PRACTICAL MANUAL

FUNDAMENTALS OF HORTICULTURE

Course No. APH 176 Credit Hrs. 2(1+1)

For Undergraduate Agriculture Students

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Syllabus

Practical: Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation including micro-propagation. Layout and planting of orchard. Training and pruning of fruit trees. Preparation of potting mixture. Fertilizer application in different crops. Visits to commercial nurseries/orchard.

Name of Student:

……..……

Roll No. …… **Batch** ……

Session …… **Semester** …….

Course Name: ……..……...

Course No: ……

Credit: ……....

CERTIFICATE

This is to certify that Shri/Km ……..……...

ID No …… has completed the practical course …… Course No ……. as per the syllabus of B. Sc (Hons) Agriculture/Horticulture …… semester in the year …… in the respective lab/field of college.

Date: Course Teacher

INDEX

S. No.	Date	Exercise	Page No.
1		Identification of Garden Tools, Implements, and Plant Protection items	
2		Identification of Fruits and Plantation Crops	
3		Identification of Vegetables and Spices Crop	
4		Identification of Annuals and Ornamental Plants	
5		Media Preparation for Plant Propagation in Nursery Beds and Root Trainer	
6		Plant Propagation Methods on Horticultural Crops	
7		Preparation of potting mixture.	
8		Training and Pruning of Fruit Plants	
9		Features and Layout of Orchard	
10		Prepare Layout of Different Planting Systems of Orchard	
11		Layout of a Nutritional / Kitchen Garden	
12		Preparation of Nursery Bed for Raising Vegetable Seedlings	
13		Digging of Pits for Planting of Fruit Plants (Banana)	
14		Preparation of Fertilizer Mixtures and Field Application	
15		Preparation and Application of Growth Regulators	
16		Visit to Tissue Culture Laboratory	
17		Visit to Commercial Horticultural nursery	
18		Visit to Commercial Fruits Orchard	

Exercise No. 1

Objective: Identification of Garden Tools, Implements, and Plant Protection items

S. No	Tools	Use
1.	Secateur	
2.	Budding cum Grafting Knife	
3.	Pruning Saw	
4.	Bill Hook	
5.	Lopper	
6.	Tree Pruner	
7.	Hedge Shear	
8.	Axe	
9.	Lawn Mower	
10.	Crow-bar	
11.	Shovel	
12.	Planting Board	
13.	Wheel Barrow	
14.	Hand Trowel	
15.	V-Hoe or Drill hoe	
16.	Flat Spade (Khurpi)	
17.	Hand Hoe	
18.	Spade	
19.	Pickaxie	
20.	Mattock	
21.	Hand weeder	
22.	Hand Cultivator	
23.	Sickle	

24.	Garden Rake or Hand Rake	
25.	Garden Rake	
26.	Garden fork	
27.	Wheel Hoe	
28.	Watering can or Rose Can	
29.	Hand sprayer	
30.	Sprayer	
31.	Manual Foot Sprayer	
32.	Hand rotary Duster	
33.	Battery Sprayer	
34.	Ladder	
35.	Dibber:	
36.	Bulb planter	
37.	Grass Sword	
38.	Magnifier Glass	
39.	Measureing Tape	
40.	Rope	
41.	Thorn remover	
42.	Brush cutter	
43.	Rubber garden gloves	
44.	Gumboot	
45.	Hose pipe	
46.	Digger	
47.	Root Trainer	

Exercise No. 2

Objective: Identification of Fruits and Plantation Crops (Tropical, Sub tropical & Temperate fruits)

S. No	Common name	Botanical name	Family
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
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24.			
25.			
26.			
27.			
28.			
29.			
30.			
31.			
32.			
33.			
34.			
35.			

Plantation crops

S. No	Common name	Botanical name	Family
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			

Exercise No. 3

Objective: Identification of Vegetables and Spices Crop

Important vegetables and spices crops and their identification

S. No.	Common Name	Botanical Name	Family
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
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23.			
24.			
25.			
26.			
27.			
28.			
29.			
30.			
31.			
32.			

Exercise No. 4

Objective: Identification of Annuals and Ornamental Plants

Summer and Rainy Season Annuals

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							
3.							

Winter Annuals

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							

All Season Annuals

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							
3.							

Ornamental Biennials

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							

HERBACEOUS PERENNIALS

Bulbous plants

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							
3.							
4.							

Orchids

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							

House plants

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							
3.							
4.							

Cacti & succulents

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							

ORNAMENTAL SHRUBS:

Flowering shrubs

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							
3.							
4.							
5.							
6.							

Foliage shrubs

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							
3.							
4.							
5.							
6.							

ORNAMENTAL TREES:

Common foliage & flowering trees:

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							

Ornamental palms

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							

2.							

Ornamental cycads

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							

Ornamental conifers

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							

Ornamental climbers

S. No	Common Name	Botanical Name	Plant Family	Method of propagation	Time of sowing/planting	Time of flowering	Colour of flower
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							

Exercise No. 5

Objective: Media Preparation for plant propagation in Nursery beds and Root trainer

Materials required: ……..……

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Soil:……

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Sand:……

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Compost: ……

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Saw dust:……..……..

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Coco peat: ……..……..

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Sphagnum moss: ……..…….

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Vermiculite: ……..……

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Perlite: ……..……..

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Procedure: ……..……..

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Precaution: ……..……

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Exercise No. 6

Objective: Plant Propagation Methods on Horticultural Crops

Materials required: ……...……

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Sexual propagation methods:……..……..

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Description of seed and seed items

S. No	Name of the crops	Monocot/Dicot	No of seeds / fruit	No of embryos
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
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12.				
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17.				
18.				
19.				
20.				
21.				
22.				

Asexual propagation methods:……

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Plant Propagation by Cuttings: ……

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Draw sketches

Plant Propagation by layering: ……..

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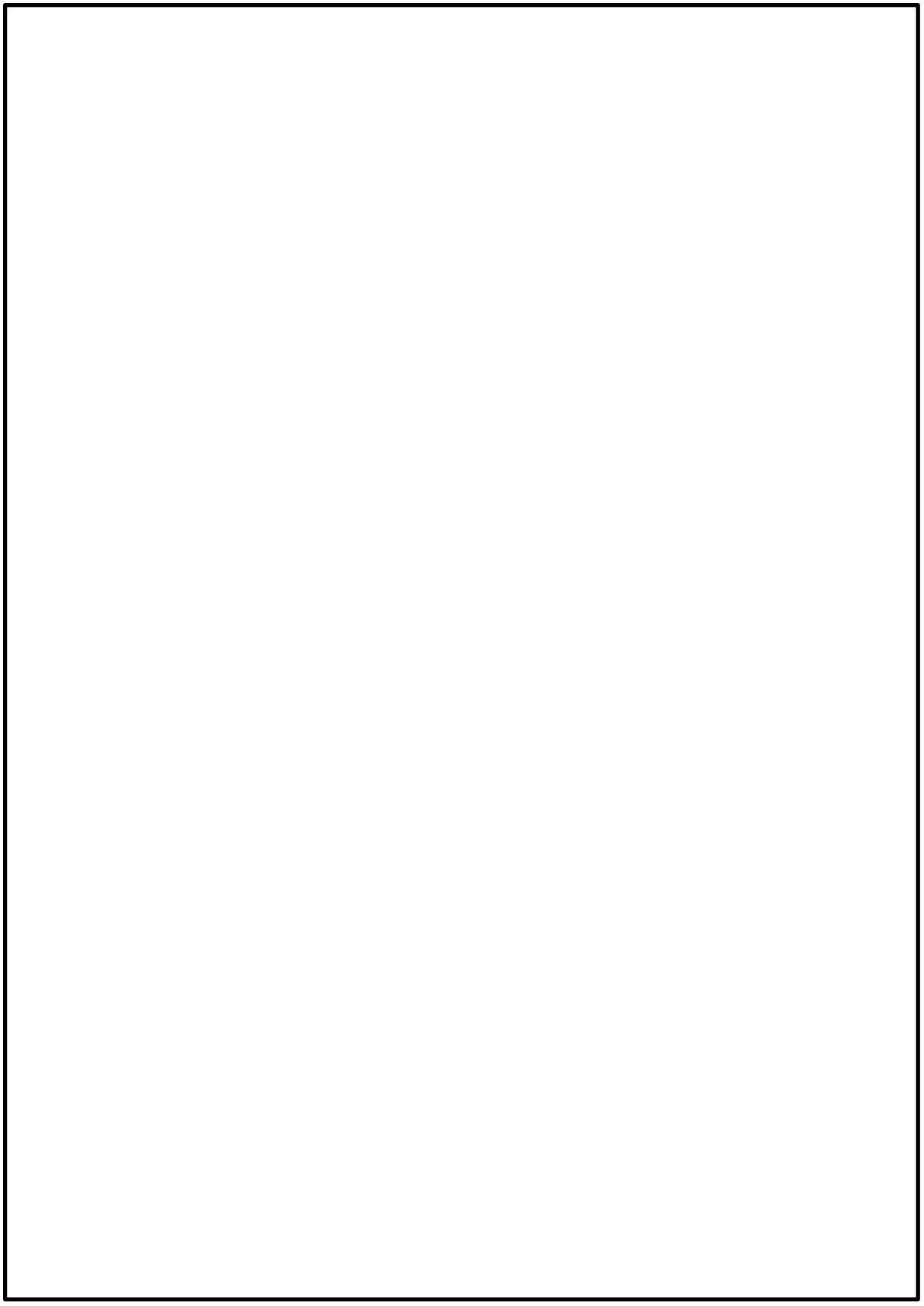
Draw sketches



Plant Propagation by grafting: ……..……

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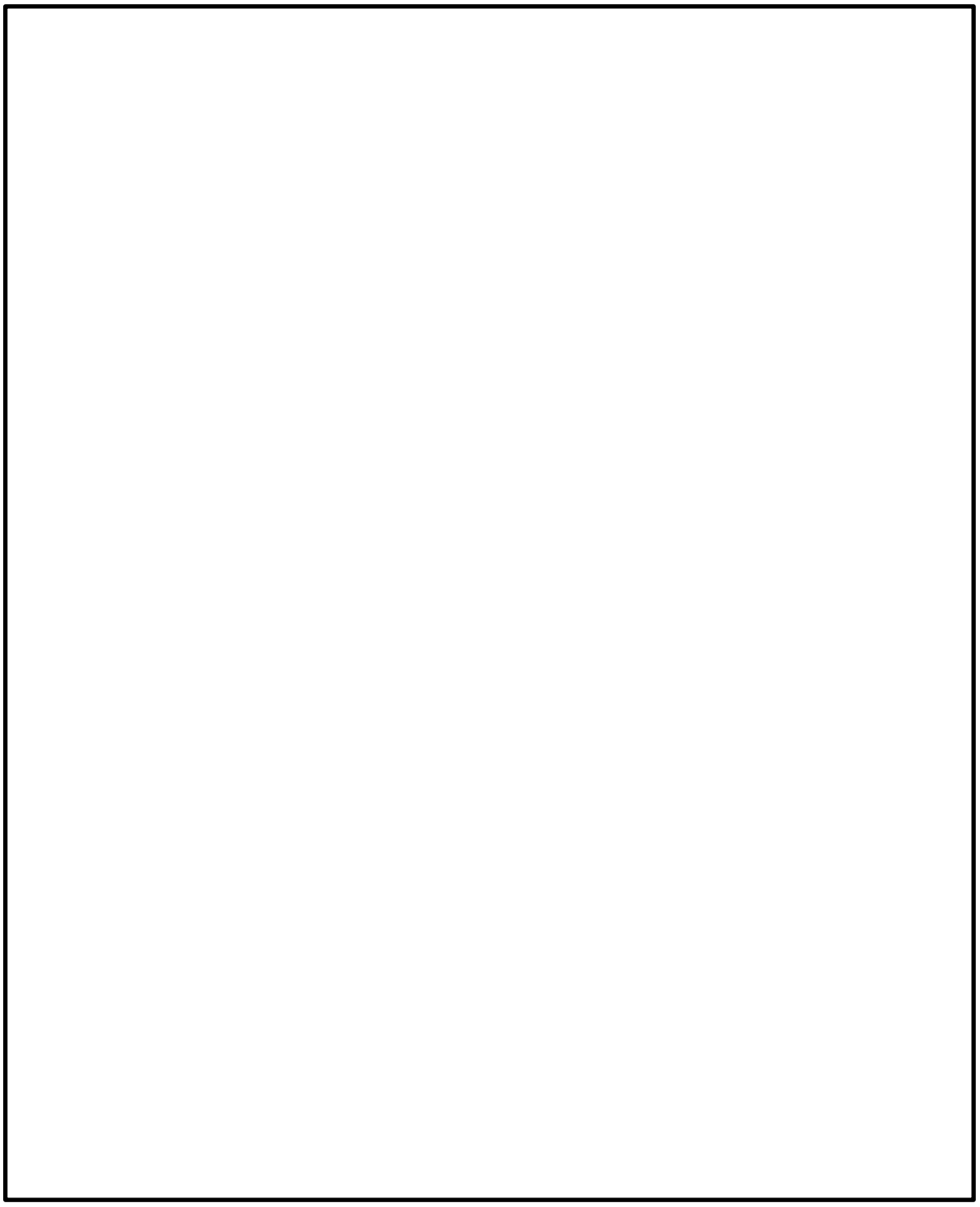
Draw sketches



Plant Propagation by budding:……

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Draw sketches

Plant Propagation by vegetative structures:

Bulbs:……..

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Tubers:……

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Tuberous roots: ……..……..

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Rhizomes: ……..……...

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Corms:……

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Runners:……

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Suckers:……

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Offsets/ offshoots:……..……..

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Exercise No. 7

Objective: Preparation of potting mixture.

Materials required: ……..……..

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Potting: ……..……

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Procedure: ……..……...

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Repotting: ……

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Propagation Media:……

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Containers: ……..

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Assignment: Practice the job in the field

Exercise No. 8

Objective: Training and Pruning of Fruit Plants

Materials Required: ……

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Procedures:

Central leader:

Open centre:

Modified leader system:

Methods of pruning: The different methods of pruning commonly followed in fruit plants are:

1. **Thinning out:**……
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2. **Heading back:** ……
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3. **Disbudding or rubbing off:** ……
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4. **Pinching and topping:** ……
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5. **Ringing and Girdling:** ……
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6. **Notching:** ……
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7. Nicking: ……
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8. De-suckering: ……
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9. **Root Pruning:** ……
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10.Ringing:……
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……
11.Smudging:……
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12.**Bending:** ……..…

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13.Disbudding: ……..…

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Assignment: Practice the procedures and draw sketches.

Exercise No. 9

Objective: Features and Layout of Orchard

Write the components of an orchard: ……

Problem: Draw a neat sketch of an orchard (10.0 ha)

Exercise No. 10

Objective: Prepare Layout of Different Planting Systems of Orchard

Materials Required: ……

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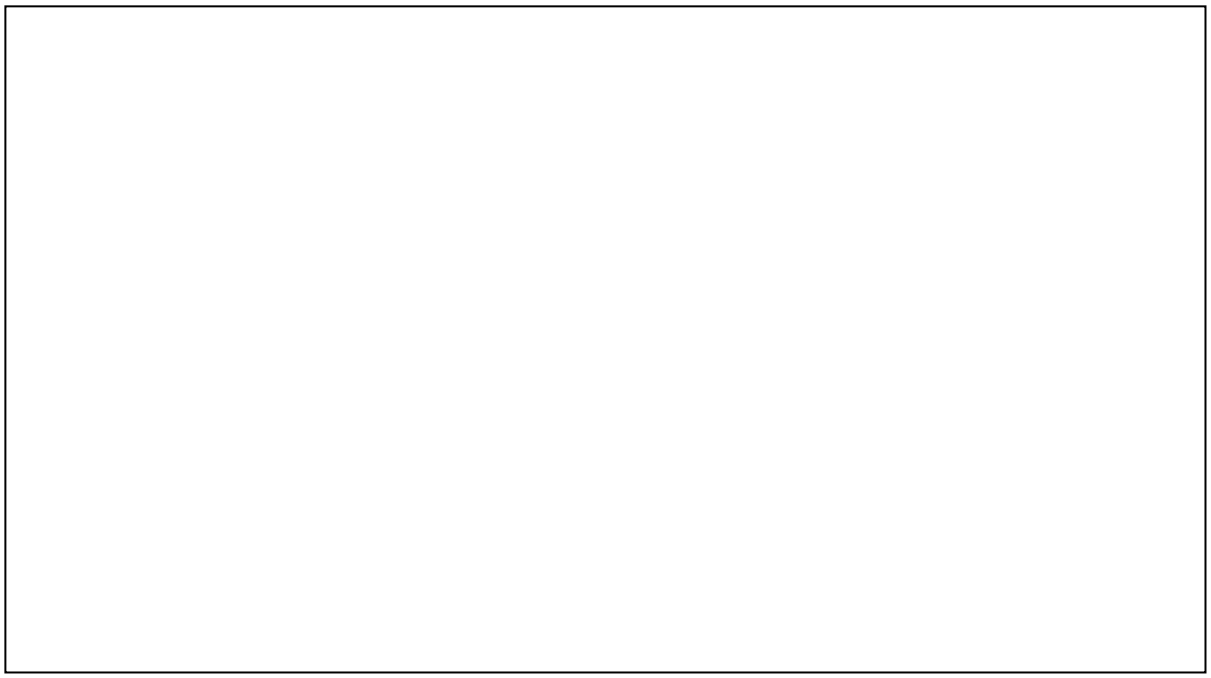
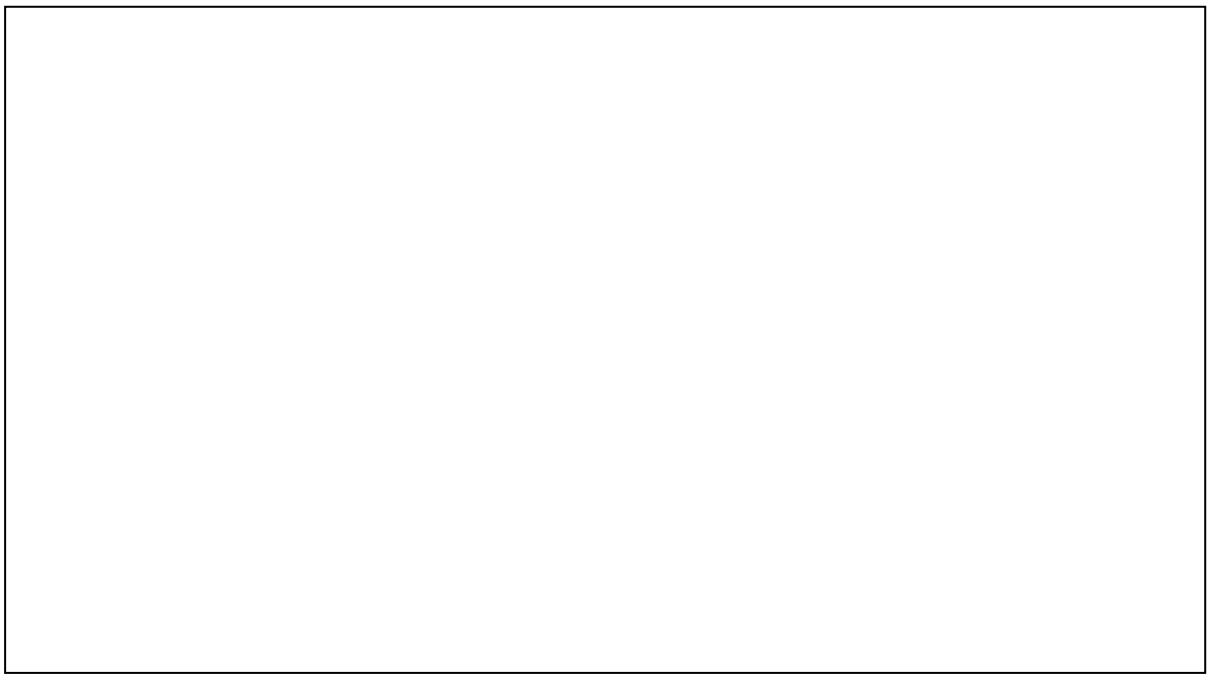
Planting system: Vertical row planting pattern

Square System:



Rectangular system:



Calculation of number of trees required per unit area: Calculation of number of different fruit crops per hectare with different system of planting by using the following formulae:

Square and rectangular systems:
No. of plants required for 1 ha = 10, 000 sq. m
Row to row distance (m) × plant to plant distance (m)

No of plants / ha

$$\textbf{No of plants / ha} = \frac{\text{Total Area}}{\text{(Row to row distance)} \times \text{(Plant to plant distance)}}$$

Problem: ……

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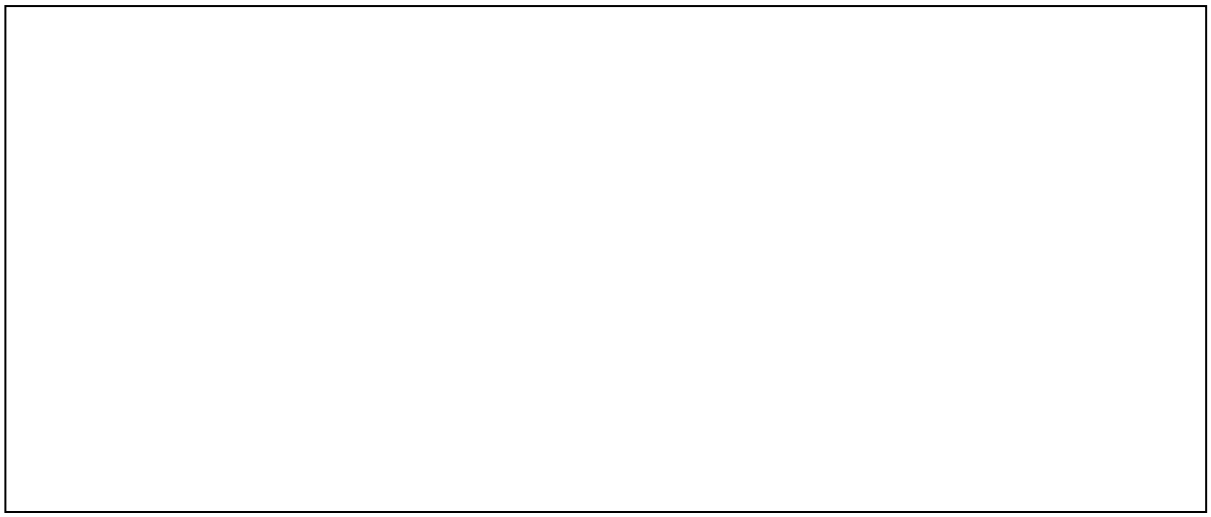
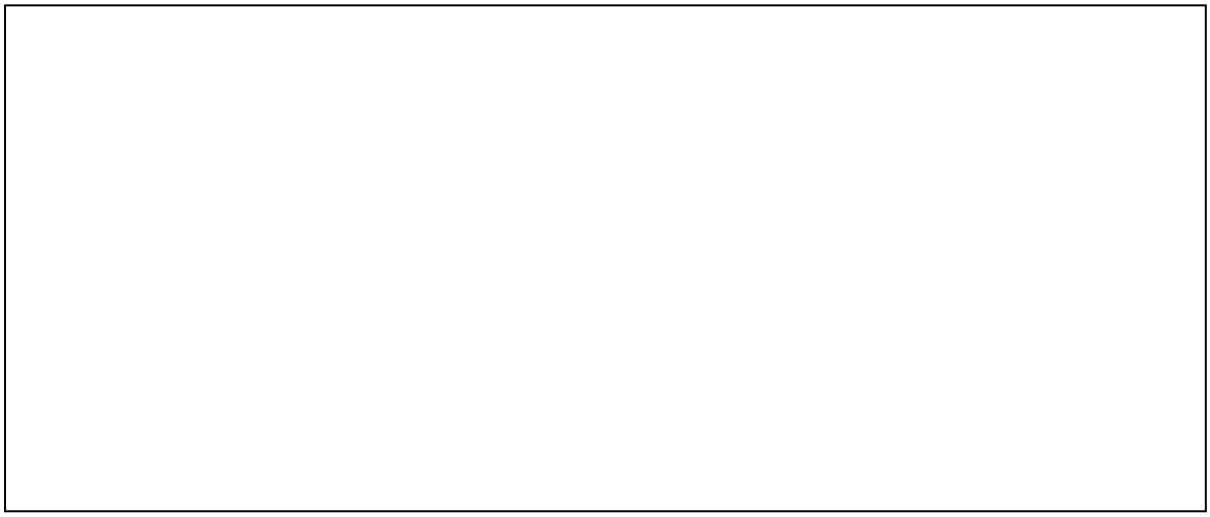
Alternate row planting pattern:

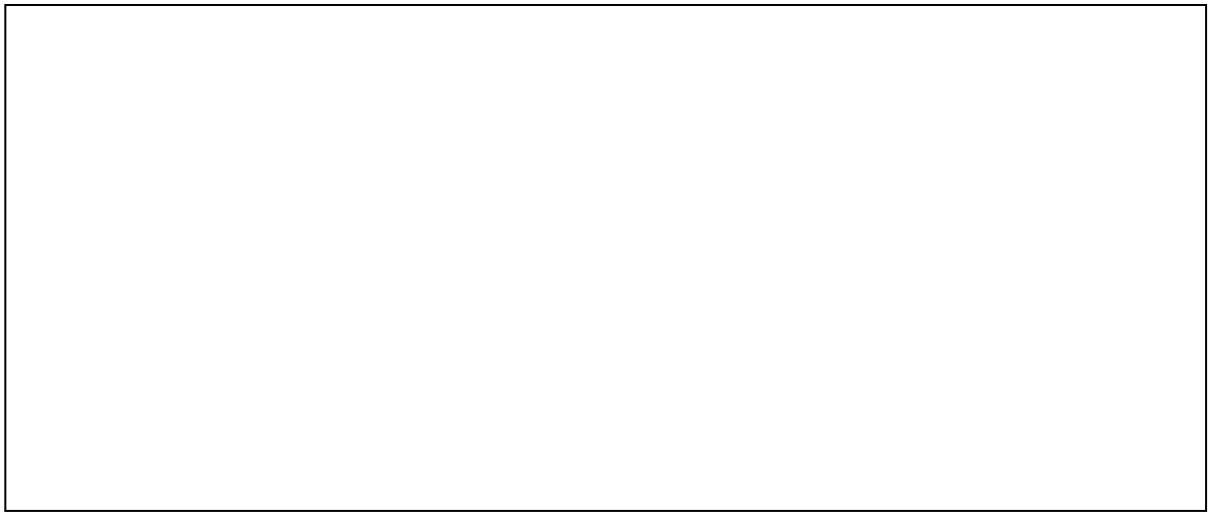
Diagonal or Quincunx system:



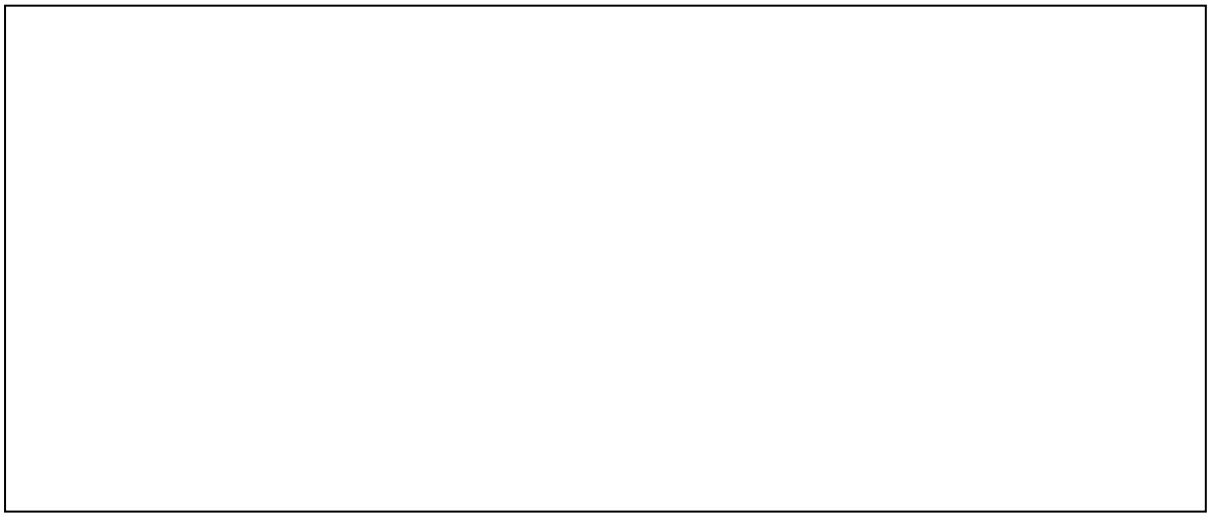
Hexagonal system:



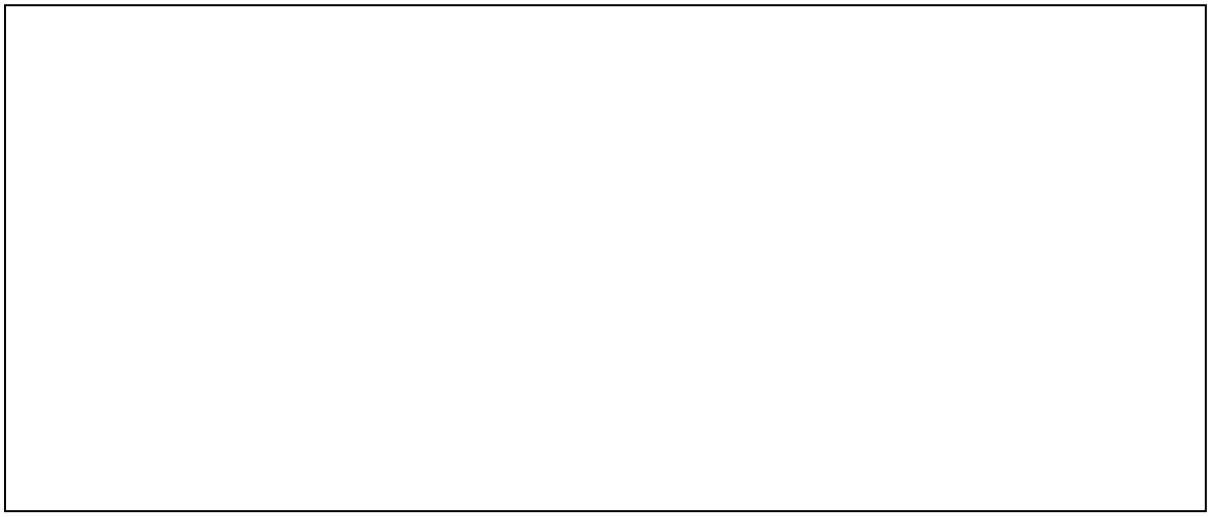
Triangular system:



Double Row System:



Contour system



Calculation of number of trees required per unit area

Quincunx system

$$\textbf{No of plants / ha} = \frac{\text{Total Area}}{\text{(Row to row distance)} \times \text{(Plant to plant distance)}}$$

If Row to Row distance and Plant to Plant distance is 10m, then

$$\textbf{No of plants / ha} = \frac{10{,}000}{10 \times 10}$$

No of plants / ha = 100

Additional plants planted in centre of square = (No. of rows length wish – 1) × (No. of rows width wish – 1)

= (10– 1) × (10 – 1)
= 9 × 9
= 81

Therefore, total no. of plants = 100 + 81 = 181

Hexagonal system:

No of plants / ha = $\frac{\text{Total Area}}{\text{(Row to row distance) × (Plant to plant distance)}}$

No of plants / ha = $\frac{10{,}000}{10 \times 8.65}$

No of plants / ha = 115

If plant to plant distance = 10 m, then as per equilateral triangles;

The row to row distance = AD=$\sqrt{AB^2 - BD^2}$

= $\sqrt{100 - 25}$

= 8.65 m

Triangular system:

P = $\frac{S}{d^2}$

Where,

P= Plant population

S= Total Area

d= length of the triangle arm

Double Row System:

No of plants / ha = $\frac{\text{Number of the Rows x Total area cropped}}{\text{(Plant to plant distance) × (Row to Row) + (Bed to Bed distance)}}$

If, the plant to plant distance is 25 cm, row to row distance is 35 cm and bed to bed distance is 90 cm.)

No of plants / ha = $\frac{2 \times 10000}{0.25 \times (0.35 + 0.90)}$

No of plants / ha = 64000

Observations to be performed:

Calculate of number of different fruit crops per hectare under different planting system.

Problem:

Practice the planting system on the field and draw neat sketches

Exercise No. 11

Objective: Layout of a Nutritional / Kitchen Garden

Kitchen Garden: ……

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Importance: ……

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Selection of Land: ……

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Selection of Crops: ……

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Important Consideration: ……

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Arrangements of vegetable and spice crops in different plots

Time	Name of the vegetable & spice
July – October	
November - March	
April - June	
June – August	
October – February	
March – June	
June – October	
October – January	
January – May	
September – December	
January – March	
March – July	
August – December	
December – March	
March – July	
October – December	
January – June	
July – September	
November – March	
April – July	
August – October	

Bund crops: ……

Fence crops: ……

Assignment: Draw a neat sketch of a model nutritional garden.

Exercise No. 12

Objective: Preparation of Nursery Bed for Raising Vegetable Seedlings

Materials Required: ……

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Procedure: ……

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Calculation:

We know, 1 ha = 10,000 m^2

Nitrogen required / 3 m^2 = $\frac{200 \text{ x } 3}{10{,}000} = 0.06\text{kg}$

So, Urea required / 3 m^2 = $\frac{100 \text{ x } 0.06}{46} = 0.130 \text{ kg}$

Phosphorus required / 3 m2 = $\frac{100 \text{ x } 3}{10{,}000} = 0.03 \text{ kg}$

So, SSP required / 3 m^2 = $\frac{100 \text{ x } 0.03}{16} = 0.1875 \text{ kg}$

Potassium required /3 m^2 = $\frac{220 \text{ x } 3}{10{,}000} = 0.066 \text{ kg}$

So, MOP required /3 m^2 = $\frac{100 \text{ x } 0.066}{60} = 0.11 \text{ kg}$

Problem: Prepare nursery beds and raise the seedlings.

Exercise No. 13

Objective: Digging of Pits for Planting of Fruit Plants (Banana)

Materials Required: ……

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Procedure: ……

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Precautions: ……

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Problem: Practice the job on the field and draw neat sketch

Exercise No. 14

Objective: Preparation of Fertilizer Mixtures and Field Application

Materials required:……

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Method of Application: ……

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Precautions: ……

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Precautions:……

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Problems: Practice the job on the field.

Exercise No. 15

Objective: Preparation and Application of Growth Regulators

Materials Required: ……

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Preparation of growth regulators

Dust form: ……

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Lanolin paste:

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Solution form: ……

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Solvents for dissolving plant growth regulators

Name of growth regulator	Solvent
Indole Acetic Acid (IAA), Indole Butyric Acid (IBA), 4 CPA, NAA	Ethyl alcohol, Methanol, Potassium hydroxide, Sodium hydroxide
2, 4-D and 2, 4,5-T	Water
Gibberellic Acid (GA3), 6-Benzyl Adenine, Benzyl Amino purine, Kinetin 2 ip	Ethanol or Methanol, 0.1 N HCL

Procedure: ……

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Example: Before preparation, the following aspects should be known-active ingredients or strength of pure chemical that is mentioned in the label of the pack, the amount of chemical required for the desired strength and volume are calculated by the following formula.

$V_1S_1 = V_2S_2$

Where V_1 = chemical required.
S_1 = strength of chemicals/hormone.
V_2 = water or powder required.
S_2 = concentration or strength of chemical/ hormone required.
[1% = 10,000 ppm]

Solved Problem:

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Assignment: Practice the job and record the calculation

Exercise-16

Objective: Visit to Tissue Culture Laboratory

Materials required: ……

Methods and observations: ……

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Details of various tissue culture rooms/chambers

S. No.	Name of the room / chamber	Facilities available	Details of the work being done at the time of visit
1.	Washing room		
2.	Media preparation room		
3.	Inoculation room		
4.	Growth chamber		
5.	Hardening room / glass house		

Details of various tissue culture techniques

Name of Lab	Types of tissue culture technique followed (Name them)	Fruit/Plantation crops in which the work is in progress	Protocols developed	Feature plans

Details of tissue culture media

Name of Media	Ingredients				
	Macro elements	Micro elements	Vitamins	PBRs	Miscellaneous

Write in brief about the important uses of the following in tissue culture.

Refrigerator: ……..…….

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Analytical balance: ……..……

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Autoclave: ……

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pH meter: ……

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Laminar airflow hood: ……..……

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……..……

Agar: ……..…

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PBRs: ……

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Surface sterilant: ……..……...

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Precautions to be followed while working in a tissue culture lab: ……..

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Exercise No. 17

Objective: Visit to commercial Horticultural Nursery

Materials required: ……..…

Method of observations: ……..

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Report of the visit: ……

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Exercise No. 18

Objective: Visit to commercial fruits Orchard

Materials required:

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Method of observations: ……..

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