YAKEEN NEET 2.0

2026

Cell Cycle and Cell Division

Botany | Lecture - 06

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Topics to be covered

1. Revision of meiosis-I
   MEIOSIS: Part-02
2. SIGNIF OF MITOSIS / MEIOSIS ?
3. SUMMARY & INTRODUCTION → BROWN BOX
   NUMERICALS QUESTION.
4. BACKLOG (MEIOSIS-I):
   NCERT BOOSTER.

?

CHAPTER COMPLETE.

Telophase I: The nuclear membrane and nucleolus reappear, cytokinesis follows and this is called as dyad of cells (Figure 10.3). Although in many cases the chromosomes do undergo some dispersion, they do not reach the extremely extended state of the interphase nucleus. The stage between the two meiotic divisions is called interkinesis and is generally short lived. There is no replication of DNA during interkinesis. Interkinesis is followed by prophase II, a much simpler prophase than prophase I.

CHANGE

INTERKINESIS

* SHORT GAP B/W MEIOSIS-I AND MEIOSIS-II OR TELOPHASE-I & PROPHASE-II
* NO DNA REPLICATION
* CENTRIOLE DUPLICATION.

MEIOSIS-II

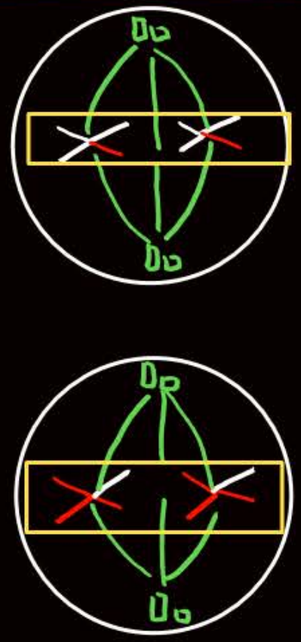
* PROPHASE-II
* METAPHASE-II
* ANAPHASE-II
* TELOPHASE-II

PROPHASE-II

2C

* NUCLEOLUS, NM: DISAPPEAR.
* CHROMOSOME BECOME COMPACT/CONDENSED.

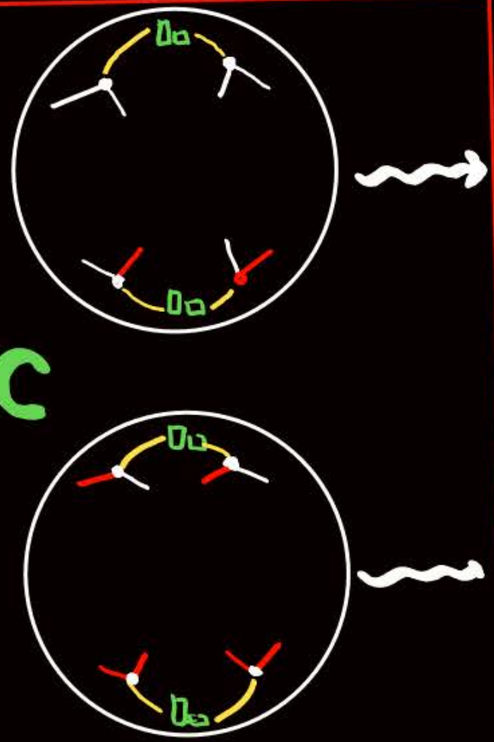
METAPHASE-II



2C

* CHROMOSOME: EQUATOR (1 PLATE)

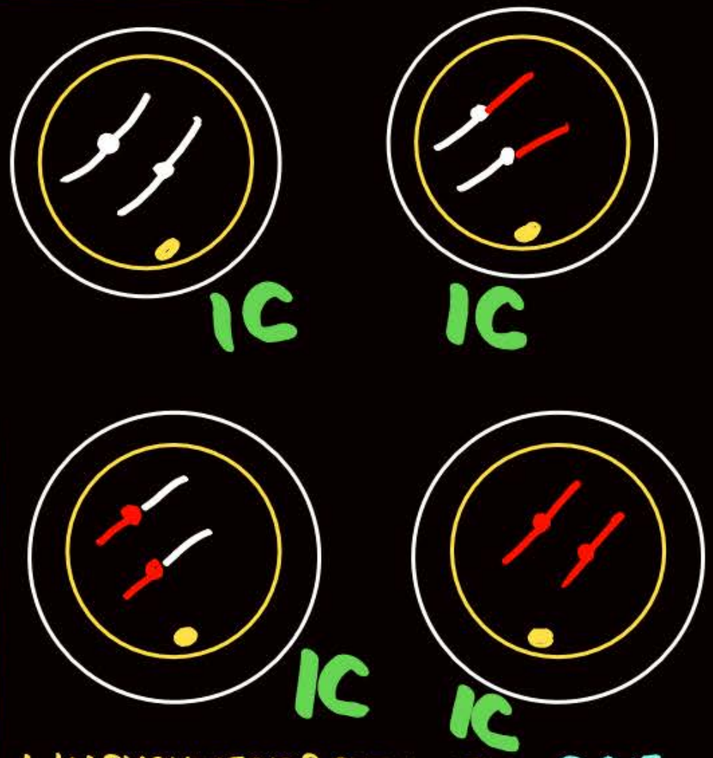
ANAPHASE-II



2C

* SPLITTING OF CENTROMERE
* SISTER CHROMATID SEPERATE
* SHORT: MICROTUBULE
* CHROMOSOME NO: DOUBLE
* CHROMOSOME MOVE TOWARDS OPPOSITE POLE.

TELOPHASE-II



1C 1C 1C 1C

* KARYOKINESIS & CYTOKINESIS: DONE
* NUCLEOLUS, NM: REAPPEAR
* 4 CELLS ARE FORMED (TETRAD) (DISIMILAR TO EACH OTHER & PARENT)

	NO. OF CHROMOSOME	DNA AMOUNT	NO. OF CHROMATID IN ONE CHROMOSOME
PARENT CELL	4	2C	1
G_1	4	2C	1
S	4	4C	2
G_2	4	4C	2
PROPHASE-I	4	4C	2
METAPHASE-I	4	4C	2
ANAPHASE-I	4	4C	2
TELOPHASE-I / MEIOSIS-I	2	2C	2
PROPHASE-II	2	2C	2
METAPHASE-II	2	2C	2
ANAPHASE-II	4	2C	1
TELOPHASE-II / MEIOSIS-II	2	1C	1

INTERPHASE

CONCLUSION

	CHROMOSOME	DNA
PARENT	4	2C
G_1	4	2C
S	4	4C
G_2	4	4C
MEIOSIS-I	2	2C
MEIOSIS-II	2	1C

Q PARENT: 30 CHROMOSOME

MEIOSIS-II: ?

G_1: 30
S: 30
G_2: 30
M-I: 15
M-II: 15

Q SPERM / EGG / POLLEN GRAIN / MICROSPORE / SPORE / GAMETE / MEGASPORE (HAPLOID) → ALL FORMED AFTER (MEIOSIS) MEIOSIS-II

Q SPERM: 20 CHROMOSOME

PARENT CELL: 40
G_1: 40
S: 40
G_2: 40
M-I: 20
M-II (SPERM): 20

Q PARENT CELL DNA: 20Pg

MEIOSIS-II: ?

G_1: 20
S: 40
G_2: 40
M-I: 20
M-II: 10

Q PARENT CELL: 60Pg DNA.

ANAPHASE-I: ?

G_1: 60
S: 120
G_2: 120
ANAP-I: 120
ME-I: 60
ME-II: 30

Q PARENT : 100 Pg DNA.

METAPHASE-II :

G_1 : 100
S : 200
G_2 : 200
M-I : 100
METAPH-II : 100
MEIOSIS-II : 50

Q. SPERM : 10Pg DNA.
PARENT : ?

PARENT : 20
G_1 : 20
S : 40
G_2 : 40
M-I : 20
M-II : 10

SIGNIFICANCE OF MEIOSIS

* MAINTAIN CHROMOSOME NO FROM ONE GEN^N TO ANOTHER. BUT PARADOX MEIOSIS CHROMOSOME NO: HAIT.
* CROSSING OVER : VARIATION
* EVOLUTION.

NOTE : IN WHICH PHASE CELL DECIDE WHETHER IT HAS TO DIVIDE/NOT (G_1)

NOTE : IN WHICH PHASE, IF CELL ENTER, IT HAS TO DIVIDE : (S)

10.3 Significance of Mitosis

Mitosis or the equational division is usually restricted to the diploid cells only. However, in some lower plants and in some social insects haploid cells also divide by mitosis. It is very essential to understand the significance of this division in the life of an organism. Are you aware of some examples where you have studied about haploid and diploid insects?

Algae.

DRONE.

DRONE (MALE)

QUEEN (2n)
WORKERS (2n)

(1) Mitosis usually results in the production of diploid daughter cells with identical genetic complement. (2) The growth of multicellular organisms is due to mitosis. (2) Cell growth results in disturbing the ratio between the nucleus and the cytoplasm. It therefore becomes essential for the cell to divide to restore the nucleo-cytoplasmic ratio. A very significant contribution of mitosis is cell repair. The cells of the upper layer of the epidermis, cells of the lining of the gut, and blood cells are being constantly replaced. Mitotic divisions in the meristematic tissues – the apical and the lateral cambium, result in a continuous growth of plants throughout their life.

CHROMOSOME NO: SAME
(INTERPHASE) = CONTENT (NUCLEUS, CYTOPLASM) ↓ INCREASE (NUCLEOCYTOPLASMIC RATIO DISTRUB)

INTERPHASE

M PHASE

MAINTAIN M-PHASE

MERISTEMATIC CELL (PLANT ANATOMY)

ROOT & SHOOT → TIP

MERISTEMATIC CELL (APICAL MERISTEM)

10.4.2 Meiosis II

Chromosome no: same
equational divⁿ.

Prophase II: Meiosis II is initiated immediately after cytokinesis, usually before the chromosomes have fully elongated. In contrast to meiosis I, meiosis II resembles a normal mitosis. The nuclear membrane disappears by the end of prophase II (Figure 10.4). The chromosomes again become compact. / condensed

Metaphase II: At this stage, the chromosomes align at the equator and the microtubules from opposite poles of the spindle get attached to the kinetochores (Figure 10.4) of sister chromatids.

Anaphase II: It begins with the simultaneous splitting of the centromere of each chromosome (which was holding the sister chromatids together), allowing them to move toward opposite poles of the cell (Figure 10.4) by shortening of microtubules attached to kinetochores.

Telophase II: Meiosis ends with telophase II, in which the two groups of chromosomes once again get enclosed by a nuclear envelope; cytokinesis follows resulting in the formation of tetrad of cells i.e., four haploid daughter cells (Figure 10.4).

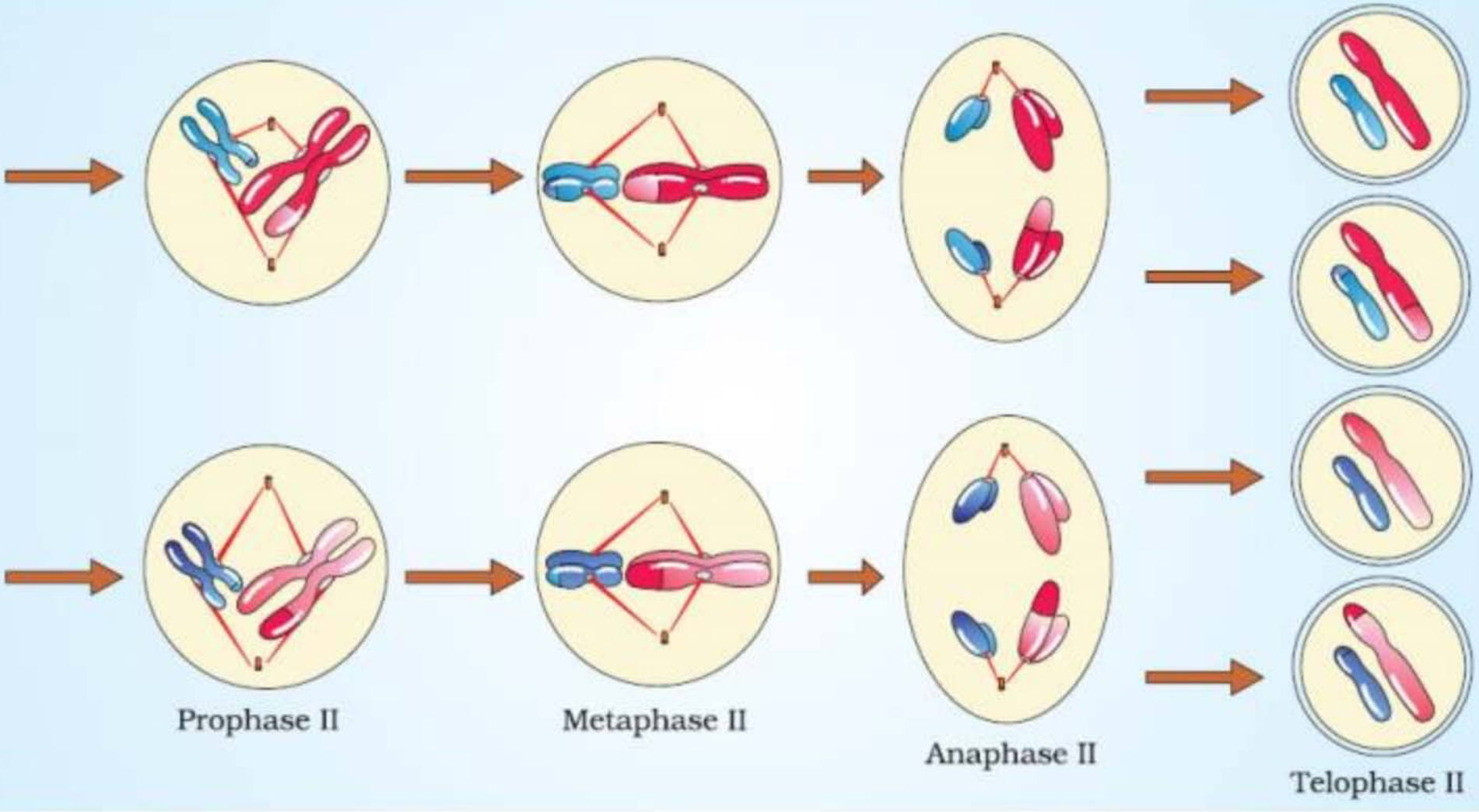
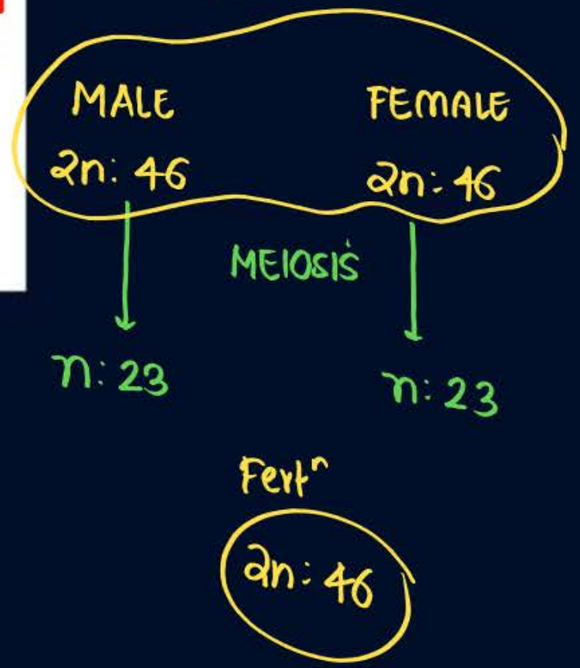


Figure 10.4 Stages of Meiosis II

10.5 Significance of Meiosis

Meiosis is the mechanism by which conservation of specific chromosome number of each species is achieved across generations in sexually reproducing organisms, even though the process, per se, paradoxically, results in reduction of chromosome number by half. It also increases the genetic variability in the population of organisms from one generation to the next. Variations are very important for the process of evolution.

सही हो पर गलत लगे.

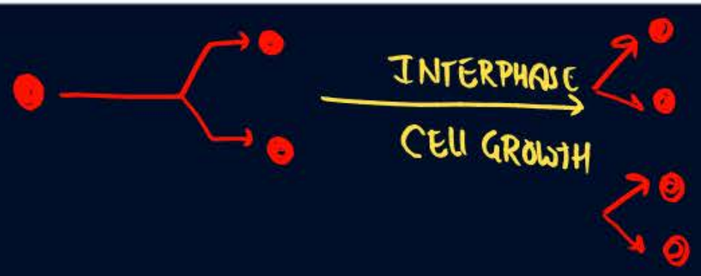


ZYGOTE

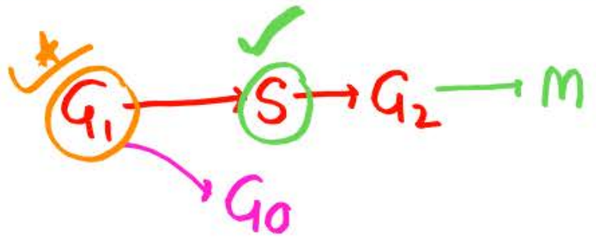
Exception.

Are you aware that all organisms, even the largest, start their life from a single cell? You may wonder how a single cell then goes on to form such large organisms. Growth and reproduction are characteristics of cells, indeed of all living organisms. All cells reproduce by dividing into two, with each parental cell giving rise to two daughter cells each time they divide. These newly formed daughter cells can themselves grow and divide, giving rise to a new cell population that is formed by the growth and division of a single parental cell and its progeny. In other words, such cycles of growth and division allow a single cell to form a structure consisting of millions of cells.

MITOSIS



SUMMARY



According to the cell theory, cells arise from preexisting cells. The process by which this occurs is called cell division. Any sexually reproducing organism starts its life cycle from a single-celled zygote. Cell division does not stop with the formation of the mature organism but continues throughout its life cycle. The stages through which a cell passes from one division to the next is called the cell cycle. Cell cycle is divided into two phases called (i) Interphase – a period of preparation for cell division, and (ii) Mitosis (M phase) – the actual period of cell division. Interphase is further subdivided into G_1, S and G_2. G_1 phase is the period when the cell grows and carries out normal metabolism.

SYNTHESIS

MAX. GROWTH

Most of the organelle duplication also occurs during this phase. S phase marks the phase of DNA replication and chromosome duplication. G_2 phase is the period of cytoplasmic growth. Mitosis is also divided into four stages namely prophase, metaphase, anaphase and telophase. Chromosome condensation occurs during prophase. Simultaneously, the centrioles move to the opposite poles. The nuclear envelope and the nucleolus disappear and the spindle fibres start appearing. Metaphase is marked by the alignment of chromosomes at the equatorial plate. During anaphase the centromeres divide and the chromatids start moving towards the two opposite poles. Once the chromatids reach the two poles, the chromosomal elongation starts, nucleolus and the nuclear membrane reappear. This stage is called the telophase. Nuclear division is then followed by the cytoplasmic division and is called cytokinesis. Mitosis thus, is the equational division in which the chromosome number of the parent is conserved in the daughter cell.

PROTEIN, MITO, CHLOROP, GB.

1 CHROMOSOME : 2 CHROMATID.

PROPHASE.

daughter Chromosome

decondense to chromatin.

In contrast to mitosis, meiosis occurs in the diploid cells, which are destined to form gametes. It is called the reduction division since it reduces the chromosome number by half while making the gametes. In sexual reproduction when the two gametes fuse the chromosome number is restored to the value in the parent. Meiosis is divided into two phases – meiosis I and meiosis II. In the first meiotic division the homologous chromosomes pair to form bivalents, and undergo crossing over. Meiosis I has a long prophase, which is divided further into five phases. These are leptotene, zygotene, pachytene, diplotene and diakinesis. During metaphase I the bivalents arrange on the equatorial plate. This is followed by anaphase I in which homologous chromosomes move to the opposite poles with both their chromatids. Each pole receives half the chromosome number of the parent cell. In telophase I, the nuclear membrane and nucleolus reappear. Meiosis II is similar to mitosis. During anaphase II the sister chromatids separate. Thus at the end of meiosis four haploid cells are formed.

23+23:46

(2)

(P)

→ NO SPLITTING OF CENTROMERE

2 → 1 POLE

MET-I (4)

ANA-I : 4.

anaphase (MITOSIS) : SISTER CHROMATID SEPERATE

2 → 1 POLE

How do plants and animals continue to grow all their lives? Do all cells in a plant divide all the time? Do you think all cells continue to divide in all plants and animals? Can you tell the name and the location of tissues having cells that divide all their life in higher plants? Do animals have similar meristematic tissues?

CELL DIVISION (MC)

NO
- MERISTEMATIC : DIVIDE
- PERMANENT TISSUE : USUALLY NOT DIVIDE

ROOT
SHOOT
→ TIP → MC → ACTIVELY DIVIDE

TO REPLACE THE DEAD CELL CELL WILL DIVIDE.

NO

① Metaphase -1
(A) bivalent chromosome aligned on one plate
(B) microtubule attach to centromere of homologous chromosome → kinetochore.
(C) Both incorrect
(D) Both correct

② Correct (ANAPHASE-I)
(A) homologous chromosome separation
(B) splitting of centromere
(C) chromosome number same in both metaphase -1 (4) @ anaphase -1 (4)
(D) both (A) & (C) are correct

③ Telophase -1 (CORRECT)
(A) nuclear membrane disappear
(B) tetrad of cell are formed
(C) chromosome do not undergoes dispersion
(D) chromosome do not reach the extended state of interphase nucleus

④ Interkinesis
(A) stage between two mitosis → meiosis
(B) similar to interphase
(C) long lived → short.
(D) centriole duplication and DNA replication
(E) all are incorrect

⑤ Diakinesis
(A) final stage of mitotic → meiotic prophase -1
(B) terminalisation of chiasmata
(C) chromosome fully condensed but spindle not formed
(D) transition to metaphase -2 → I
(E) by early → late diakinesis nucleolus nuclear membrane disappear
(F) all are incorrect

6 Diplotene

(A) dissolution of synaptonemal complex in late of this stage (early)

(B) chiasmata formed

(C) in oocyte of some invertebrate, it last for month or year

(D) all are incorrect

7 Leptotene (Incorrect)

(A) Chromosome not visible

(B) chromosome viable in light microscope

(C) short lived

(D) compaction of chromosome continue

8 Pachytene (CORRECT)

(A) Recombinase not involved

(B) Recombination completed by early (Late) Pachytene

(C) prophase of first meiotic is longer and complex compare to prophase of mitosis

(D) Both (B) & (C) are correct

9 Zygotene (CORRECT)

(A) second stage of prophase - I

(B) pairing of chromosome - synapsis

(C) Paired chromosome called non homologus chromosomes

(D) complex formed by homologous chromosome is bivalent or tetrad which is NOT clearly visible

(E) synaptonemal complex formed lipid (PROTEIN) in nature

10 Pachytene (CORRECT).

(A) first two stage of prophase - I is short lived

(B) tetrad is clearly visible in form of two (FOUR) chromatid

(C) recombination nodule formed where mutation occur (CROSS OVER).

(D) crossing over is exchange of genetic material between non sister chromatid of homologous chromosome

(E) None

Prophase -2

(A) Meiosis -2 initiated immediately after cytokinesis before chromosome fully elongated
(B) meiosis -2 resemble to mitosis
(C) nuclear membrane reappear
(D) chromosome become elongated
(E) Both (C) & (D) are incorrect

Metaphase -2 (Incorrect)

(A) chromosome on equator
(B) 2 plates are formed
(C) spindle attach to kinetochore of non sister chromatid
(D) Both (B) & (C) are incorrect

Anaphase -2

(A) splitting of centromere
(B) chromosome move towards opposite pole
(C) shortening of microtubule
(D) all are correct

Telophase -2

(A) mitosis end with telophase-2
(B) tetrad of cells are formed
(C) all four haploid cells are similar to each other and parent
(D) nuclear membrane disappear

How many statement are correct

A. In animal cell cytokinesis occur due to furrow formation in cell membrane
B. Furrow move centre to periphery
C. Furrow gradually deepens and join in centre
D. Plant cell wall is extensible
E. In plant cell, wall formation start in centre and grow periphery or outward to meet existing lateral wall
F. The formation of new cell wall begins with simple percuteer called middle lamella
G. At the end of cytokinesis organelle Like Mitochondria & plastid distributed between two daughter cell

Option

(A) 4 (B) 5 (C) 3 (D) 6

Syncytium

(A) Karyokinesis is not followed by cytokinesis
(B) Multinucleated condition arise
(C) Liquid endosperm in coconut
(D) All of these

How many statement are correct

A. Mitosis produce diploid daughter cell with non identical genetic complement
B. Growth of multicellular organism due to meiosis
C. Cell growth results in disturbing ratio between nucleus and cytoplasm so cell divide to maintain or restore nucleocytoplasmic ratio
D. Mitosis do not contribute in cell repair
E. Cell of upper layer of epidermis. Cells lining gut, blood vessel Are being constantly replaced
F. Mitosis occur in meristematic tissue -apical and lateral cambium result in limited growth of plant throughout their life

Options

(A) 4 (B) 5 (C) 3 (D) 2

Correct statement

(A) Mitosis is equational division restricted to haploid cell only
(B) In some lower plant and social insect haploid cell also divide by meiosis
(C) Both are correct
(D) None

How many statement are correct

A. Nuclear and cytoplasm division occur twice

B Cell division occur twice

C. DNA Replication occur twice and centriole duplication single

D. Meiosis involve meiosis 1 and meiosis 2 only

E Two haploid cells are formed at end of meiosis - 1

F. Four haploid cell Are formed at end of meiosis - 2

G. Meiosis initiated after duplication of parental chromosome (DNA) in S phase where identical sister chromatid produce

Options

(A) 6 (B) 5 (C) 4 (D) 3

How many statement are correct statement

A. The production of offspring by sexual reproduction include fusion of gamete, each with diploid set of chromosome

B. Gamete formed by haploid cell

C. Meiosis maintain the same chromosome number & produce haploid daughter cell

D. Meiosis ensure haploid phase in life cycle of sexually reproducing organism & fertilisation restore the diploid phase in progeny

E. Meiosis occur during gametogenesis in plants & animal

F. Meiosis produce diploid gametes

(A) 5 (B) 4 (C) 3 (D) 2

Significance of meiosis

(A) Conservation of chromosome number from generation to generation in sexually reproducing organism even though process paradoxically result in reduction of chromosome number by half

(B) Genetic variability

(C) Evolution

(D) All

Question

How many meiosis are required to form 100 pollen grains from microspore mother cells?

1. 100
2. 50
3. 25
4. 200

1 PMC $\xrightarrow{1 \text{ MEIOSIS}}$ 4 POLLEN GRAIN

25 MEIOSIS x 4 ⇒ 100

Question

What would be the DNA content in a diploid cell at anaphase-I if its egg cell has 10 pg DNA?

1. 10 pg
2. 20 pg
3. 30 pg
4. 40 pg

PARENT

G_1 20

S 40

G_2 40

ANAP-I ⇒ ? 40

M-I 20

M-II : 10

Question

If a sperm of an organism has 5 pg of DNA in its nucleus, how much DNA would be present in a somatic cells of this organism during metaphase-I?

1. 5 pg
2. 10 pg
3. 20 pg ✓
4. 40 pg

PARENT
G_1 10
S 20
G_2 20
MET-I 20
MEIO-I : 10

M-II : 5 pg DNA

Question

DIPLOID CELL WHICH UNDERGOE MEIOSIS

If the amount of DNA in meiocyte at G1 phase is 2C then, the amount of DNA in each daughter cell, after meiosis-I will be

1. 2 C ✓
2. 1 C
3. 4 C
4. 8 C

G-1 : 2C
S : 4C
G_2 : 4C
m-I : 2C
m-II : 1C

Question

If spores have 10 chromosomes and 20 picogram DNA then what would be the chromosome number and DNA amount in spore mother cell at the end of S-phase in the life cycle of same plant?

1. 40 chromosomes and 80 pg DNA
2. 20 chromosomes and 80 pg DNA
3. 20 chromosomes and 40 pg DNA
4. 40 chromosomes and 40 pg DNA

PAR.	20	40
G_1	20	40
S	20	80
G_2	20	80
M-I	10	40

M-II : 10 CHRO, 20 Pg DNA.

Question

If the number of bivalents aligned on the equatorial plate of metaphase-I is 10. What will be the number of chromosomes in each haploid cell after meiosis II?

1. 5
2. 10
3. 15
4. 20

Question

(after meiosis) M-II : ?

If a meiospore has 20 picograms DNA then what was the DNA content in its meiocyte at G_1 and S phase respectively?

G_1 : 40
S : 80
G_2 : 80
M-I : 40
M-II : 20 pg DNA

1. 20, 40
2. 40, 80
3. 20, 80
4. 40, 40

Question

How many meiosis are required for the formation of 200 seeds in Pisum sativum?

1. 200
2. 250
3. 300
4. 400

/embryo

$\Rightarrow n + \frac{n}{4}$

$\Rightarrow \frac{200+200}{4} \Rightarrow \frac{800+200}{4} \Rightarrow \frac{1000}{4} \Rightarrow 250$

Homework from YAKEEN NEET 2.0 2026 Module

MODULE

(MITOSIS, MEIOSIS)

PYQ →

150 QUESTION → I WILL DISCUSS
DISCUSSION

PYQ / EXTRA QUESTION /
NUMERICAL.

THANK YOU