of Record

- (a) After each work done in laboratory it is properly recorded. The details, observation, procedure, experiment etc. is written on the writing sheet. **Writing or recording of observations is done on left hand side only.** Write neatly and precisely with blue ink pen.
- (b) Refer the practical book for it.

On the drawing sheet (right side) the diagram is made with the pencil without shading. Neat and well labelled diagrams carry weightage.

- (c) Mention the day, date and get it checked when the work is complete. For keeping your record maintained neat and tidy, with permission of your teacher, keep the used and checked sheets at home, carry one or two blank sheets only.

3. Categories or Types of Work

There are various types of work to be done by you in laboratory. The recording of same is different for different work. They are of following types:

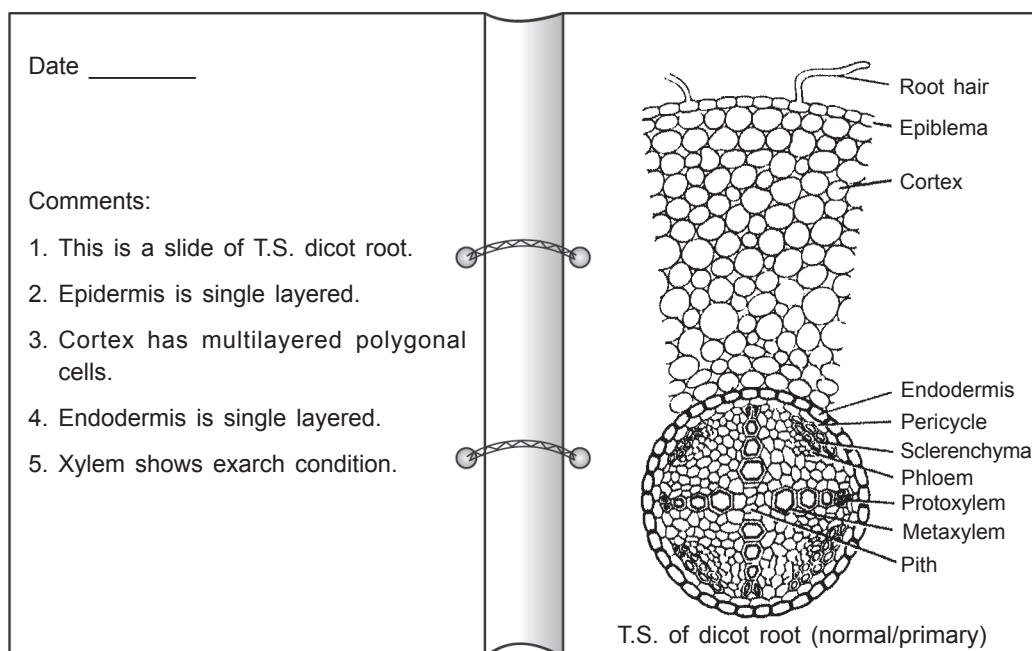
RECORDING OF OBSERVATIONS OF SLIDES (TEMPORARY OR PERMANENT SLIDES)

1. While writing the observations, write the brief description of the structure in small sentences under heading/comments.
2. Write in maximum 5 to 6 points.
3. Note: The procedure of making slides is not written.
4. A neat and well labelled diagram should be drawn.

RECORDING OF OBSERVATIONS OF SPECIMENS

1. While writing the observations write the brief description of the structure in small sentences under heading-comments.
2. Write in maximum 5-6 points.
3. A rough labelled diagram should be drawn.

These two categories are used for spotting during examinations. You will be given three spots and 1-1½ minutes to write about a spot. Hence, the comments should be brief, upto the mark, with one or two identification features. Your writing skill is seen by this.



RECORDING OF PHYSIOLOGICAL EXPERIMENTS

You are supposed to write—

Aim, materials required, procedure or setting of experiment, observations, recordings/readings, inference, result and precautions, and a labelled diagram.

Note:

1. All the work should be supplemented by good diagrams on the drawing sheet.
2. On one page 1 or 2 diagrams can be drawn depending upon the size of the diagrams.
3. Follow the instructions given by your teacher.
4. Take the help of practical book.
5. Keep your record clean and tidy.

3. MAGNIFYING INSTRUMENTS

There are many things, materials, specimens that cannot be seen clearly with our naked eyes. Therefore, we need the help of certain magnifying instruments in order to aid our naked eye for better vision and study. The common magnifying instruments are—

(a) Magnifying Glass (Hand Lens)

It is a very common magnifying instrument also known as hand lens. It is a biconvex lens mounted on a handle. It is of different sizes with magnifying powers 2X, 5X or 10X. It is commonly used to magnify an object.

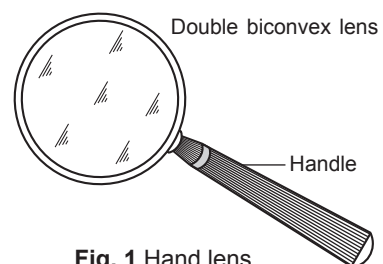


Fig. 1 Hand lens

(b) Dissecting Microscope

It is a simple microscope with better magnifying power than hand lens. The main parts are—

1. **Base.** It supports the other parts of the microscope. It is either horse shoe shaped or circular.
2. **Stand.** A vertical stand to hold the microscope.
3. **Vertical limb.** A short cylindrical rod that can be moved up and down with the help of adjustment screw.
4. **Arm.** It is a horizontal flat arm attached to the vertical limb. It can be folded. At the free end is a hole in which the lens is fitted. It is of various magnifications such as 5X, 10X, 20X. It can be changed for better magnification and through it the object is seen.
5. **Stage.** A rectangular glass plate attached to the lower end of the stand. It is used to keep the object over it for observation. Two clips are there to hold the slide in position.
6. **Mirror (concave).** A concave mirror is fitted to the lower end of the stand. It is used to reflect the light rays on the stage.

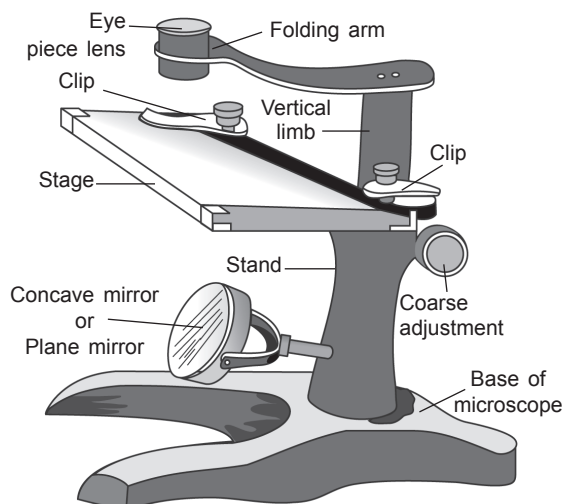


Fig. 2 Dissecting microscope

Use or Working of Dissecting Microscope

1. The object is kept on the stage.
2. The objective lens is brought over the object and is focused by adjustment screw for better magnification or vision.
3. For better vision light rays are focused on the stage by adjusting the mirror.
4. It is used for low magnification of objects.
5. After use keep the dissecting microscope in the box and cover the lens.

(c) Compound Microscope

Mechanical Parts of Compound Microscope

1. **Base.** A horse shoe-shaped structure on which the various parts rest.
2. **Pillar.** A vertical projection from the base.
3. **Inclination joint.** The joint attached to the pillar from where the microscope can be inclined, forward or backward.
4. **Arm.** A curved handle to hold the microscope.
5. **Stage.** A rectangular flat plate on which the object is kept for magnification. It has a hole in the centre through which the light rays pass. Two clips are present to hold the slide in position.
6. **Diaphragm.** To adjust the amount of light needed. It is of two types—disc diaphragm with a series of holes, and iris diaphragm—like that of a camera.
7. **Condenser.** A condenser with lens for passing the light beam.
8. **Body tube.** The tubular hollow part attached to the arm at upper end is body tube. It can be adjusted up or down by the screw.
9. **Nose piece.** It is a circular metallic part which can be rotated. It has

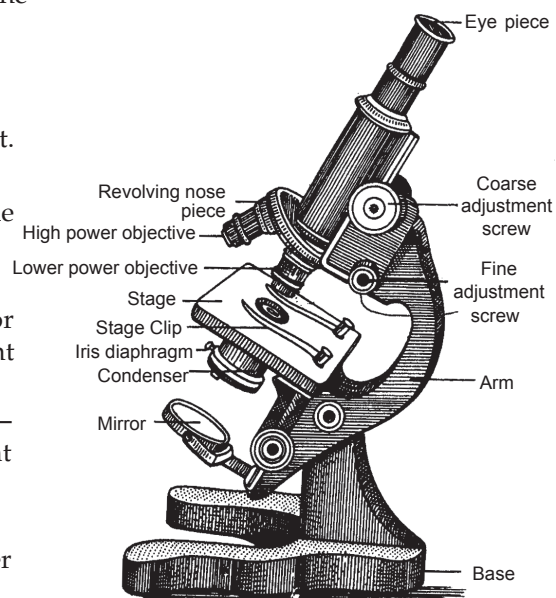


Fig. 3 Compound microscope

three (holes) screws to fit three objective lenses.

10. **Adjustment screws.** Coarse adjustment screw is at the upper end of the arm. It is bigger in size. It is used to focus the object by bringing the body tube up and down.

11. **Fine adjustment screw.** It is used for fine focusing of the lens on the object for clear structure.

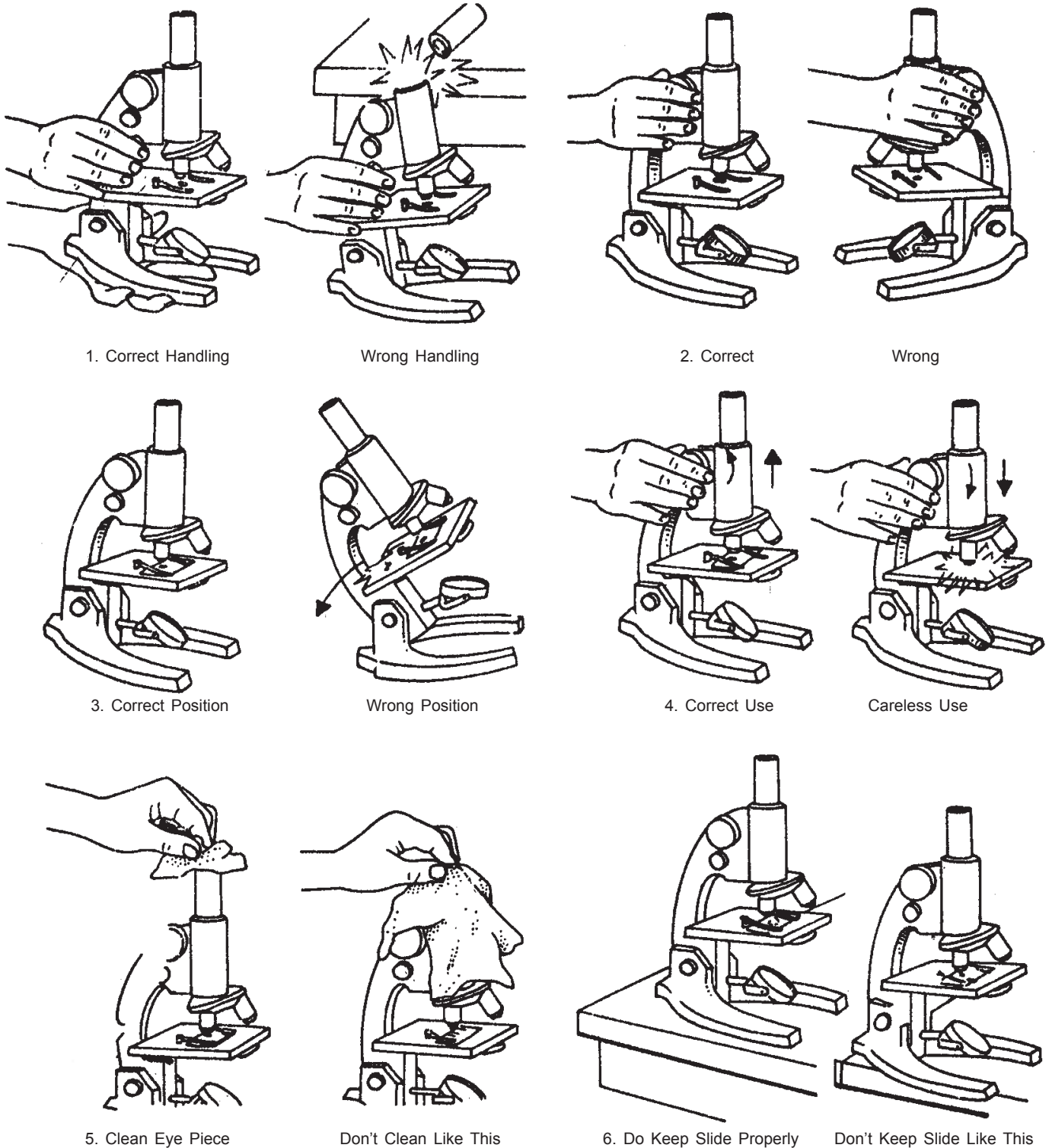


Fig. 4 Handling of microscope

PRACTICAL RECORD BOOK

[This section is regarding your practical record book or file. This is an important record to be possessed by each biology student. Four marks are allotted for this file. And it is evaluated as following.]

1. Completeness of Practical Work

- All the practicals done in the practical classes during the session are recorded in this record or file. You have to record all the practicals, related diagrams/figures, observations, result etc., performed by you in the practical classes.
- These records are written on the left hand side on the writing (ruled) sheets. The labelled figures are drawn on the right hand side on the drawing (white) sheets.
- The experiments performed and noted should be complete in all respects—*viz.*, date, experiment number, aim, requirements, procedure, observation table, inference, conclusion, diagram and precautions.

2. Regular Submission of Record

- The record file should be submitted to the concerned teacher. After, completing the assignment or practical, as said above, on the next day or the proposed date given by the teacher.
- See that your work is checked by the concerned teacher. Regular submission for checking is very important. It means student is sincere and regular in work. Irregularly checked work compels the examiner in board examination to draw wrong conclusion against you.

3. Neatness and Accuracy of Record

- A neat and tidy record file is liked by everyone. This shows that the student is good and takes interest in studying his subject. Good labelled diagrams, observation tables, written work, properly kept sheets, file etc., all adds to your personality. It is an advantage over careless and untidy work. Take care of your record file.

4. Viva voce on Record

- A general Viva voce is there based on your record. Prepare yourself accordingly from the viva voce given after each experiment. This is to judge weather the student has merely copied the experiments from the book or he/she has actually, performed it in the laboratory. Also, this helps the examiner to know that how much the student knows about or remembers about the experiments he/she had done in the class. Keep revising the work done at intervals.

A GOOD RECORD FILE

1. It is properly covered with brown or any coloured chart paper. With your name, class, section, session and your board roll no., on a label.
2. A complete index page with details and teacher's signature.
3. Practical sheets properly tagged/fastened with lace to the file. (No loose sheets please.)
4. All experiments/records completely checked and in a sequence.
5. The edges/corners of file not worn/damaged.

Some Instruments used in Biology Laboratory

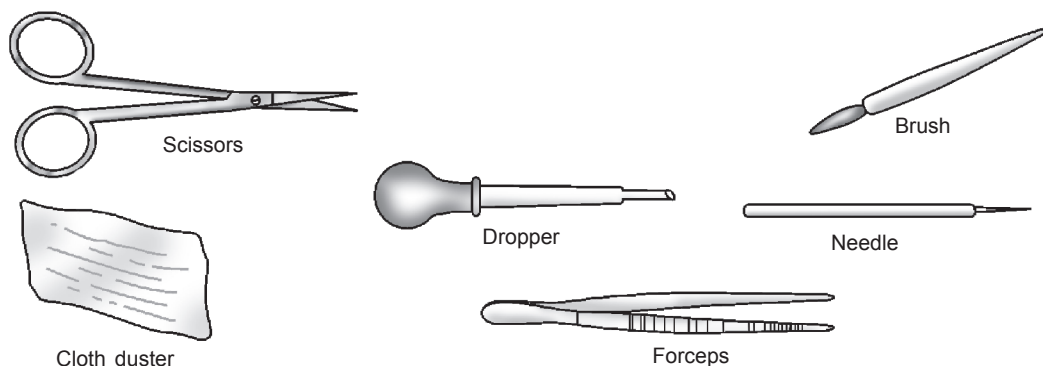


Fig. 5 Some instruments used in biology lab

SECTION – A

EXPERIMENT 1

Pollen Germination

AIM

To study the pollen germination on a slide (*Portulaca*/grass/china rose).

Pollen Germination on a Slide

YOU NEED

(1) Study material—*Portulaca* or china rose flower, (2) Slide, (3) Coverslips, (4) Microscope, (5) Chemicals -- sucrose 10 g, boric acid 10 mg, potassium nitrate 10 mg, magnesium sulphate 20 mg, calcium nitrate 30 mg, 100 ml distilled water, (6) Beaker and a dropper.

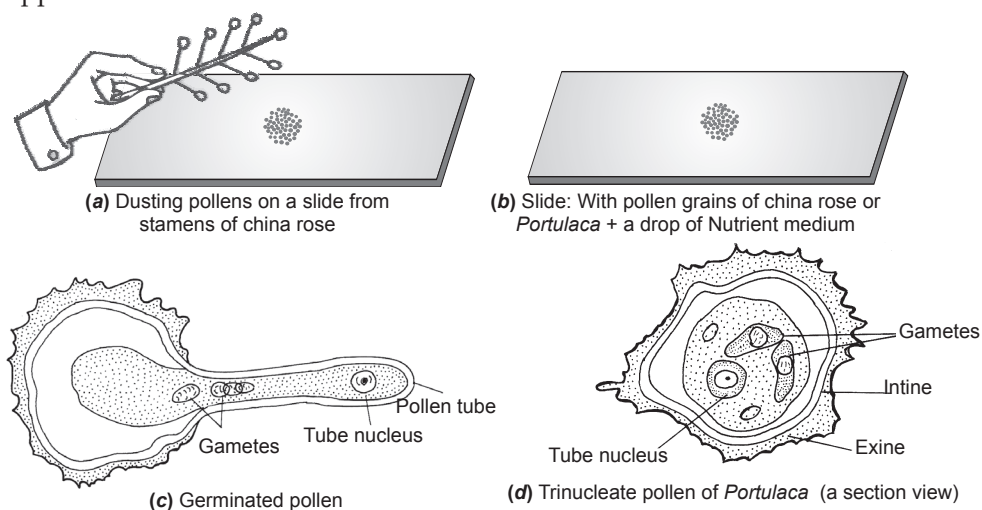


Fig. 1.1 (a) Germination of pollen grain and (b) a section view

HOW TO DO IT

1. Mix the above chemicals in the required amount in 100 ml of distilled water in a clean and dry beaker. This solution is called *nutrient medium*.
2. Dust the pollen grains from the stamens of a flower on a clean and dry slide.
3. Add a drop of nutrient medium with a dropper over the pollen grains.
4. Let the slide be kept undisturbed for 10-15 minutes.
5. Observe the slide under low power of microscope.
6. Write comments and draw the labelled diagram in your practical record file.

OBSERVATION

You will see

1. Some pollen grains will germinate and develop pollen tube. These pollen grains are said as viable pollen grains.
2. Some pollen grains may not show the development of pollen tube. These pollens did not germinate. They are called as *non-viable pollen grains*.

CONCLUSION

Viable pollen grains germinate in nutrient medium.

- Note:**
1. Pollen grains are products of meiosis cell division. Formation of pollen grains is called *microsporogenesis*.
 2. These structures have variable shapes, such as they may be spherical, oblong or triangular in various species.

3. A mature pollen has two layers—
 - (a) **exine** the tough, carved and rough protective coat made of sporopollenin, and
 - (b) **intine** smooth inner layer made of pectocellulose.
4. At certain places exine layer is thin and delicate known as **germ pores** through which pollen tube (*intine*) pushes out with male gametes and other cells.

BE CAREFUL

1. Use clean and dry slide for dusting pollens on it.
2. Use two-three drops of nutrient medium.

VIVA VOCE QUESTIONS

Q1. What is pollen grain?

Ans. It is the product of meiosis cell division in angiosperms.

Q2. What is the other name of pollen?

Ans. Microspore.

Q3. What is the outer coat of pollen called?

Ans. Exine.

Q4. What does the pollen contain?

Ans. Pollen has male gametophytes (gametes) and tube nucleus/cell or generative cell and tube nucleus.

Q5. What is pollen tube?

Ans. Pollen tube is extension of intine.

Q6. What is the role of pollen tube?

Ans. Pollen tube carries the male gametes to the ovule.

Q7. What is the source of pollens?

Ans. Stamens with mature anther lobes.

Q8. Why is nutritive medium needed?

Ans. It is needed for source of energy for the pollen tube to grow?

Q9. Do the flowers (stigma) also have a nutritive medium that helps the pollen to grow on it after pollination?

Ans. Yes.

Q10. From which place/spot does the pollen come out of the pollen grain?

Ans. Germ pore.

MULTIPLE CHOICE QUESTIONS

Tick (✓) the correct answer/statement in the box.

1. The pollen cell has —

(a) Tube nucleus

(b) Generative nucleus

(c) Both (a) and (b)

(d) None of the above

2. Spermatogenesis means —

(a) Formation of pollens

(b) Formation of male gametes

(c) Formation of gametes

(d) All the above

3. Male gametes are formed from —

(a) Tube cell

(b) Vegetative cell

(c) Pollen

(d) Generative cell

4. Pollen is trinucleate as a rule in —

(a) Portulaca

(b) Cereal crops like wheat

(c) Maize and sugarcane

(d) All the above

5. Tube nucleus in the pollen tube —

(a) Always precedes gametes

(b) Follows gametes

(c) Disturbs gametes

(d) Kills gametes

Ans. 1. (c), 2. (b), 3. (d), 4. (d), 5. (a)

EXPERIMENT 2

Study of Soil

AIM

To collect and study soil from at least two different sites and study them for texture and moisture content, pH and water holding capacity of soil. To correlate with the kinds of plants found in them.

A. Texture of Soil

(From different sites – (1) Garden, (2) Field and (3) Roadside)

AIM

To study the texture* of soil.

*A physical property.

YOU NEED

(1) Hand lens, (2) Sieves with meshes of different sizes, (3) Soil samples collected from different sites, (4) White sheets/ plain papers.

HOW TO DO IT

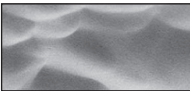
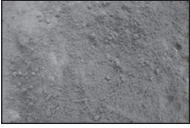

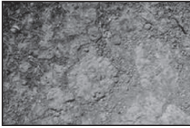


There are two methods to study the texture of soil.

(a) Study by hand lens and in between fingers

1. Take little soil in hand and feel it, and also squeeze it in between the thumb and fingers. (Dry soil as well as moist soil.)
2. Note your observations and compare/tally it with the information given in the table. And note it in your practical record file.
3. Take little soil on the white paper. Observe it under the hand lens. (Dry soil as well as moist soil.)

Note your observations and compare it with the information given in the Table A.

Table A: Texture of Soil (A physical property)

S.No.	Texture		Soil as felt between thumb and fingers
1.	Sand		(a) Individual dry soil grains may be seen or felt. (b) They form a cast when moist soil is squeezed.
2.	Sandy loam		(a) Individual soil grains can be seen and felt. (b) They form a cast but fall apart when dry soil is squeezed. (c) Moist soil forms a cast that does not break.
3.	Loam		(a) Gentle and gritty feeling. (b) When dry soil is squeezed, forms a cast bearing a careful handling. (c) Moist soil cast is easily handled without breaking.
4.	Silt loam		(a) Soil appears cloddy or lumpy with soft feeling. (b) Dry and moist soil forms cast that can be easily handled without breaking it. (c) If moist soil is squeezed it does not form ribbons.
5.	Clay loam		(a) Hard and dry soil breaks into lumps or clods. (b) Moist soil when pinched, it forms thin ribbon which breaks readily. (c) Moist soil forms cast that can bear much handling.
6.	Clay		(a) Dry soil forms very hard lumps or clods. (b) Wet soil is sticky. (c) Moist soil forms long flexible ribbon when it is squeezed.

OBSERVATION TABLE (A)

Study of soil particles by hand lens and in-between the fingers

S. No.	Source/Name of soil	Observation by hand lens	Feeling of soil particles in-between fingers	Inference
1.				
2.				
3.				
4.				

CONCLUSION

(Write your conclusion)

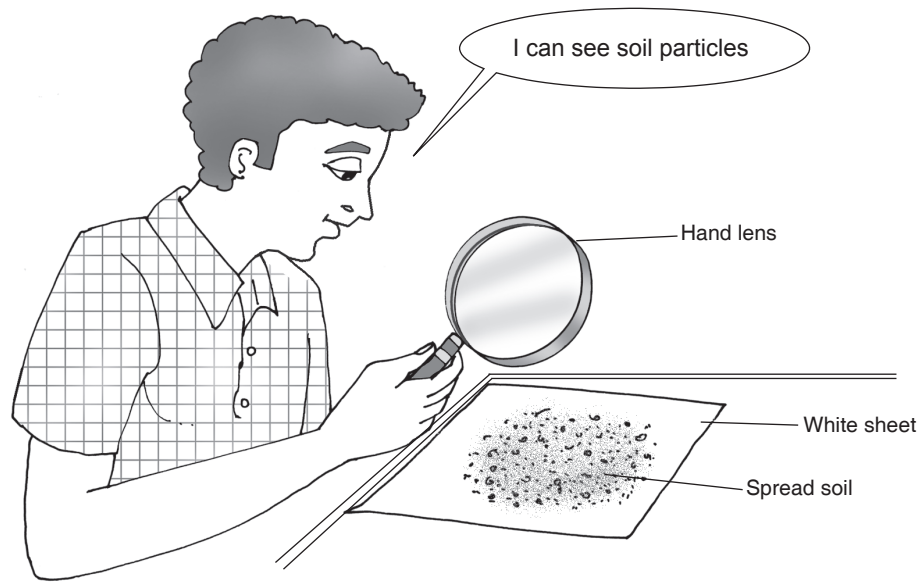


Fig. 2.1 A student observing soil spread on a sheet through hand lens

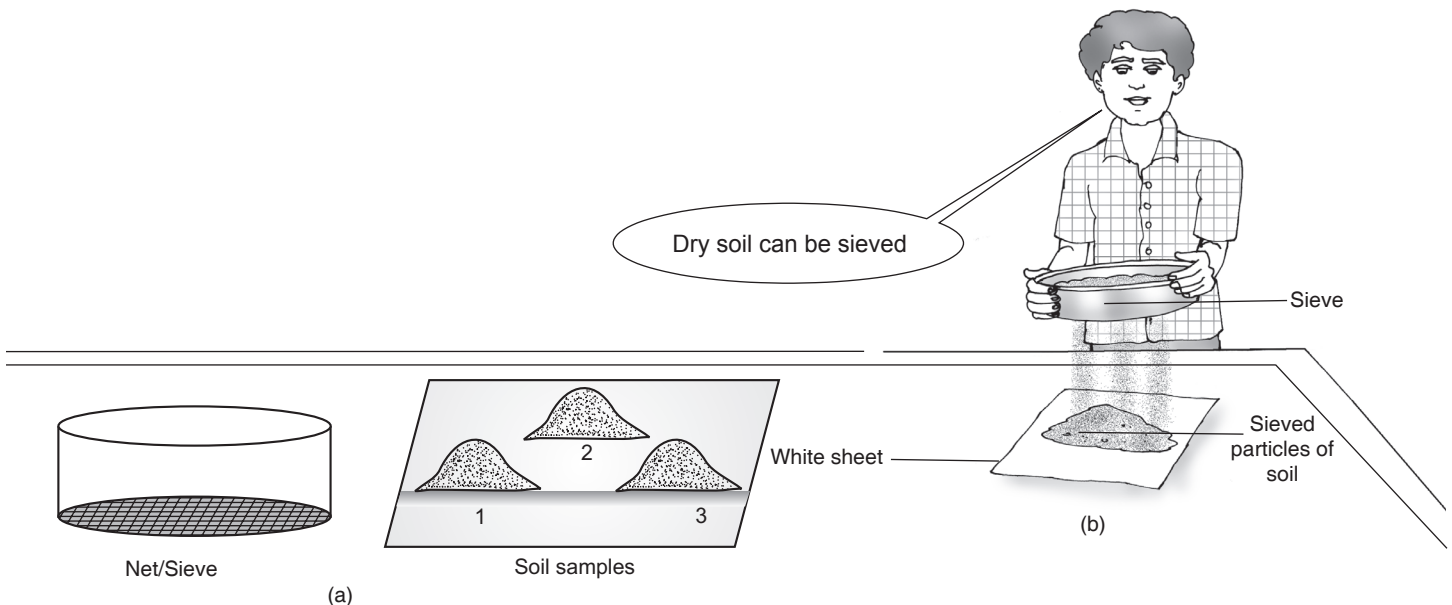


Fig. 2.2 Sieving of dry soil

(b) Study by sieving method (standard method)

1. Take soil samples and separately pass them/sieve them through sieves with meshes (nets) of different sizes.
2. Start with big/maximum mesh size. Sieve the soils over a white sheet of paper.
3. Sieve out/separate out the soil particles of different sizes with the help of sieves on separate papers. Note the name of soil (parent soil). Repeat this process for all samples of soil.
4. Find out the relative proportion of each fraction. Note it. Study the texture/tally it from table (B1 and B2).

Table (B1): Texture of soil (A physical property)

S. No.	Soil particle	Size (diameter in mm) of particle
1.	Gravel	2.00 mm and more
2.	Coarse sand	2 mm – 0.20 mm
3.	Fine sand	0.2 mm – 0.02 mm
4.	Silt	0.2 mm – 0.002 mm
5.	Clay	Below 0.002 mm

Table (B2): Texture of soil (A physical property)

S. No.	Soil type textural group	Main particles	Percentage
1.	Sandy soil	Sand	85%–90% + 15% clay or silt or both
2.	Sandy loam	Sand, loam	50%–55%
3.	Loamy soil	All particles	in equal amount
4.	Clay loam	Clay, loam	50–55%
5.	Silt loam	Silt, other particles	55%
6.	Clay	Clay	65%

OBSERVATION TABLE (B)**Study of soil particles by sieving method**

S. No.	Sample of soil	Size of soil particles	Main particles	Inference
1.	A			
2.	B			
3.	C			
4.	D			

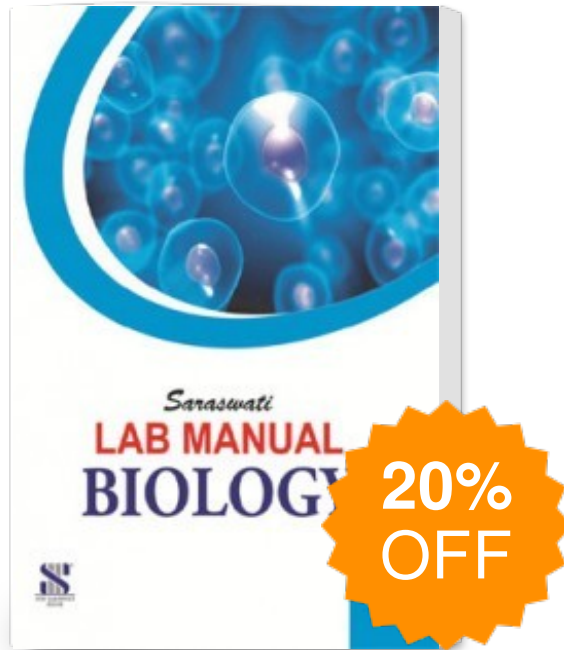
CONCLUSION

_____ (Write your conclusion)

BE CAREFUL

1. Collect soil from different locations.
2. Collect soil in a polybag (small) or a paper or aluminium foil or pouches.
3. Separate soil samples must be collected separately.

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