Date _____ 20___
M T W T F S S

REPRODUCTION IN PLANTS

→ formation of young ones of ones own kind is an essential character of all living things

Specie : a group of similar organisms which can reproduce freely in nature and produce fertile off springs.

1. Asexual Reproduction
2. Sexual Reproduction

→ stem + leaves + roots → vegetative parts (asexual)
↳ presence of nodes at root tips, one at shoot tip, one at intervals and one at stems in the form of rings
↳ retain capability of cell division

nodes, root tip, shoot tip } have groups of undifferentiated cells called meristems (generally known as stem cells) ↳ which retain division capability throughout their lives

→ when plants use these 3, they must involve mitosis in cell division
↳ means new generation will be identical

ASEXUAL REPRODUCTION

→ this process does not involve gametes formation and their fusion
→ a fast process
→ the offsprings are genetically identical
→ Types : i. Vegetative Propagation
ii. Micro Propagation
ii. Spore formation

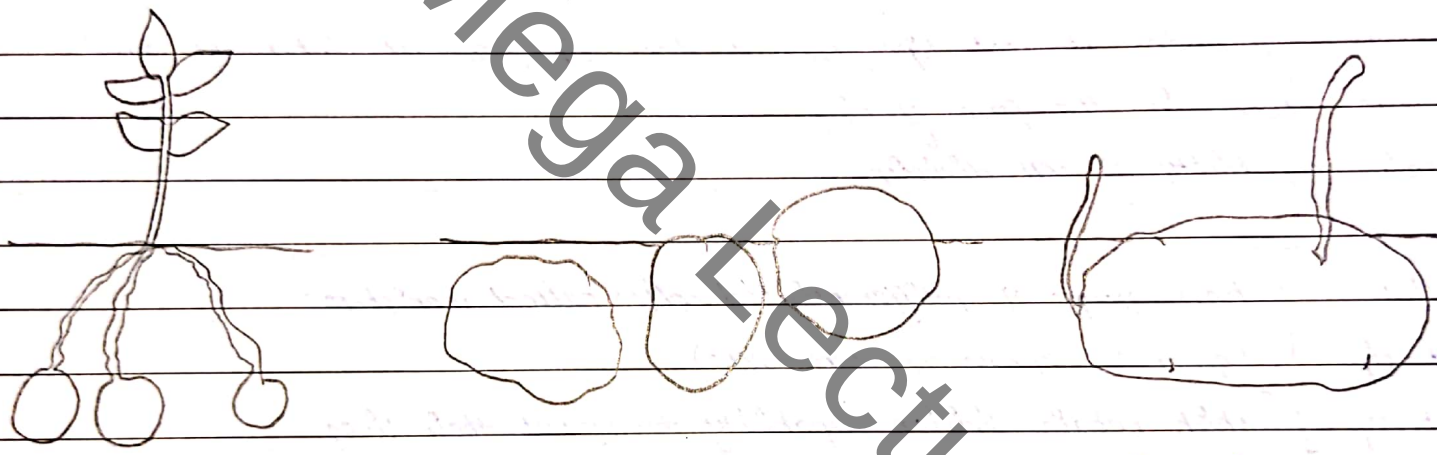
Date
M T W

Vegetative Propagation

→ reproduction of flowering plants using vegetative parts, involving mitosis
→ 2 types : 1. Natural Vegetative Propagation
2. Artificial Vegetative Propagation

1. Natural Vegetative Propagation

→ during favorable conditions, plants photosynthesize and produce carbohydrates which are stored in storage organs in same plants
→ plants pass the unfavorable conditions on the storage organs which support to produce new plants on the arrival of favorable conditions



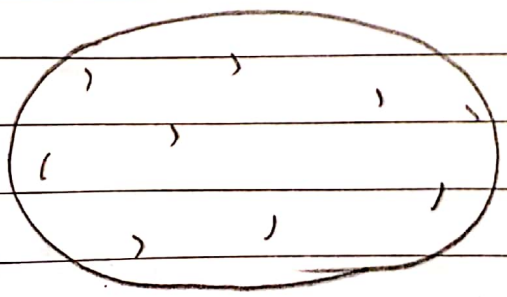
Favorable Unfavorable Favourable

→ few examples of this :

1). Tuber

→ underground modified stem of a plant for storage (extra food material)

e.g/ potatoes



• markings are actually nodes

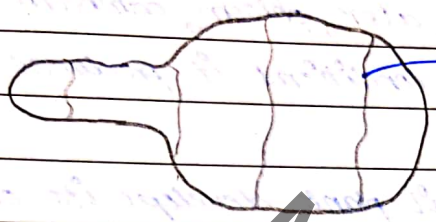
Date ____ 20 ____
M T W T F S S

availability of favorable conditions, the storage organ can activate this, the cells would divide & make an identical plant to the parent plant

2). Rhizome

→ underground modified storage cells

e.g/ ginger



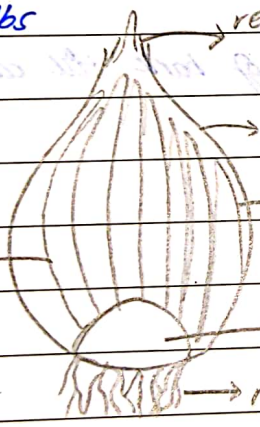
→ sealing on ginger (scaly leaves) - along these we have presence of nodes

→ on activation of nodes, we can get a new plant

3). Bulb

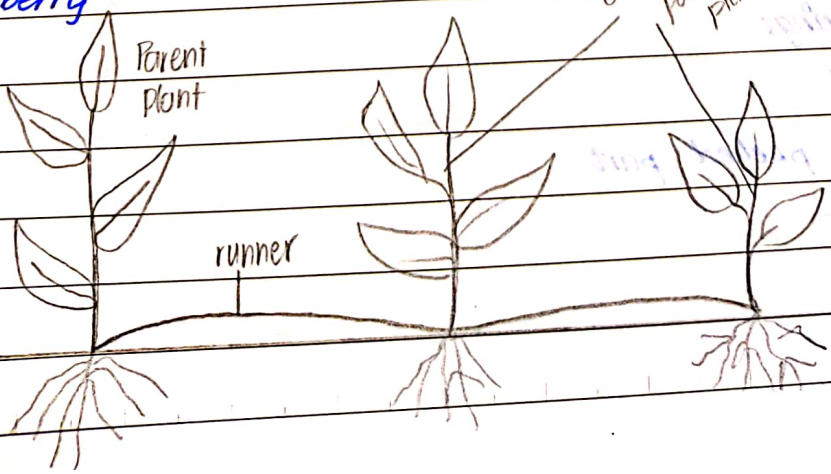
→ underground modified leaves

e.g/ onion bulbs



4). Runner.

e.g/ Strawberry



→ underground modified storage stem

Date
M T

2. Artificial Vegetative Propagation

→ involves human intervention

→ most common methods are cutting, layering, tissue culturing, grafting and marcotting

1). Cutting

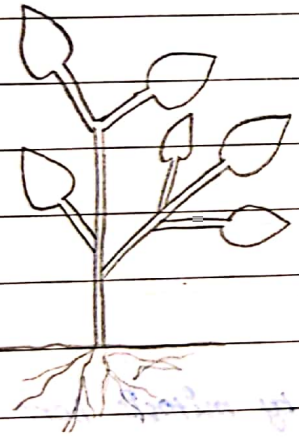
→ cut a mature shoot of a plant which has buds on it

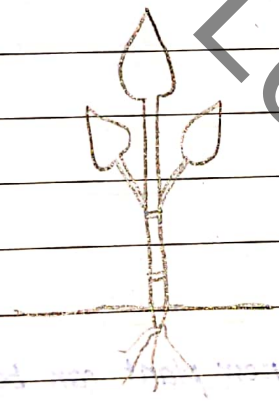
→ then bury it in soil, upon arrival of favorable conditions it produces roots and shoots

→ the food stored in the stem is used until plant develops its own leaves

→ examples:

roses, sugar cane





* removal of bark till cambium

2). Layering

→ cut a few mm thick rings slightly away from the tip of the shoot, few cm away from each other

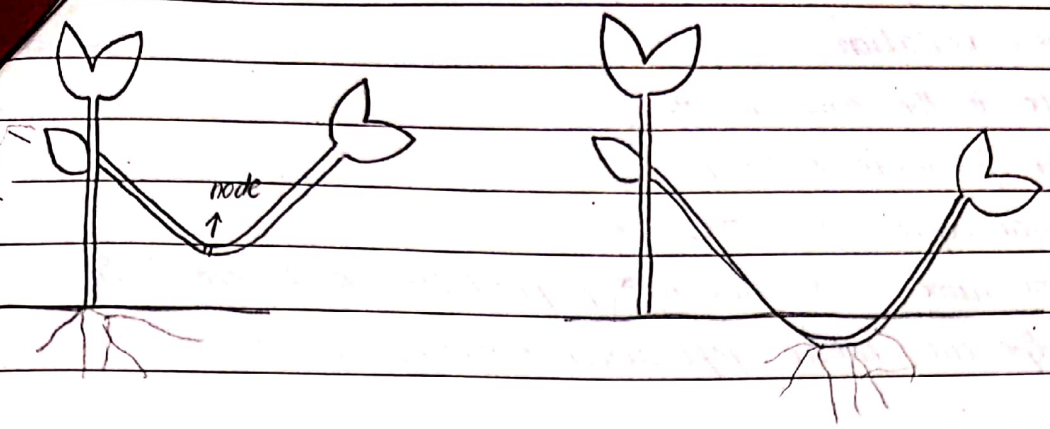
→ peel the bark b/w these rings

→ bury this part in the soil

→ new root emerges from the peeled part

→ remove the attachment

Date _____ 20___
M T W T F S S



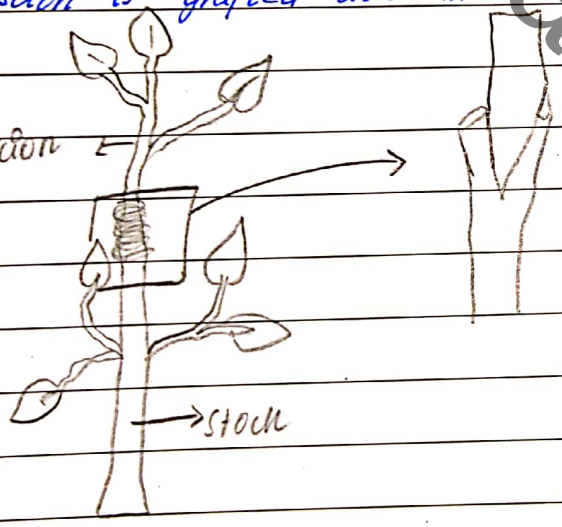
→ e.g/ citrus plants

3). Grafting

→ cut a shoot from a plant which has desired fruit quality, it is called scion

→ the stem of the plant with the root system is cut and called stock

→ scion is grafted onto the stock



Q. Why do farmers use asexual means of reproduction?

Ans. → quick as compared to sexual

→ requires one plant only

→ no external agents required

→ little waste

→ ensures that desirable characteristics of the parent plant will persist

Date ____ 20__
M T W T F S S

Q. What are the disadvantages of asexual reproduction?

Ans. → minimum genetic variation
→ all are vulnerable to the same disease
→ occurs only under favorable conditions
→ nature favors sexual reproduction over asexual
→ same traits means same weaknesses ⟶ if predator attacks one & is successful it will wipe out entire population resulting in extinction

Q. Write down some features of Vegetative Propagation?

A. → identical to parent plant
→ miniature plant can be nourished by parent plant until it is established enough to live independantly
→ the plant doesn't need to produce flowers

Date _____ 20___
M T W T F S S

SEXUAL REPRODUCTION

→ for the formation of gametes, the reproductive structure present in plants are flowers

→ flowers may be present singularly or in clusters called inflorescence and may differ from each other

Parts of flowers & their functions

1. Calyx

→ a collection of sepal makes the first whorl of flowers called calyx

→ encloses and protects the other parts of a flower when it is a bud

2. Corolla / petals

→ petals of different shapes & colors may be present

→ second whorl of the flower

→ they are large and scented to attract insects for pollination

nectories : sac-like and contain nectar
microscopic

nector guides : to guide insects to nectories
no. in accordance with the other whorls
sometimes separated & sometimes alternative (overlapping)

3. Androceium / stamens

→ male reproductive part of a flower

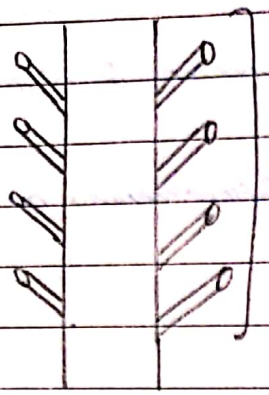
→ each stamen is made up of a filament & anther
↓
tube-like & long

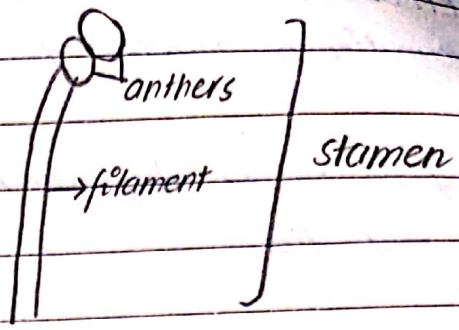
→ not specific to specie

→ each anther is a lobed structure which contains pollen sacs

Inside these pollen sacs, meiosis occurs & produces numerous, thick-walled 4° nucleated haploid cells called pollen grains

Date
M T W T F

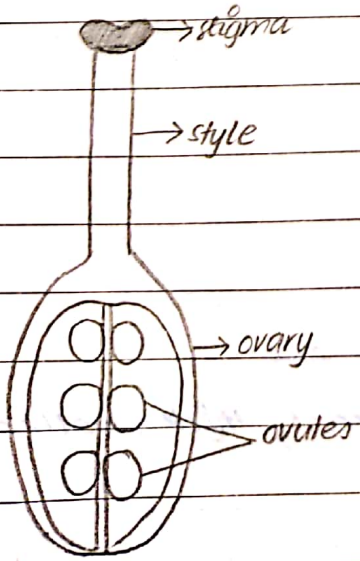


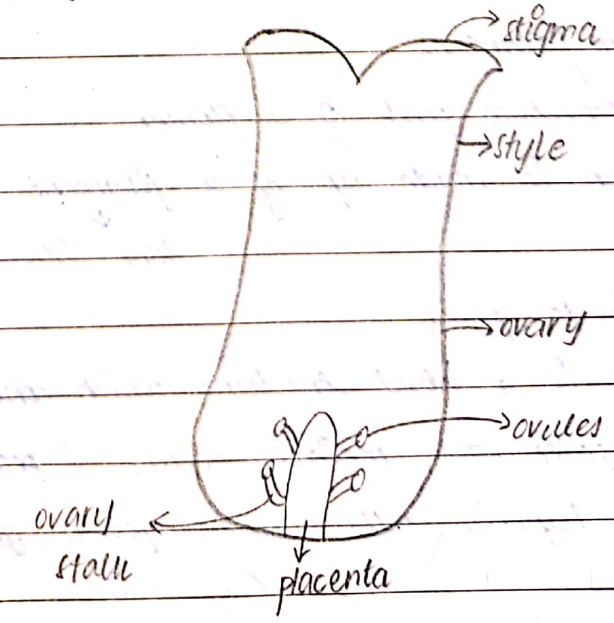


filament tube
10 stamens (9+1)
Papilinaceon

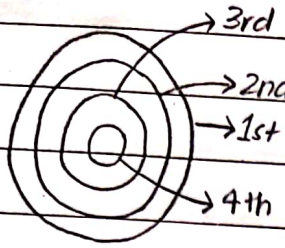
4. Gynoecium / Carpel / Pistel
→ female reproductive part of the flower
→ each carpel consists of:
* stigma — stage for landing of pollen grains
* style — tube-like
* ovary — part containing ovules
↓
haploid, female gametes mature here

→ ovary contains one or more ovules inside it
→ leathery and bifercated
→ no. of carpels is equal specific to species in accordance with the other whorls

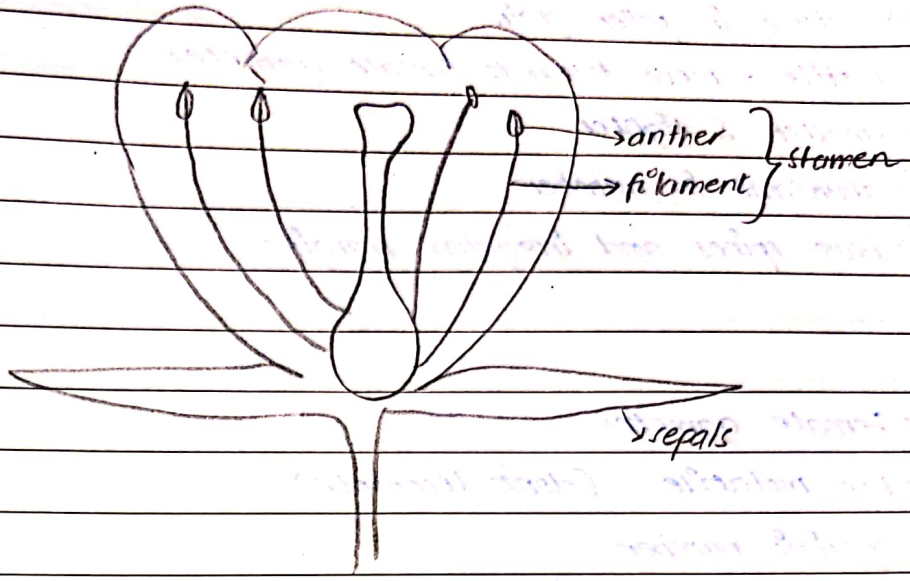




Date _____ 20___
M T W T F S S



Floral whorls



⇒ complete flower: all 4 whorls are present
incomplete flower: any of the whorls is missing
⇒ perianth: calyx or corolla is absent
⇒ pistilate flower: androceum absent (female)
⇒ stamanate flower: gynoceum absent (male)

bisexual flower: both sexes in one flower — Hermophrodite e.g/Lily/Hibiscus
unisexual flower: pistilate or stamanate flower e.g/Papaya
big fruits/vegetables: unisexual flavers usually famous (+ mango) flowers: bisexual
radical symmetrical: can be cut into 2 halves at more than one plane
bilateral symmetrical: can be divided into 2 halves at only one plane

superior ovary: all whorls arranged lower than ovary on thalamus
inferior ovary: all whorls arranged above ovary on thalamus

monoecious: bisexual flower
dioicous: unisexual flower

Date
M T W

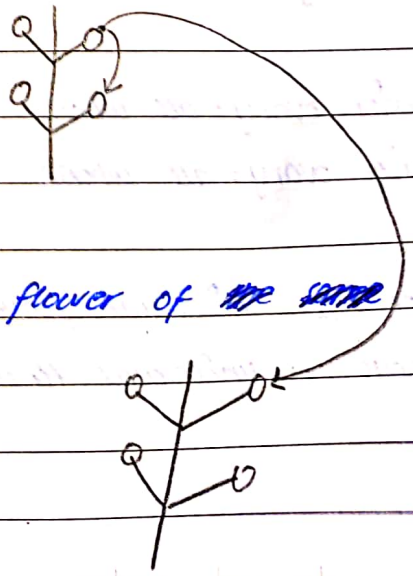
* Male gametes
↳ mature in pollen grain
↳ motile : move towards female gametes
↳ smaller & lighter
↳ abundant in number
↳ have spines and irregular margins

* Female gametes
↳ non-motile (don't locomote)
↳ specific number
↳ larger in size } more cytoplasmic content (none of the males involved)
↳ heavier

POLLINATION

→ transfer of pollen grains from anthers to stigma by wind or insects
→ 2 types : 1. Self-Pollination
2. Cross-Pollination

1. Self-Pollination
→ transfer of pollen grains from one flower to another flower of the same plant



2. Cross-Pollination
→ transfer of pollen grains from one flower to another flower of ~~the same plant~~ a different plant
→ favored by nature over self-pollination

Date ____ 20____
M T W T F S S

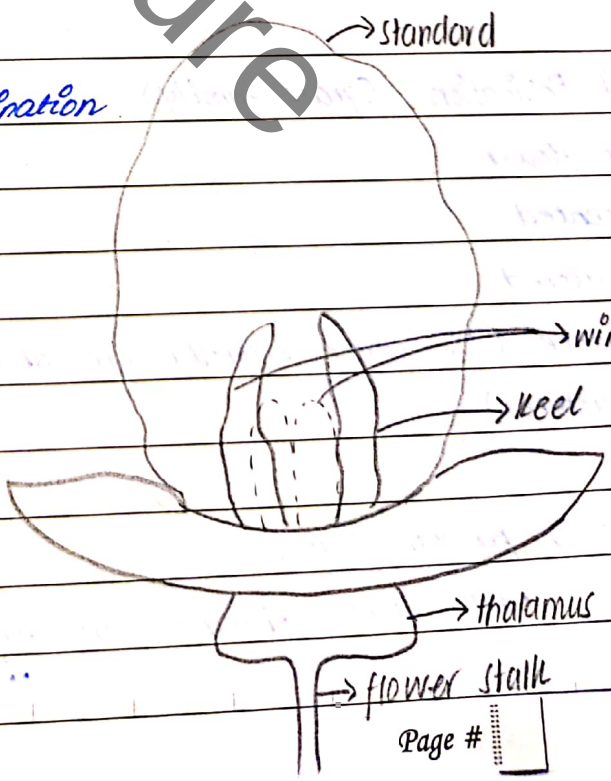
...tions :-

→ the position of anthers and stigma are different in the flower
→ maturing time of both reproductive parts is different in same flower — male part matures earlier
→ plants have only one sex flower
→ position of pistilate flower is higher than stamanate flower on the same plant to avoid self-pollination

advantages:
→ increased probability of genetic variation
→ ↑ genetic variation in next generation leads to ↑ gene pool of a population
→ ↓ chances of genetic disorders
→ ↓ competition b/w parents & next generation

∴ MODES OF POLLINATION
① . Insect Pollination ② . Wind Pollination

1. Insect Pollination
→ large flower
→ large petals acts as a landing site
→ must be colored
→ scented
→ presence of nectories
→ nectar guides
→ compact reproductive parts



Date
M T W T

e.g/ clitoria (diagram on previous page: bottom)

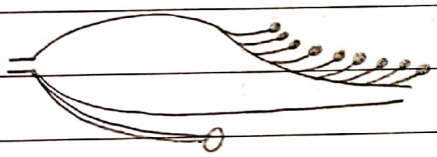
→ complete, hermophrodite, bilateral

i. calyx
- 5
- green
- bell-shaped with free margins

ii. corolla
- 5 : 1 + 2 + 2 arrangement
  - standard - largest, purple in color
  - wings - purplish white & smaller than standard
  - keel - white & smaller than wings

*standard provides landing stage, turns backward when insect lands on it, opens the flower & guides the insect to nectories

iii. androceium
- paplinaceous : 10 (9+1)
- free anthers



iv. gynoecium
- 5
- stigma is hairy & style is short
- syncarpous condition + fused

2. Wind Pollination (grass family)
→ smaller flower
→ not scented
→ dull colored
→ incomplete (b/c calyx & corolla are absent & there is instead presence of scale like structures)

e.g/ oats

↳ presence of perianth leaves
- dull leaves
- having scaly leaf like structures "Bracts"

Date ____ 20 ____
M T W T F S S

flowers : * each has 2 flowering bracts

* lower axis — staminate flowers → 3 stamens

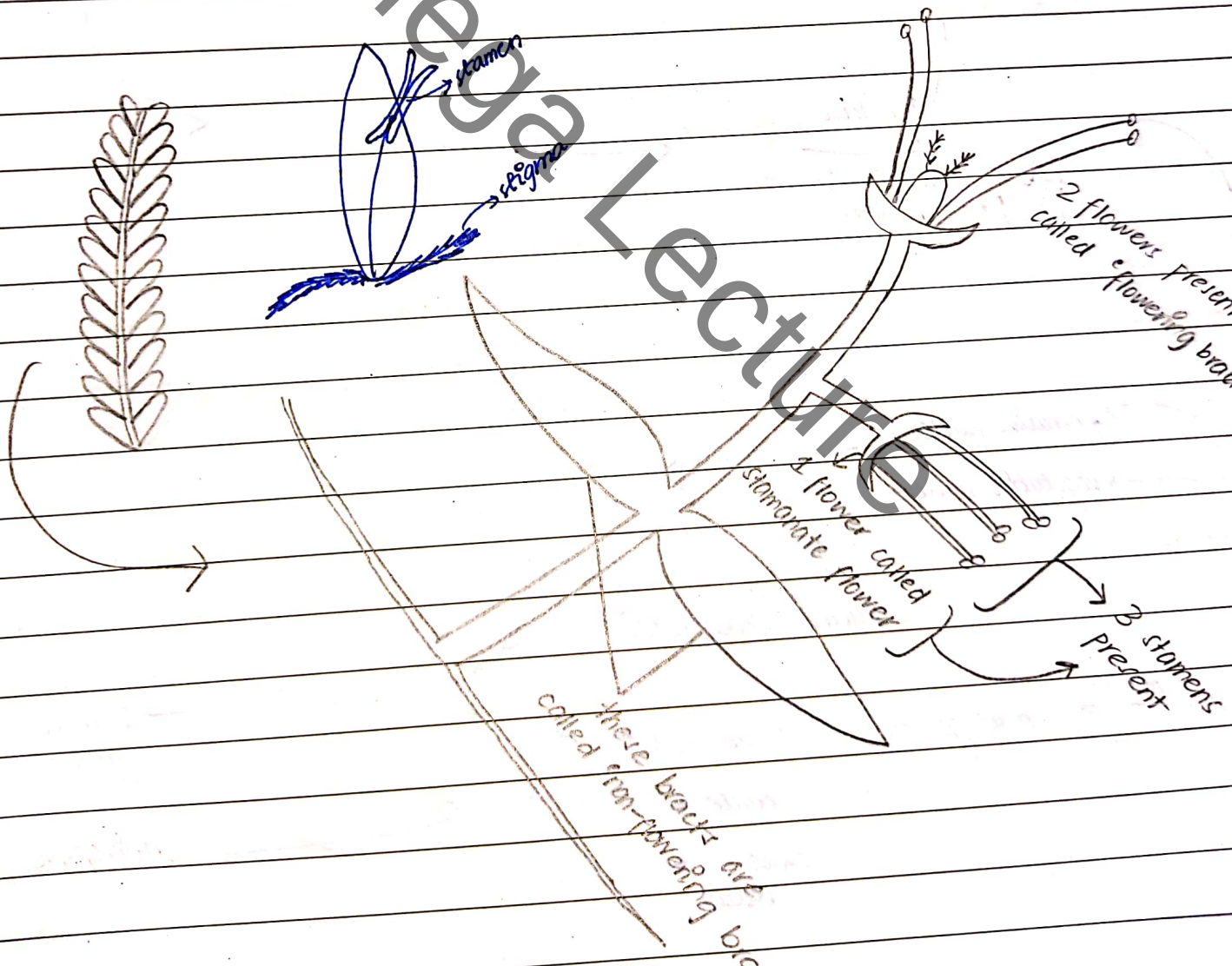
* higher axis — hermaphrodite — bisexual → 3 stamens

→ 3 carpels → syncarpous

- short style
- bifercated
- feathering stigma (A.S.A)

→ reproductive parts are not protected or hidden & are instead protecting —
" " " protruding

→ all 6 stamen have long filaments which are pendalous
↓
protruding

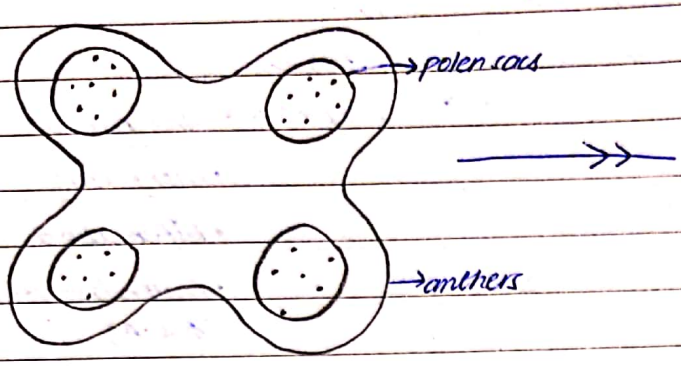


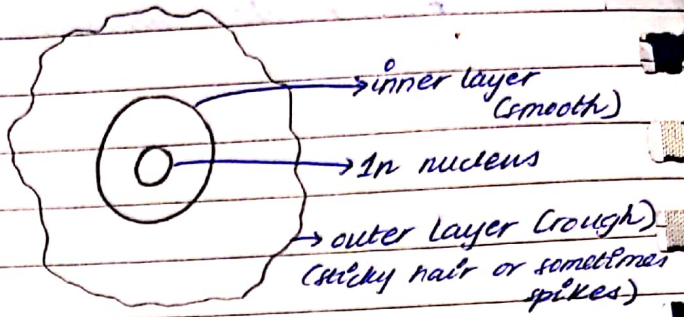
Page #

Date
M T W

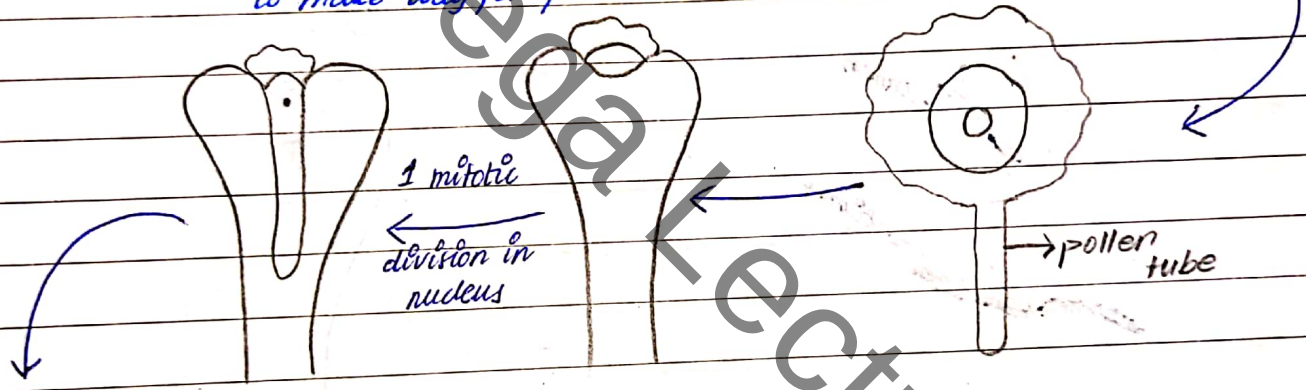
MATURATION OF POLLEN GRAINS TO MALE GAMETES

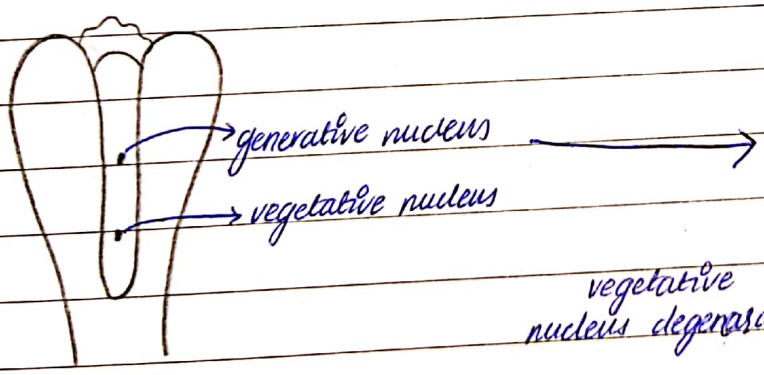
→ before maturation they pass a specie specific recognition test

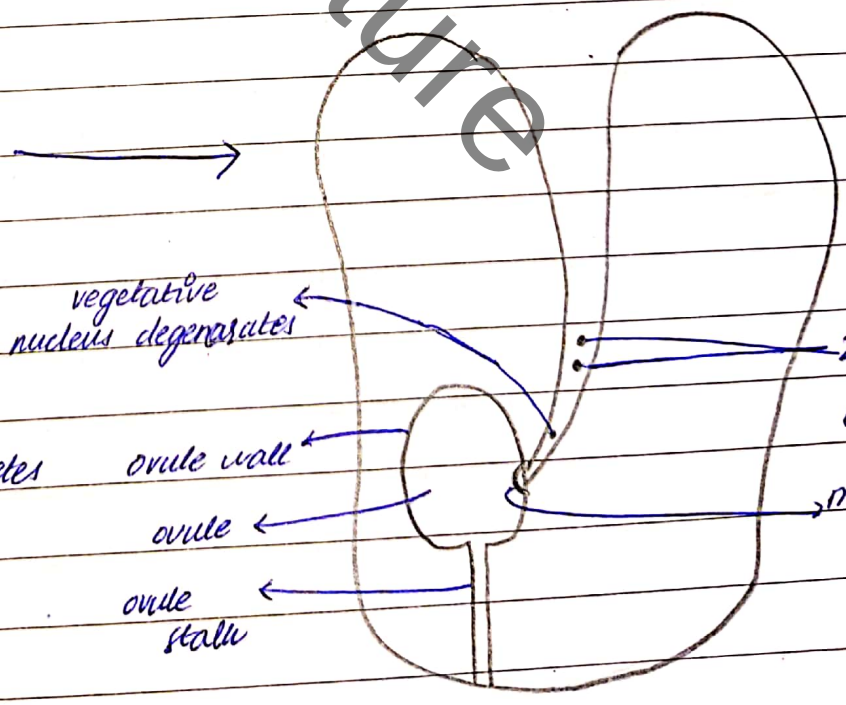




→ stigma produces an enzyme to stall maturation process
dissolves walls of stigma
to make way for pollen tube and directs it to the ovary







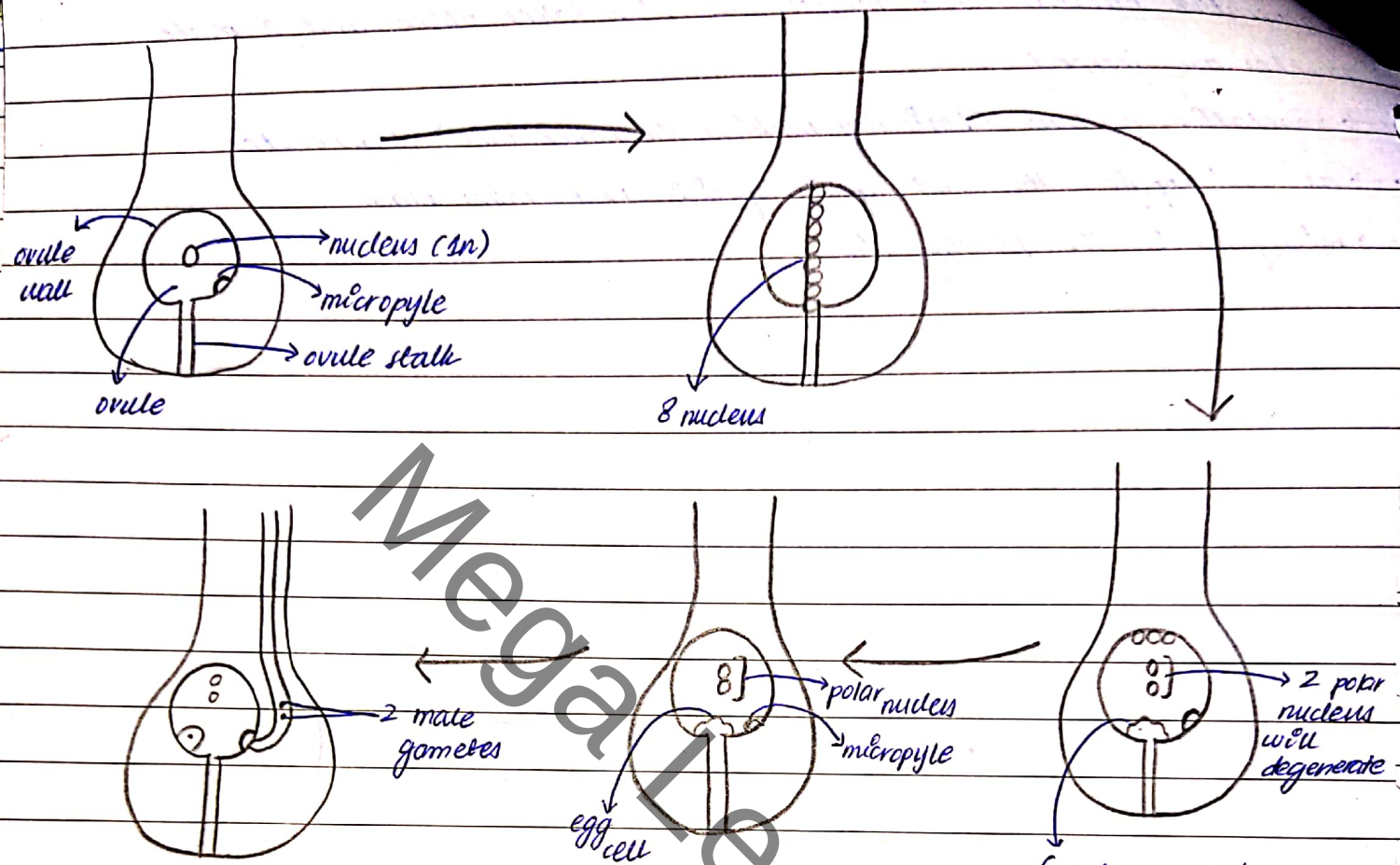
generative nu. —mitosis→ 2 male gametes

Date _____ 20___
M T W T F S S

pollen tube starts penetrating
→ pollen tube can't attach anywhere but micropyle
→ generative nucleus — 1 mitotic division takes place and 2 male gametes are formed
→ vegetative nucleus (basically making the pollen tube) degenerates
→ at micropyle, the 2nd specie specific test takes place
→ micropyle is the binding site

MATURATION OF FEMALE GAMETE

→ the nucleus is inside the ovule



dissolving of wall of ovule at micropyle — both male gametes into ovule

(3 from opp. pole & 2 from micropyle will degenerate)

Date _____ 20___
M T W T F S S

Germination of the pollen grain

→ after pollination the pollens soak substances released by stigma which stimulate the pollen grain bursts
→ the inner one protrudes as the pollen tube
→ both of the nuclei enter into the pollen tube
→ the one at the top is called the tube nucleus which controls the elongation of the pollen tube
→ the pollen tube continues to grow down through the style to the ovary
→ as it enters the embryo sac through micropyle, the tip of the pollen tube and tube nucleus degenerate
→ meanwhile the nuclei following behind called Generative, divides to make two sperms
→ these sperms are mobile and released into the embryo sac
→ one fuses with the egg to make zygote while the other fuses with definitive nucleus to make endosperm nucleus.
→ this process is called double fertilization because two fertilizations are taking place at the same time

Date _____ 20___
M T W T F S S

POST FERTILIZATION

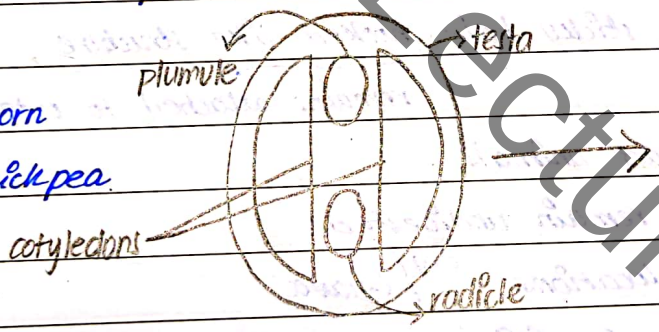
* ovary turns into fruit
* ovary wall → fruit wall → pericarp
* ovule → seed
* ovule wall → seed coat / testa } hard & resistant
* ovule stalk → seed stalk
* micropyle remains the same
* style, stigma, stamen, petals wither off
* calyx sometimes with dries off or sometimes is retained with the fruit e.g/ apples
  sometimes it transforms/modifies into dry, wing like structure

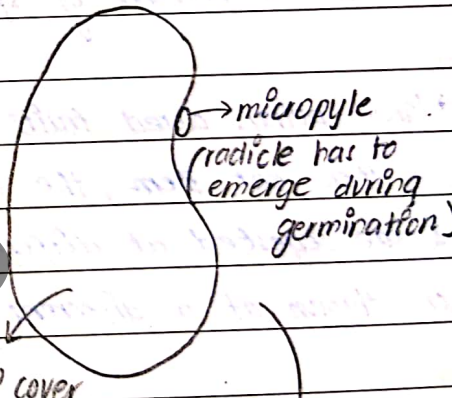
cotyledons, plumule, radicle are formed when the zygote from fertilization multiply

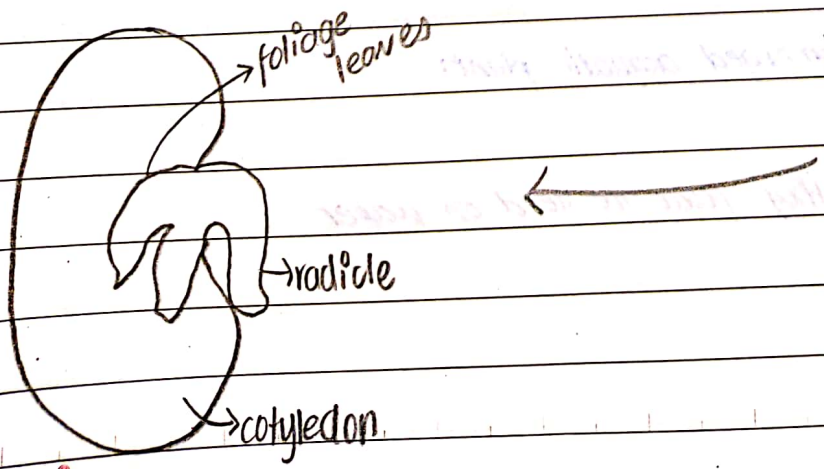
Ovule → seed
- ovule wall — thick & resistant
- embryo → embryosac → R, L] Dormant (resting stage)
- → cotyledons — stored food
  — inactive enzymes] **

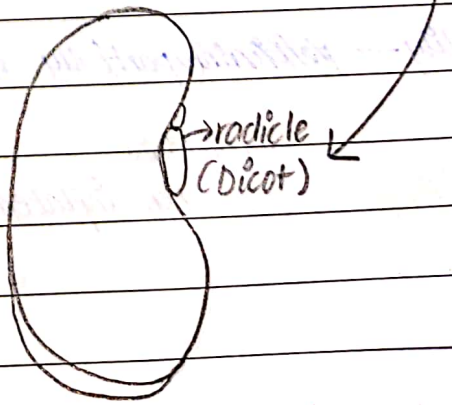
** carbohydrates stored in form of starch — amylase
proteins — protease
fats — lipase
} a combination can be present & only one as well

monocotyledon — corn
dicotyledon — chickpea









Date ____
M T W T F S

Seed Dispersal/Fruit Dispersal

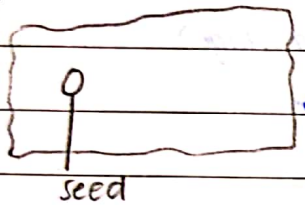
- can't be separated from fruit dispersal
- Modes : 1. Wind 2. Animal 3. Water
- always favored by nature to avoid competition b/w parent & young plant
- advantages : * avoid competition
  * ↑ gene pool = ↓ probability of genetic disorders = ↑ genetic variation
  * to adapt to a new habitat

1. Wind

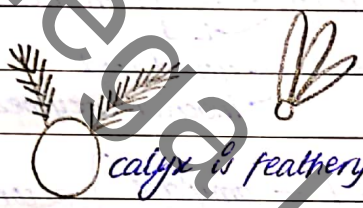
→ seed must be smaller in size

→ lighter in weight & must have presence of a modified structure

e.g/



⇒ makes it easier to move with currents



2. Animals

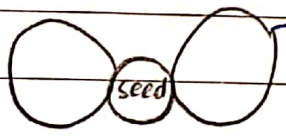
→ testa has presence of spines, sticky hair, hooked like structure, remains attached to outer structure

→ large, pulpy, colored fruits attract animals

- as they eat them, the seeds remain undigested
- & are egested at different locations e.g/ Guava
- or thrown at a different location e.g/ mango

3. Water

e.g/ water lily — particularly partially submerged aquatic plants



→ air sacks when inflated they float the seed on water

Date ____ 20__
M T W T F S S

→ sacks dephlate & germinate on arrival of suitable conditions, sinking the seed into the base of the waterbody

e.g/ coconut

seed + thick fruit wall,

contains husks (hair like)

*→ hair like structure contains numerous holes, when water moves in, it floats on water & when it comes out the seeds come to the top

Date ____
M T W T F S

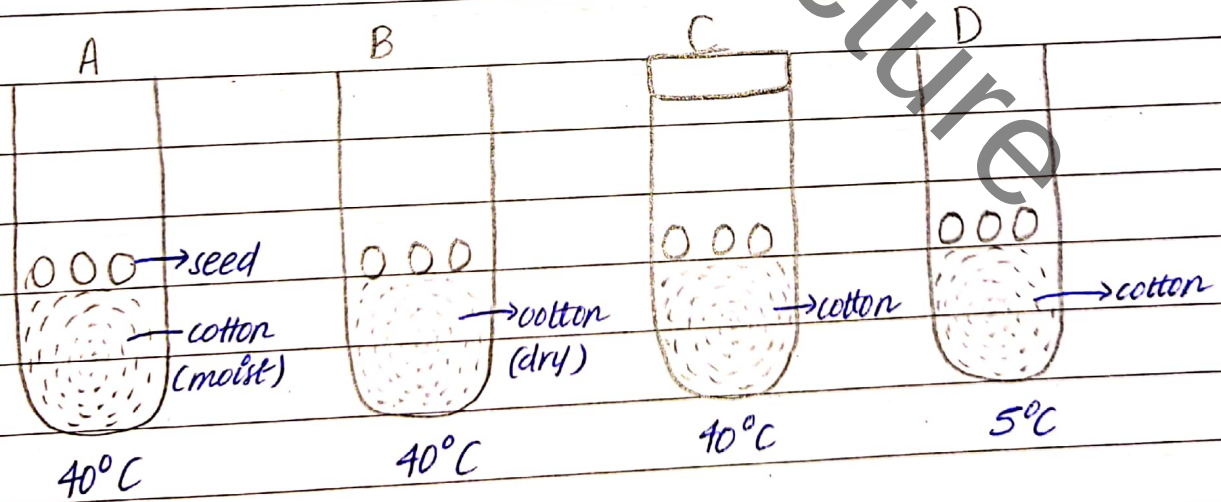
SEED GERMINATION

→ breaking of dormancy, controlled by enzymes
→ development of a seed to a new young plant is called germination
→ seed germinates in presence of certain conditions :

i. Moisture / Water
→ makes testa soft and permeable to O_2 gas
→ activates enzymes (in cotyledon) → hydrolysis of stored food in cotyledon to start providing nutrients for respiration

ii. Oxygen
→ start of respiration (metabolic process)
→ release of energy for active cell division (growth)

iii. High temperatures / Temperatures suitable for the enzymes involved
→ ↑ metabolic rate
→ a few degrees above optimum



⇒ Initial decrease of mass (mass) → using up of cotyledon
⇒ after few days : ↑ mass — growth

Date ____ 20____
M T W T F S S

→ dormant seed — embryo and food stores are surrounded by an impermeable seed coat

↳ the micropyle is the only gap in the seed coat

→ water enters through the micropyle

↳ activates enzymes to convert insoluble stores to soluble foods (e.g. amylase for starch to glucose, protease for proteins to amino acids)

↳ makes tissues swell so that the testa is split open

→ water & oxygen enter through gaps in the testa

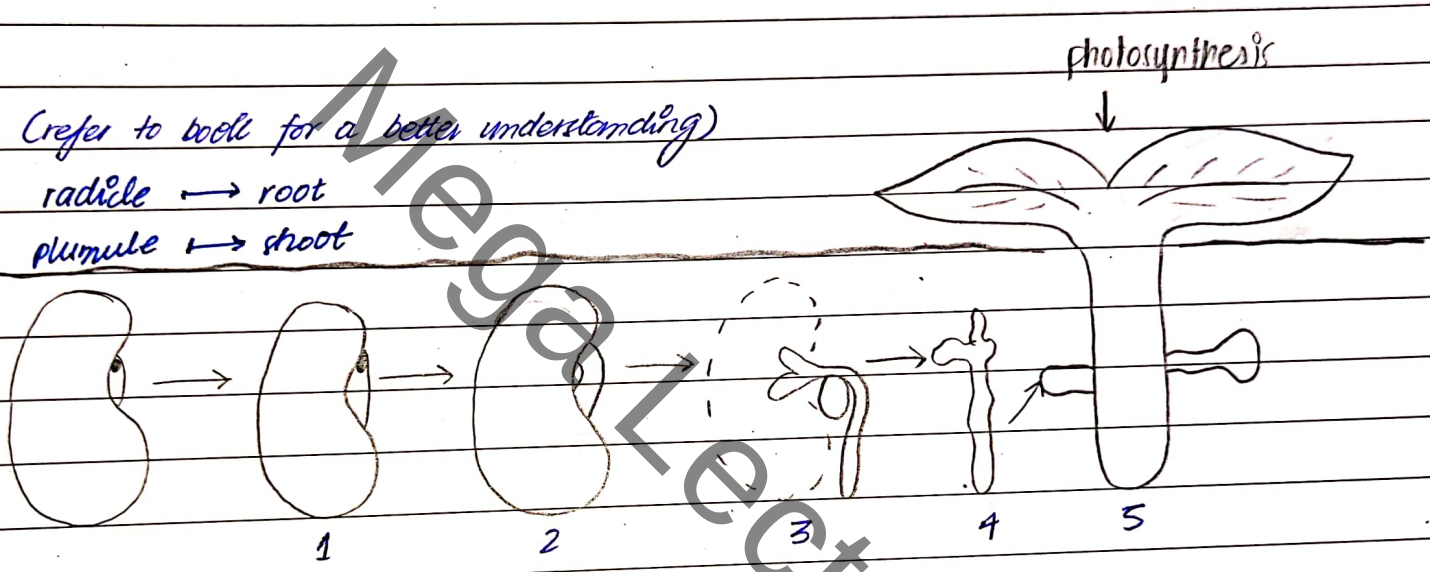
↳ oxygen & glucose enable aerobic respiration, which releases energy

→ the embryo is able to grow as it receives raw materials and energy

(refer to book for a better understanding)

radicle ⟶ root

plumule ⟶ shoot



1. The radicle (young root) emerges first — it anchors the seedling in the soil and starts to absorb water and mineral ions

2. The plumule (young shoot) emerges as the testa is split away from cotyledons — the hooked shoot protects the young leaves from damage by soil particles

3. The plumule grows upwards retaining its hooked shape.
Cotyledon visible through split testa.

4. Foliage leaves show / Plumule emerges above ground and starts to straighten out to lift foliage leaves above soil.
Lateral roots increase in size : important for anchorage and absorption of water and mineral ions.

Date
M T W T F

5. ~~Folig~~ Foliage leaves open / Plumule straight — holds leaves upwards
Testa begins to shrivel
Food stores in cotyledons provide nutrients for growth and energy
Seedling has now been established