APPENDICES
APPENDIX -A

PROGRAMMED LEARNING MATERIAL IN BIOLOGY
FOR STANDARD IX

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OVERVIEW
This booklet is intended as a self-study material for the pupils of standard IX. It deals with reproduction in plants. It is a sort of self-contained package. It can be used in any setting convenient to the learner's pace. It is prepared in a simple way so that you can learn yourself without depending on the teacher. It is not to be read like other books, but you have to work through it. This booklet contains 100 frames. Each frame of the book contains something to read and some blanks. You have to read the material and write your answer on the response sheet given to you. The answer for each frame is given at the end of the material. Check your answer with the answers given and if answer is correct go to the next frame.

The students in Kerala have no practice for learning using programmed learning material. The investigator will therefore explain to the students how this material has to be used.
PREREQUISITE TEST
(Each correct answer carries 1 mark)

1. The basic unit of all living things is...
   a) Protoplasm b) Cytoplasm c) Cell d) Mitochondria

2. Plants grow by the process of ...
   a) Cell division b) Mutation c) Fertilization d) Pollination

3. ... is the process through which plants perpetuate life.
   a) Growth b) Reproduction c) Cell division d) Mitosis

4. An example for a flowering plant is...
   a) Hibiscus b) Mosses c) Algae d) Fungi

5. The most attractive part of most of the plants is...
   a) Fruit b) Leaf c) Flower d) Stem

6. The parts of a flowering plant are roots, stem, leaves, flowers and ...
   a) Fruits b) Seeds c) Branches d) Chlorophyll

7. Vegetative reproduction is the process in which a new plant is formed from
   .................

8. The two types of reproduction are asexual and...
   a) Hybridization b) Fertilization c) Pollination d) Sexual Reproduction

9. The part of the plant involved in sexual reproduction is...
   a) Flower b) Stem c) Root d) Leaf

10. The system involved in the production of new generation in man is ...
    a) Circulatory b) Reproductive c) Nervous d) Respiratory

   If you have succeeded in scoring seven or above you are ready to take the Pretest.
Reproduction in Plants

Objectives

Knowledge

The pupil,

Recalls the terms, reproduction: sexual, asexual, vegetative propagation, budding, fission, regeneration, and fragmentation, layering, grafting, unisexual flowers, bisexual flowers, pollination and fertilization.

Understanding

The pupil,

1. Explains vegetative propagation, asexual reproduction in lower organisms, artificial means of vegetative propagation and sexual reproduction
2. Compares the process of sexual reproduction in different plants.
3. Identifies the ways by which plants perpetuate life.
4. Differentiates between sexual and asexual reproduction, unisexual and bisexual flowers, flowers pollinated by wind, water, animals and birds.
5. Classifies the plants on the basis of reproduction.

Application

The pupil

1. Analyses the different methods of reproduction in plants and lower organisms.
2. Gives reason for the absence of vegetative reproduction in animals.

Skill

The pupil develops skill:

1. In observing flowers and plants, in doing grafting, layering
2. In drawing the LS of flower, budding in Hydra and fission in amoebae
Unit 1
Reproduction

1. Observe the figure 1. You can see small plants and big plants. These small plants are formed from.

2. The small plants are formed from the big plants. We may call the big plants parent plants. Then what can we call the small plants?

3. The daughter plants are formed from the parent plant. This is how plants continue life. is the process by which plants continue life.

4. There are mainly two types of reproduction. They are sexual and asexual reproduction. The two types of reproduction are and.

5. When new plants are produced as a result of the union of male and female sex cells, it is known as sexual reproduction. Sexual reproduction involves the union of.

6. When a new plant is formed without the union of sex cells it is known as.

7. Asexual reproduction is achieved by several methods. They are fission, budding, fragmentation and regeneration in lower plants. In higher plants it takes place by spore formation and vegetative propagation. The different methods of sexual reproduction in lower plants are budding, fragmentation, regeneration and.

8. Fission is a type of sexual reproduction in which the unicellular organisms divide or split unto two or more than two equal parts. Notice it in Figure-2.
9. If the cell divides into two parts it is known as binary fission. Binary fission is the mode of asexual reproduction in which a cell divides into parts and each part develops into a new organism.

10. If the cell divides into more than two parts it is called multiple fission. In multiple fission the cell divides into parts.

11. Budding is a method of asexual reproduction in which new organisms are formed from the buds produced by the parent organism. Bud is a bulb like structure formed as an outgrowth of the parent cell. The nucleus of body divides and one nucleus passes to the newly formed bud. The bud soon detaches from the parent body and develops into a new individual. Figure 3 illustrates budding in Hydra. Label the diagram.
12. Take some Hydra culture and put it in a watch glass and observe the buds present with the help of a hand lens. Note the changes taking place and record your observations. You have seen new Hydra growing from --------

13. Take a few Hydra and put them in a watch glass containing pond water. With the help of a very sharp razor cut one Hydra in a transverse plane, second in a vertical plane and another one at bud area. Cut the remaining Hydra in different planes. Cover the watch glass with a petridish containing sufficient pond water to avoid evaporation. Place the watch glass in diffused light. Observe it daily. You can see the pieces of Hydra regenerating into new Hydras. Regeneration is the process by which new organism is formed from damaged or lost parts. An organism in which regeneration occurs is --------

14. In several organisms the body breaks into two or more parts called fragments. Each of the fragment grows into a new individual. This is called fragmentation. It is seen in spirogyra. Fragmentation is the process in which a new individual is formed from a -------- of the parent organism.

15. Spore formation is another method of asexual reproduction in several members of Algae, Rhizopus etc. Spores are produced inside sporangium. Each spore develops into a new organism. Figure 4 is the diagram of sporangium in bread mould. Spores are formed inside-----------------

16. An example for an organism in which spores are formed is--------
Unit II

Vegetative Propagation

17. When plants reproduce asexually from any of the vegetative parts, it is known as vegetative propagation. Name the vegetative parts of the plants———

18. Take a Potato tuber, cut it into a number of bits in such a way that each bit contains an eye. Sow the pieces inside a flat box containing a mixture of sand and sawdust. Moisten the pot generously and regularly. From each piece a new plant will be formed. The part involved in propagation in potato is ———

19. Take a Bryophyllum leaf. Observe its appearance. Put it into moist sawdust or sand. Cover it slightly with sawdust or sand. Observe it after a week. You will see new plants arising. The part of the plant which is involved in propagation is ———

20. Select a piece of Sugar cane stem with buds on the node. Sow it in a well-watered soil and observe it. You will see new plant arising. The part of the plant which is involved in propagation is ———

21. Select the stem cutting of a rose plant and plant it in the soil. Observe the changes. Notice the time taken by the rose to grow into a new plant. The part of the plant which is involved in propagation is ———

22. ——— is an example for a plant which reproduces through roots.

23. ——— is an example for a plant which reproduces through leaves.

24. ——— is an example for a plant which reproduces through stems.

25. Ixora is an example for a plant which reproduces through ———

26. The different types of reproduction are ———and———

27. Vegetative propagation is a method of asexual reproduction. When the ——— parts of the plant are involved in reproduction, it is known as vegetative propagation.

28. Vegetative parts of the plant are ———

29. Curry leaf is an example for a plant propagated by ———
30 Banana plants are propagated through ------------------
31 Name a plant in your garden that is propagated through the vegetative parts --------
32 Name a garden plant that is propagated through bulbs------------------
33 Tapioca is propagated through ------------------
34 Sweet potatoes are propagated through------------------
35 Orchids are propagated through --------

Unit III

Artificial Methods of Vegetative Propagation

36 Select a potted rose plant (variety other than des) Cut a mature twig from it below
the node making a slanting cut end. This is called the scion. Cut the main stem of a
young rose (des), leaving six inch stump above the soil of the pot making a slanting
cut so that it is a mirror image of the first twig cut end. This is called the stock. Fix on
this stock the scion and tie it tightly with the help of a rope (Figure- 5) Water the stock
and observe it regularly. You will see new leaves arising from scion and thus a
plant with the characteristics of scion has formed. This process is known as grafting
------------------ is an example for a plant in which grafting can be done

Figure- 5
37. Scion is the

38. Stock is

39. Another artificial method of vegetative propagation is Budding. You can conduct budding in your garden plants. Select a healthy rose plant. Observe it carefully and select a healthy bud from it. With the help of a razor remove the bud along with little bark. Select a similar bud from another rose plant. Make a ‘T’ cut and remove the bud. Paste the bud you have already taken on to the bud region. Tie the pasted bud with plastic paper without damaging the bud. Seal the portion with wax. Observe the plant closely and provide enough water and manure for the plant. Budding is done to produce-----------------

40. Visit your school garden and locate a jasmine plant. Select a branch of this plant. Bend it and keep it below the soil. Give a slight cut on the branch before pressing it in the soil, keep the soil moist. Apply root hormone in the soil to accelerate root growth. Observe it after seven, ten, twelve, fifteen and twenty days. Record your observations. When the portion kept under soil has developed leaves and roots separate it from the parent plant. This process is known as layering. It is done to produce improved varieties of plants. Mention a plant in which layering can be done. -----------------

41. ----------- is an example of a plant in which budding can be done.

42. ----------- is used to accelerate root growth.

43. Name a plant in which budding and layering can be done.��

44. Which of the artificial method of propagation is done in lime plants-----------

45. The three important methods of artificial propagation are-----------------,----------------and-----------
Unit IV

Flower

46. Name any three flowers in your garden

47. Take a hibiscus flower and observe its parts. The outermost part of the flower is the sepals. It is green in colour. The part next to it is the petal. Petals are usually attractively coloured. Label sepal and petals in the Figure – 6

Figure – 6

48. In addition to sepals and petals, a flower has two more parts. They are the sexual parts of the flower. Stamens are the male reproductive part and pistil is the female reproductive part. Observe these parts in Figure – 6

(a) -------------- is the male reproductive part of a flower
(b) -------------- is the female reproductive part of a flower.

49. Stamens are collectively known as the Androecium. A stamen has two parts. A long stalk like portion known as filament and the tip of which is the anther. Note the structure of stamen in a flower. Label the parts of the figure- 7
50. Pistil is the female reproductive part of the flower. It is a flask-shaped structure with a long narrow neck. It has three parts namely ovary, style, and stigma. The lower flask-shaped part is called the ovary. The neck-like portion connecting the ovary and stigma is style. The tip of the style is the stigma. Label the different parts in Figure 8.

51. Label the four parts of the flower in Figure 9.
52. The three parts of the pistil are ovary, style and ---------
53. The two parts of the stamen are anther and ---------
54. A flower having both the male and female parts are known as bisexual flower. An example for a bisexual flower is --------
55. Flowers having only one of the reproductive parts are called unisexual flowers. An example for a unisexual flower is ---------
56. Coconut flower is an example of --------flower.
57. In Hibiscus both the reproductive parts are present. So it is a --------flower.
58. Cite four examples of bisexual flowers in your garden.-----------------
59. Cite two examples of unisexual flowers-----------------
60. When both the sex cells are produced by the same organism, it is known as hermaphrodite. Tape worms and earthworms are examples of hermaphrodites. Give another example for a hermaphrodite---------
61. Example for a bisexual flower is a)coconut b)cucumber c)nutmeg d)Ixora
62. Example for a unisexual flower is a)coconut b)peas c)Hibiscus d)Ixora
63. Plants like coconut, cucumber produces male and female flowers separately in the same plant. These plants are bisexual but the flowers are ---------
64. In some plants male and female flowers are found in different plants. Such plants are called unisexual plants. An example for unisexual plant is---------
65. Some plants produce bisexual flowers. These plants are known as bisexual plants. An example of bisexual plant is---------
66. The essential parts of a flower are --------and ---------
67. The non-essential parts of a flower are --------and ---------
68. Flower is the most attractive part of the flower because it has brightly coloured petals to attract the agents of pollination. The petals are brightly coloured to--------
69. The petals and sepals are together known as Perianth. Perianth consists of ------and
70. The four parts of a typical flower are--------,------,--------&------
Unit V
Pollination

71. In the Figure -10 the anther has burst open letting out some of the powdery particles. These are called pollen grains.

Figure -10

72. After bursting, the pollen grains get transferred from anther to the stigma. This process of transfer of pollen grains from the anther to the stigma is called Pollination. Pollination is the process of transfer of pollen grains from the anther to the stigma.

73. Pollination takes place through some external agencies. They are wind, water, insects, birds and animals. Some agencies help in pollination.

74. Examples of wind pollinated flowers are maize and grass. Another flower which is wind pollinated is ________

75. Wind pollinated flowers are usually small and inconspicuous. They do not have scent or nectar. Anthers are large and loosely attached to the filament. Wind pollinated flowers produce ________ { (a) large quantities of pollen (b) small quantities of pollen}. 

76. Insect pollinated flowers are large. Petals are brightly coloured and scented. Nectars are present. Anthers are not so large and are firmly attached to the filament. Give an example for insect pollinated flower.

77. Water plants are pollinated by water. Hydrilla and ________ are examples of such plants.

78. Silk cotton is an example for a plant pollinated by birds. Give an example for a plant pollinated by birds.

79. Animals bring about pollination in rose apple, silk cotton etc. Give an example for a
plant pollinated by animals

80 Observe the flowers in your school garden and classify them into wind and insect pollinated flowers. Enter your findings in the Table A-1

Table A-1

<table>
<thead>
<tr>
<th>Wind Pollinated Flowers</th>
<th>Insect Pollinated Flowers</th>
</tr>
</thead>
</table>

Unit VI

Fertilization

81 The Figure-11 shows the inner contents of ovary. There are various small rounded structures. These are called ovules. In the given figure ovules are labelled. In which of the two figures it is correctly labelled?

![Diagram A](image1)

![Diagram B](image2)

Figure-11
The rounded structures present in the --- are called ovules.

The ovary contains ---------------

Figure -12 shows the condition of pollen grain soon after pollination. You can notice small tubes growing from each of the pollen grain. At the end of the pollen tube is the male gamete.

**Figure -12**

The pollen tube develops from the ------------- deposited on the stigma.

In Figure -13, pollen tube shows inside it two small oval structures. These are called the male nuclei. Label them.

**Figure -13**
87. Male nuclei are present inside the

88. Refer to figure -14. In the ovule there is an oval structure which contains eight nuclei.
   This is called the embryo sac. Label the embryo sac.

89. The shape of the embryo sac is _______ and it contains _______ nuclei.

90. Among the eight nuclei present in the embryo sac one is slightly larger and elongated.
   This is the female nucleus or egg. Label the female nucleus.

91. Among the eight nuclei present in the embryo sac one is slightly big and elongated.
   This is the female nucleus or egg. Label the female nucleus in figure-14.

92. After bursting of pollen tube and releasing of ______ one of them fuses with the
   bigger nucleus called ___________ thus effecting fertilization.

93. When a male gamete fuses with the female gamete in the ovule, a zygote is formed.
   Only one male gamete fertilizes a female gamete. The process of fusion of male
   nucleus with the female nucleus is known as fertilization. Define fertilization.
There are two types of fertilization, external and internal. When the fusion of male and female nuclei takes place inside the organism it is ------- fertilization.

When the fusion of male and female nuclei takes place outside the organism it is ---- fertilization.

Name an organism in which internal fertilization takes place?

Name an organism in which external fertilization takes place?

As a result of fertilization a zygote is formed. The zygote develops into an embryo.

Zygote is formed by the fusion of ---------and ---------cells

Embryo is the tiny plant inside a seed. The zygote develops into ---------

The fruit of the plant we eat is the ripened ---------

---

Answers of the Prerequisite Test

1. C
2. A
3. B
4. A
5. C
6. A
7. New plants are formed without sexual union.
8. A
9. A
10. B

Answers of the Programmed Learning Frames

1. Big plants
2. Daughter plants
3. Reproduction
4. Sexual and asexual reproduction
5. Male and Female sex cells

---

241
6. Sexual Reproduction
7. Fission
8. Notice the given diagram
9. Two
10. More than two
11. Diagram of Hydra showing the bud
12. Buds
13. Hydra
14. Fragment
15. Sporangium
16. Algae
17. Roots, leaves and stems
18. Stem tuber
19. Leaf
20. Stem cutting
21. Stem
22. Bread fruit
23. Bryophyllum
24. Rose
25. Stems
26. Asexual and sexual
27. Vegetative
28. Roots, leaves and stems
29. Roots
30. Shoots
31. Ixora
32. Gladioli
33. Stems
34. Stem tuber
35. Stem
36. Mango
37. Scion is the segment of the plant to be propagated that is inserted into another plant.
38. Stock is the plant on which the scion is inserted.
39. Improved varieties of plants.
40. Lime
41. Rose
42. Root hormones
43. Rose
44. Layering
45. Layering, Budding and Grafting.
46. Rose, Ixora and Cosmos
47. Diagram of a flower
48. Diagram of a flower
49. Diagram
50. Diagram of Pistil
51. Diagram
52. Stigma
53. Filament
54. Hibiscus
55. Cucumber
56. Unisexual
57. Bisexual
58. Ixora, Hibiscus, Orchids, Balsam
59. Nutmeg, Cucumber
60. Ring worm
61. D
62. A
63. Unisexual
64. Papaya
65. Hibiscus
66. Androecium and Gynoecium
67. Sepals and Petals
68. To attract the insects and animals
69. Sepals and Petals
70. Diagram of stamen
71. Diagram of Stamen
72. Stigma
73. External
74. Bamboo
75. A
76. Bougainvillaea
77. Vallisneria
78. Silk cotton
79. Coral tree
80. –
81. b
82. Ovary
83. Ovules
84. Diagram of pollen tube
85. Pollen grains
86. Diagram of pollen tube
87. Pollen tube
88. Diagram of Ovary
89. Flask, female
90. Diagram of Ovary
91. Diagram of Ovary
92. Male gamete, Female gamete
93. Fertilization is the process of fusion of male and female nuclei to form a zygote.
94. Internal
95. External
96. Man
97. Frog
98. Male, Female
99. Embryo
100. Ovary
APPENDIX-B

INSTRUCTIONAL MODULES IN BIOLOGY
FOR STANDARD IX

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1999

Assisted by DR. K.R. SIVADASAN
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and Director Planning and Development,
Mahatma Gandhi University)
OVERVIEW
This booklet is intended as a self-study material for the pupils of standard IX. It deals with reproduction in plants. It is a sort of self-contained package. It can be used in any setting convenient to the learners' pace. This booklet contains two modules. Each module is divided into submodular units with appropriate titles. Modules are expected to be an effective and economical way of developing specific knowledge and skills with minimum of teacher's direction and supervision. The students in Kerala have no practice for learning using a module. The investigator will therefore explain to the students how the modules have to be used. Since this is a supervised module the investigator will supervise the experiments to be conducted. There is provision for guiding the student's activities in the modules. The diagrams pertaining to each unit is given together at the end of the unit.
INSTRUCTIONS

[Before you go through the modules, please read the instructions carefully]

1. This booklet has a prerequisite test. It includes ten multiple-choice items based on the lessons you have already learned. Read each item carefully and write the correct answer in the blank provided.

2. The key for the prerequisite test is given at the end of the module. Score your answers. If your score is at least seven out of ten, please go through the module. If it is less, learn the previous lessons in your text and answer again the prerequisite test.

3. Once you have successfully completed the test start with the module. You are asked to undertake certain activities in order to learn the topic "Reproduction in Plants". Discuss with your classmates and teacher the outcomes of the activities. You can do the experiments yourself or in-groups.

4. After each unit answer the formative evaluation questions. Sometimes you will have to go back to the module again and learn it to answer the questions.
PRE-REQUISITE TEST
(Each correct answer carries 1 mark)

1. The basic unit of all living things is...
   a) Protoplasm b) Cytoplasm c) Cell d) Mitochondria

2. Plants grow by the process of ...
   a) Cell division b) Mutation c) Fertilization d) Pollination

3. ... is the process through which plants perpetuate life.
   a) Growth b) Reproduction c) Cell division d) Mitosis

4. An example for a flowering plant is...
   a) Hibiscus b) Mosses c) Algae d) Fungi

5. The most attractive part of most of the plants is...
   a) Fruit b) Leaf c) Flower d) Stem

6. The parts of a flowering plant are roots, stem, leaves, flowers and ...
   a) Fruits b) Seeds c) Branches d) Chlorophyll

7. Vegetative reproduction is the process in which a new plant is formed from
   ........................................

8. The two types of reproduction are asexual and...
   a) Hybridization b) Fertilization c) Pollination d) Sexual Reproduction

9. The part of the plant involved in sexual reproduction is...
   a) Flower b) Stem c) Root d) Leaf

10. The system involved in the production of new generation in man is ...
    a) Circulatory b) Reproductive c) Nervous d) Respiratory

If you have succeeded in scoring seven or above you are ready to take the Pretest.
SUPERVISED LEARNING MODULE

Reproduction in Plants

Objectives

Knowledge

The pupil,

Recalls the terms, reproduction: sexual, asexual, vegetative propagation, budding, fission, regeneration, and fragmentation, layering, grafting, unisexual flowers, bisexual flowers, pollination and fertilization.

Understanding

The pupil,

1. Explains vegetative propagation, asexual reproduction in lower organisms, artificial means of vegetative propagation and sexual reproduction
2. Compares the sexual reproduction in different plants.
3. Identifies the ways by which plants perpetuate life.
4. Differentiates the sexual and asexual reproduction, unisexual and bisexual flowers.
5. Classifies plants on the basis of sexual and asexual reproduction.

Application

The pupil

1. analyses the different methods of reproduction in plants and lower organisms.
2. gives reasons for the absence of vegetative reproduction in animals.

Skill

The pupil develops skill: In observing flowers and plants, in doing grafting, layering and in drawing LS of a flower, budding in Hydra and fission in amoebae
The living organism has the ability to produce its own kind. Its purpose is to perpetuate life. There are two types of reproduction, sexual and asexual. Asexual reproduction is the process by which a new organism is produced without the union of sex cells. Sex cells are involved in sexual reproduction.

Student Activities:

1. Have you observed the plants in your neighbourhood? List the different plants that you have noticed. Did you come across a begonia plant? Break a leaf from it and plant it in the soil. Notice the changes occurring. Record your observations. Check it with the outcomes of the activities provided in the next page.

2. Have you noticed a *Bryophyllum* plant? Observe its leaf thoroughly. Break it and plant it in the soil. Observe the same for a few days. Record your observation in the table provided. Check it with the guidelines given in the next page.

3. Take some Balsam seeds. Sow them in the soil. Pour water. Note down the changes taking place. Check your observations.

4. Take some Pea seeds. Sow them in the soil. Pour water for a few days and observe the changes. Check your observations with those given in the next page.
Table B-1

Record of observations of the reproduction of Plants

<table>
<thead>
<tr>
<th>Plants</th>
<th>1st day</th>
<th>2nd day</th>
<th>3rd day</th>
<th>4th day</th>
<th>5th day</th>
<th>6th day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Begonia leaf</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bryophyllum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balsam seeds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pea seeds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Guidelines for Activities:

1. The different plants around are Rose, Ixora, Mango, Jackfruit etc.

2. From the Begonia leaf, new plants have developed.

3. From a single Bryophyllum leaf a number of plants have arisen.

4. The Balsam seeds developed into new plants.

5. Pea seeds too developed into new plants.

Student Activities:

1. Take a Potato. Observe it. You will see buds on the Potato. Cut the Potato so that each bit has a bud. Plant it in the soil and provide water sunlight and manure. Note down the changes taking place in Table B-2.
2. Select the stem cutting of a Rose plant and plant it in the soil. Observe the changes. Note them down in Table B-3.

Table B-2

Record of observations of the growth of Potato

<table>
<thead>
<tr>
<th>2nd day</th>
<th>3rd day</th>
<th>4th day</th>
<th>5th day</th>
<th>6th day</th>
<th>7th day</th>
<th>8th day</th>
<th>9th day</th>
<th>10th day</th>
</tr>
</thead>
</table>

Table B-3

Record of observations of the growth of the Rose Cutting

<table>
<thead>
<tr>
<th>2nd day</th>
<th>4th day</th>
<th>6th day</th>
<th>8th day</th>
<th>10th day</th>
<th>12th day</th>
<th>16th day</th>
</tr>
</thead>
</table>

Discussion:

In the above cases you have seen new plants arising from the parent plants. This is how plants perpetuate life. The process by which one or two parent organisms...
produce a new organism is known as reproduction. There are two types of reproduction: sexual and asexual.

**Formative Evaluation:**
1. Define reproduction.
2. What are the two types of reproduction?
3. Mention some plants that reproduce sexually.

**Unit II Asexual Reproduction**

**Content Overview**
Asexual reproduction is the process by which new plants are formed without sexual union. There are different types of asexual reproduction. They are fission, fragmentation, budding and regeneration in lower plants.

**Student Activities:**
1. Take a Hydra from the Hydra culture given. Put them in a watch glass containing pond water and observe. With the help of a razor cut the Hydra into two or three bits. Cover the watch glass with a dish. Observe the Hydra daily and record the observations.
2. Observe a few Hydra from Hydra culture. Isolate a hydra with a small protuberance (bud) on its side. Put this Hydra in a watch glass containing some pond water. Cover it with a petri dish. Observe the Hydra after every twelve hours. Every time note the size of the bud. Record the time taken by the bud to grow into a complete Hydra. Draw the diagram.
3. Take a drop of culture of amoeba. Observe binary fission in amoebae. Draw diagrams of the various stages of binary fission.

**Guidelines for Activities:**
1. A new Hydra is formed from each bit of Hydra by regeneration.
2. A new Hydra is formed from the bud through the process of budding.
3. Amoebae produced new offspring through binary fission.

**Discussion:**
In the above cases you have seen new organisms produced from the different body parts of the parent organism. Regeneration is a process in which the organism is capable of regenerating damaged or lost parts. Budding is a process in which, in certain organisms a small bud appears on the body surface. This bud grows into a new organism. Fission is the process by which unicellular organisms like amoebae produces new organisms through cell division.

**Formative Evaluation:**
1. What is budding?
2. What is regeneration?
3. Explain fission with the help of examples.
4. What are the different types of asexual reproduction?

<table>
<thead>
<tr>
<th>Content Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asexual reproduction is the process in which new plants are formed without sexual union. There are different types of asexual reproduction. It takes place by spore formation and vegetative propagation in higher plants. In vegetative propagation the vegetative parts of the plants are capable of propagation. In spore formation, spores are formed from the body parts of the parent organism. Each spore develops into a new organism.</td>
</tr>
</tbody>
</table>

**Student Activities:**
1. Take a Potato tuber, cut it into a number of bits in such a way that each bit contains an eye. Sow the pieces inside a flat box containing a mixture of sand and sawdust. Moisten the pot generously and regularly. Observe the changes. Note them down in the card provided.
2. Take a *Bryophyllum* leaf. Observe its appearance. Put it into moist sawdust or sand. Cover it slightly with sawdust or sand. Observe it after a week. Record your observations.
3. Select a piece of Sugar cane with buds on the node. Sow it in a well-watered soil observe it. Record your observations.

4. Select the stem cutting of a rose plant and plant it in the soil. Observe the changes. Note them down in Table B-4

Table B-4

Record of observations of the growth of Plants

<table>
<thead>
<tr>
<th>Plants</th>
<th>2nd day</th>
<th>4th day</th>
<th>6th day</th>
<th>8th day</th>
<th>10th day</th>
<th>16th day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato tuber</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bryophyllum</td>
<td></td>
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<td></td>
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<tr>
<td>Sugarcane</td>
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<tr>
<td>Sweet Potato</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rose cutting</td>
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<td></td>
</tr>
</tbody>
</table>

Guidelines for Activities:
1. From each Potato bit a new plant has grown.
2. From the Bryophyllum leaf, a number of new plants have grown.
3. A new Sugar cane plant has come up.
4. From the rose cutting a new rose plant has grown.
5. From each sweet Potato bit a new plant has grown
Discussion:

In all the above cases we see that new plants have grown from the different parts of the parent plant. In other words new plants have grown from the roots, stem and leaves of parent plants. It is known as vegetative propagation. Identify the plants that are vegetatively propagated from your locality.

Formative Evaluation:

1. What are the various means of vegetative propagation?
2. Give example for a plant that reproduces through leaves.
3. Give example for a plant that reproduces through roots?
4. Give example for a plant that reproduces through leaves.

Unit IV Artificial Method of Vegetative Propagation

<table>
<thead>
<tr>
<th>Content Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetative propagation is the process in which new plants are formed from the vegetative parts of the plant. There are different artificial means of propagation. They are budding, layering and grafting.</td>
</tr>
</tbody>
</table>

Student Activities:

1. Select a potted rose plant (variety other than desi). Cut a mature twig from it below the node, making a slanting cut end. This is known as the scion. Cut the main stem of a young rose (desi), leaving six inch stump above the soil of the pot making a slanting cut so that it is a mirror image of the first twig cut end. This is known as stock. Fix on this stock the scion and tie it tightly with the help of a rope. Cover the joint with polythene paper. by Water the stock regularly. Observe it regularly and record your observations.
2. Select a mango plant and conduct the same experiment as given above.
3. The investigator demonstrates budding and asks the students to do it according to the instructions given. Select a mature twig of rose plant and take a bud from it. Select a similar bud from another rose plant. Remove this bud and paste the
selected bud from the first rose plant. Tie it with plastic paper. Do all the activities carefully. Observe the plant for few days. Water the plant regularly.

4. Visit your school garden and locate a jasmine plant. Select a long-branch of this plant. Bend it and keep it below the soil. Give a slight cut on the branch before pressing it in the soil, keep the soil moist. Observe it after seven, ten, twelve, fifteen and twenty days. Record your observations. When the portion kept under soil has developed leaves and roots separate it from the parent plant.

**Guidelines for Activities:**

1. From the grafted portion new leaves have grown and slowly it has developed into a new plant.
2. From the grafted portion a new variety of mango tree has grown.
3. From the pasted bud new leaves have grown.
4. From the jasmine branch kept in the soil, a new jasmine plant has grown.

**Discussion:**

In the above cases we have seen new varieties of plants produced by artificial means of budding, grafting and layering. Layering is an artificial method of vegetative propagation in which runners or branch of a plant is bend towards the ground and covered with moist soil. After some time roots develop and a new plant is formed from the bend portion. Grafting is a method of vegetative propagation in which a segment (scion) of a plant to be propagated is inserted into another plant called stock. Budding is the process in which buds are removed and pasted on to another plant to produce a new variety.

**Formative Evaluation:**

1. Explain the technique of layering?
2. Name any three artificial methods of vegetative propagation.
3. Explain the technique of grafting?
4. Explain the technique of budding?
MODULE - II
Unit I - Flower

Content Overview
A flower has four main parts namely sepals, petals, stamen and pistil. The male reproductive part is the stamen and the female reproductive part is the pistil. Flowers having both male and female reproductive organs are known as bisexual flowers. Flowers having only one of these are unisexual flowers.

Student Activities
1. Take any four flowers from your garden and mention the parts.
2. Draw the diagram of a shoe flower.
3. Take the LS of any flower and carefully observe the parts.
4. Take a Cucumber, Papaya and coconut flower and observe the parts.
5. Select from your garden unisexual and bisexual flowers.

Guidelines for Activities:
1. A flower has four main parts namely sepal, petals, stamens and pistil.
2. Draw the diagram of a typical flower.
3. Papaya, Coconut and Cucumber are unisexual flowers. Hibiscus, Ixora, Balsam are bisexual flowers.

Discussion:
In the hibiscus flower that is common around us the green coloured part is the sepal. The attractively coloured part is the petal. When these two parts are removed we see the reproductive parts of the flower namely stamens and pistil. These parts are known as the essential parts of the flower. 

Formative Evaluation:
1. Name the reproductive parts of a flower?
2. Give an example for a unisexual flower.
3. Give an example for a bisexual flower.
4. What are the essential parts of a flower?

### Unit II Pollination

#### Content Overview

Pollination is a process of transfer of pollen grains from the anther to the surface of the stigma. This can happen in several ways, e.g. by wind, water, insects, birds and animals. There are two types of pollination, self and cross-pollination.

#### Student Activities

1. Observe the peculiarities of jasmine, coffee and flowers. Notice the peculiarities of maize and grass flowers.
2. Select pea flowers and conduct artificial pollination.
3. Select a salvia flower and transfer the pollens from anther to the stigma artificially

#### Guidelines for Activities:

1. Insects pollinate jasmine, coffee flower. Their flowers are white in colour, sweet scented with nectarines. Anthers are not long and are firmly attached to the filament. They are located inside the petals where insects may brush.
2. Grass and maize flowers are very small and are pollinated by wind. Anthers are large and loosely attached to the filament so that the slightest air movements shake them.

#### Discussion:

Pollination is the process of transfer of pollen from anther to stigma. Self-pollination occurs when pollen grains from one flower are transferred to the stigma of the same flower. Cross-pollination occurs when pollen grains from one flower are transferred to the stigma of another flower.

#### Formative Evaluation

1. Define Pollination.
2. What do you mean by cross-pollination?
3. Differentiate between cross-pollination and self-pollination.
What are the characteristics of wind pollinated flowers?

**Unit III Fertilization**

**Content Overview**

Pollen trapped by the stigma produces a long tube. It grows through the style and enters the ovary. The pollen tube contains the male cell or gamete. It unites with the female cell or gamete. This process of union of male gamete with the female gamete to form a zygote is called fertilization. The zygote divides and re-divides to form a mature embryo. Embryo is the young plant contained in the seed. Union of a female gamete of one plant by a male gamete from another genetically different plant is known as cross-fertilization. Fertilization of a female gamete of one plant by a male gamete of the same plant or genetically identical plant is known as self-fertilization.

**Student Activities:**

1. Take some strong sugar solution (10%) in a saucer. Shake pollen grains from different plants into the saucer. Cover the saucer with a sheet of glass paper and keep it in a warm place for several hours. Using a hand lens observe the changes taking place in the pollen grain.

2. Observe the Ls of ovule from the chart in your biology lab and observe the parts

**Guidelines for Activities**

1. From the pollen grains small tubes are seen protruding out.

2. In the chart the pollen tubes entering the ovule can be observed.

**Formative Evaluation:**

1. Define fertilization.

2. Differentiate between cross-fertilization and self-fertilization.

**Answers of the Prerequisite Test**

1. c
2. a
3. b
4. a
Answers of Formative Evaluation Questions

Module-I

Unit-I Reproduction

1. Define reproduction.

The process by which one or two parent organisms produce a new organism is known as reproduction. The process by which one or two parent organisms produce new organisms is known as reproduction.

2. What are the two types of reproduction?

The two types of reproduction are sexual and asexual.

3. Mention some plants that reproduce sexually.

Mango, Papaya, Beans

Unit II Asexual Reproduction

1. What is budding?

Budding is a process in which, in certain organisms a small bud appears on the body surface. This bud grows into a new organism.

2. What is Regeneration?

Regeneration is a process in which the organism is capable of regenerating damaged or lost parts.

3. Explain fission with the help of examples.

Fission is the process by which unicellular organisms like amoebae produces new organisms through cell division.

4. What are the different types of asexual reproduction?

The different types of asexual reproduction are fission, budding and regeneration in
lower plants

**Unit III Vegetative Propagation**

3. What are the various means of vegetative propagation?

The various means of vegetative propagation are roots, stem leaves and bulbils.

4. Give example for a plant that reproduces through leaves.

Bryophyllum

5. Give example a plant that reproduces through roots?

Bread-fruit

6. Give example a plant that reproduces through stem?

Tapioca

**Unit IV Artificial Method of Vegetative Propagation**

1. Explain the technique of layering?

Layering is an artificial method of vegetative propagation in which runners or branch of a plant is bend towards the ground and covered with moist soil. After some time roots develop and a new plant is formed from the bend portion. This one kind of layering.

2. Name any three artificial methods of vegetative propagation.

Grafting, Budding and Layering

3. Explain the technique of grafting?

Grafting is a method of vegetative propagation in which a segment (scion) of a plant to be propagated is inserted into another plant called stock in such a way that the vascular tissues combine.

4. Explain the technique of budding?

Budding is the process in which buds are removed and pasted on to another plant to produce the qualities of the plant from which buds are taken.
MODULE – II

Unit I - Flower
1. Name the reproductive parts of a flower?
   Stamens and Pistil
2. Give an example for a unisexual flower.
   Cucumber
3. Give an example for a bisexual flower.
   Hibiscus
4. What are the essential parts of a flower?
   Stamens and Pistil

Unit II Pollination
1. Define Pollination.
   Pollination is the process of transfer of pollen grains from the anther to the surface of
   the stigma.
2. What do you mean by cross-pollination?
   Cross-pollination the process in which pollen grains from one flower are transferred
   to the stigma of another flower.
3. Differentiate between cross-pollination and self-pollination.
   Self-pollination occurs when pollen grains from one flower are transferred to the
   stigma of the same flower. Cross-pollination occurs when pollen grains from one
   flower are transferred to the stigma of another flower.
4. What are the characteristics of Wind pollinated flowers?
   In wind pollinated flowers are very small. Anthers are large and loosely attached to
   the filament so that the slightest air movements shake them. Ex. grass and maize

Unit III Fertilization
1. Define fertilization.
   It is the process of union of the male gamete with the female gamete to form a
   zygote.
2. Differentiate between cross-fertilization and self-fertilization.
Fertilization of a female gamete of one plant by a male gamete from another plant is known as cross-fertilization. Fertilization of a female gamete of one plant by a male gamete of the same plant is known as self-fertilization.

budding in Hydra.

Layering in jasmine

binary fission in amoebae
Grafting by stem cutting.

Stigma

Ovary

Petal
Sepal
Style
Ovary
Ovule

Bi sexual flower
APPENDIX-C

GUIDED INDUCTIVE INQUIRY MODEL LESSONS
IN BIOLOGY

By

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1999

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and Director Planning and Development,
Mahatma Gandhi University
Kottayam)
GUIDED INDUCTIVE INQUIRY MODEL LESSONS

Lesson – I Reproduction

Content Analysis

Terms: - Reproduction, sexual reproduction and asexual reproduction

Facts: - Reproduction is the process by which plants perpetuate its kind.

There are two kinds of reproduction, sexual and asexual.

Reproduction, which involves the fusion of sex cells, is known as sexual and reproduction without the fusion of sex cells is called asexual reproduction

Concepts: - Reproduction is the process by which plants produce their own kind.

There are number of plants which reproduce by sexual means. Examples of such plants are balsam, beans, cucumbers, coconuts, mangoes.

Reproduction in which plants produces its own kind from any of the vegetative parts is called asexual reproduction.

Instructional Objectives: - The pupil

1) acquires knowledge of the above mentioned biological terms and facts.
2) develops understanding of the above mentioned facts and concepts.
3) develops the ability to apply the understanding in new and relevant situations.
4) develops skill in observing the plants around them and thus identify the mode of reproduction in them.
5) develops interest in identifying different modes of reproductions in plants.
6) develops scientific attitude towards propagation of plants

Previous Knowledge: - The pupil already knows the parts of a typical plant.

Teaching Aids: - Balsam, Hibiscus and some plants.
Introduction

Shows a big balsam plant and a tiny balsam plant

What do you see here?
A big plant and a small plant.
From where does the small plant come?
The small plants are formed from the big plants.
Suppose you like to have a balsam plant in your garden what will you do?
We will sow seeds and put manure and water. After few days new plants will come.
If all the balsam seeds in nature perish will you be able to grow new balsam plants?
No
In other words they will be extinct from nature. Can you name any organism, which
is extinct now?
Dinosaurs
How does an organism or plant exist in nature?
By producing their-own kind.
Plants, animals, human beings and all the organisms exist in nature by producing
their own kind. What can we call this process?
Reproduction.
What do you mean by reproduction?
It is the process by which plants and other organisms produce their own kind.
Students are taken to the school garden. They observe the different plants there.
A problem is posed to the students as to find out how the different plants in the
garden produces new plants.
The teacher asks the students to discuss the ways by which plants like Rose, Jasmine
Balsam and Cosmos reproduce.
Shows a mango fruit. How do these mangoes produce new plants?
From their seeds new plants will grow.
How will you grow tapioca in your courtyard?
Plant stem cuttings in the soil, provide enough water, manure, and sunlight. It will grow into a new plant.

What do you notice in these different plants?
Some of them reproduce through seeds whereas some of them reproduced from the different parts of the plant

What can you infer from this?
There are mainly two types of reproduction. They are sexual and asexual reproduction.

What do you mean by sexual reproduction?
Reproduction, which involves the union of sex cells, is called sexual reproduction.

What do you mean by asexual reproduction?
When new plants are formed without the union of sex cells it is known as asexual reproduction.

Teacher asks the students to classify the different plants in the courtyard according to the mode of reproduction.

Review
How do plants perpetuate its species?
What are the two types of reproduction?
Differentiate between sexual and asexual reproduction?
Name some of the plants, which reproduce sexually?
Name some of the plants, which reproduce asexually?

Assignment
Identify the mode of reproduction in the plants in your neighbourhood.
LESSON -11
ASEXUAL REPRODUCTION
Part-1

Content Analysis

Terms: - Asexual Reproduction, Regeneration, Budding

Facts: - Reproduction without the fusion of sex cells is called asexual reproduction

Concepts: - Reproduction is the process by which plants produce their own kind.

There are number of organisms which reproduce by asexual means.

Examples of such organisms are Hydra and Yeast.

Instructional Objectives: - The pupil

1) acquires knowledge of the above mentioned biological terms and facts.

2) develops understanding of the above mentioned facts and concepts.

3) develops the ability to apply the understanding in new and relevant situations.

4) develops skill in observing the mode of reproduction in Hydra, Yeast, Amoeba etc.

5) develops interest in identifying different modes of reproductions in plants.

6) develops scientific attitude towards propagation of lower organisms.

Previous Knowledge: - The pupil already knows that reproduction is the process by which organisms perpetuate their life.

Teaching Aids: - Hydra culture, Fresh baker’s Yeast, watch glass, petridish,
Revision

What do you mean by asexual reproduction?
Define asexual reproduction?
Differentiate between sexual and asexual reproduction

Presentation.

Asexual reproduction is a kind of reproduction in which sex cells are not involved. A single organism is capable of producing its own kind.

Lower plants reproduce asexually in different ways. The students are made to do the following experiments to understand the different methods of asexual reproduction in lower plants.

Experiment – 1

Aim: - To understand regeneration in Hydra

Materials required: - Hydra culture, watch glasses, hand lens, microscope, razor.

Procedure: - Take a few Hydra (four or five) from Hydra culture. Put them in a watch glass containing some pond water. With the help of the razor cut one hydra in a transverse plane, second in a longitudinal plane and the third at bud area. Cut the remaining Hydra in different planes. Cover the watch glass with a petri dish containing sufficient pond water to avoid evaporation. Place the watch glass in diffused light. Observe the hydra daily with the hand lens. Notice the changes and record them.

Conclusion: - Hydra produces its own kind by a process known as regeneration.

From each bit of Hydra a new Hydra is formed. This is a method of asexual reproduction.
Experiment -11

Aim: - To study budding in Hydra

Procedure: - Observe a few Hydra from the Hydra culture. Isolate a hydra with small protuberance (bud) on its side. Put this Hydra in a watch glass containing water. Cover it with a petri dish.

Observe the Hydra after twelve hours. Every time notice the changes taking place in the bud region. Note the time taken by the bud to grow into a new Hydra.

Inference: -The process by which a new organism is formed from the buds produced by the parent organism is known as budding.

Experiment -11

Aim: - To study budding in Yeast

Materials Required: - Fresh baker’s yeast, compound microscope, plain glass slides, droppers, flask, glass rod, cotton, sugar solution, cotton wool

Procedure: - Take 100ml of 10% solution of sugar in 250ml flask and add 10gm of yeast. Plug the mouth of the flask with cotton plug and leave it for half an hour.

Take a few drop of this solution with the help of a dropper and place it on a plain slide. Stain this slide with methylene blue or cotton blue. Put a cover slip on it.

Observe under low and high power of microscope. Locate a few yeast cells with small buds. Notice the changes taking place and how it grows into a new yeast.

Draw the diagram in your note books.

Inference: - In Yeast too asexual reproduction takes place by the process of budding.

Review

1. What do you mean by regeneration?

2. Explain the process of budding in yeast?

3. Explain the process of budding in hydra?
Content Analysis

Terms: - Asexual Reproduction, fission, fragmentation, spore formation.

Facts: - Reproduction without the fusion of sex cells is called asexual reproduction.

Concepts: - Reproduction is the process by which plants produce their own kind.

There are number of organisms which reproduce by an asexual means known as fission, fragmentation, spore formation.

Instructional Objectives: - The pupil

1) acquires knowledge of the above mentioned biological terms and facts.
2) develops understanding of the above mentioned facts and concepts.
3) develops the ability to apply the understanding in new and relevant situations.
4) develops skill in observing the mode of reproduction in rhizopus, amoebae.
5) develops interest in identifying different modes of reproductions in plants.
6) develops scientific attitude towards propagation of lower organisms.

Previous Knowledge: - The pupil already knows that reproduction is the process by which organisms perpetuate their life.

Teaching Aids: - Bread mould, hand lens, Chart showing fission in amoebae.

Revision

Name some unicellular organisms?

How do they produce new plants?

What do you mean by asexual reproduction?

Fission

The students observe the mode of reproduction in amoebae as the teacher draws the diagram on the board.
Inference:- Fission is a type of asexual reproduction in which the cell in some unicellular organisms divide into two or more parts. Each part is capable of developing into a new organism.

**Fission.**

Shows the chart of spirogyra and make the students observe the process of asexual reproduction by fragmentation.

**Experiment 1V**

**Aim :-** To study spore formation as a means of reproduction in bread mould.

**Materials Required** - Bread mould, hand lens

**Procedure: -** The bread mould is shown to the students. They observe the sporangium and learn how it develops into new organisms.

**Review**

Mention the different ways of asexual reproduction in lower organisms?
What do you mean by spore formation?
Explain the process of fragmentation?
Explain the process of fission?

**Lesson -1V**

**Vegetative Propagation**

**Content Analysis**

**Terms :** - Vegetative propagation,

**Facts:** Vegetative propagation is a type asexual reproduction in which plants perpetuate life through their vegetative parts namely roots, leaves, stems etc.

**Concepts:** Reproduction is the process by which plants produce their own kind.

There are number of plants which reproduce by asexual means.

Vegetative propagation is a type asexual reproduction in which plants perpetuate life through their vegetative parts namely roots, leaves or stems

**Instructional Objectives:** The pupil

1) acquires knowledge of the above mentioned biological terms and facts.
2) develops understanding of the above mentioned facts and concepts.
3) develops the ability to apply the understanding in new and relevant situations.
4) develops skill in observing the mode of reproduction in rose, tapioca, onion, potato, curry leaves, ginger etc.
5) develops interest in identifying different modes of reproductions in plants.
6) develops scientific attitude towards vegetative propagation in plants.

**Previous Knowledge:** The pupil already knows that reproduction is the process by which organisms perpetuate their life.

**Teaching Aids:** Potato, tapioca, curry leaves, bryophyllum, ginger, sugar cane, rose cuttings & ixora.

**Introduction**
Shows a typical plant, What are the parts of this plant?
Root, stem, leaves and flowers.
What do we call the root, leaf and stem of a plant?
Vegetative parts of the plant
What are the functions of these parts?
If these parts are capable of producing new plants, what do we call such type of reproduction?
vegetative reproduction
Shows a bread fruit plant, which part of this plant produces new plant?
Roots
Shows a bryophyllum leaf, which part of this plant produces new plant?
Leaves
Shows a rose plant, which part of this plant produces new plant?
Stem
Students are shown number of plants, which propagate vegetatively and are asked to classify them according to the part involved in propagation. Students are taken to the garden. They observe and identify the vegetative parts involved in reproduction. They are divided into different groups and carry out the discussions and identification.
Review
Mention the plants, which are propagated by roots
Mention the plants, which are propagated by stems
Mention the plants, which are propagated by leaves

Assignment
Make a list of the plants in your neighbourhood which are propagated by stems, leaves and roots.

Lesson –V
Artificial Means of Vegetative Propagation

Content Analysis
Terms :- Grafting, dormant buds, t-cut, wax.
Facts :- Budding is a method of vegetative propagation.
Dormant buds are used for budding
Bud starts growing when it has taken hold of the stem of sapling.
Concepts :- Budding is an artificial means of vegetative propagation.
Grafting is another artificial means of vegetative propagation

Instructional Objectives :- The pupil
1) acquires knowledge of the above mentioned biological terms and facts.
2) develops understanding of the above mentioned facts and concepts.
3) develops the ability to apply the understanding in new and relevant situations.
4) develops skill in doing budding and grafting.
5) develops interest in studying improved means and methods of cultivation.
6) develops scientific attitude towards vegetative propagation in plants.

Previous Knowledge :- The pupil already knows that vegetative propagation takes place in plants.

Teaching Aids :- rose plant and stem cuttings.
**Introduction**

What are the vegetative parts of a plant?
Roots, stems, and leaves.

What do you mean by vegetative propagation?
It is a type of asexual reproduction in which a whole new plant is formed from the vegetative part of the plant.

Shows a bud rose, make the students observe its characteristics and discuss how it is grown. Teacher demonstrates budding in a rose plant.

**Activity -1**
Teacher asks the students to conduct budding according to the instructions given.

**Activity-11**
Conduct grafting in your garden according to the directions given.

**Review**

Explain the process of grafting.
Explain the process of budding.
Give examples for plants in which budding and grafting can be done.

**Lesson VI**

**Artificial Means of Vegetative Propagation**

**Layering**

**Content Analysis**

Terms: - layering, rooting hormones.

Facts: - Layering is a means of vegetative propagation.
Rooting hormones promotes production of roots.

Concepts: - Layering is an artificial means of vegetative propagation.
**Instructional Objectives**: The pupil

1. acquires knowledge of the above mentioned biological terms and facts.
2. develops understanding of the above mentioned facts and concepts.
3. develops the ability to apply the understanding in new and relevant situations.
4. develops skill in conducting layering.
5. develops interest in studying improved means and methods of cultivation.
6. develops scientific attitude towards vegetative propagation in plants.

**Previous Knowledge**: The pupil already knows that vegetative reproduction takes place in plants. Grafting and budding are artificial means of vegetative reproduction.

**Teaching Aids**: Jasmine plant to show layering.

**Revision**

What are the vegetative parts of a plant?

Explain the process of grafting.

Explain the process of budding.

**Presentation**

Teacher illustrates layering. It is another artificial method of vegetative propagation. Let us do it in the garden plant. Students are taken to the garden.

**Activity-1**

Locate a jasmine plant with a long branch. The branch selected should be close to the soil so that it can reach the soil. Give a slight cut on the branch and press it in the soil, keep the soil moist. Take care to see that the cut portion of the branch is under the soil and is not disturbed. Observe the plant regularly.

When new leaves have arisen from the branch separate it from the mother plant. Record your observations in the Table C-1.
Table C-1

Record of observations of the changes in the jasmine branch

<table>
<thead>
<tr>
<th>Date</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fifth day</td>
<td></td>
</tr>
<tr>
<td>Seventh day</td>
<td></td>
</tr>
<tr>
<td>Tenth day</td>
<td></td>
</tr>
<tr>
<td>Fifteenth day</td>
<td></td>
</tr>
<tr>
<td>Twentieth day</td>
<td></td>
</tr>
</tbody>
</table>

Review
Explain the process of layering.

Assignment
Identify from your garden the plants in which layering can be done and list them.

Lesson VII

Parts of a flower

Content Analysis:
Terms: Sepal, Petal, Stamens, Pistil, Unisexual and Bisexual flowers.
Facts: Flower is the most attractive part in most of the plants.
A flower has four main parts.

Flower having male and female sexual parts is known as a bisexual flower.

Unisexual flowers have only one of the sex organs.

Concepts: There are unisexual and bisexual flowers.
Bisexual flowers are also known as hermaphrodites.
The male reproductive part of the flower is the stamen.
The female reproductive part is the pistil.
**Instructional Objectives:** The pupil

1. Acquires knowledge of the above mentioned biological terms and facts.
2. Develops understanding of the above mentioned facts and concepts.
3. Develops ability to apply the understanding of the above facts and concepts in new and relevant situations.
4. Develops skill in observing unisexual and bisexual flowers.
5. Develops interest in studying the different types of flowers.
6. Develops scientific attitude in observing different flowers.

**Previous Knowledge:** The pupil already knows the parts of a typical plant.

**Teaching Aids:** Flowers of Ixora, Hibiscus, Peas, Cucumber, Coconut, Papaya.
Chart showing the LS of a flower.

**Introduction**

Teacher shows a Rose plant with flower:

Q. Which is the most attractive part of this plant?
   A. Flower

Q. Why is it so?
   A. It has attractive colour; shape and some have fragrance too.

Q. Is it the sexual part or vegetative part of the plant?
   A. It is the sexual part of the plant.

Each student is given a shoe flower:

Q. What are the parts of this flower?
   A. Sepal, Petal, Stamen, Pistil.

Teacher asks the student to observe the outermost portion of the flower that is green in colour.

The Sepals form a calyx. It protects the inner whorls of the flower during bud stage.

Teacher shows few flower buds

Shows different flowers like Rose, Ixora, Balsam etc. and asks the students to identify the sepals and petals.
The petals are collectively known as corolla. These two parts calyx and corolla are also known as accessory whorls. Shows a spider lily and asks the students to differentiate calyx and corolla. In this flower calyx and corolla are undifferentiated and they together form a perianth. Remove the outer parts of the flower and identify stamens and pistil. Stamens and pistil are the reproductive parts of the flower. Stamens and pistil are also known as androecium and gynoecium. Shows a coconut flower.

What are the parts of this flower?
A. Calyx Corolla and stamens.

Shows female flowers of cucumber and papaya.
Take a stamen and observe carefully.
The teacher shows a chart and explains the structure of stamen.
Stamen is the male reproductive organ of the flower. It has a long slender part known as filament and anther.
Teacher asks the students to observe the pistil.
Teacher asks the students to take the LS of flower, observe and identify the parts.
Look at the flower LS and draw the diagram.
The stamen and pistil are together known as the reproductive parts of the flower. They are the essential parts of the flower.
Shows number of flowers and ask the students to classify them into male and female flowers.
Bisexual flowers are known as hermaphrodites.
Show hibiscus, peas, balsam, and cucumber and asks the students to identify the hermaphrodites.

Review:
1. What are the parts of a flower?
2. What are the essential parts of the flower?
3. What are the accessory parts of the flower?
4. What is the peculiarity of stamen?
5. What are the parts of stamen?
6. What are the parts of pistil?

Assignment:
1. Classify the flowers in your garden into male and female flowers.
2. Draw the diagram of a typical flower.

Identify from your neighbourhood the unisexual flowers.

Lesson VIII

Pollination

Content Analysis:
Terms: Pollination, self-pollination and cross-pollination.
Facts: Pollination is the transfer of pollen grains from anther to stigma.

Pollen grain develops a tube and pushes itself into the ovule.
Concepts: Pollination is a process in which pollen grains from anther of a flower are transferred to the stigma of the same flower or another flower.

There are two types of pollination - self and cross-pollination. The external agencies that help pollination are wind, water, birds, animals and insects.

Instructional Objectives: The pupil
1) Acquires knowledge of the above mentioned biological terms and facts.
2) Develops understanding of the above mentioned facts and concepts.
3) Develops ability to apply the understanding of the above facts and concepts in new and relevant situations.
4) Develops skill in observing self-pollination and cross-pollination.
5) Develops interest in studying the different types of pollination.
6) Develop scientific attitude towards pollination of plants.

Previous Knowledge: The pupil already knows the parts of a flower.

Teaching Aids: Charts showing cross and self-pollination. Flowers of Ixora, Hibiscus, Peas.
Revision:

What are the parts of a flower?

What are the essential parts of the flower?

What do you mean by sexual reproduction?

The fusion of male and female gametes produces a zygote, which in turn divides and grows into a new plant. For the production of a new plant, male and female cells have to unite.

Shows the diagram of stamen. The students observe the diagram and say the parts.

Anther is present at the tip of the filament. They carry pollen grains. When they are ripe the anther bursts out and pollen grains are ejected out.

Give each student a shoe flower and asks them to observe the peculiarities of stamen.

Pollen grains are small structures that produce male gametes.

What has to take place for the fusion of male and female gametes?

The male cells must reach the ovules located in the ovary.

From the LS of shoe flower the students locate the ovule.

The process of transfer of pollen grains from the anther to the stigma is known as pollination. When the pollen grains are carried to the stigma of a flower of another plant or another flower of the same plant it is called cross-pollination.

The students conduct artificial self-pollination and cross-pollination in pea flowers.

Students are given flowers to identify the mode of pollination.

Teacher gives the students flowers like jasmine, coffee, and bougainvillea that are...
pollinated by insects and ask them to observe the characteristics.

Flowers of grass are given to the students and they are asked to observe the characteristics using a hand lens.

Teacher shows a salvia flower and students explain the process of pollination in it.

The students are taken to the garden to observe the different flowers and they identify them and the agents of pollination.

Review:

1. Define pollination.

2. What are two types of pollination?

3. Name the flowers pollinated by wind?

4. What are the characteristics of insect pollinated flowers?

Assignment

Identify the wind, insect, water pollinated flowers in your locality.

List the flowers pollinated by animals.

Conduct cross-pollination in pea flowers.
Lesson IX

Fertilization

Content Analysis:

Terms: Fertilization, self-fertilization and cross-fertilization.

Facts: Fertilization is the process in which male nucleus fuses with the female nucleus to form a zygote.

Zygote divides and re-divides to form a mature embryo.

Embryo is the young plant contained in a seed.

Concepts: Fertilization is a process in which male nucleus fuses with the female nucleus.

There are mainly two types of fertilization, self and cross-fertilization.

Ovary of the flower becomes the fruit.

Ovule becomes the seed.

Instructional Objectives: The pupil

1. Acquires knowledge of the above mentioned biological terms and facts.
2. Develops understanding of the above mentioned facts and concepts.
3. Develops ability to apply the understanding of the above facts and concepts in new and relevant situations.
4. Develops skill in observing the flowers in which self-fertilization and cross-fertilization occurs.
5. Develops interest in studying the different types of fertilization.
6. Develop scientific attitude towards fertilization of plants.

Previous Knowledge: The pupil already knows the parts of a flower and pollination.

Teaching Aids: Charts showing cross and self-fertilization. Flowers of ixora, shoe flower & peas and seeds of beans and peas.
Revision:
What is pollination?
What are the parts of pistil?
As a result of pollination what happens to the pollen grains?
Pollen grains reach the stigma.

Let us see what happens to the pollen grains. To observe well the changes taking place in a pollen grain let us do the following experiment. Pour a strong sugar solution into a saucer. Pollen grains from different plants are shaken into the saucer containing sugar solution and it is covered with a sheet of glass and kept in a warm place for several hours. Using a hand lens students see the changes.

In the stigma of the flower the stigmatic fluids stimulate the germination of pollen grains and tubular outgrowth occurs. It is called pollen tubes. Pollen tube containing male nucleus bursts into the embryo sac. It pushes through the style dissolving the tissues with certain enzymes. One of the male nuclei fuses with the female nucleus. This is called fertilization. Shows the diagram of the LS of a typical ovule. The students observe and describe the process of fertilization. The zygote divides and re-divides to form a mature embryo. Embryo is the young plant contained in a seed. Teacher shows the seeds of peas, beans and balsam and the students identify them. They are asked to sow the seeds and observe the changes.

There are two types of fertilization, self-fertilization and cross-fertilization.

Review:
1. Define fertilization.
2. What are the changes taking place in the pollen grain.
3. Which part of the flower becomes seed?

Assignment:
Identify flowers in which cross-fertilization occurs.
Appendix D

List of Experts

1. Dr. I.G. Ray,

2. Dr. Jessy Mathews
   Lecturer in Natural Science, St. Joseph’s Training College, Ernakulam.

3. Sr. Estelle Vaz
   Mt Carmel Training College, Kottayam

4. Sr. Celia
   Lecturer in Natural Science, Mount Carmel Training College, Kottayam

5. Mrs. Jane K.S
   Mt. Carmel Higher Secondary School, Kottayam.

6. Miss. Mary K.
   St. Joseph’s High School, Kottayam.

7. Dr. K.R. Sivadasan,
   Rtd. Professor, Department of Education, Trivandrum
Appendix E

Evaluation Schedule for Teachers

Programmed Learning Materials on Reproduction in Plants

(Kindly mark Yes or No to the following statements)

1. It gives due weightage to the different instructional Objectives.
2. Trains the students to acquire knowledge independently.
4. Helps students to score high marks in the examination.
5. Develops interest in biology.
7. Provides chances for independent learning.
8. Promotes creative thinking.
9. Provides opportunity for developing reasoning power.
10. Self-pacing is possible.
11. Self-evaluation is possible.
12. Frames are appropriate for the level of understanding of the students.
13. Helps to avoid competition among students.
15. Develops positive attitude towards learning.
17. Students can learn according to their interest.
18. Suitable for all categories of students.
19. Enough learning activities are provided.
20. There is provision for interaction with the teachers.
21. The following suggestions I would like to make for improvement.
Appendix F
Evaluation Schedule for Teachers
Supervised Learning Module on Reproduction in Plants

(Kindly mark Yes or No to the following statements)

1. It gives due weightage to the different instructional Objectives.
2. Trains the students to acquire knowledge independently.
4. Helps students to score high marks in the examination.
5. Develops interest in biology.
7. Provides chances for independent learning.
8. Promotes creative thinking.
9. Provides opportunity for developing reasoning power.
10. Self-pacing is possible.
11. Self-evaluation is possible.
12. May lead to waste of time.
13. Helps to avoid competition among students.
15. Develops positive attitude towards learning.
17. Students can learn according to their interest.
18. Suitable for all categories of students.
19. Enough learning activities are provided.
20. There is provision for interaction with the teachers.
21. The following suggestions I would like to make for improvement.
Appendix G

Evaluation Schedule for Teachers

Guided Inductive Inquiry Lessons on Reproduction in Plants

(Kindly mark Yes or No to the following statements)

1. It gives due weightage to the different instructional Objectives.
2. Trains the students to acquire knowledge independently.
4. Helps students to ask questions to acquire knowledge.
5. Students learn to formulate hypotheses and evaluate them.
7. Provides chances for independent learning.
8. Promotes creative thinking.
9. Provides opportunity for developing reasoning power.
10. Self-pacing is possible.
11. Self-evaluation is possible.
12. Frames are appropriate for the level of understanding of the students.
13. Helps to avoid competition among students.
15. Develops positive attitude towards learning.
17. Students develop scientific attitude.
18. Suitable for all categories of students.
19. Enough learning activities are provided.
20. There is provision for interaction with the teachers.
21. The following suggestions I would like to make for improvement.
Appendix H

SCHOOL OF PEDAGOGICAL SCIENCES
MAHATMA GANDHI UNIVERSITY
1999

ACHIEVEMENT TEST
IN
BIOLOGY (Draft)

Standard: IX Marks: 70

Name of the pupil:

The questions given below are based on Reproduction in Plants. All answers are to be marked in the answer sheet provided along with the test material. Four answers are given for each question in section A, but only one corresponds to the correct answer. Pick out the correct answer and mark against the letter given (A, B, C and D) in the box with an 'X' mark. For example, let the answer to a question be 'C'. The method to be adopted for marking the answer is given below:

A  B  C  D
☐  ☐  ☐  ☑

For questions in section B write True or False. Label the figures given in section C.

Start marking the answers after the teacher's instruction
TOPIC: REPRODUCTION IN PLANTS

Each question carries one mark

PART A

1. The process by which plants perpetuate life.
   (A) Reproduction (B) Pollination (C) Growth (D) Fertilization

2. Mention the type of reproduction in human beings
   (A) asexual (B) Sexual (C) cloning (D) Vegetative

3. Mention the type of reproduction in amoebae
   (A) Fission (B) Regeneration (C) Fragmentation (D) Budding

4. The process by which a single organism produces its own kind?
   (A) Asexual reproduction (B) Sexual reproduction (C) Pollination
   (D) Fertilization

5. A plant which reproduces its own kind from its leaf
   (A) Rose (B) Pea (C) Coffee (D) Bryophyllum

6. Mention the type of reproduction in Hydra
   (A) Fission (B) Regeneration (C) Fragmentation (D) Spore formation

7. Identify the organism in which regeneration and budding takes place
   (A) Yeast (B) Hydra (C) Amoebae (D) bread mould

8. Identify the organism in which sexual and asexual reproduction takes place
   (A) Yeast (B) Hydra (C) Amoebae (D) bread mould

9. Identify a plant which reproduces asexually by roots.
   (A) Curry leaf plant (B) Balsam (C) Rose (D) Bryophyllum
10. Identify the mode of asexual reproduction in Hydra
   (A) Budding  (B) Fission (C) Regeneration (D) Spore formation

11. Name the male part of the flower
    (A) Androecium (B) Gynoecium (C) Sepal (D) Petal

12. Name the female part of the flower
    (A) Stamen (B) Petal (C) Gynoecium (D) Androecium

13. The pollen grains are located in the -------------
    (A) Pistil (B) Ovary (C) Calyx (D) Anther

14. Gynoecium has three parts namely ovary style and -------------
    (A) Petal (B) Pistil (C) Filament (D) Stigma

15. An example for Hermaphrodite is -----------
    (A) Earthworm (B) Rat (C) Cat (D) Man

16. ________ is a unisexual flower.
    (A) Cucumber  (B) Hibiscus (C) Pea  (D) Balsam

17. Give an example for a bisexual flower.
    (A) Papaya  (B) Nutmeg (C) Hibiscus  (D) Coconut

18. Pollen is transferred from anther to stigma through some ______ agency.
    (A) External (B) Internal (C) None of these (D) Filament

19. Which of the following helps in pollination.
    (A) Soil (B) Chemicals  (C) Insects (D) Insecticide
20. The male and female gametes fuse to form ________
   (A) Zygote (B) Cell (C) Embryo (D) Egg

21. The fertilization that takes place inside the organism
   (A) Asexual (B) External (C) Internal (D) Sexual

22. Zygote develops into ________
   (A) Egg (B) Embryo (C) Seed (D) Shoot

23. An organism in which internal fertilization takes place.
   (A) Man (B) Codfish (C) Whale (D) Frogs

24. The fusion of male gamete with the female gamete
   (A) Fertilization (B) Germination (C) Reproduction (D) Pollination

25. Where is the male gamete located?
   (A) Pistil (B) Stigma (C) Pollen tube (D) Ovule

26. Pollen is carried from the anther to the stigma by wind, water and ________
   (A) Insects (B) Man (C) Insecticide (D) Pollen tube

27. Ovules are located in ________
   (A) Anther (B) Ovary (C) Petals (D) Sepal

28. The zygote develops into a new organism by ________
   (A) Division (B) Growth (C) Fertilization (D) Reproduction

29. A scientist observed that some types of flowers produce small amounts of pollen grains with spiky surface. These flowers are pollinated by ________
   (A) Animals (B) Water (C) Insects (D) Wind

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30. The mode of reproduction in banana plant is ________.
   (A) Asexual (B) Sexual (C) Budding (D) Layering

31. External fertilization is not possible in land because ________.
   (A) Soil is not good (B) Eggs and sperm would soon dry up
   (C) Land is too humid (D) There are different chemicals in the soil.

32. Which of the following pairs are reproductive parts of a flower.
   (A) Stamens and sepals (B) Sepals and pistil (C) Corolla and pistil
   (D) Stamens and pistil

33. The fruit of a plant which we eat is a ripened ________ enclosing the seed.
   (A) Corolla (B) Calyx (C) Ovary (D) Perianth

34. The embryo is actually a very young ________ contained in the seed
   (A) Ovary (B) Plant (C) Ovule (D) Root

35. Which of the following is a unisexual flower ________.
   (A) Maize (B) Pea (C) Hibiscus (D) Lily

36. The transfer of pollen from anther to the surface of the stigma is called
   (A) Fertilization (B) Pollination (C) Vegetative reproduction (D) Propagation

37. The transfer of pollen from the anther of one flower to the stigma of another flower is ________
   (A) Cross pollination (B) Self pollination (C) Fertilization (D) pollination

38. Identify a plant which propagates through stems?
   (B) Papaya (B) Rose (C) Potato (D) Bryophyllum

39. Stigma is ________ in nature.
   (A) Sticky (B) Smooth (C) Attractive (D) Rough
40. _________ is the product of an asexual method of forming new plant.

(A) Eyes of potato  (B) Seed of cucumber  (C) Pea seeds  (D) Balsam seeds

41. Which is a true statement?

(A) Insect pollinated flowers have beautiful colours and scent
(B) Insect pollinated flowers are very small
(C) Insect pollinated flowers are spiky
(D) Insect pollinated flowers are very heavy.

42. Identify an organism in which regeneration and budding takes place?

(A) Hydra  (B) Amoebae (C) Bread mould  (D) Yeast

43. Name an organism in which asexual and sexual reproduction takes place?

(A) Fungus  (B) Amoebae (C) Algae  (D) Yeast

PART B

Read the following statements and indicate true or false by writing T for true and F for false.

44. Asexual reproduction does not depend on sexual process whereas sexual reproduction depends on male and female sexes.

45. A flower having both the reproductive parts is a unisexual flower.

46. In plants pollination takes pollen grains away from the ovule.

47. Wind pollinated flowers are sweet scented and heavy.

48. Male gametes are passive whereas female gametes are active.

49. Fertilization occurs in plants as well as in animals.

50. Reproduction is a unique characteristic because it allows the species to perpetuate even after the death of the individual.
51. Identify an organism in which regeneration and budding takes place?

   A) Bacteria (B) Fungus (C) Hydra (D) Algae

52. The process by which a lost part of an organism grows is ------

   (A) Budding (B) Fission (C) Cutting (D) Regeneration

53. After fertilization ovule develops into --------

   (A) Seed (B) Fruit (C) Nut (D) Zygote

54. Name a plant in which grafting can be done.

   (A) Balsam (B) Potato (C) Papaya (D) Mango

55. Layering is done in plants like--------

   (A) Balsam (B) Potato (C) Coffee (D) Jasmine

56. An example for an artificial means of vegetative propagation is------

   (A) Budding (B) Fission (C) Fragmentation (D) Regeneration

57. In the process of layering root production is accelerated by using------

   (A) Rooting hormones (B) Minerals (C) Water (D) Manure

58. In grafting the plant on which the good variety plant is inserted is ----

   (A) Scion (B) Stalk (C) Host (D) Stump

59. Tissue culture is an example for --------

   (A) Sexual reproduction (B) Artificial reproduction

   (C) Vegetative reproduction (D) Clowning
PART C

Label the following figures (Each correct labelling carries one mark)
### Appendix I

**Answer Sheet**

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Appendix J

**Difficulty Index and Discriminating Power of Achievement Test in Biology**

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* indicates items selected
ACHIEVEMENT TEST
IN
BIOLOGY (Final)

Standard : IX
Marks: 50

Name of the pupil

The questions given below are based on the topic ‘Reproduction in Plants’. All answers are to be marked in the answer sheet provided along with the test material. Four answers are given for each question in section A, but only one corresponds to the correct answer. Pick out the correct answer and mark against the letter given (A, B, C and D) in the box with an ‘X’ mark. For example, let the answer to a question be ‘C’. The method to be adopted for marking the answer is given below.

A   B   C   D
☐   ☐   ☒   ☐

For questions in section B write True or False. Label the figures given in section C.

Start marking the answers after the teacher’s instruction
TOPIC: REPRODUCTION IN PLANTS

{Each question carries one mark}

PART A

1. The process by which plants perpetuate life.
   (A) Reproduction (B) Pollination (C) Growth (D) Fertilization

2. Mention the type of reproduction in human beings
   A) asexual (B) Sexual (C) cloning (D) Vegetative

3. Mention the type of reproduction in amoebae
   A) Fission (B) Regeneration (C) Fragmentation (D) Budding

4. Name the process by which a new organism is produced from a single parent?
   (A) Asexual reproduction (B) Sexual reproduction (C) Pollination (D) Fertilization

5. Name a plant which produces its own kind from its leaf?
   (A) Rose (B) Pea (C) Coffee (D) Bryophyllum

6. Mention the type of reproduction in Hydra
   (A) Fission (B) Regeneration (C) Fragmentation (D) Spore formation

7. Identify the organism in which regeneration and budding takes place
   (A) Yeast (B) Hydra (C) Amoebae (D) Bread mould

8. Identify the organism in which sexual and asexual reproduction takes place
   (A) Yeast (B) Hydra (C) Amoebae (D) Bread mould

9. Identify the plant, which reproduces by means of roots.
   (A) Curry leaf plant (B) Balsam (C) Rose (D) Bryophyllum
10. Name the male part of the flower
   (A) Androecium (B) Gynoecium (C) Sepal (D) Petal

11. Where are the pollen grains located?
   (A) Pistil (B) Ovary (C) Calyx (D) Anther

12. Gynoecium has three parts namely ovary, style and ________
   (A) Petal (B) Pistil (C) Filament (D) Stigma

13. Give example for a Hermaphrodite
   (A) Earthworm (B) Rat (C) Cat (D) Man

14. Give example for a bisexual flower.
   (A) Papaya (B) Nutmeg (C) Hibiscus (D) Coconut

15. Pollen is transferred from anther to stigma through some ______ agency.
   (A) External (B) Internal (C) None of these (D) Filament

16. Which of the following helps in pollination.
   (A) Soil (B) Chemicals (C) Insects (D) Insecticide

17. The male and female gametes fuse to form ________.
   (A) Zygote (B) Cell (C) Embryo (D) Egg

18. Zygote develops into ________.
   (A) Egg (B) Embryo (C) Seed (D) Shoot

19. Name an organism in which internal fertilization takes place.
   (A) Man (B) Codfish (C) Whale (D) Frogs

20. Where are the male gametes located?
   (A) Pistil (B) Stigma (C) Pollen tube (D) Ovule
21. Pollen is carried from the anther to the stigma by wind, water and ________.
(A) Insects  (B) Man  (C) Insecticide  (D) Pollen tube

22. Where are the ovules located?
(A) Anther  (B) Ovary  (C) Petals  (D) Sepal

23. By which process the zygote develops into a new organism?
(A) Division  (B) Growth  (C) Fertilization  (D) Reproduction

24. A scientist observed that some types of flowers produce small amounts of pollen grains with spiky surface. How are these flowers pollinated?
(A) Animals  (B) Water  (C) Insects  (D) Wind

25. Why is it not possible for external fertilization to take place in land?
(A) Soil is not good  (B) Eggs and sperm would soon dry up  
(C) Land is too humid  (D) Many chemicals are present in the soil

26. Which of the following pairs are reproductive parts of a flower.
(A) Stamens and sepals  (B) Sepals and pistil  (C) Corolla and pistil  
(D) Stamens and pistil

27. The embryo is actually a very young ________ contained in the seed.
(A) Ovary  (B) Plant  (C) Ovule  (D) Root

28. Identify a plant which propagates through stems?
(A) Papaya  (B) Rose  (C) Potato  (D) Bryophyllum

29. The transfer of pollen from the anther of one flower to the stigma of another flower is called
(A) Cross pollination  (B)Self pollination(C) Fertilization  (D) pollination

30. What is the nature of stigma?
(A) Sticky  (B) Smooth  (C) Attractive  (D) Rough
31. --------is the product of asexual method of forming new plant.

   (A) Eyes of potato  (B) Seed of cucumber  (C) Pea seeds  (D) Balsam seeds

32. Which is a true statement?

   (A) Insect pollinated flowers have beautiful colour and scent
   (B) Insect pollinated flowers are very small
   (C) Insect pollinated flowers are spiky
   (D) Insect pollinated flowers are very heavy.

33. After fertilization ovule develops into --------

   (A) Seed  (B) Fruit  (C) Nut  (D) Zygote

34. Identify a plant in which grafting can be done.

   (A) Balsam  (B) Potato  (C) Papaya  (D) Mango

35. Layering is done in plants like--------

   (A) Balsam  (B) Potato  (C) Coffee  (D) Jasmine

36. In the process of layering root production is accelerated by using------

   (A) Hormones  (B) Minerals  (C) Water  (D) Manure

37. Tissue culture is an example for --------

   (A) Sexual reproduction  (B) Fertilization  (C) Artificial reproduction  
   (D) Cloning

**PART B**

*Read the following statements and indicate true or false by writing T for true and F for false.*

38. In plants pollination takes pollen grains away from the ovule.

39. Wind pollinated flowers are sweet scented and heavy.

40. Male gametes are passive whereas female gametes are active.
PART C

Label the following parts in the given figures. (Each correct labeling carries one mark)
# Appendix L

**Answer Sheet**

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Appendix M

Scoring Key

5. D  17. A  29. A
8. A  20. C  32. A
10. A  22. B  34. D
Appendix-N

SCHOOL OF PEDAGOGICAL SCIENCES

MAHATMA GANDHI UNIVERSITY

1999

DIAGNOSTIC TEST OF LEARNING DISABILITY

(Draft)
Diagnostiс Test of Learning Disability

1. എ ഓ ല ജ ാ ന ല ജ
2. ഒ ര ഡ ജ ന ല ജ
3. എ ഓ ല ജ വ ാ ന ല ജ
4. എ ഓ ല ജ ര വ ാ ന ല ജ
5. എ ഓ ല ജ വ ാ ന ല ജ
6. എ ഓ ല ജ വ ാ ന ല ജ
7. എ ഓ ല ജ വ ാ ന ല ജ
8. എ ഓ ല ജ വ ാ ന ല ജ
9. എ ഓ ല ജ വ ാ ന ല ജ
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15. എ ഓ ല ജ വ ാ ന ല ജ
16. എ ഓ ല ജ വ ാ ന ല ജ

313
17. (c) (d) (b) (a) 

18. (a) (b) (c) (d) 

19. (a) (b) (c) (d) 

20. (a) (b) (c) (d) 

21. (a) (b) (c) (d) 

22. (a) (b) (c) (d) 

23. പഠനം 

24. പഠനം 

25. പഠനം 

26. പഠനം 

27. പഠനം 

28. പഠനം 

29. പഠനം 

30. പഠനം 

31. പഠനം 

32. പഠനം 

33. Teacher 

34. (5 marks) 

(5 marks)
### Section B

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<td>b. 3/7</td>
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<td>40</td>
<td>Find the number of students who scored 18 or 20 marks in the examination. A student's score is based on the number of questions attempted.</td>
<td>a. 18</td>
<td>b. 8</td>
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<td>A student can select 40 questions out of the 50 questions in the examination. The student's total marks are a. 5% b. 4% c. 3% d. 5%</td>
<td>a. C</td>
<td>b. AB</td>
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<td>Raju selects 25 questions from the 300 questions in the examination. Find the total marks.</td>
<td>a. 250</td>
<td>b. 300</td>
<td>c. 5</td>
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<td>8780 students took the test. The number of students who scored 3588 marks or more is.</td>
<td>a. 5192</td>
<td>b. 5202</td>
<td>c. 6202</td>
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<td>44</td>
<td>TV viewers watch 6480/- TV programs. Raju selects 25 programs from the 4230/- TV programs. TV programmers select 3 programs from the selected 25 programs. What is the total number of combinations?</td>
<td>a. 2350</td>
<td>b. 2250</td>
<td>c. 2210</td>
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<td>Find the number of students who scored 50% or above in the examination.</td>
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<td>b. 110</td>
<td>c. 101</td>
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<td>In a class of 8 students, 5 students score above 80 marks. Find the total number of students who scored above 80 marks.</td>
<td>a. 50</td>
<td>b. 5</td>
<td>c. 100</td>
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<td>A student has to solve 261 questions in a test. He solves 20 questions correctly. What is the percentage of correct answers?</td>
<td>a. 178</td>
<td>b. 284</td>
<td>c. 174</td>
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<td>Find the percentage of marks obtained by a student.</td>
<td>a. 10%</td>
<td>b. 100%</td>
<td>c. 100%</td>
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<td>b. 100/100 x 100</td>
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<td>100% =</td>
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<td>c. 100+10 x 100</td>
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### Section C

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<td>c. 100</td>
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<td>a. 25%</td>
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<td>c. 2.5%</td>
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56  Solve the following problems:
   a. 100 b. 150 c. 110 d. 10
57  10% of 150
   a. 15 b. 15 c. 10 d. 1
58  100% of 150
   a. 15 b. 15 c. 10 d. 1
59  20% of 150
   a. 30 b. 30 c. 20 d. 2
60  15% of 150
   a. 22.5 b. 22.5 c. 22.5 d. 22.5
61  X% of 150
   a. x-1 b. 100-x c. x-100 d. x+100

62  $X^2 \times X^3 = \ldots a. X^6 \quad b. X^5 \quad c. X^6 \quad d. X^6$
63  $X^6 \times X^{20} = \ldots a. X^{26} \quad b. X^6 \quad c. X^{26} \quad d. X^{120}$
64  $X^{30} \times X^{40} = \ldots a. X^{60} \quad b. X^{50} \quad c. X^{30} \quad d. X^{300}$
65  $X^{10} \div X^2 = \ldots a. X^8 \quad b. X^10 \quad c. X^{17} \quad d. X^2$
66  $X^8 \div X^{12} = \ldots a. X^4 \quad b. X^{12} \quad c. X^{16} \quad d. X^4$
67  $X^3 + X^7 = \ldots a. X^7 \quad b. X^4 \quad c. X^{10} \quad d. X^4$
68  $(a^2)^5 = \ldots a. a^7 \quad b. a^{25} \quad c. a^5 \quad d. a^{10}$
69  $(2xy)(x^2y^2) = \ldots a. 2x^3y^3 \quad b. 2x^2y^2 \quad c. 4x^2y^2 \quad d. 2xy$
70  $(2xy)^2(x^2y^2)^3 = \ldots a. 3x^2y^3 \quad b. 6x^2y^3 \quad c. 6x^4y^7 \quad d. 108x^8y^8$

71  Evaluate:
72  a. 12 b. 12 c. 12 d. 12
73  a. 2 b. 2 c. 2 d. 2
74  T F F T
75  T F F T
76  T F F T
77  (1, 3, 5, 7, 9) \ldots \ldots (7)
78  Let $U = \{5, 10, 15, 20, 25, 30, 35, 40\}$
A = \{5, 10, 15, 20\} B = \{20, 25, 30\}
C = \{30, 35, 40\}
Section C

Teacher മുദ്രാ വിദ്യാസാഹിത്യത്തിന്റെ ഭാഗമായി അമിതമായ കാര്യങ്ങൾ എന്നിവയ്ക്ക് പ്രതിഫലിപ്പിക്കുന്ന സാഹിത്യം എന്നാണ് ഇത്തരത്തിലുള്ള പ്രതിഫലിപ്പിക്കുന്നത്. താഴെ കാണുക:

(a) പ്രവൃത്തി ഭാവികമായി (b) പ്രവൃത്തി വിസ്മയമായി. ക്രിയാരൂപാനന്തരം (c) പ്രവൃത്തി യോഗ്യം കൂടാതെ (d) പ്രവൃത്തി യോഗ്യം അനുസരിച്ച് കൂടാതെ വിശേഷിപ്പിക്കുന്നത്.

Teacher മുദ്രാലഭ്യത

മുദ്രാലഭ്യത എന്നത് മറ്റു വിദ്യാഭ്യാസന്തെയും പഠനതിരുട്ടെയും വിദ്യാസാഹിത്യത്തിന്റെ മൂലം എന്നാണ് പദ്ധതി ഒതുക്കുന്നത്. പ്രവൃത്തിയുറപ്പിക്കുന്നത്. 1/2 മുതൽ പെട്ര വിദ്യാസാഹിത്യത്തിന്റെ പ്രവൃത്തി വിവിധ വിഭാഗങ്ങളിലാണ്. പ്രവൃത്തിയുറപ്പിക്കുന്ന പഠന പഠനതിരുട്ടിന്റെ മൂലം എന്നാണ് പദ്ധതി ഒതുക്കുന്നത്. 1/2 മുതൽ പെട്ര വിദ്യാസാനന്തരം എന്നാണ് പദ്ധതി ഒതുക്കുന്നത്. 1/2 മുതൽ പെട്ര വിദ്യാസാനന്തരം എന്നാണ് പദ്ധതി ഒതുക്കുന്നത്. 1/2 മുതൽ പെട്ര വിദ്യാസാനന്തരം എന്നാണ് പദ്ധതി ഒതുക്കുന്നത്.

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317
89. കോഴിക്കോട് പട്ടണത്തിലെ കന്യകാമാധ്യമാട്രിയായി രാമചന്ദ്രായിനീ നിരവധി വൈദ്യുതമേളകളായിരുന്നു
  a. ഖുലാസക്കുറിച്ച്  b. ലോപിനെലക്കുറിച്ച്  c. കുട്ടികൾക്കുറിച്ച്  d. പരാമർശം

90. എന്തു പ്രശ്നമായിരുന്നു തുടങ്ങുന്നതോടെ നാലും പദ്ധതികൾ
  a. കാൻവാസ്  b. മുട്ടക്ക് വിനോദങ്ങൾ
  c. കാർഷികായോഗ്യതയോടെ പരിശീലനം  d. പരിശീലനം

91. കേരളത്തിൽ എത്ര പട്ടണങ്ങളിലെ പരീക്ഷയുടെ ഉദ്ദേശ്യം?
  a. കേരളത്തിൽ ബ. കേരളത്തിൽ ക. കാരണമായിരുന്നു ഉദ്ദേശ്യം  d. സഹായികൾ

92. നാലും പദ്ധതികളെ എത്ര പ്രായ വരെ പ്രവർത്തിക്കേണ്ടതാണ്?
  a. പാലകർഷക b. മലയാളികളുടെ പരിശീലനങ്ങൾ c. മുട്ടക്ക് സക്കുറിച്ച് d. കാർഷികായോഗ്യതകൾ

93. എന്തു പ്രശ്നമായിരുന്നു എന്തു പണം?
  a. വിദ്യാഭ്യാസം എന്തെങ്കിലും b. പാലകർഷക c. മലയാളികൾ d. കാരണമായിരുന്നു

Teacher വിദ്യാഭ്യാസം

1997 നവംബറിൽ 7-നു വിദ്യാഭ്യാസ പരീക്ഷകളിൽ പെട്ടവരെയും വൈദ്യുതം മുട്ടക്കിന് നിരക്ക്

തുടങ്ങുന്ന കാരണങ്ങൾ എന്ന് പറഞ്ഞു. പ്രായനാണ് കമ്പ്യൂട്ടർ നിരക്ക് പെട്ടവരെയും നിരക്ക്

തുടങ്ങുന്ന വൈദ്യുതം മുട്ടക്കിന് നിരക്ക് പെട്ടവരെയും നിരക്ക്

തുടങ്ങുന്ന വൈദ്യുതം മുട്ടക്കിന് നിരക്ക് പെട്ടവരെയും നിരക്ക്

തുടങ്ങുന്ന വൈദ്യുതം മുട്ടക്കിന് നിരക്ക് പെട്ടവരെയും നിരക്ക്

തുടങ്ങുന്ന വൈദ്യുതം മുട്ടക്കിന് നിരക്ക് പെട്ടവരെയും നിരക്ക്.

92. നാലുമത്തിലെ പെടുത്തിയ വൈദ്യുതമേളകളായിരുന്നു ഹൈടെക്കബി

93. എന്തു പ്രശ്നമായിരുന്നു എന്തു പണം?

Teacher വിദ്യാഭ്യാസം
94 എന്നും വാവും കണ്ടെക്കാം എന്നും മൂത്തെയാണ് സാധാരണ ശിലാക്കാരന്റെ
അനുമാനത്തല്ലുള്ളത്.

a. ആവശ്യാന്വേഷണം മൂത്തെയാണ് 
b. കണ്ടെക്കാം മൂത്തെയാണ്

c. വാവും കണ്ടെക്കാം മൂത്തെയാണ്

d. കണ്ടെക്കാം മൂത്തെയാണ്

95 മറ്റൊരു മൂത്തെയാണോ എന്നും?

a. കണ്ടെക്കാം 
b. കണ്ടെക്കാം 

c. വാവും കണ്ടെക്കാം 
d. വാവും കണ്ടെക്കാം 

96 ഇന്ന് തീയതി മൂത്തെയാണോ എന്നും?

a. കണ്ടെക്കാം 
b. കണ്ടെക്കാം 

c. വാവും കണ്ടെക്കാം 
d. വാവും കണ്ടെക്കാം 

97 മറ്റൊരു മൂത്തെയാണോ എന്നും?

a. കണ്ടെക്കാം 
b. കണ്ടെക്കാം 

c. വാവും കണ്ടെക്കാം 
d. വാവും കണ്ടെക്കാം 

98 എന്നു മൂത്തെയാണോ എന്നും എന്നും എന്നും?

a. കണ്ടെക്കാം 
b. കണ്ടെക്കാം 

c. വാവും കണ്ടെക്കാം 
d. വാവും കണ്ടെക്കാം 

99 A

100 B
# Appendix O

## Answer Sheet

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<th>Name of the Pupil</th>
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### Section A

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Section B

37. A B C D  47. A B C D  57. A B C D
40. A B C D  50. A B C D  60. A B C D
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43. A B C D  53. A B C D  63. A B C D
44. A B C D  54. A B C D  64. A B C D
45. A B C D  55. A B C D  65. A B C D
68. A B C D  70. A B C D  72. A B C D
73. 74. 75. 76. 77.
Section C

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## Appendix P

### Difficulty Index and Discriminating Power of Diagnostic Test of Learning Disability

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</table>

D. I = Difficulty Index, D. P = Discriminating Power. The items chosen for the final test are highlighted with asterisks.

324
Appendix-Q

SCHOOL OF PEDAGOGICAL SCIENCES

MAHATMA GANDHI UNIVERSITY

1999

DIAGNOSTIC TEST OF LEARNING DISABILITY

(Final)
Test of Learning Disability

Section A

1. Which of the following sentences is correct? a. The cat is eating the fish. b. The fish is eating the cat. c. The dog is eating the cat. d. The dog is eating the fish.


3. What is the correct punctuation in the sentence? a. She was so happy that she jumped for joy. b. She was so happy, that she jumped for joy. c. She was so happy, that she jumped for joy. d. She was so happy that she jumped for joy.

4. What is the correct subject in the sentence? a. The weather b. is c. cold d. The weather is cold.

5. What is the correct verb in the sentence? a. She likes to read books. b. She like to read books. c. She like to read books. d. She likes to read books.

6. Which of the following is the correct answer? a. The capital of France is Paris. b. The capital of Italy is Florence. c. The capital of Germany is Berlin. d. The capital of France is Florence.

7. What is the correct answer to the question? a. The capital of France is Paris. b. The capital of Italy is Florence. c. The capital of Germany is Berlin. d. The capital of France is Florence.
Section B

13. 1/2 + 2/5 = ......... a. 9/10 b. 3/7 c. 2/10 d. 3/10
14. 4,9,16 ......... 36,69 a. 30 b. 25 c. 47 d. 48
15. 5,25,125 ......... 3125 a. 625 b. 725 c. 675 d.750
16. 2, 4, ............... 16, 32 a. 6 b. 10 c. 8 d. 12
17. 1, 2, 3, 5, 8, 13 ............... a. 20 b. 21 c. 36 d. 28
18. a) 6 b) 7 c) 2 d) 4
19. a) 6 b) 7 c) 2 d) 4
20. a) 6 b) 7 c) 2 d) 4
21. 8780 a) 6 b) 7 c) 2 d) 4
22. a) 6 b) 7 c) 2 d) 4
23. a) 6 b) 7 c) 2 d) 4
24. a) 6 b) 7 c) 2 d) 4

Teacher conducted the examination. (5 marks)

Section B marks (5 marks)
25. Evaluate the following expressions: 261 + 100 ÷ 100, 100 ÷ 100, 100 × 100, 100 × 100 ÷ 100. Which of the following represents the correct order of operations?

26. 100% = --------- a. 100/100 x 100 b. 10/100 x 100 c. 100/10 x 100 d. 1/100 x 100

27. 400 ÷ 25% = a. 100 b. 250 c. 150 d. 75

28. 3/7 a. 300/7% b. 30/7% c. 3/70% d. 3/3%

29. 100% ÷ 100% = a. 100 b. 200 c. 110 d. 250

30. x% ÷ 100% = a. x-1 b. 100-x c. x-100 d. x+100

31. (2xy) (x^2y^2) = a. 2x^2y^3 b. 2x^2y^2 c. 4x^2y^2 d. 2xy

32. The union of two sets is the set of all elements which are in at least one of the sets. Given the sets A, B, and C, which of the following Venn diagrams correctly represents their union?

U = \{ 5, 10, 15, 20, 25, 30, 35, 40 \}

A = \{ 5, 10, 15, 20 \} B = \{ 20, 25, 30 \}

C = \{ 30, 35, 40 \}

A: [Diagram A]

B: [Diagram B]

C: [Diagram C]

D: [Diagram D]
Section C

Teacher: (a) Teacher: 1/2
Teacher: (b) Teacher: 1/2
Teacher: (c) Teacher: 1/2
Teacher: (d) Teacher: 1/2
38 ദേശാന്ത മുസ്ലിം കുടുംബങ്ങൾ അത്യുദ്ധരുകയായി വിദേശത്തായിരുന്നു.

  a. വടക്കേ പെരുത്തൂരാണ് മുസ്ലിം കുടുംബങ്ങൾ നിരക്ക്
  b. കിഴക്കേ മുസ്ലിം കുടുംബങ്ങൾ നിരക്ക്
  c. തെക്കേ മുസ്ലിം കുടുംബങ്ങൾ നിരക്ക്
  d. വാട്ടക്കരാറാണ് മുस്ലിം കുടുംബങ്ങൾ നിരക്ക്

39 റാംലാണ് മുസ്ലിം കുടുംബങ്ങൾ ഏത്?

  a. തടാകാനാട്
  b. കണ്ണൂർ
  c. കൊച്ചി
  d. ഓരോന്നാനാട്

40 കേരളത്തിലെ മുസ്ലിം കുടുംബങ്ങളിലെ ഏറ്റവും പ്രായമേറിയ വയസ്സുകാരാണ്?

  a. കൊച്ചി
  b. തൃക്കോട്
  c. തടാകാനാട്
  d. വാട്ടക്കര

41 വിദേശം എവിടെയാണ്?

  a. തെക്കേ മുസ്ലിം കുടുംബങ്ങൾ
  b. വടക്കേ മുസ്ലിം കുടുംബങ്ങൾ
  c. തെക്കേ മുസ്ലിം കുടുംബങ്ങൾ
  d. വടക്കേ മുസ്ലിം കുടുംബങ്ങൾ

42 കേരളാണ് മുസ്ലിം ജനങ്ങളുടെ ഏറ്റവും പ്രായമേറിയ ജനസാന്നിധ്യമായി?

  a. കൊച്ചി
  b. തൃക്കോട്
  c. തടാകാനാട്
  d. വാട്ടക്കര
## Appendix R

### Answer Sheet

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Appendix S

**Scoring Key**

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Appendix-T
PUPIL BEHAVIOUR RATING SCALE
(Draft)

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In order to assess the behaviour pattern of your children some questions are given below. It is a five-point scale. Two opposing responses are given for each question on the two ends of a line, which is divided into five points. Your answer can be between these two responses. Consider the line as the measuring rod and mark 'X' for the appropriate number. For example,

"Is the child attentive in class?"

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<td>Never</td>
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</table>

If the child is on the whole attentive put 'X' under 1. In this way answer all the questions.

The information gained from this scale will be used only for research purposes. Hence I humbly request you to read the questions carefully and answer them correctly.

1. Does the child get distracted easily while studying or doing any other work

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2. Does he have the habit of moving from one work to another?

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<tr>
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3. Does he take long to complete a task due to the inability to concentrate.

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4. Does he forget things due to carelessness

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<tr>
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5. Does he show the ability to act according to the directions given

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</table>
6. Does he have the ability to reproduce the information he heard from others?

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7. Does he use appropriate vocabulary while talking?

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8. Does he show the ability to narrate stories and explain life experiences?

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9. Is he conscious of the meaning of time?

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10. Does he show motor co-ordination?

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12. Is he generally careless in whatever he does?

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15. Does he need the help of the parents for everything?

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17. Does he mingle freely with his peers?

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18. Does he show the tendency to mingle with peers only?

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19. Is he careful in doing the responsibilities entrusted?

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20. Does he walk behind others to get things done?

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21. Can he sit quietly without doing any work for sometime?

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22. Does he notice anything that is different from the routine things?

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23. Does he have the habit of talking while studying or listening to stories?

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24. Does he show interest in games which require jumping and running?

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25. Does he show anger or stubbornness even for little things?

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<tbody>
<tr>
<td>Often</td>
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26. Does he know the concept big, large, direction and distance?

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<tr>
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27. Is he enthusiastic by nature?

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28. Is he good at arithmetics?

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<tr>
<td>Often</td>
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29. Is he interested in doing mathematical computation?

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<tr>
<td>Often</td>
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30. Does he read the lessons fluently without anybody's help?

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Appendix-U

PUPIL BEHAVIOUR RATING SCALE
(Final)

Name of the Pupil
Name of the Parent
Name of the school
Occupation
Division

In order to assess the behaviour pattern of your children some questions are given below. It is a five-point scale. Two opposing responses are given for each question on the two ends of a line, which is divided into five points. Your answer can be between these two responses. Consider the line as the measuring rod and mark ‘X’ for the appropriate number. For example,

"Is the child attentive in class?"

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<tbody>
<tr>
<td>Often</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
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<tr>
<td>Never</td>
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</table>

If the child is on the whole attentive put ‘X’ under 1. In this way answer all the questions. The information gained from this scale will be used only for research purposes. Hence I humbly request you to read the questions carefully and answer them correctly.

1. Does the child get distracted easily while studying or doing any other work

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<td>Never</td>
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2. Does he take long to complete a task due to the inability to concentrate.

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3. Does he forget things due to carelessness

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4. Does he show the ability to act according to the directions given

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18. Is he good at arithmetics?

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19. Is he interested in doing mathematical computation?

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20. Does he read the lessons without anybody’s help?

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APPENDIX V

LEARNING PROBLEM CHECKLIST (Draft)

Name of the Pupil: 
Standard: 
School: 
Name of the Teacher: 

Classroom behaviour
In many cases, children display behaviour patterns that impede their ability to learn. They alert teachers and parents that such a condition may exist. Kindly put tick mark (✓) if the stated problem exists.

1. Moves constantly ( )
2. Has difficulty beginning or completing tasks ( )
3. Is often tardy or absent ( )
4. Is generally quite or withdrawn ( )
5. Is disorganised ( )
6. Has difficulty with peer relationships ( )
7. Is easily distracted by sights or sounds ( )
8. Displays inconsistencies in behaviour ( )
9. Seems to misunderstand oral directions ( )
10. May do the same thing again and have difficulty 
    Shifting to a new activity, or stopping when it is time ( )
11. May not know what day of the week it is, or the time 
    Of the day, the month or the year. ( )
12. May not seem to remember something previously learned ( )
13. May appear to be bright but does not seem to be learning to read, spell, or do arithmetic ( )
14. May be erratic in his or her performance ( )
15. May feel personality frustrated or stupid and may see herself or himself as a failure. ( )
Academic Symptoms

Reading
16. Loses place, repeat words ( )
17. Does not read fluently ( )
18. Confuses similar words and letters ( )
19. Uses finger to follow along ( )
20. Subvocalizes when reading ( )
21. Does not read willingly ( )
22. Does not look at the whole word when reading ( )

Arithmetic
23. Has difficulty associating number with symbol ( )
24. Cannot remember maths facts ( )
25. Fails to not process signs ( )
26. Confuses columns and spaces ( )
27. Has difficulty with story problems ( )
28. Fails to comprehend math concepts ( )

Spelling
29. Uses incorrect order of letters in words ( )
30. Has difficulty associating correct sound with appropriate letter ( )
31. Reverses letters and words (mirror imagery) ( )

Writing
32. Cannot stay on line ( )
33. Has difficulty copying from broad or other source ( )
34. Uses poor written expression for age ( )
35. Is slow in completing written work ( )
36. Uses cursive writing and printing in some assignment ( )
37. Mixes lower and upper case letters in the same word ( )

Verbal Communication
38. Hesitates often when speaking ( )
39. Uses poor verbal expression for ago ( )
40. Inappropriate speaking voice

**Motor Response**

41. Displays poor coordination
42. Has problems of balance
43. Confuses right and left
44. Cannot consistently cross midline of the body
45. Lacks rhythm in movements, loses sequence
APPENDIX W
LEARNING PROBLEM CHECKLIST (Final)

Name of the Pupil: 
Standard: 
School: 
Name of the Teacher: 

In many cases, children display behaviour patterns that impede their ability to learn. They alert teachers and parents that such a condition may exist. Kindly put tick mark (✓) if the stated problem exists.

Classroom behaviour
1. Moves constantly ( )
2. Is generally quite or withdrawn ( )
3. Is easily distracted by sights or sounds ( )
4. Displays inconsistencies in behaviour ( )
5. May not seem to remember something previously learned ( )
6. May appear to be bright but does not seem to be learning to read, spell, or do arithmetic ( )

Academic Symptoms
Reading
7. Loses place, repeat words ( )
8. Does not read fluently ( )
9. Confuses similar words and letters ( )
10. Does not read willingly

Arithmetic
11. Has difficulty associating number with symbol ( )
12. Cannot remember maths facts ( )
13. Fails to not process signs ( )
14. Confuses columns and spaces ( )
Spelling
15. Uses incorrect order of letters in words
16. Has difficulty associating correct sound with appropriate letter

Writing
17. Cannot stay on line
18. Has difficulty copying from broad or other source
19. Uses poor written expression for age
20. Mixes lower and upper case letters in the same word

Verbal Communication
21. Hesitates often when speaking
22. Uses poor verbal expression for age

Motor Response
23. Confuses right and left
24. Lacks rhythm in movements, loses sequence
25. Has poor muscle strength for age.
RAO'S STUDY-HABITS INVENTORY

(FOR GRADES IX, X, & XI)

By
Dr. D. Gopal Rao
Reader in Education
NCERT, NEW DELHI

Name .................................................................
School .............................................................. Father's Occupation ...........................................
Class ............................................................... Parent's Income .............................................
Date of Birth ..................................................... Address ......................................................

DIRECTIONS

This is an attempt to understand your study habits. Below are given 40 statements. You will find five categories against each statement—Always, Most often, frequently, Sometimes and Never. Read each statement carefully and put a tick mark (✓) in the column which correctly describes your habits. Check each item not according to what you think should be done but according to what you actually do.

Answer all the questions. There is no time limit, but do not spend too much time on each item.

The main purpose of this test is to make you think about your own methods of study and help you to improve your study habits. What you answer has nothing to do with class marks. So, feel free to answer all the questions frankly.

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Agra Psychological Research Cell
Tiwari Kothi, Belanganj, Agra-282004
1. I plan my work before I begin to study.
2. I strictly observe my plan of study.
3. I distribute my study periods among various subjects.
4. I study regularly throughout the year.
5. I work harder in the subject I feel I am weak.
6. I plan my study even for holidays.
7. I get headache when I begin to study.
8. I cannot sit at a stretch and concentrate on my studies.
9. I take much time to get started to the task of study.
10. I look for main ideas while reading a lesson.
11. I question the material as it is being read.
12. I collect new words and phrases as I read a passage.
13. I look up the meaning of an unfamiliar word in the dictionary.
14. While reading, I try to understand the authors view point by relating it to my own experience.
15. I relate material learnt in one subject to that learnt in others.
16. I day-dream when I study.
17. I understand the lesson while reading it, but I have trouble in remembering what I have read.
18. I find it difficult to decide what points are important in a lesson.
19. I note down the points as I read a passage.
20. I supplement my class notes with outside study.
21. I organise my notes so that the important points stand out.
22. I find it difficult to take notes in the class.
23. I miss important points while taking down notes.
24. I go to the class well prepared.
25. I revise what is done in the class each day, when I get back home.
26. I spend some time each week, in revising the lesson.
27. I feel I spend more time in my studies, but achieve little.
28. I feel so tired that I cannot study efficiently.
29. I find my studies interesting.
30. I feel I should keep on studying throughout my life.
31. I take pride in doing well in my studies.
32. I forget to do my homework.
33. I go on postponing what I should be studying to-day.
34. I plan in the morning though I spend the day.
35. I study even in the midst of distractions like radio, people talking children's play etc.
36. I plan my answer before I start writing in the examination.
37. I revise my answers in the examination.
38. I study hard only a few months before the examination.
39. I have difficulty in expressing myself in writing.
40. I get nervous during the examination.

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Appendix Y

Home Learning Facility Inventory
Dr. A. Sukumaran Nair & Nirmala Devi

This questionnaire is meant to know your Home Learning Facilities. Read the statements carefully and put the tick (✓) mark in the appropriate column.

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<th>Yes</th>
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<tbody>
<tr>
<td>1. Do you have a study table?</td>
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<td>2. Do you have an English-Malayalam Dictionary at home?</td>
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<td>3. Do you have a map of Kerala at Home?</td>
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<td>4. Do you have an English Dictionary at home?</td>
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<td>5. Do your elders at home help you to do your homework?</td>
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<td>6. Do your parents plan out your time-table?</td>
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<td>7. Do your parents check your note books well ahead and correct them?</td>
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<td>8. Do your parents check whether you are punctual in your studies?</td>
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<td>9. Do your parents encourage you to keep your books and other articles neat and tidy?</td>
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<td>10. Do your parents create a favourable atmosphere at home for you to study?</td>
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Appendix Z

Achievement Motivation Scale

Dr. Beena Shah

INSTRUCTION
Kindly, read each of the following statements and its three alternative responses. Then you have to select one most suitable response out of them and tick (√) against the selected response.

For Example:
I like to ............ (a) do light works.
(b) repair the broken articles/things
(c) collect information about new inventions

In the above example, suppose out of the responses (a), (b) and (c) you prefer (b) as the most suitable response, tick (√) against the (b). Similarly, you have to select the most suitable answer for every statement. Kindly, give the response of all the statements.

(Thanks)

Published By

Agra Psychological Research Cell

TIWARI KOTHI, BELANGANJ, AGRA-282004.
1. I will like to study those Subjects in which
   a) less labour is needed.
   b) higher probability of success is definite
   c) generally difficulty is felt.

2. I think to get better marks in examination depends upon
   a) teacher's goodwill
   b) encouragement of parents and relatives
   c) hard labour

3. Before starting any work I
   a) prepare it's plan
   b) discuss it with the experienced persons
   c) perceive the probable problems and find out their solutions

4. I study at home lest
   a) my parents will rebuke me.
   b) I will be blamed for being unsuccessful in the examination.
   c) I will fail in the examination.

5. I like to become rich by
   a) doing any type of work.
   b) winning lottery
   c) earning money through work.

6. At leisure I like to read
   a) the detective (Jasusi) novels & film magazines
   b) Comics
   c) Knowledgeable books.

7. When the light suddenly goes at study time, I
   a) feel happy of being free from study.
   b) feel irritation.
   c) complete my work in light of candle/kerosene lamp.

8. I like to utilise my knowledge in the task through which I may get
   a) money
   b) fame
   c) self-satisfaction.

9. When I fail to follow any lesson then
   a) I leave that lesson
   b) I take help from others to understand that lesson.
   c) I try again and again to follow that lesson.

10. I feel proud of those friends who
    a) achieve pass marks in examination
    b) provide help to weaker students.
    c) get brilliant success in examination.
Appendix A1

MAHATHMA GANDHI UNIVERSITY
SCHOOL OF PEDAGOGICAL SCIENCES
KOTTAYAM

1999

Instructions

This scale is meant for your parents/guardians, but most of the information required is known to you. So you are requested to fill in all the columns given below in consultation with your parents/guardians. Please show the brothers, sisters and others who stay in your family by putting tick (✓) marks.

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Standard: .............................................
Name of School: ........................................ (Urban/Rural)
Place: ..................................................

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