4 Cell Division

4.0 : Introduction :

Q.1. How does every cell arise from the pre-existing cell?

Ans: Every cell arises from the pre-existing cell by the process of cell division.

4.1 : Cell cycle :

Q.2. Define cell cycle.

Ans: A series of changes or sequential events which occur in the life of a dividing cell is called cell cycle ..

Q.3. What is cell division?

Ans: Cell division is a process by which a cell divides into two or more daughter cells.

Q.4. What is generation time?

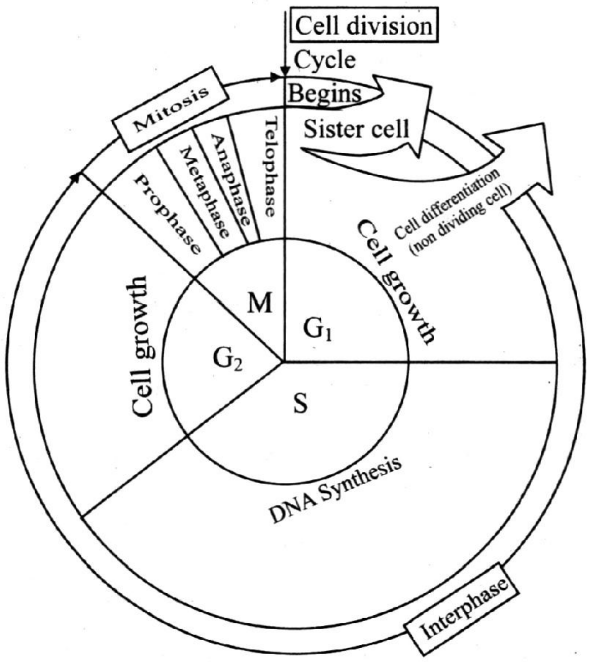
Ans: The period between two successive divisions is called generation time.

Q.5. Graphically represent various stages of cell cycle.

OR

Give graphic representation of cell cycle.

Ans: The cell cycle includes the period from the beginning of one cell division to the beginning of the next cell division.



Cell cycle

Q.6. What is Go (quiescent phase) of cell cycle?

Ans: Go is the stage when cell cycle is arrested during interphase.

Q.7. Briefly describe the interphase.

OR

Describe the events taking place during interphase.

Ans: Interphase:

It was formerly considered as a resting phase.

But, the cell remains highly active and prepares itself for the division. Hence, it is the preparatory and synthetic phase of cell division.

This phase involves many metabolic activities.

This phase involves replication of DNA, synthesis of RNA, and nuclear proteins - Histones. Synthesis of energy rich compounds which provide energy for mitosis also takes place.

The interphase is further divided into three sub-phases:

i. G_1 phase ii. S phase iii. G_2 phase

i. G_1 phase:

It is the first growth phase or the post-mitotic gap phase.

During this phase, synthesis of proteins (enzymes) and energy molecules take place which is required for DNA replication.

Proliferation of cell organelles takes place and if a cell is not going to divide then it enters a quiescent stage called Go phase. The cell in Go state may again enter into G, phase and get differentiated and become permanent cell.

ii. S phase:

It is a synthetic phase.

Replication of DNA takes place during this stage. Duplication of entire genetic material (DNA) also occurs.

DNA content doubles and a duplicate set of chromosomes is formed. Histone proteins which are required for organization of chromosomes are also produced.

iii. G_2 phase:

It is the second growth phase and also called the pre-mitotic gap phase or growth phase.

It involves synthesis ofRNA. Tubulin protein is also synthesized which is used in spindle formation.

The cell prepares to enter mitotic phase. In this phase, duplication of cell organelles such as mitochondria, chloroplast, centrioles, etc. takes place.

Centrioles duplicate and two centrosomes are formed.

Q.8. Which phase is called synthetic phase?

Ans: S phase is called as synthetic phase.

Q.9. Answer in one word:

i. A period of preparation in cell cycle for cell division.

Ans: Interphase.

ii. A phase in cell cycle during which a cell withdraws from cell cycle.

Ans: G_0 or quiescent stage.

Q.10. Though interphase is described as a 'resting phase', it is not so. Give scientific reason.

OR

Explain why interphase is now called preparatory phase.

Ans: i. Initially, interphase was known as resting phase.

ii. However, the cell is resting only with respect to division. Actually, during this time, the cell is metabolically very active.

iii. In this phase, a cell grows to its maximum size, chromosomal material (DNA and histone proteins). duplicates and the cell prepares itself for next mitotic division.

iv. Hence, interphase is known as preparatory phase.

Q.11. Give the significance of cell cycle.

Ans: Significance of cell cycle:

i. Cell cycle prepares a cell for cell division.
ii. If control over cell cycle is lost, abnormal growth takes place.
iii. Loss of control over cell cycle may lead to formation of cancerous cells.
iv. Cell cycle involves the synthesis of DNA, m-RNA, t-RNA, r-RNA, proteins.
v. Properly controlled and regulated cell cycle results in normal and proportionate growth of multicellular organisms.
vi. In multicellular organisms, it helps in growth, reproduction, healing of wounds and replacement of dead cells.

Q.12. What are the types of cell division in eukaryotes?

Ans: In eukaryotes, the cell division is typical and is of the following types:

i. Amitosis ii. Mitosis iii. Meiosis

Q.13. Write a short note on amitosis.

Ans: Amitosis:

i. Amitosis is exhibited by the meganucleus of Paramoecium, foetal cells, endosperm cells, etc.
ii. In this type of division, the nuclear membrane is retained throughout the division.
iii. The nucleus enlarges, elongates and divides directly.
iv. It is followed by cytokiriesis leading to the formation of two daughter cells.
v. As amitosis does not distribute the chromatin equally in the daughter cell, it may lead to structural and functional irregularities.

Q.14. In which cells does amitosis take place?

Ans: Amitosis takes place in meganucleus of Paramoecium, foetal cells and endosperm cells.

Q.15. Define mitosis.

Ans: Mitosis is an equational division, dividing the mother cell into two daughter cells which are identical to one another and also to the mother cell in having the same number and kind of chromosome.

Q.16. Who coined the term mitosis?

Ans: Walther Flemming coined the term mitosis.

Q.17. What is karyokinesis?

Ans: Karyokinesis is a stage in which nucleus undergoes a series of changes to form two daughter nuclei.

Q.18. Give brief account of somatic cell division.

OR

Describe mitosis and its stages in brief.

Ans: The term 'Mitosis' was coined by Walther Flemming, a German biologist, who observed dividing cell for the first time in 1878.

Mitosis is a type of cell division in which cell divides to form two daughter cells having same chromosome number as that of the parent cell.

Mitosis maintains chromosome number in daughter cells equal to that of mother cell, hence it is also called as equational division. .

Mitosis results in formation of somatic cells, hence also called as somatic cell division.

Mitosis is divided into two stages: Karyokinesis and Cytokinesis

A. Karyokinesis:

It is a nuclear division in which nucleus undergoes a series of changes to form two daughter nuclei.

Karyokinesis is further divided into prophase, metaphase, anaphase and telophase.

i. Prophase:

It marks the beginning of cell division.

This is the longest phase of mitosis.

During prophase, chromatin network undergoes condensation and forms definite number of chromosomes.

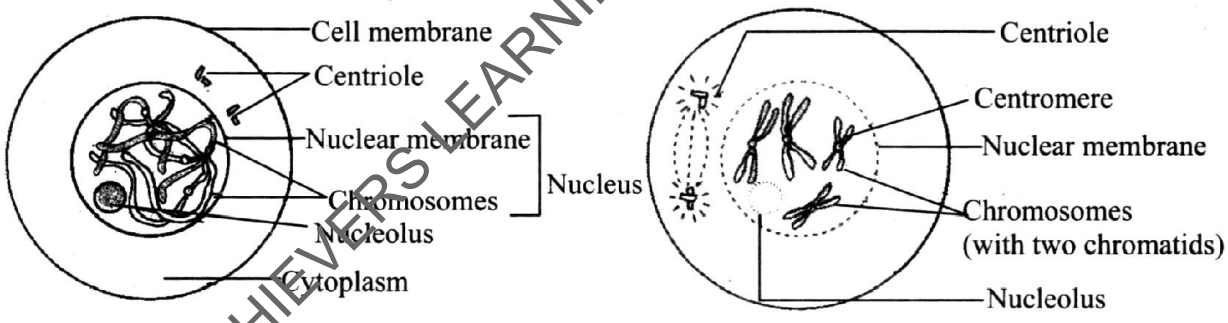
At early prophase, each chromosome appears single stranded (monad chromosome), thin and long.

Soon, these monads become diads in which identical chromatids are held together by a - centromere.

Chromosomes undergo dehydration and coiling to become thick and short.

In late prophase, nuclear membrane and nucleolus disappear.

In animal cell, the centrioles move away and occupy polar position.



(A) Early Prophase **(B) Late Prophase**

ii. Metaphase:

During metaphase, nuclear membrane and nucleolus completely disappear, condensation of chromosomes is completed.

The chromosomes are arranged along the equatorial plane of the cell.

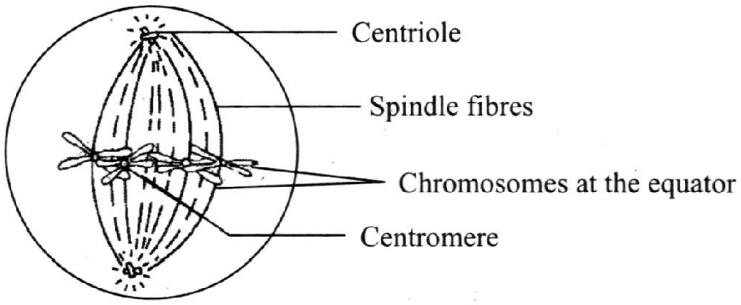
This phase is characterized by the formation of kinetic spindle fibres made up of contractile proteinaceous chromosomal fibres and inter polar fibres.

The spindle fibres are of two types;

Some fibres extend from pole to pole (continuous fibres or non-chromosomal fibres) and other fibres extend from pole to centromere (discontinuous or chromosomal fibres).

In animal cells, the spindle fibres radiate as an aster from centriole and are called astral rays. Hence, it is called astral mitosis.

In plant cells, asters are absent so, it is called anastral mitosis.



Metaphase

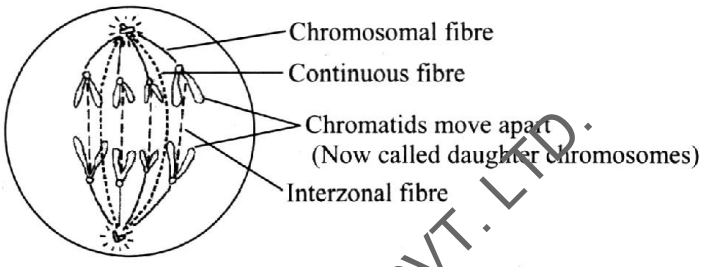
iii. Anaphase:

It is the shortest phase of karyokinesis.

Centromeres are divided into two resulting in the separation of chromatids.

Each separated chromatid forms a daughter chromosome.

The spindle fibres take the daughter chromosomes to the opposite poles of the cell.



Anaphase

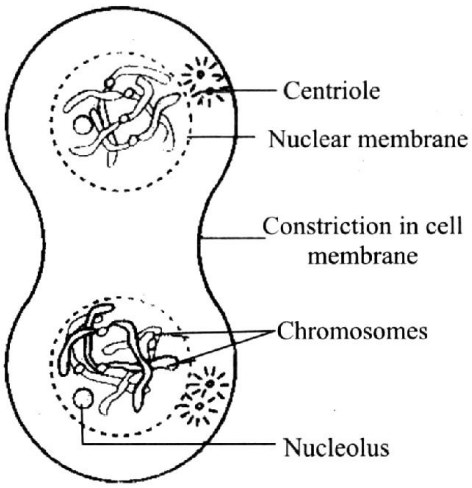
iv. Telophase:

It is the last phase of karyokinesis.

The daughter chromosomes uncoil and undergo hydration to form chromatin network.

The nuclear membrane reappears around each group of daughter chromosome. As a result, two daughter nuclei are formed.

The spindle fibres disappear and nucleolus reappears in newly formed nucleus .



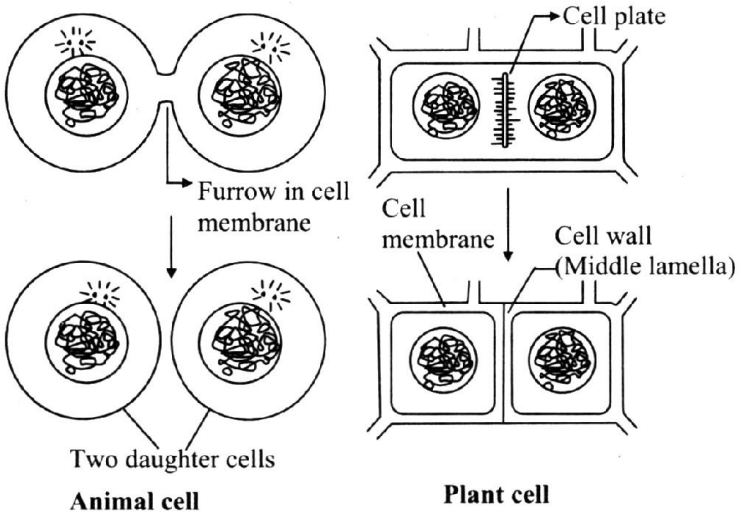
Telophase

B. Cytokinesis:

The division of cytoplasm of the mother cell is called cytokinesis. It takes place after karyokinesis.

In animal cell, it occurs by formation of furrow in the plasma membrane which deepens ultimately forming two daughter cells. This process is called cleavage.

In plant cell, cell plate is formed and extended from centre to the periphery.



Cytokinesis in an animal cell and a plant cell

Q.19. Which is the longest phase in mitosis?

Ans: Prophase is the longest phase in mitosis.

Q.20. What happens in metaphase?

Ans: During metaphase, the condensation of chromosomes is completed and the thick chromosomes get arranged along the equatorial plane of the cell.

Q.21. Give significance of mitosis.

Ans: Significance of mitosis:

i. Mitosis ensures that the daughter cells inherit the same number of chromosomes. Hence, the chromosomes which carry hereditary information in the form of genes pass unaltered from one generation to another.

ii. Dead cells are replaced by newly formed cells through mitosis. Thus, it helps in the healing and repair of cells. ego Blood cells, cells of skin surface.

iii. It helps to maintain equilibrium in the amount of DNA and RNA contents of a cell and also the nuclear and cytoplasmic balance in the cell.

iv. In unicellular organisms, mitosis helps in asexual reproduction.

Q.22. What is astral and anastral mitosis?

Ans: Astral mitosis:

In animal cells, the spindle fibres radiate as an aster from centriole and called astral rays. Hence, it is called astral mitosis.

Anastral mitosis:

In plant cells, the astral rays are not noticed due to the absence of centrioles. Such mitosis is called anastral mitosis.

Q.23. In which cells does astral mitosis takes place?

Ans: Astral mitosis takes place in animal cells.

Q.24. Which are the four types of fibres that make the kinetic spindle in anaphase?

Ans: The kinetic spindle has four types of fibres made up of microtubules. They are:

i. Astral rays: Radiating away from centriolar pairs towards the periphery of the cell. They are absent in plant cells.

ii. Inter polar fibres: Extending between the opposite pairs of centrioles (poles).

iii. Chromosomal fibres: Connecting centromeres to respective poles.

iv. Interchromosomal fibres: Appears between the centromere of daughter chromatids, also called inter-zonal fibres.

Q.25. Give reasons:

i. Mitosis often called as somatic cell division.

Ans: In mitosis, cell division results in the formation of somatic cells. Hence, it is often called as somatic cell division.

ii. Mitosis Is also known as equational division.

Ans: In mitosis, the parent cell divides into two identical daughter cells, each of which contains the same number and kind of chromosomes present in the parent cell. Hence, mitosis is also called as equational division.

iii. Mitosis is called centric in animal cells and acentric in plant cells.

Ans: Mitosis is called centric in animal cells because in animal cells, it involves centrosome. In plant cell, it is without the participation of centrosome and hence, mitosis is acentric in plant cells.

iv. Animal cells show astral mitosis, whereas plant cells show anastral mitosis.

Ans: In animal cells, the centrosomes start forming spindle apparatus which shows aster like (star like) appearance.

Since, aster is absent in plants they show anastral mitosis.

Q.26. Answer in one word:

i. The division of cytoplasm is called:

Ans: Cytokinesis.

ii. Nuclear division is known as:

Ans: Karyokinesis.

Q.27. Which type of cell division helps in the process of regeneration?

Ans: Mitotic division helps in the process of regeneration.

Q.28. Distinguish cytokinesis from karyokinesis.

Ans:

No.	Cytokinesis	Karyokinesis
i.	It is the division of the cytoplasm after the division of nucleus.	It is the division of cell nucleus into two during mitosis and meiosis.

Q.29. Distinguish between cytokinesis in plant and animal cell. OR

How does cytokinesis in plant cells differ from that in animal cells?

Ans:

No.	Cytokinesis in plant cells	Cytokinesis in animal cells
i.	Cytokinesis occurs by the formation and extension of cell plate from centre to the periphery.	Cytokinesis occurs by furrowing of plasma membrane that deepens and the daughter cells are formed.
ii.	Cleavage absent.	Cleavage present.

Q.30. Define meiosis.

Ans: Meiosis is reductional division in which the chromosome number is reduced to half. During meiosis, four haploid daughter cells are formed from one parental cell.

Q.31. Write the general characteristics of meiosis.

Ans: General characteristics of meiosis:

i. Meiosis is a complex type of cell division.
ii. It helps in achieving rejuvenation and recombinations.
iii. It is usually associated with formation of spores (in plants and fungi) and gametes (in animals).
iv. It takes place only in reproductive cells.
v. Meiosis involves halving of the chromosome number. Thus, it becomes half in daughter cells.
vi. Here, chromosomes duplicate only once but cell divides twice.
vii. It results in the formation of four haploid cells.
viii. Meiosis involves two successive divisions: Meiosis I or reduction division and Meiosis II or equational division.

Q.32. By which type of cell division does genetic recombination take place?

Ans: Genetic recombination takes place due to meiosis.

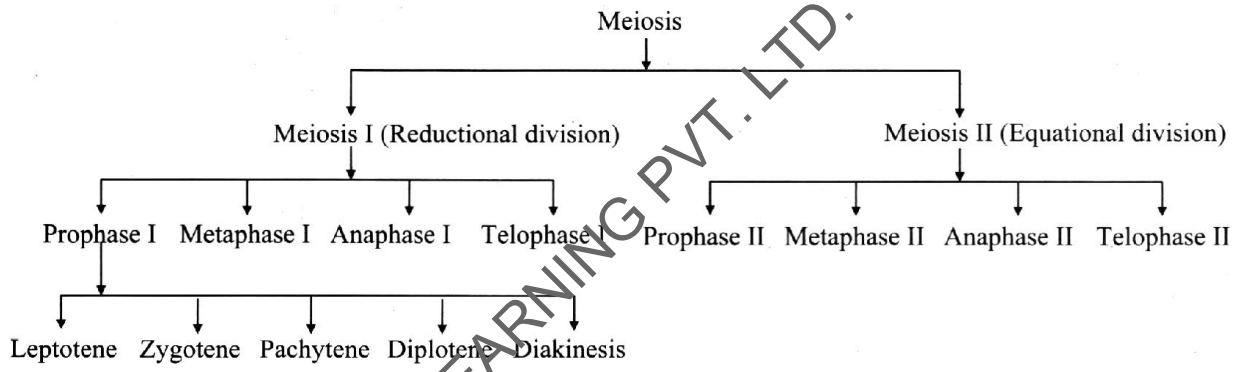
Q.33. Enlist the various stages in meiosis.

OR

State the various stages of meiosis.

Ans: Meiosis is a type of cell division which involves reduction from the diploid number of chromosomes (2n) to a haploid number (n).

It is a process in which the chromosomes duplicate only once but the cell divides twice.
It results in formation of four haploid cells. Hence, it is also called reduction division.
The various stages in meiosis are represented as follows:



Q.34. Describe the various phases of meiosis I.

Ans: Meiosis-I or reduction division

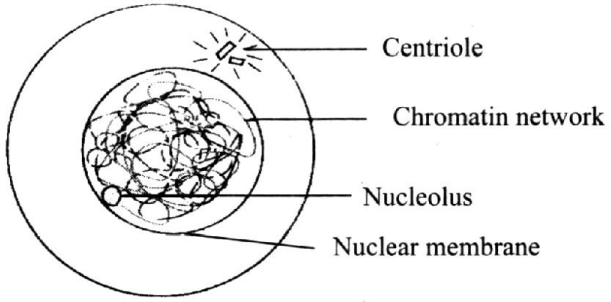
Meiosis-I is completed through two stages as, interphase and karyokinesis.

Interphase:

It is similar to that seen in mitosis and involves the duplication of genetic material, i.e. DNA.

Karyokinesis:

It shows the following phases:



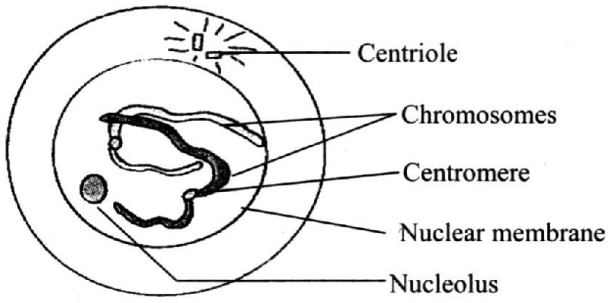
Interphase

a. Prophase-I:

It is the most complicated and longest phase of meiotic division.
It is further divided into five sub-phases viz: leptotene, zygotene, pachytene, diplotene and diakinesis.

i. Leptotene or leptonema or thin-thread stage (leptos = thin, nema = thread):

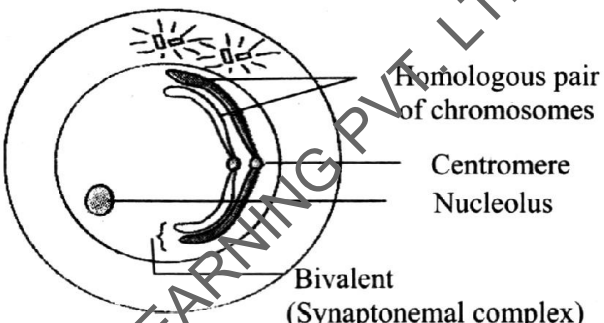
During this phase, nuclear membrane and nucleolus start disintegrating.
The chromatin network condenses and resolves into long and thin thread like chromosomes.
Each chromosome consists of two chromatids but appear as a single thread.



Leptotene

ii. Zygotene or zygonema (Zygo = paired, nema = thread):

It is a phase in which homologous chromosomes coming from two parents begin to pair lengthwise. Such a pairing of homologous chromosomes is called synapsis. The pairs of chromosomes at this stage are called bivalents.



Zygotene

iii. Pachytene or Pachynema (pachus = thick, nema = thread):

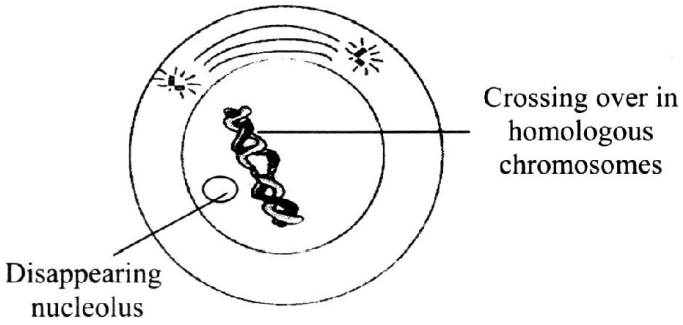
During this phase, chromosomes condense further and appears short and thick.

Each homologue shows two chromatids.

Therefore, each bivalent now appears as a tetrad consisting of four chromatids. The twisting of chromatid arms results into breakage followed by reunion. There is exchange of chromatid arms between non-sister chromatids of homologous chromosomes.

Non-sister chromatids of the homologous chromosomes cross each other by exchanging genetic material. This is known as crossing over.

It occurs at one or more points caned chiasmata.



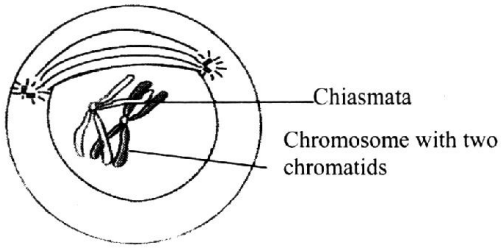
Pachytene

iv. Diplotene stage (Diplos = two, nema = thread):

Homologous chromosomes repel from each other and begin to separate.

This phenomenon is called repulsion.

However, the chromatids remain attached at the point of crossing over. Nucleolus and nuclear membrane start disappearing.



Diplotene

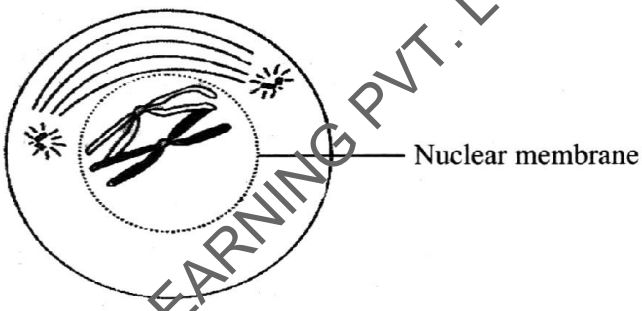
v. Diakinesis:

During this phase, chromosomes continue to shorten and condense.

As the separation proceeds, the chiasmata are shifted to the end of the chromatids.

This process is called terminalisation.

The nucleolus and nuclear membrane completely disappear and spindle fibres begin to appear.



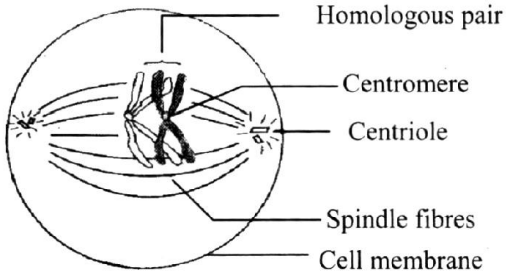
Diakinesis

b. Metaphase I:

The spindle formation is completed and occupies nuclear region.

The bivalents move and arrange themselves on the equatorial plane ..

Each chromosome pair is attached by spindle fibres at the centromere and extends from the poles to the centromeres of corresponding homologues.



Metaphase – I

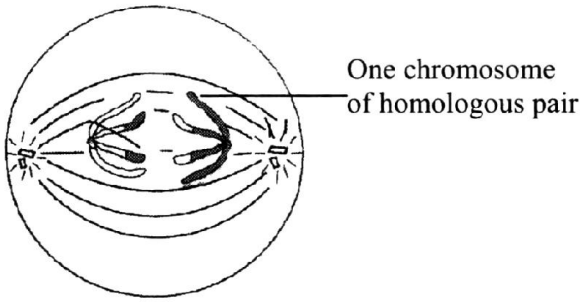
c. Anaphase I:

The chromosomal fibres contract and pull the homologues and inter-chromosomal fibres appear and extend so that homologous chromosomes start moving towards opposite poles.

However, the centromere does not divide so that chromatids remain together.

During this stage, homologous chromosomes (i.e., homologues) which are still attached at chiasmata, finally get separated.

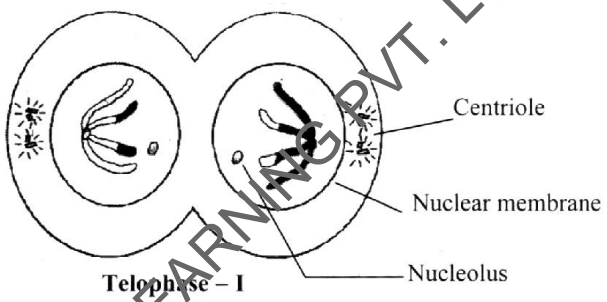
At the end of anaphase- I, each pole of the cell possesses half the number of chromosomes.



Anaphase – I

d. Telophase I:

The chromosomes uncoil to form chromatin.
The chromosomes become elongated and indistinct.
The spindle fibres disappear.
The nucleolus and nuclear membrane reappear forming two daughter nuclei.



Telophase – I

e. Cytokinesis - I:

Telophase-I is immediately followed by division of the cytoplasm.
The plasma membrane constricts in the middle in animal cell, while a cell plate is formed in plant cell to form two haploid daughter cells.
Each daughter cell contains a single nucleus with a single set of chromosomes.

Q.35. Which is the most important event during prophase-I?

Ans: Pachytene is the most important event during prophase-I.

Q.36. What are chiasmata?

Ans: Chiasmata are the points where crossing over takes place between non-sister chromatids of homologous chromosomes.

Q.37. Define bivalent.

Ans: It is the pair of homologous chromosomes formed by synapsis, Its number is half to the number of chromosomes in a diploid organism.

Q.38. What are homologous chromosomes?

Ans: Homologous chromosomes homologues:

The morphologically and genetically similar chromosomes - one paternal and other maternal- present in the diploid cell are called homologous chromosomes or homologues.

Q.39. What is synapsis?

Ans: The process of pairing of homologous chromosomes is called synapsis. It occurs in zygotene phase of meiosis I.

Q.40. What is crossing over? Give its significance.

Ans: Crossing over:

The process of exchange of genetic material between non-sister chromatids of homologous chromos.omes is known as crossing over.

Significance of crossing over:

Crossing over results in genetic recombination of parental characters that leads to variations.

Q.41.Define disjunction.

Ans: During anaphase I of meiosis I, homologous chromosomes (i.e., homologues) which are still attached at chiasmata, finally get separated. This process is called disjunction.

Q.42. During which stage disjunction takes place?

Ans: Disjunction takes place during Anaphase I of meiosis I.

Q.43. What happens during diakinesis?

Ans: In diakinesis, chromosomes continue to condense and shorten. The separation of homologues proceeds

and the chiasmata get, shifted to the ends of chromatids. This process is called terminalization. The nucleolus and nuclear membrane completely disappear and kinetic spindle appears.

Q.44. Distinguish between anaphase of mitosis and anaphase I of meiosis.

Ans:

No.	Anaphase of mitosis	Anaphase I of meiosis
i.	Centromere divides into two, resulting in the separation of chromatids.	Centromere do not divide.
ii.	Homologous chromosomes are not involved.	Homologous chromosomes are involved.
iii.	Disjunction does not occur.	Disjunction occurs.

Q.45. Describe the various stages of meiosis II.

Ans: Meiosis II:

Both the haploid daughter cells that are formed at the end of meiosis I undergo meiosis II.

A short resting period between meiosis-I and meiosis-II is called interkinesis.

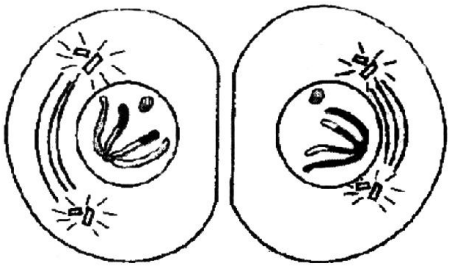
Meiosis-II is divided into two sub-stages as karyokinesis and cytokinesis.

The karyokinesis involves prophase-II, metaphase-II, anaphase-II and telophase-II.

i. Prophase IT:

During this phase, chromosomes with chromatids become very distinct.

The nucleolus and nuclear membrane disappear.

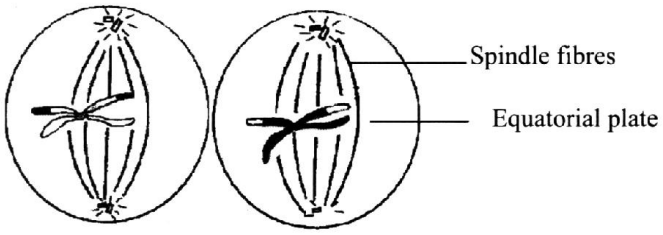


Prophase - II

ii. Metaphase IT:

Spindle formation occurs and chromosomes get arranged on the equatorial plane.

Chromosomes get connected to the respective poles by the chromosomal fibres.



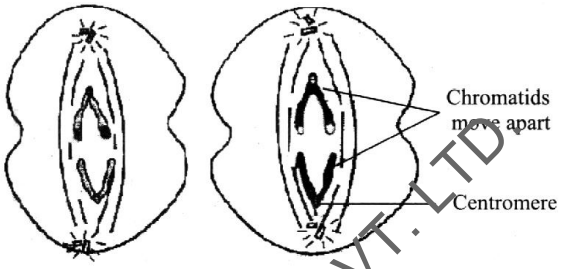
Metaphase - II

iii. Anaphase IT:

The centromere of each chromosome divides and chromatids are separated.

Each chromatid is now called daughter chromosome. Inter-chromosomal fibres are formed in between the centromeres of daughter chromosome.

They move towards opposite poles by shortening of the chromosomal fibres and elongation of interchromosomal fibres.



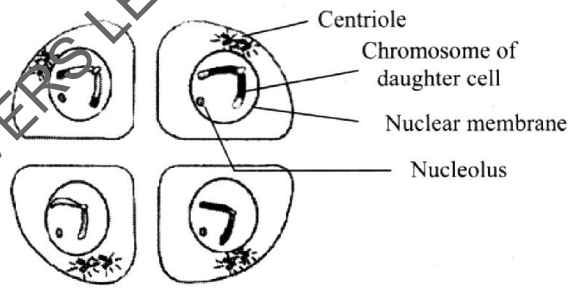
Anaphase - II

iv. Telophase IT:

The daughter chromosomes at each pole starts uncoiling.

The nucleolus reappears and the nuclear membrane is formed around each group of chromosomes forming two daughter nuclei.

The daughter chromosomes form chromatin network.



Telophase II and Cytokinesis

v. Cytokinesis - II:

Telophase-II is followed by division of cytoplasm of each cell to form two daughter cells.

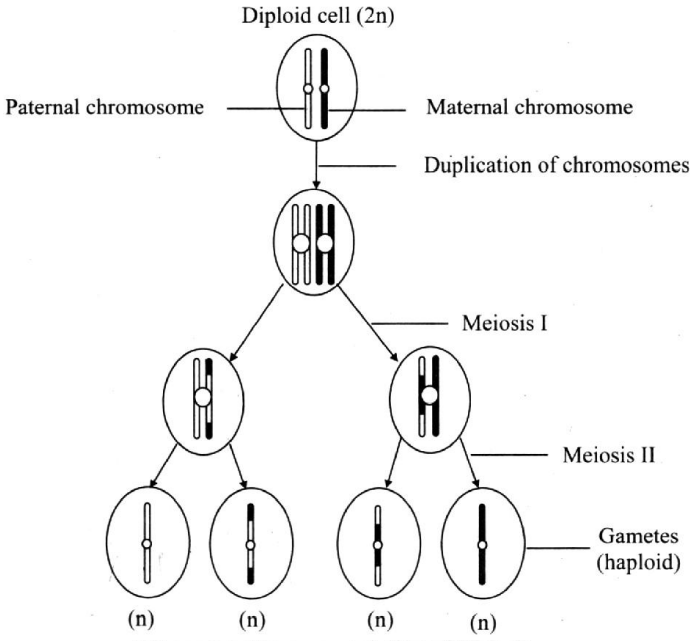
At the end of meiosis-II, four haploid daughter cells are produced.

Q.46. How many cells are produced at the end of meiosis?

Ans: During meiosis, one diploid cell gives rise to four haploid cells.

Q.47. Give a diagrammatic representation of meiosis.

Ans:



Diagrammatic representation of Meiosis

Q.48. Name the stage of cell cycle at which one of the following events occur:

i. Chromosomes are moved to spindle equator.
ii. Centromere splits and chromosomes separate.
iii. Pairing between homologous chromosomes takes place.
iv. Crossing over between homologous chromosomes takes place.

Ans: i. Metaphase
ii. Anaphase
iii. Zygotene of prophase - I of meiosis.
iv. Pachytene of prophase - I of meiosis.

Q.49. Distinguish between:

A. Equational division and Reduction division.

OR

Mitosis and Meiosis.

B. Meiosis I and Meiosis II.

Ans: A. Equational division and Reduction division

OR

Mitosis and Meiosis

No.	Equational Division/ Mitosis	Reduction division/ Meiosis
i.	Occurs in somatic cells.	Occurs in reproductive cells.
ii.	Nucleus divides only once.	Nucleus divides twice – Meiosis I and II.
iii.	Two daughter cells are formed.	Four daughter cells are formed.
iv.	No synapsis occurs.	Synapsis of homologous chromosomes and exchange of segments occurs during crossing over.
v.	Prophase is comparatively simple.	Prophase is complex and divided into Leptotene, Zygotene, Pachytene, Diplotene, and Diakinesis.
vi.	Occurs in both sexually as well as asexually reproducing organisms.	Occurs only in sexually reproducing organisms.
vii.	The chromosome number remains constant at the end of mitosis.	The chromosome number is reduced from diploid to haploid.
viii.	It plays an important role in growth, repair, healing and development.	It is important for formation of haploid gametes and spores.
ix.	The genetic constitution of daughter cells is identical to that of the parent cell.	The genetic constitution of daughter cells differs from that of the parent cell.

B. Meiosis I and Meiosis II

No.	Meiosis I	Meiosis II
i.	It is a reductional phase.	It is an equational phase.
ii.	Chromosomes get reduced to half.	Chromosomes are equally distributed.
iii.	Prophase I is of very long duration.	Prophase–II is of short duration.
iv.	Crossing over of chromosomes results in variation.	No crossing over of chromosomes.
v.	Telophase I results into 2 daughter cells.	Telophase II results in 4 daughter cells.

Q.50. Give reasons: Meiosis is known as reductional division.

Ans: Meiosis is known as reductional division because the parent cell produces four daughter cells each having half the number of chromosomes present in the parent cell.

Q.51. Write the significance of meiosis.

Ans: Significance of meiosis:

i. Haploid gametes required for sexual reproduction are formed by meiosis.
ii. In plants, spores are formed due to meiosis.
iii. Meiosis introduces genetic recombinations leading to variations and evolution.
iv. In meiosis, haploid gametes are formed, these gametes unite at the time of fertilization and thus chromosome number is restored.

Q.52. Analyze the events during every stage of cell cycle and notice how the following two parameters change:

i. Number of chromosomes (N) per cell ii. Amount of DNA content (C) per cell

Ans: i. In G_1 phase, the number of chromosomes (N) per cell remains the same and each chromosome is formed of one chromatid.
In S phase, each chromosome is formed of two sister chromatids joined at the centromere.
Same condition continues in G_2 phase while in M phase, sister chromatids separate and move to different cells, but the number of chromosomes remain same in mitosis.

ii. In G_2 phase, the amount of DNA content (C) per cell remains the same, but in S phase, it is doubled due to DNA replication. It remains double in G_2 phase, but is halved in M phase of cell cycle.

Additional Theory Questions :

Q.1. Sketch and label prophase of animal cell. Refer Q.18.

Q.2. Sketch and label metaphase stage in mitosis. Refer Q.18.

Q.3. Sketch and label anaphase of plant cell. Refer Q.18.

Q.4. Sketch, label and describe telophase in mitosis. Refer Q.18.(iv}

Q.5. Draw a neat, labelled diagram of cytokinesis in animal and plant cell. Refer Q.18.(B}

Q.6. Describe prophase-I of meiosis. Refer Q.34.(a}

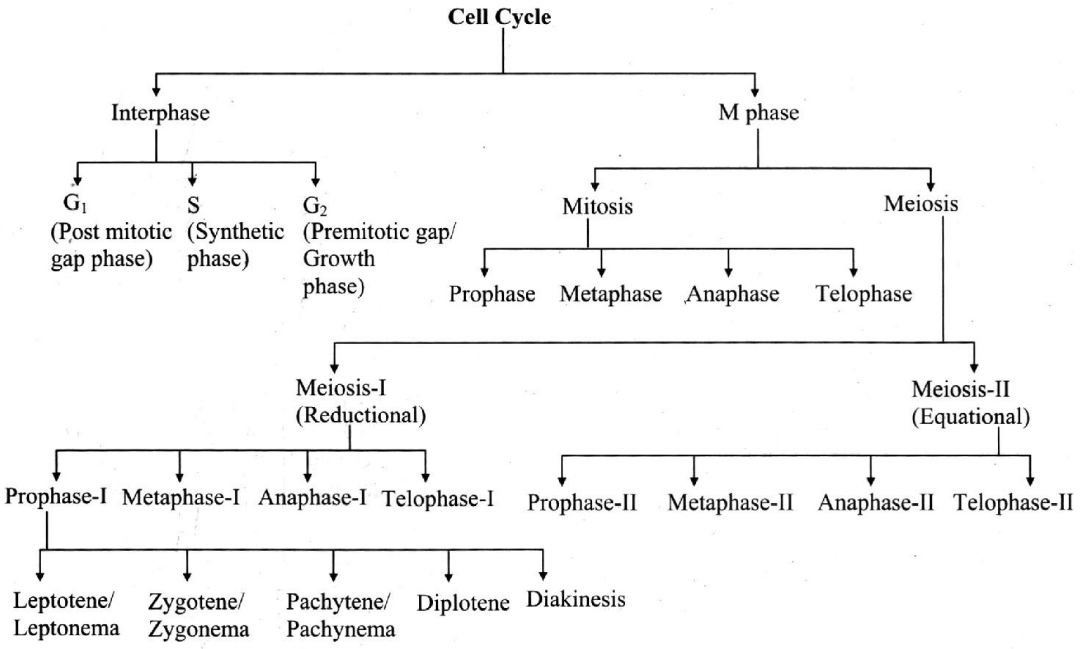
Q.7. Sketch, label and describe zygotene. Refer Q.34 (a) point (ii)

Q.8. Describe chiasmata. Draw diagram to. illustrate your answer. Refer Q.36 and Q.34(iii}: For diagram

Q.9. What is bivalent? Draw diagram to illustrate your answer. Refer Q.37 and Q.34(ii}: For diagram.

Q.10. Define synapsis. Draw diagram to illustrate your answer. Refer Q.39 and Q.34(ii): For diagram.

Quick Review :



Multipal Choice Question's

1. Cell cycle includes
a) Cell growth b) DNA synthesis
c) Mitosis d) All of these

2. Interphase is also called as
a) Synapsis b) Preparatory phase
c) Telophase d) Developmental stage

3. The loss of control at Go leads to
a) resting phase
b) normal growth and development
c) death of an organism
d) uncontrolled division as in tumor

4. Which of the following is called post-mitotic gap phase?
a) Interphase b) S-phase
c) G_2 phase d) G_1 phase

5. Replication of DNA takes place during
a) prophase b) S-phase
c) G_2 phase d) Interkinesis

6. The term 'mitosis' was coined by
a) W. Flemming b) F. Blackmann
c) J. Karma d) J. Endus

7. Which of the following is not a divisional phase?
a) Prophase b) Interphase
c) Metaphase d) Telophase

8. Karyokinesis is the division of
a) nucleus b) cytoplasm
c) cell wall d) pollen grain

9. Which part of the cell disappears during mitosis?
a) Plasma membrane b) Nucleolus
c) Plastid d) None of these

10. During metaphase, chromosomes
a) become short and thick
b) get arranged at the equator
c) duplicate and divide
d) move to the respective poles

11. During cell division, spindle fibres are attached to
a) telomere b) centromere
c) chromomeres d) chromosome

12. Chromosomal morphology is best observed during
a) prophase b) interphase
c) metaphase d) telophase

13. Spindle fibres are composed of
a) Lipids b) Proteins
c) Pectins d) Cellulose.

14. Anastral mitosis is common in
a) invertebrates b) vertebrates
c) both a) and b) d) higher plants

15. Which of the following is the shortest phase?
a) metaphase b) anaphase
c) interphase d) S-phase

16. The stage of mitosis in which chromosomes begin to separate and move to the two poles of the dividing cell is called
a) prophase b) metaphase
c) anaphase d) telophase

17. Chromosomes move to the respective poles due to the contraction of
a) inter-zonal fibres b) chromosomal fibres
c) inter-polar fibres d) astral rays

18. Reappearance of nucleolus is during
a) telophase b) prophase
c) cytokinesis d) inter-kinesis

19. During telophase
a) nuclear membrane is formed
b) nucleolus appears
c) astral rays disappear
d) all the above three take place

20. How many mitotic divisions are needed for a single cell to make 128 cells?
a) 7 b) 14
c) 28 d) 64

21. In the meristematic cell of shoot apex, division will take place by
a) mitosis b) meiosis
c) amitosis d) any of these

22. Cytokinesis in plant cell takes place by
a) furrowing b) cell plate formation
c) anyone of a) or b) d) none of these

23. Meiosis is a
a) homotypic division
b) equatorial division
c) reductional division
d) none of the above

24. The prophase I of the meiotic division has _____ sub-stages.
a) two b) three
c) five d) six

25. Prophase I is the _____ stage of meiotic division.
a) longest b) shortest
c) tallest d) least complicated

26. In which of the following stages, chromosomes

are thin and long thread like?
a) Leptotene b) Zygotene
c) Pachytene d) Diplotene

27. Pairing of homologous chromosomes is called
a) crossing over
b) synapsis
c) chiasma formation
d) duplication

28. Synapsis occurs in
a) leptotene b) pachytene
c) zygotene d) diplotene

29. Formation of bivalents (Synaptonemal complex) during meiosis occurs at
a) Leptotene b) Zygotene
c) Diplotene d) Pachytene

30. During which phase of meiosis tetrads are formed?
a) Anaphase I b) Prophase-II
c) Prophase-I d) Anaphase-II

31. The crossing over takes place in the _____ stage.
a) leptotene b) zygotene
c) pachytene d) diplotene

32. Crossing over takes place between
a) sister chromatids
b) non-homologous chromosomes
c) non-sister chromatids ofhomologues
d) any two chromatids

33. Exchange of genetic material takes place during
a) diplotene b) leptotene
c) zygotene d) pachytene

34. Crossing over of chromosomes during meiosis leads to
a) mutation
b) sex determination
c) new gene combination
d) loss of chromosomes

35. Recombinations of parental characters are due to
a) chiasma b) synapsis
c) linkage d) crossing over

36. Points at which crossing over has taken place between homologous chromosomes are called
a) chiasmata
b) synaptonemal complexes
c) centromeres
d) telomere

37. Which of the following events take place during diplotene stage of prophase I of meiosis?
a) Compaction of chromosomes
b) Formation of synapsis
c) Process of crossing over
d) Repulsion ofhomologues

38. Terminalisation is a process related with
a) Mitosis b) Meiosis II
c) Cytokinesis d) Diakinesis

39. In which of the following, nuc!eolus is almost not visible?
a) Leptonema b) Zygonema
c) Pachynema d) Diakinesis

40. The cytogenetic eventls which occurs during prophase I is
a) synapsis
b) crossing-over
c) chiasma formation
d) all of these

41. The chronological sequence of stages in prophase I of meiosis is
a) Leptotene, Pachytene, Zygotene, Diakinesis, Diplotene
b) Zygotene, Leptotene, Pachytene, Diakinesis, Diplotene
c) Leptotene, Zygotene, Pachytene, Diplotene, Diakinesis
d) Diplotene, Diakinesis, . Pachytene, Zygotene, Leptotene

42. Poleward movement of dyads occurs in
a) anaphase of mitosis
b) anaphase I
c) anaphase II
d) all of these

43. In which phase of meiosis are homologous chromosomes separated?
a) Anaphase I b) Prophase II
c) Anaphase II d) Prophase I

44. The transition between meiosis I and meiosis II is called
a) Interkinesis b) Cytokinesis
c) Diakinesis d) Karyokinesis

45. During meiosis, centromere divides
a) only once at anaphase II
b) only once at anaphase I
c) twice in meiosis I and II
d) twice in anaphase I and II

46. Significance of meiosis is associated with
a) DNA duplication

b) asexual reproduction
c) growth of the body
d) sexual reproduction

47. Mitosis differs from meiosis in not having
a) Long prophase
b) duplication of DNA
c) Synapsis and crossing over
d) interphase

48. How many divisions are required to produce 128 gametes?
a) 64 b) 16
c) 32 d) 12

49. Number of cells undergoing meiotic divisions to produce 124 microspores in angiosperm is
a) 62 b) 31
c) 124 d) 8

50. Genetic recombinations leads to
a) division b) variations
c) evolution d) both b) and c)

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Answer Keys

1. d)	2. b)	3. d)	4. d)	5. b)	6. a)	7. b)	8. a)	9. b)	10. b)
11. b)	12. c)	13. b)	14. d)	15. b)	16. c)	17. b)	18. a)	19. d)	20. a)
21. a)	22. b)	23. c)	24. c)	25. a)	26. a)	27. b)	28. c)	29. b)	30. c)
31. c)	32. c)	33. d)	34. c)	35. d)	36. a)	37. d)	38. d)	39. d)	40. d)
41. c)	42. b)	43. a)	44. a)	45. a)	46. d)	47. c)	48. c)	49. b)	50. d)