Chapter 2

Cell Cycle and Cell Division

Solutions (Set-1)

SECTION - A

School/Board Exam. Type Questions

Very Short Answer Type Questions :

1. How many meiotic divisions are required to produce 32 microspores?

Sol. Eight

2. Name the stage which connects meiosis I and meiosis II.

Sol. Interkinesis

3. Name the first stage of the interphase in which active synthesis of RNA and protein occurs.

Sol. G_1 phase

4. What percentage of duration of cell cycle does interphase last?

Sol. More than 95%

5. Name the last stage of prophase I.

Sol. Diakinesis

6. Name the phase in which the chromatids move apart in mitosis and meiosis.

Sol. Mitosis – Anaphase

Meiosis – Anaphase II

7. Which process changes the long, fine chromatin fibres into chromosomes?

Sol. Condensation of chromosomes

8. How does the cell plate divide the plant cell into two daughter cells?

Sol. The cell plate starts from the centre of the cell and moves or grow outwards, centrifugally to meet the lateral cell wall. It therefore, divides the cell into two halves.

9. Name the three sub-stages of interphase.

Sol. G_1 phase, S phase, G_2 phase

10. Which type of cell division produces new cells for regeneration?

Sol. Mitosis

Short Answer Type Questions :

11. Why is DNA duplicated well before cell division?

Sol. DNA is duplicated well before cell division to ensure that daughter cells have identical genetic information about their structure and functioning. It is to ensure that both the daughter cells have intact genome.

12. Differentiate between anaphase I and anaphase II of meiosis.

Sol.

Anaphase I	Anaphase II
1. The homologous chromosomes separate from each other and start moving towards the poles.	1. The chromatids of the chromosomes separate from each other and start moving towards the opposite poles.
2. The centromere holding the two chromatids do not break and the entire chromosome move towards the pole.	2. The centromere holding the two chromatids breaks and the chromatids move towards the opposite poles.
3. It reduces the number of chromosomes to half.	3. It does not reduce the chromosome number.

13. Mention the significance of crossing over phenomenon occurring during meiosis I.

Sol. Crossing over introduces new combinations of genes which results into variations. Thus, exchange of genetic material produces variations.

14. What is the difference between S phase and G_2 phase?

Sol.

S Phase	G_2 Phase
1. It is a phase where synthesis of DNA takes place.	1. It is a phase where RNA and proteins required during the M phase are synthesized.
2. It lasts for 6–8 hours in humans.	2. It lasts for 2–5 hours in humans.

15. Write the names of two cells which do not divide after attaining fully differentiated state.

Sol. RBC, nerve cell.

16. What is meant by metaphasic plate?

Sol. The plane of alignment of the chromosomes at metaphase is referred to as the metaphase plate.

17. What is M phase? Which two processes are involved during M phase?

Sol. M phase or mitotic phase is the phase where actual cell division occurs. It consists of two processes namely :

(i) Karyokinesis – Division of nucleus

(ii) Cytokinesis – Division of cytoplasm.

18. What are the four major stages of karyokinesis?

Sol. Prophase, metaphase, anaphase, telophase.

19. Define cell plate.

Sol. The formation of the new cell wall begins with the formation of a simple precursor, called the cell plate that represent the middle lamella between the walls of two adjacent cells.

20. What happens to the somatic cell if its surface area to volume ratio decreases?

Sol. If the surface area volume ratio of a cell decreases, then the cell undergoes mitosis or cell division. It maintains the size of the cell which is essential for proper functioning of the cell.

21. In which phase of the cell cycle, the following take place?

    (i) Replication or duplication of DNA

    (ii) Separation of chromatids

Sol. (i) Interphase (S-phase)

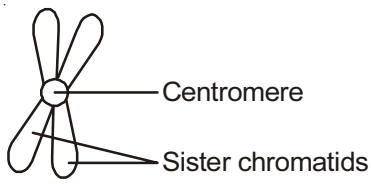
(ii) M phase (Anaphase)

22. Schematically show the following :

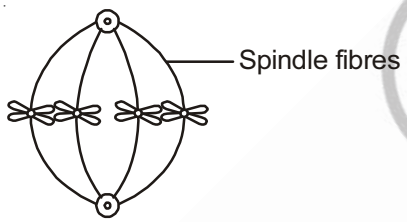
    (i) Centromere

    (ii) Spindle fibres

Sol.



(i) Centromere



(ii) Spindle fibres

23. What is the major difference between S phase and M phase of the cell cycle?

Sol. S phase is the phase where synthesis or duplication of DNA occurs and M phase is the phase where the DNA duplicated during S phase is distributed between the two daughter cells.

24. What will happen to the lizards whose tail is surgically removed (cut)?

Sol. The cells present at the tail of the lizard undergo mitosis to produce new cells which regenerate the new tail.

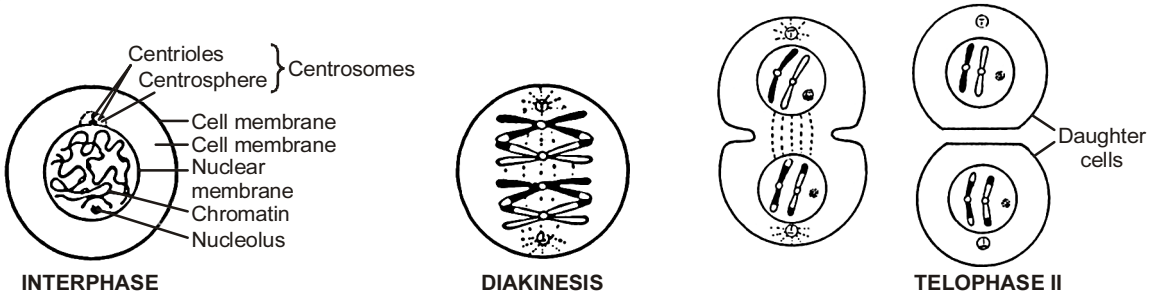
25. Draw the diagram of the following :

    (i) Interphase

    (ii) Diakinesis

    (iii) Telophase II

Sol.



INTERPHASE DIAKINESIS TELOPHASE II

26. Diagrammatically explain the behaviour of chromosome during the following phases.

(i) G_1 phase

(ii) S phase

(iii) G_2 phase

Sol.

G_1-Phase S-Phase G_2-Phase

27. Which is the event that occurs during anaphase II?

Sol. The event which occurs during anaphase II is the separation of the chromatids of the univalent chromosomes present in the daughter cell formed after meiosis I. The chromatids present in the univalent chromosomes differ from each other due to crossing over.

28. Why are haploid gametes important for the sexual reproduction?

Sol. During sexual reproduction, two gametes fuse together to form a fertilized egg. If the gametes are diploid (2n), then the offspring produced would be (4n) and when it would reproduce, the new offspring would have 8n condition and so on. This would disturb the stability of the organism, so in order to maintain the diploid condition in the offsprings, meiosis produces two haploid gametes which fuse together to form a diploid offspring.

29. Write the major events occurring during prophase II.

Sol. (i) It is a short phase where the chromatids of the univalent condenses.

(ii) The chromatin material becomes compact.

(iii) The nucleolus and nuclear membrane disintegrates and disappears.

30. What is the role of mitosis in repair, reproduction, healing and regeneration?

Sol. (i) Repair : Mitosis is a mechanism for replacing old, dead and worn out cells by new cells.

(ii) Reproduction : Mitosis brings about reproduction in unicellular organisms.

(iii) Healing and regeneration : Mitosis produces new cells for healing the wounds and for regeneration.

Long Answer Type Questions :

31. Define :

(i) Synapsis

(ii) Synaptonemal complex

(iii) Bivalent

(iv) Dyad

(v) Metaphasic plate

Sol. (i) Synapsis : The pairing of homologous chromosomes during zygotene of prophase I of meiosis is called synapsis.

(ii) Synaptonemal complex : Chromosome synapsis is accompanied by the formation of complex structure called synaptonemal complex.

(iii) Bivalent : The complex formed by a pair of synapsed homologous chromosomes. The two homologous chromosome pair together and thus form a bivalent.

(iv) Dyad : The sister chromatids of homologous chromosomes which become visible during cell division are called dyads.

(v) Metaphasic plate : The plane of alignment of the centromere of all the chromosomes of the cell at the equator during metaphase, is called metaphasic plate.

32. Give the scientific term for each of the following :

(i) An inactive stage shown by the cells which does not proliferate unless called on to do so.

(ii) A disc-like structure surrounding the centromere.

(iii) The stage which lasts for months or years in the oocytes of some vertebrates.

(iv) A unicellular organism whose cell cycle time is 90 min.

Sol. (i) Quiescent or G_0 stage.

(ii) Kinetochore

(iii) Diplotene

(iv) Yeast

33. Describe prophase of mitosis.

Sol. Pro means first and phase means stage, therefore prophase is the first stage of mitosis which follows the interphase of the cell cycle. The following events occur during prophase :

(i) **Initiation of condensation of chromosomal material :** The condensation of this chromatin material takes place and during condensation, the DNA strands unwind or untangles to form compact mitotic chromosomes.

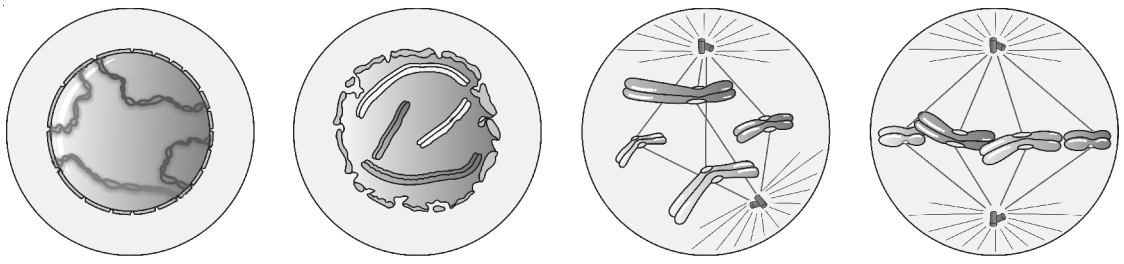
(ii) The centrioles in the animal cells, begins to move towards the opposite poles of the cell.

(iii) Initiation of mitotic spindle occurs during prophase.

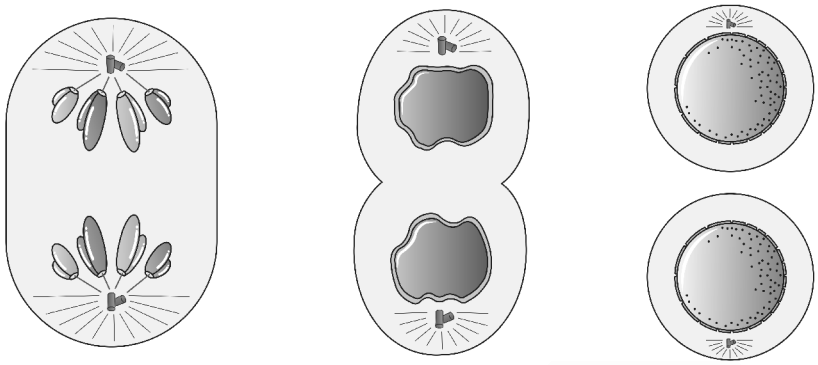
(iv) Cells at the end of prophase, when viewed under the microscope, do not show golgi complexes, endoplasmic reticulum, nuclear membrane and nucleolus.

34. Draw the diagram of different phases of mitosis.

Sol.



(a) Early Prophase (b) Late Prophase (c) Transition to Metaphase (d) Metaphase



(e) Anaphase (f) Telophase (g) Interphase

35. When does each of the following occur in meiosis II?

(i) The nuclear membrane reappears.

(ii) The centromere divides into two.

(iii) The chromosomes are thickest and shortest.

(iv) The chromosomes align at the equator.

Sol. (i) Telophase II

(ii) Anaphase II

(iii) Metaphase II

(iv) Metaphase II

36. Name the last stage of karyokinesis of meiosis I. Mention the events that occur during this stage and also represent this stage with the help of a diagram.

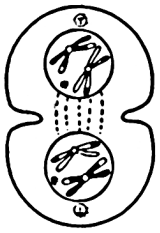
Sol. Telophase I is the final stage of reductional division, *i.e.*, meiosis I. It is characterised by following events :

(i) The chromosomes reach the poles. The spindle fibres completely disappear.

(ii) The nucleolus and nuclear membrane reappear.

(iii) The chromosomes uncoil and elongate but remain straight in this phase. They do not reach the extremely extended state of the interphase nucleus.

(iv) It produces two daughter cells each containing a single nucleus. The nucleus of the daughter cell receives only one chromosome from each homologous pair and thus it has half the number of chromosome. The separation of the two chromatids occurs during meiosis II.



Telophase I

37. Describe the second stage of meiosis I.

Sol. After completing prophase I, the chromosomes enter metaphase I. Following events occur during metaphase I :

(i) The bivalent chromosomes align themselves at the equator on the equatorial plate. The centromeres of the two chromosomes are arranged in two rows at the equator.

(ii) The distribution of the bivalent chromosomes are at random. The two chromosomes can face either of the two poles. There is no fixed direction in which paternal or maternal chromosomes would face.

(iii) The microtubules of the spindle fibres from opposite poles attach to the centromere of the chromosome facing towards it.

38. Draw the diagram of following stages :

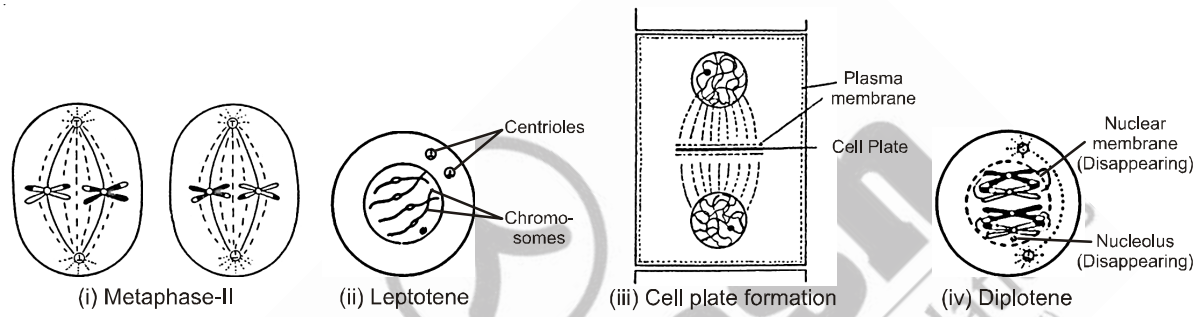
(i) Metaphase II

(ii) Leptotene

(iii) Cell plate formation

(iv) Diplotene

Sol.



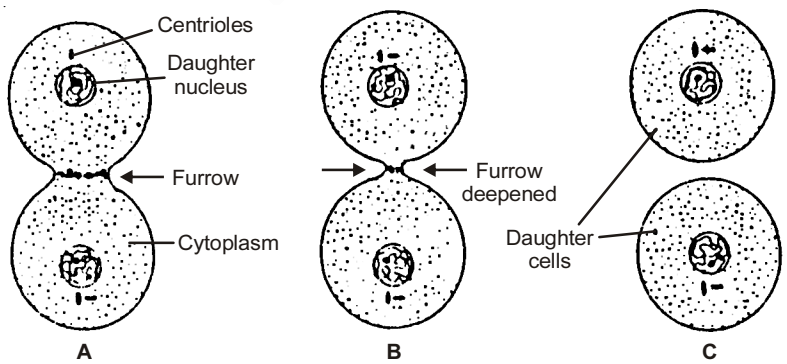
39. Explain the stage/phase of cell cycle where you would find nerve cells.

Sol. The non-dividing cells such as nerve cells enter the quiescent stage or G_0 stage of the cell cycle. In this phase, the cell remain metabolically active but do not proliferate unless they are called on to do so. They proliferate depending upon the requirement of the cell.

The cells which enter G_0, do not divide further rather start differentiating into specific types of cells. These cells do not go beyond the G_1 phase.

40. Describe the process of cytokinesis which occurs by the centripetal movement of the plasma membrane.

Sol. In animal cells, cytokinesis is achieved by the formation of a furrow. The furrow forms in the plasma membrane of the cell which deepens gradually. It moves centripetally and ultimately joins in the centre dividing the cell cytoplasm into two. The ingrowing constriction of the plasma membrane moves inside the cell which finally joins and divide the animal cell into two daughter cells.



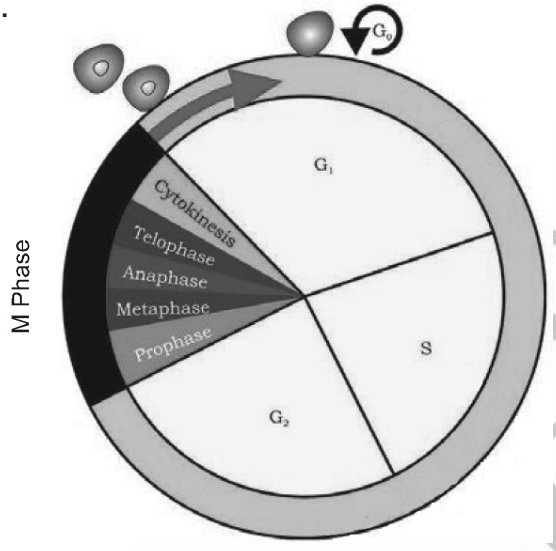
41. Explain the diplotene stage of meiosis.

Sol. (i) The synaptonemal complex formed during the zygotene dissolves partially during the diplotene. Therefore, the homologous chromosomes separate excepts in the region of crossing over.

(ii) The point of attachment between the homologous chromosomes after the partial dissolution of the synaptonemal complex is called **chiasmata**. It becomes visible during diplotene stage. The two homologous chromosomes begin to separate from each other but remain attached at the chiasmata. Chiasmata marks the sites where crossing over occurred during pachytene. The homologous chromosomes do not separate at chiasmata, and hence they are seen as a X-shaped structure.

42. Diagrammatically represent different phases of the cell cycle.

Sol.



43. What is the significance of pachytene?

Sol. Pachytene : It is the third stage of prophase I. It occurs after zygotene and the following events occur during pachytene :

(i) The synapsed chromosomes continue to become thick and short. The four chromatids of the homologous chromosomes now become clearly visible and are referred as tetrad. The two chromatids of the same chromosome are called sister chromatids and two chromatids of the two different homologous chromosomes is called as non-sister chromatids.

(ii) During pachytene, crossing over occurs between non-sister chromatids of the homologous chromosomes. The exchange of genetic material (DNA) between the non-sister chromatids of the homologous chromosomes is known as **crossing over**.

(iii) Crossing over leads to recombination of genetic material which involves a mutual exchange of the corresponding segments of non-sister chromatids of homologous chromosomes. It takes place by breakage and reunion of chromatid segments.

44. Why is G_1 phase important during cell cycle?

Sol. G_1 phase corresponds to the interval between mitosis and initiation of DNA replication. In this phase, cell replicate DNA and remain metabolically active. The cell grows in size continuously and synthesizes nucleotides, ATP, proteins, amino acids, enzymes, RNAs etc. (required during S phase) during this phase. It is the Gap phase which occur prior to the S phase. If G_1 phase does not occur the DNA replication would not occur.

45. What will happen if zygotene stage is skipped by the cells?

Sol. Zygotene is the second stage of prophase I. It occurs after leptotene. A diploid cell contains two set of chromosomes. The two chromosomes which are similar in form, size, structure are called homologous chromosomes. One of the homologous chromosomes is paternal chromosome and the other is maternal chromosome.

During zygotene, these homologous chromosomes start pairing together. These homologous chromosome come to lie side by side in pairs and this pairing is known as **synapsis**. The complex formed by a pair of synapsed chromosome is called bivalent. If zygotene is skipped, then crossing over, recombinations would not occur. Meiosis would not occur and gamete would not be properly formed.

SECTION - B

Model Test Paper

Very Short Answer Type Questions :

1. Which type of cell division is involved in regeneration?

Sol. Mitosis

2. What is the duration of M-phase in cell cycle?

Sol. < 5%

3. In which cell, the cytokinesis occurs by formation of a furrow?

Sol. Animal cell

4. If the amount of DNA after S phase is equal to 20 pg, then what was the amount of initial DNA?

Sol. After S phase, 2C amount of DNA = 20 pg. In G1 phase, it would be 1 C or 10 pg.

5. Name the phase of mitosis when the chromosomes are thickest, smallest and easily studied.

Sol. Metaphase

6. Name the stage of meiosis when bivalents or homologous chromosomes separate from each other.

Sol. Anaphase I

7. If a plant cell containing 23 chromosomes at the end of S phase, then what number of chromosomes are present at G_1 phase?

Sol. 23

8. Which type of cell division maintains the nucleocytoplasmic ratio?

Sol. Mitosis

Short Answer Type Questions :

9. Define cell cycle.

Sol. A sequence of events by which a cell duplicates its genome, synthesize other constituents of the cell which eventually distribute and divides into two daughter cells is known as cell cycle.

10. Define the period between two successive mitosis.

Sol. Interphase is a phase where the cell prepares itself for division. It is a biosynthetic phase in which the cell duplicates its organelles and replicates its DNA or genetic material.

11. Describe the structures surrounding the constriction holding the two sister chromatids.

Sol. Centromere is the constriction which holds the two sister chromatids. It is surrounded by kinetochore which serves as the point of attachment of the chromosomes where the microtubules constituting the spindle fibres attach themselves.

12. Briefly describe why meiosis I is called reductional division and meiosis II is called equational division?

Sol. Meiosis I is called reductional division because during this division, the chromosome number is reduced to half and meiosis II is called equational division because during this division, the number of chromosome remains the same as produced at the end of meiosis I.

13. What is synaptonemal complex? When is it formed and what is its role?

Sol. It is formed during zygotene of prophase I. It is thought that synaptonemal complex stabilizes the two homologous chromosomes till the crossing over is completed.

14. What is chiasmata? Explain its significance.

Sol. The point of attachment between the homologous chromosomes after the partial dissolution of the synaptonemal complex is called chiasmata. Chiasmata marks the site where crossing over occur during pachytene. They hold the homologous chromosome together.

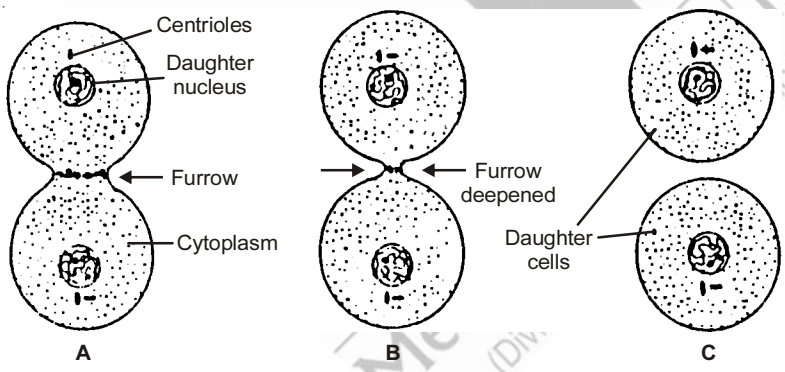
15. Write the name of meristems in which mitotic divisions result in a continuous growth of plants throughout their life?

Sol. Apical meristem and lateral cambium.

Short Answer Type Questions :

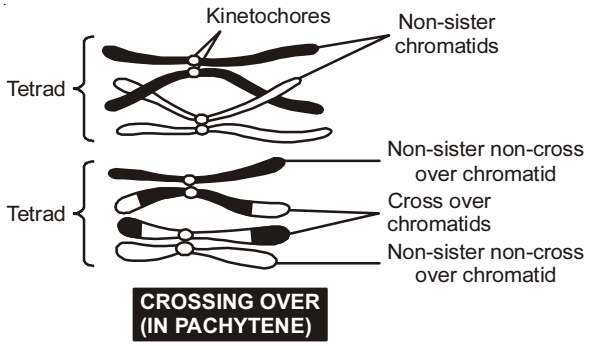
16. Diagrammatically explain cytokinesis in an animal cell.

Sol.



17. What is crossing over? Explain with a diagram.

Sol. The exchange of genetic material between the non-sister chromatids of the homologous chromosomes is called crossing over.



18. Why do chromosomes assume short, rod-like forms during mitosis?

Sol. The chromosome condenses to assume short, rod-like forms during mitosis because it is easier for short, compact chromosomes to move through the cytoplasm in anaphase than it is for a long, slender twisted interphase chromosomes.

19. Explain the events occurring during telophase.

Sol. Telophase : Telo means end and phase means stage, hence telophase is the end stage of karyokinesis. The following events occur during telophase :

(i) The chromosomes (sister chromatids) reach their respective poles. The mitotic spindle disappears.

(ii) After reaching the poles, the chromosomes gradually uncoil and become thin, slender, long and lose their identity. The decondensation of chromosomes occur and finally they become indistinguishable mass and collect at the poles.

(iii) Nucleolus, endoplasmic reticulum, golgi bodies, and other organelle reappear in the daughter cells.

(iv) The nuclear envelope develops around the chromatin cluster.

20. Explain the events occurring during metaphase II.

Sol. The univalents, *i.e.*, chromosomes align themselves at the equator, (on the equatorial plane) in the metaphase II. The microtubules, from the opposite poles, extend towards the equator and attach at the kinetochore of the chromatids.

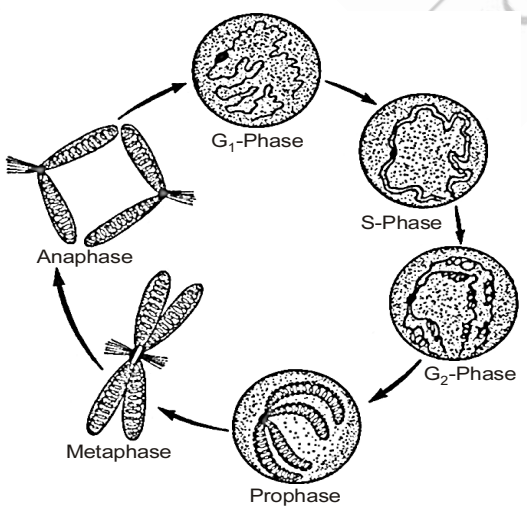
21. Describe the quiescent stage of the cell cycle.

Sol. The non-dividing cells enter the quiescent stage or G_0 stage of the cell cycle. In this phase, the cells remain metabolically active but do not proliferate unless they are called on to do so. They proliferate depending upon the requirement of the cell. The cells which enter G_0, do not divide further and start differentiating into specific types of cells. These cells do not go beyond the G_1 phase, *i.e.*, the cell cycle for such cells stops at this phase. The cells present in the G_0 phase have two fates. They can either re-enter into the cell cycle, *i.e.*, G_1 phase or they can fully differentiate and die.

Long Answer Type Questions :

22. Diagrammatically explain the behaviour and structure of chromosome during interphase and mitosis.

Sol.



23. Write the significance of meiosis.

Sol. (1) **Formation of gametes :** Meiosis produces gametes for sexual reproduction. Gametes are essential for sexual reproduction because in sexual reproduction an organism is formed by the fusion of two gametes.

(2) **Maintenance of chromosome number :** Meiosis reduces the chromosomal number to half in the gametes, so that fertilization restores the original diploid number in the zygote.

(3) **Introduction of variations :** Meiosis provides a chance for the formation of new combination of chromosomes. This brings out variations. The new combinations are produced by crossing over in prophase I.

❑ ❑ ❑

Solutions (Set-2)

Objective Type Questions

(Cell Cycle, Phases of Cell Cycle, Interphase, M-Phase)

1. The sequence of events by which cells duplicate their genome, synthesize the other components of cell which eventually distribute into two daughter cells is called

   (1) Quiescent stage (2) Generation time

   (3) Cell cycle (4) Kinetochore

Sol. Answer (3)

While **:**

Quiescent stage $\rightarrow$ In this phase cell remains metabolically active but do not proliferate unless they are called on to do so.

Generation time $\rightarrow$ Time between two consecutive cell cycles *i.e.*, Time taken by the number of cells to be doubled.

Kinetochore $\rightarrow$ Trilamellar proteinaceous structure present at centromere.It is attachment site for spindle fibers.

2. DNA replication occurs in

   (1) S phase (2) G_1 phase

   (3) G_2 phase (4) M phase

Sol. Answer (1)

While

G_1 phase – Organelles duplicate in this phase

G_2 phase – Tubulin protein synthesis

M phase – Mitotic phase

3. The phase between the two successive M phase is called as

   (1) Metaphase (2) Anaphase

   (3) Prophase (4) Interphase

Sol. Answer (4)

At interphase cell undergo growth.

4. A biosynthetic phase where cell organelle duplicate itself is

   (1) Interphase (2) Anaphase (3) Prophase (4) Telophase

Sol. Answer (1)

While

Prophase : Condensation of chromatin begin.

Anaphase : Centromere splits and chromatid separation

Metaphase : Condensed chromosome align themselves at equator.

5. Yeast can progress through the cell cycle in about

(1) 90 sec (2) 90 min

(3) 90 hrs (4) 90 yrs

Sol. Answer (2)

Yeast cell completes its cell cycle in 90 min.

6. _____ represents the most active stage of the cell cycle.

(1) Metaphase (2) Anaphase

(3) Telophase (4) Interphase

Sol. Answer (4)

Because in this phase cell prepares itself for cell division.

7. Interphase is called the resting phase because

(1) It is the most active phase of the cell cycle

(2) There is no apparent activity related to cell division

(3) It does not prepare cell for cell division

(4) It is the phase where cell rests before entering into mitosis

Sol. Answer (2)

Interphase stage of cell cycle involves growth of cell and does not involves division of cell.

8. _____ phase synthesizes enzymes required during S phase.

(1) G_2 (2) M

(3) S (4) G_1

Sol. Answer (4)

While

M $\rightarrow$ Mitotic phase

G_2 $\rightarrow$ Organelle duplication like Mitochondria

S $\rightarrow$ DNA duplication

9. Non-dividing cells enter the

(1) G_2 phase (2) M phase

(3) G_0 phase (4) S phase

Sol. Answer (3)

G_0 phase also known Quiescent phase.

10. The cells which enter _____ phase start differentiating into specific types of cell.

(1) G_1 (2) G_2 (3) S (4) G_0

Sol. Answer (4)

G_0 phase is the phase of cell differentiation.

11. If the initial amount of DNA is 8 C, then after S phase the amount of DNA would be

(1) 4 C (2) 8 C (3) 64 C (4) 16 C

Sol. Answer (4)

Because DNA duplicates during S phase.

12. The number of chromosomes in G_1 phase is 36, the number of chromosomes in S phase is

(1) 36 (2) 18 (3) 22 (4) 37

Sol. Answer (1)

Because after S phase only DNA content duplicates not the number therefore, each chromosome will be having two chromatids.

13. A phase of the cell cycle which lasts more than 95% of the total duration is

(1) Prophase (2) Interphase (3) Anaphase (4) Telophase

Sol. Answer (2)

Because cell prepares itself for division during this phase.

14. Most dramatic period of cell cycle is

(1) G_1 phase (2) G_2 phase (3) S phase (4) M phase

Sol. Answer (4)

Because during mitotic phase movement of chromosomes is visible.

(Mitosis, Significance of Mitosis)

15. Two daughter cells formed after mitosis are

(1) Non-identical to each other (2) Identical to each other

(3) Non-identical to parents (4) Irregular in size

Sol. Answer (2)

Identical to each other because mitosis is an equational division.

16. A cell division in which a diploid somatic cell divides into two identical daughter cells is called

(1) Meiosis I (2) Meiosis II (3) Mitosis (4) Cytokinesis

Sol. Answer (3)

Mitosis (equational division) occurs in somatic cells.

17. Which type of cell division is called somatic cell division?

(1) Meiosis I (2) Meiosis II (3) Reduction division (4) Mitosis

Sol. Answer (4)

Mitosis cell division is also called somatic cell division.

18. Mitosis occurs in

(1) Meristematic cells (2) Undifferentiated germ cells

(3) Somatic cells (4) More than one option is correct

Sol. Answer (4)

Mitosis occurs in both somatic cells and undifferentiated germ cells of both plants and animals.

19. The first phase of mitosis which follows interphase is

(1) Metaphase (2) Prophase (3) Telophase (4) Anaphase

Sol. Answer (2)

Prophase is the first phase of mitosis.

20. Initiation of condensation of chromatin material occurs in

(1) Prophase (2) Anaphase (3) Telophase (4) Metaphase

Sol. Answer (1)

Chromatin condenses to form chromosome in prophase.

21. Mitotic spindle initiates during

(1) Telophase (2) Anaphase (3) Prophase (4) Metaphase

Sol. Answer (3)

In late prophase mitotic spindle starts organising.

22. Nucleolus and nuclear membrane disappear during

(1) Anaphase (2) Interphase (3) Telophase (4) Prophase

Sol. Answer (4)

At the end of prophase (late) nuclear envelope and nucleolus disappear.

23. The chromosomes are shortest and thickest during

(1) Anaphase (2) Metaphase (3) Telophase (4) Interphase

Sol. Answer (2)

Because condensation is completed.

24. The chromosomes align at the equator during

(1) Interphase (2) Prophase (3) Metaphase (4) Telophase

Sol. Answer (3)

In Metaphase all chromosome arrange at equator of cell to form equatorial or metaphasic plate.

25. Read the following statements

(a) Complete disintegration of the nuclear envelope marks the start of the second phase of mitosis.

(b) Metaphase chromosome is made up of one sister chromatid.

(1) Only (b) is correct (2) Both (a) & (b) are incorrect

(3) Only (a) is correct (4) Both (a) & (b) are correct

Sol. Answer (3)

Complete disintegration of nuclear envelope marks the start of the second phase of mitosis. *i.e.*, Metaphase.

Metaphasic chromosome has two sister chromatids.

26. The morphology of the chromosomes is studied during

(1) Metaphase (2) Interphase (3) Prophase (4) Telophase

Sol. Answer (1)

Because chromosomes are completed condensed, shortest and thickest in this stage.

27. The point of attachment of microtubules on the chromosome is called as

(1) Centromere (2) Kinetochore (3) Chromatid (4) Spindle

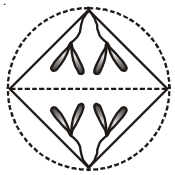
Sol. Answer (2)

Kinetochore which is a trilamellar proteinaceous structure present at centromere.

28. Chromosomes move towards the pole during

(1) Prophase (2) Metaphase (3) Telophase (4) Anaphase

Sol. Answer (4)



Poleward movement is also called anaphasic movement.

29. The centromere splits during

(1) Anaphase (2) Telophase (3) Interphase (4) Prophase

Sol. Answer (1)

At anaphase centromere splits and the chromatids move towards opposite poles.

30. The chromosomes cluster at opposite poles and their identity is lost as discrete elements during

(1) Telophase (2) Anaphase (3) Metaphase (4) Prophase

Sol. Answer (1)

Because chromosomes start decondensing into chromatin network.

31. The mitotic spindle disappears in

(1) Prophase (2) Metaphase (3) Anaphase (4) Telophase

Sol. Answer (4)

Because proper division and distribution of DNA has been done, so now there is no further use of spindle apparatus.

32. Decondensation of chromosomes occur during

(1) Prophase (2) Metaphase (3) Anaphase (4) Telophase

Sol. Answer (4)

Telophase shows decondensation of chromosome, and reapperance of chromatin.

33. The nuclear envelope reassembles during

(1) Prophase (2) Telophase (3) Anaphase (4) Metaphase

Sol. Answer (2)

Telophase is marked by reassembling of nuclear envelope.

34. _____ phase marks the end of M-phase.

(1) Karyokinesis (2) Prophase (3) Cytokinesis (4) Telophase

Sol. Answer (3)

M-phase begins with karyokinesis and ends with cytokinesis.

35. If karyokinesis is not followed by cytokinesis, then gives rise to

(1) Zygote (2) Fertilised egg

(3) Multinucleate condition (4) Embryo

Sol. Answer (3)

Because Karyokinesis means division of nucleus and cytokinesis means division of cytoplasm, So, if nucleus divides and cytoplasm does not divide, then more than one nucleus will be there in a single cell *i.e.*, multinucleate condition. 

36. A single cell containing large number of nuclei is called

(1) Syncytium (2) Cell plate (3) Monad (4) Bivalent

Sol. Answer (1)

Multinucleate cell

Cell plate forms cell wall in plant cell.

37. A type of cell division which reduces chromosome number to half is

(1) Mitosis (2) Multiple fission (3) Fragmentation (4) Meiosis

Sol. Answer (4)

Meiosis is also known as reductional division where one diploid cell divides to form 4 haploid cells.

38. What will be the total number of mitotic divisions in the formation of 64 daughter cells?

(1) 6 (2) 32 (3) 63 (4) 16

Sol. Answer (3)

Number of cell = 64

Number of divisions = n – 1 = 64 – 1 = 63

(Meiosis, Significance of Meiosis, Amitosis)

39. In meiosis-I, condensation and coiling of chromatin fibres started during

(1) Metaphase (2) Leptotene

(3) Diakinesis (4) Diplotene

Sol. Answer (2)

Leptotene which is the first stage of prophase I.

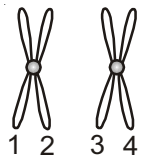
40. In pachytene, each tetrad contains

(1) Two chromatids (2) One chromatid

(3) Four chromatids (4) Three chromatids

Sol. Answer (3)

Two homologus (*i.e.*, homologus pair) chromosomes each having 2 chromatids.



41. Crossing over occurs during

(1) Anaphase I (2) Leptotene

(3) Diplotene (4) Pachytene

Sol. Answer (4)

Prophase I of meiosis I shows exchange of genetic materials between non-sister chromatids of homologus chromosomes which results in recombination.

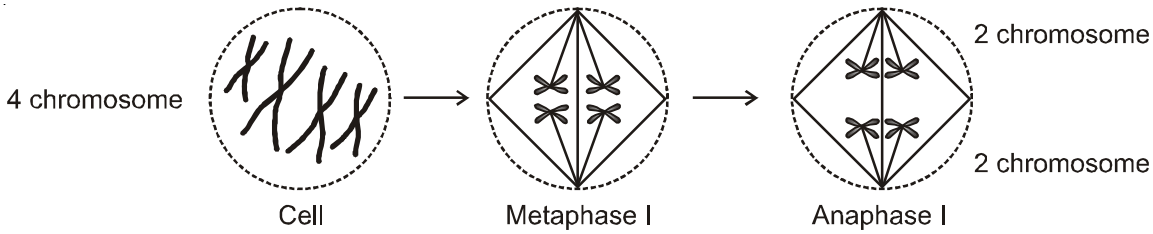
42. The homologous chromosomes move towards the opposite poles during

(1) Anaphase I (2) Anaphase II (3) Leptotene (4) Pachytene

Sol. Answer (1)

Segregation or seperation of homologous chromosomes at

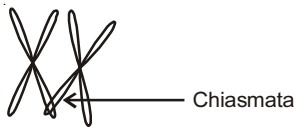
Anaphase-I results in reduction in chromosomes no.



43. _____ marks the site where crossing over had occurred.

(1) Diakinesis (2) Synapsis (3) Chiasmata (4) Leptotene

Sol. Answer (3)



(x-shaped structure)

44. Terminalisation of chiasmata occurs during

(1) Prophase-I (2) Metaphase-I (3) Anaphase-I (4) Telophase-I

Sol. Answer (1)

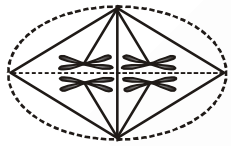
In Diplotene stage terminalisation of chiasmata occurs.

45. Bivalent chromosomes align themselves at the equator during

(1) Metaphase I (2) Prophase I (3) Metaphase II (4) Anaphase II

Sol. Answer (1)

Pair of homologus chromosomes are termed as bivalents.



46. If there are 30 chromosomes in G_1 phase then what will be number of bivalents in zygotene stage?

(1) 30 (2) 15 (3) 45 (4) 60

Sol. Answer (2)

Number of bivalents *i.e.*, no. of pair of chromosomes in Zygotene = 15

47. What will be the amount of DNA in meiosis II products if meiocyte contains 30 pg DNA in G_1 phase?

(1) 30 pg (2) 60 pg (3) 15 pg (4) 120 pg

Sol. Answer (3)

Meiocyte (2n, 2c) = 30 pg $\xrightarrow[\text{I}]{\text{meiosis}}$ $\frac{n}{2c}$ $\frac{n}{2c}$ $\xrightarrow[\text{II}]{\text{meiosis}}$ $\frac{n}{c}$ $\frac{n}{c}$ $\frac{n}{c}$ $\frac{n}{c}$

Therefore, 15 pg

❑ ❑ ❑