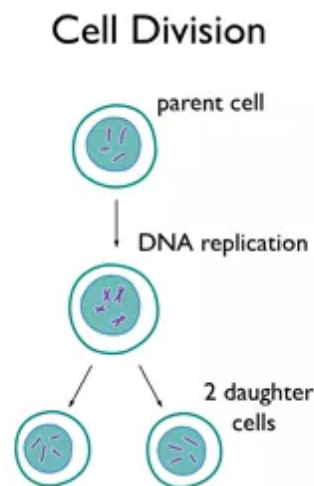


Chapter 1. Cell Division

Short Questions

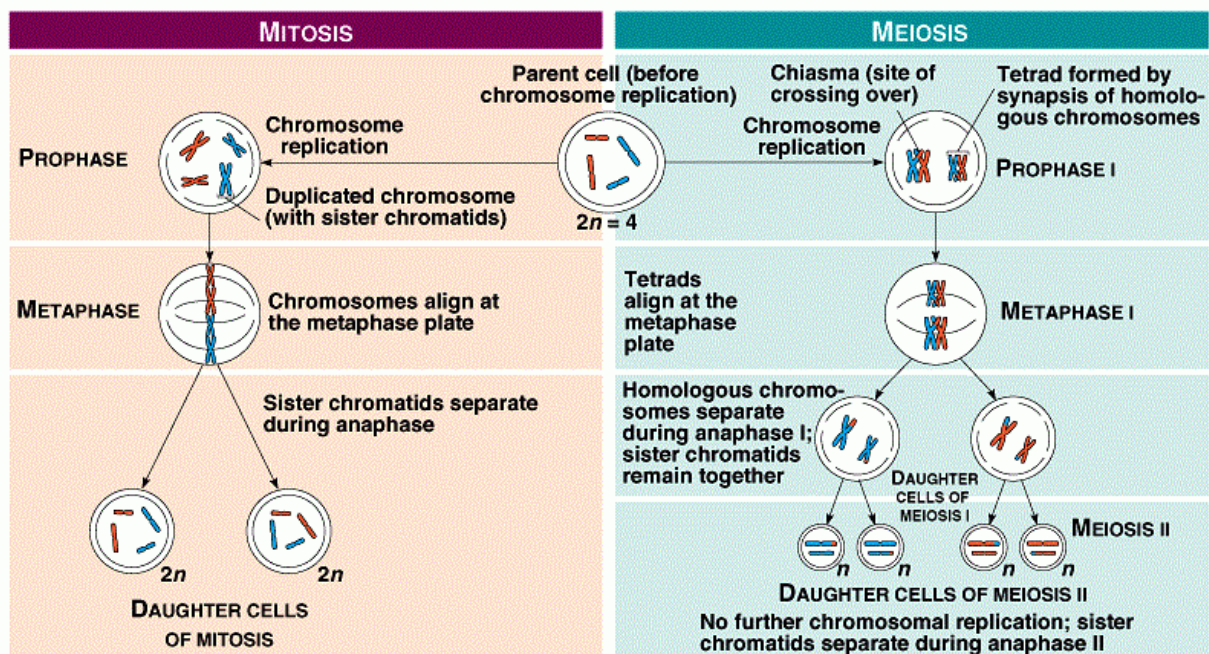
Question 1: What is direct cell division ? Explain with an example.

Answer: Amitosis is the direct cell division. It is the simplest type of cell division in which there is no spindle formation or condensation of fibres. Nucleus is directly divided into two, e.g., bacteria.



Question 2: Name the two kinds of cell division found in living organisms.

Answer: Meiosis and Mitosis.



Question 3: What type of cell division does occur in somatic cells of the body ?

Answer: The mitotic cell division occurs in somatic cells of the body.

Question 4: Where does the meiosis occur in our body ?

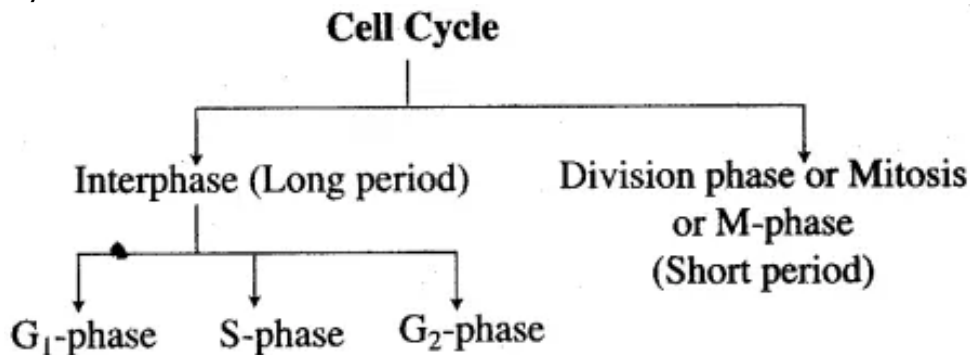
Answer: In our body meiosis occurs in germ cells i.e. in gonads.

Question 5: What do you mean by cell-cycle ?

Answer: Every cell capable of cell division passes through different stages or phases in a cyclic manner. It is called the cell cycle.

Question 6: Write the name of various steps of cell cycle.

Answer: Cell Cycle



Question 7: Name the structure which initiates cell division ?

Answer: Centriole (Centrosome).

Question 8: Why gametes have a haploid number of chromosomes ?

Answer: The gametes are produced as a result of meiosis hence they have haploid number of chromosomes.

Question 9: Mention three significant changes that occur in a cell during interphase.

Answer: The three significant changes that occur in a cell during interphase are:

- (i) The cell grows in size.
- (ii) New DNA is synthesized as per the old DNA template.
- (iii) Synthesis of RNA and protein takes place.

Question 10: What is cytokinesis ?

Answer: During cell division karyokinesis (division of nucleus) is followed by the division of cytoplasm. It is called cytokinesis. Or in other words cytokinesis is the division of cytoplasm.

Question 11: How does colchicine act as mitotic poison ? Is there any advantage of it ?

Answer: Colchicine is an alkaloid obtained from Autumn crocus (*Colchicum autumnale*). It inhibits the formation of mitotic spindle. As a result, chromosomes duplicate but they remain within the same cell, increasing in number (endoduplication). Such cells are called polyploid cells.

Its advantage is that, plant breeders have used colchicine-induced polyploidy as a means of producing variants of agricultural and horticultural crops.

Question 12: Explain the significance of mitosis.

Answer:

- (i) It helps to maintain linear heredity of an organism by keeping the chromosome number constant in daughter cells.
- (ii) It helps in development of organism from zygotic stage to adult stage.
- (iii) It is the means of repair and regeneration of cells.
- (iv) Asexual reproduction is accomplished only through mitosis.
- (v) Details of mitosis are similar in all organisms which emphasizes the unity of life.

Question 13: Why is meiosis referred to as reduction division ?

Answer: The meiosis is referred to as reduction division because the number of chromosomes in the daughter cells is half than that of the mother cell.

Question 14: What is the importance of meiosis in creating variations ?

Answer: During meiosis, the exchange of chromosomal material takes place between the non-sister chromatids forming new combinations. These new combinations give rise to variations which result in the evolution of species and even in the origin of new species.

Question 15: State how does meiosis maintain chromosome number in a species.

Answer: The gametes are formed by meiosis. During meiosis the number of chromosomes is reduced to half i.e. the gametes contain haploid number of chromosomes. The male and female gametes fuse to form a diploid zygote. In this way meiosis maintains chromosome number in a species.

Question 16: How prophase-I of meiosis differs from prophase of mitosis in an essential way ? Describe how it affects the daughter cells ?

Answer: Prophase-I of meiosis has five sub-stages namely Leptotene, Zygotene, Pachytene, Diplotene and Diakinesis. In pachytene exchange of genetic material between non-sister chromatids takes place through crossing over and chiasma formation which does not occur in prophase of mitosis. As a result, the daughter cells have a variation in their genetic composition contrary to identical daughter cells of mitosis.

Question 17: What is the importance of chiasma formation ?

Answer: Chiasma is the region where crossing-over takes place. By the formation of chiasma, exchange of genetic material between non-sister chromatids of the homologous

chromosomes is accomplished. So, chiasma is the means of bringing about recombination of characters and thus variations in multicellular organisms.

Question 18: What is the importance of meiosis?

Answer: The meiosis is important to maintain the constant number of chromosomes in a species. It also brings about variations which result in the evolution or origin of new species.

Give Reasons

Question 1: The mitosis is called equational division.

Answer: Mitosis is called equational division because during mitosis the cell divides equally into two identical daughter cells.

Question 2: The meiosis is called reductional division.

Answer: The meiosis is called reductional cell division since the four daughter cells formed have half the number of chromosomes than the mother cell.

Question 3: Gametes must be produced by meiosis for sexual reproduction.

Answer: The number of chromosomes in sex cell is halved.

Question 4: Chromosomes are the carriers of heredity.

Answer: The chromosomes contain gene which carry specific features to the offsprings.

Differentiate

Question 1: Mitosis and Meiosis.

Answer:

Mitosis	Meiosis
(i) It occurs in somatic cells.	It occurs in generative cells.
(ii) It involves a single division resulting into two daughter cells.	It involves two successive divisions resulting in the formation of four daughter nuclei.
(iii) Prophase is short and simple.	Prophase is of longer duration and complex.
(iv) Number of chromosomes in daughter cells is equal to that of parent cell.	Number of chromosomes in daughter cells is half to that of the mother cells.
(v) Equational division.	Reductional division.

(vi) Mitosis brings about growth, repair and healing.	Meiosis forms gametes and spores and maintains the chromosome number constant from generation to generation.
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Question 2: Chromatin and Chromosome.

Answer:

Chromatin	Chromosome
(i) Uncondensed form of nucleoprotein.	Condensed form of nucleoprotein.
(ii) Seen in interphase stage of cell division.	Seen in M-phase.
(iii) Control of metabolic activities.	Vehicles of heredity.

Question 3: Centrifugal cytokinesis and Centripetal cytokinesis.

Answer:

Centrifugal cytokinesis	Centripetal cytokinesis
During the partition of the cytoplasm following karyokinesis, when the cell plate formation begins in the centre and proceeds towards outwards, the division is said to be centrifugal.	When the cell membrane starts constricting from the sides and proceeds inwards, till the mother cell is divided into two daughter cells, the division is known as centripetal cytokinesis.
All plant cells follow centrifugal cytokinesis by cell plate formation.	All animal cells follow centripetal cytokinesis through cell furrow formation.

Question 4: Anaphase of Mitosis and Anaphase of Meiosis-I.

Answer:

Anaphase of mitosis	Anaphase of meiosis-I
During this phase of mitosis the centromeres divide, the spindle fibres contract and move towards opposite poles, pulling the daughter chromosomes apart.	With the contraction of microtubules of the spindle apparatus each homologous chromosome with its two chromatids and unbroken centromeres (unlike anaphase of mitosis) start moving towards the opposite poles of the cell.

Question 5: Gametic meiosis and Zygotic meiosis.

Answer:

Gametic meiosis	Zygotic meiosis
When the reproductive cells of a diploid organism undergoes meiosis to produce haploid gametes, it is called gametic meiosis.	Some algae and fungi are haploid adults. They produce haploid gametes which upon fertilization form a diploid zygote. This zygote undergoes meiosis to form haploid spores, which on repeated mitotic division form the adult body.

Question 6: Cytokinesis and Karyokinesis.

Answer:

Cytokinesis	Karyokinesis
It is the division of cytoplasm.	It is the division of nucleus.
It is followed by Karyokinesis.	It is the first division.

Question 7: Chiasmata and crossing over.

Answer:

Chiasmata	Crossing Over
It is the part of attachment of non-sister chromatids of homologous chromosomes where crossing over takes place.	It is exchange of genetic material between non-sister chromatids of homologous chromosomes.

Question 8: Centrosome and centromere.

Answer:

Centrosome	Centromere
It is an organelle of the animal cell.	It is a non-stainable part of chromosome at which two chromatids join.
It contains two centrioles which move towards the opposite poles and forms spindle fibres during cell division.	It provides attachment of spindle fibres during cell division.

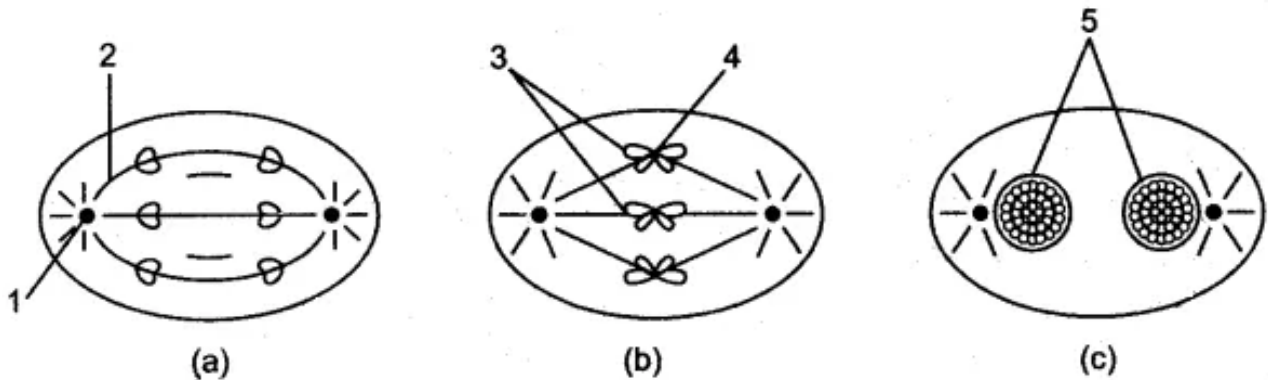
Question 9: Cytokinesis in plant and animal cell.

Answer:

Cytokinesis in plant cell	Cytokinesis in animal cell
It starts with a plate formation.	Plate formation is absent. A constriction forms in the middle of cell membrane.
It is centrifugal.	It is centripetal.

Diagram Based Questions

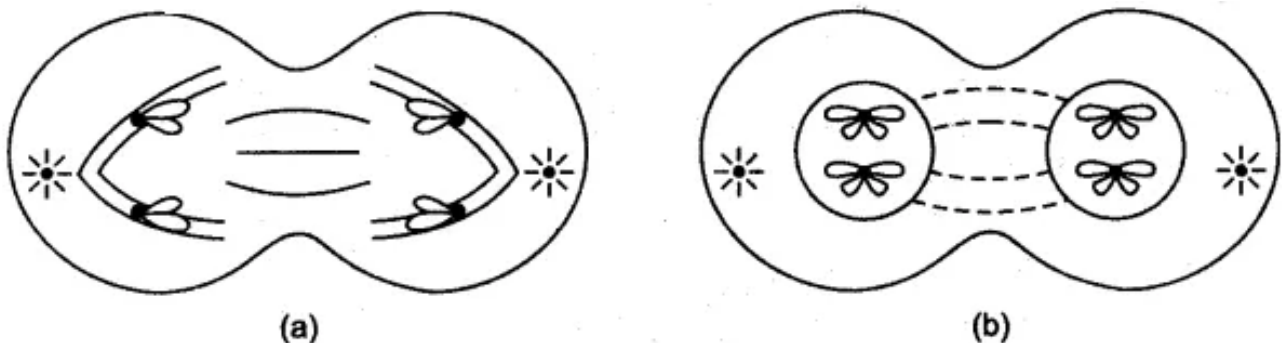
Question 1: Identify the stages of mitosis given below and label the figures.



Answer: (a) Anaphase, (b) Metaphase, (c) Telophase.

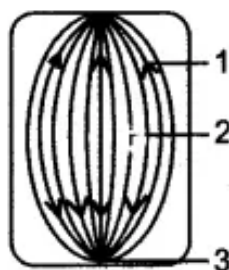
1. Centriole, 2. Spindle fibres, 3. Chromosomes, 4. Centromere. 5. Daughter nuclei.

Question 2: Identify the stages of meiosis below and label them.



Answer: (a) Anaphase I, (b) Telophase I.

Question 3: The diagram below represents a certain stage of a cell.



- Is it an animal cell or a plant cell? Give one reason in support of your answer.
- Label the parts numbered 1 – 3.

(iii) Which stage (phase) of mitosis is represented in this diagram.

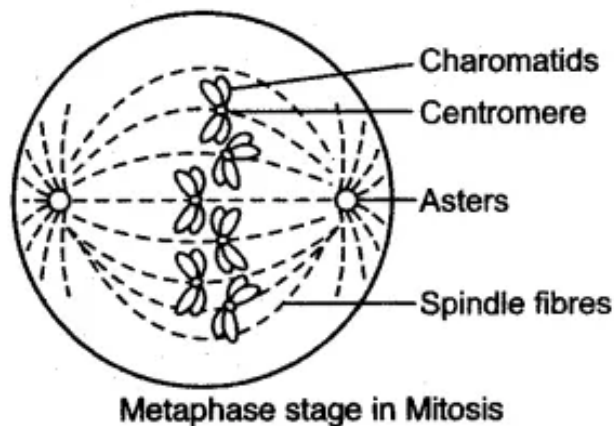
Answer:

- (i) It is a plant cell because it has cell wall.
- (ii) 1. Chromatids 2. Spindle fibres 3. Centromere.
- (iii) Anaphase.

Question 4:

- (i) Draw a neat labeled diagram to show the metaphase stage of mitosis in an animal cell having '6' chromosome.
- (ii) How many daughter cells are formed at the end of mitosis and at the end of meiosis?
- (iii) With reference to cell division explain the following terms:
(Chromatid, Centromere, Haploid).
- (iv) Name the type of cell division that occurs during:
1. Growth of shoot 2. Formation of pollen grains.
3. Repair of worn out tissues.

Answer: (i) See diagram.



(ii) **Mitosis:** two daughter cells.

Meiosis: four daughter cells.

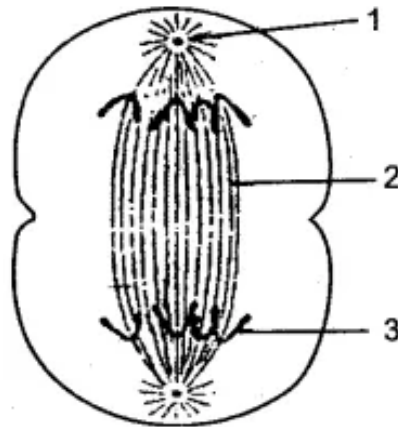
(iii) **Chromatid:** Duplicated chromosomes consist of two identical strands, each of these is called a chromatid.

Centromere: It is the point at which the two chromatids remain attached. It is also the point of attachment for spindles.

Haploid: A cell having only one set of chromosomes is called haploid.

- (iv) 1. Mitosis
- 2. Meiosis
- 3. Mitosis

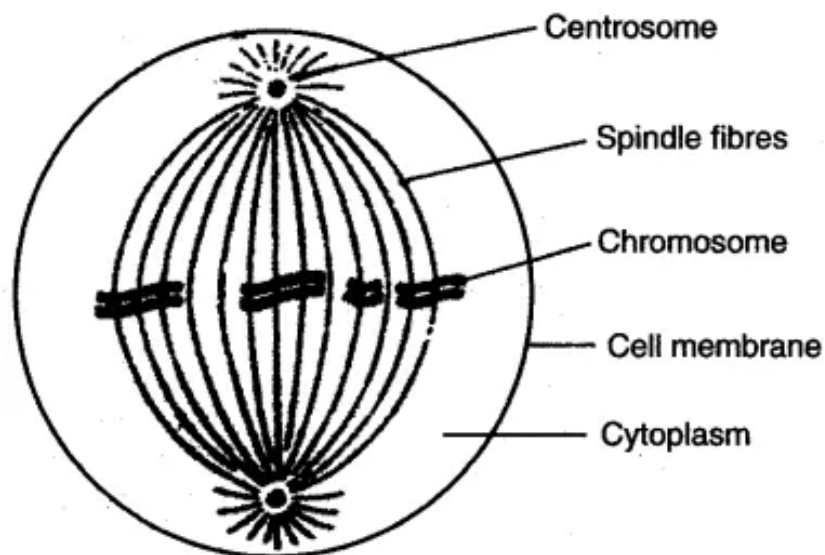
Question 5: The diagram below represents a stage during cell division. Study the same and then answer, the questions, that follow :



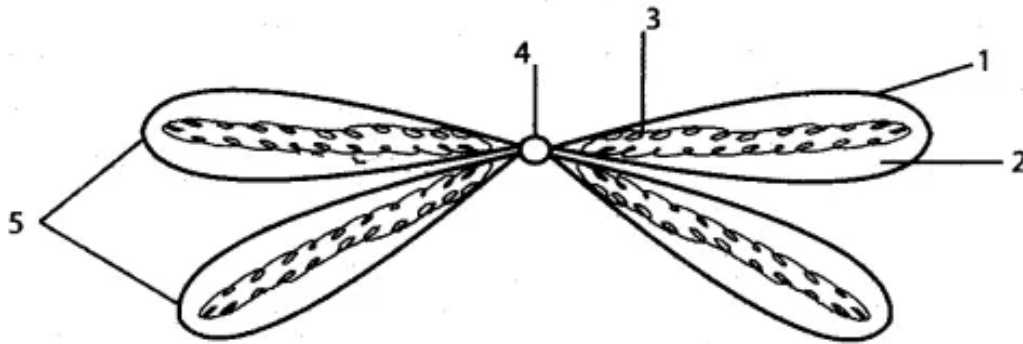
- (i) Name the parts labelled 1, 2 and 3.
- (ii) Identify the above stage and give a reason to support your answer.
- (iii) Mention where in the body this type of cell division occurs.
- (iv) Name the stage prior to this stage and draw a diagram to represent the same.

Answer: (i) 1. Centriole
 2. Spindle fibres
 3. Chromatid

- (ii) Anaphase—The daughter chromosomes are reaching to the opposite poles of the cell.
- (iii) In the somatic cells of the body.
- (iv) Metaphase

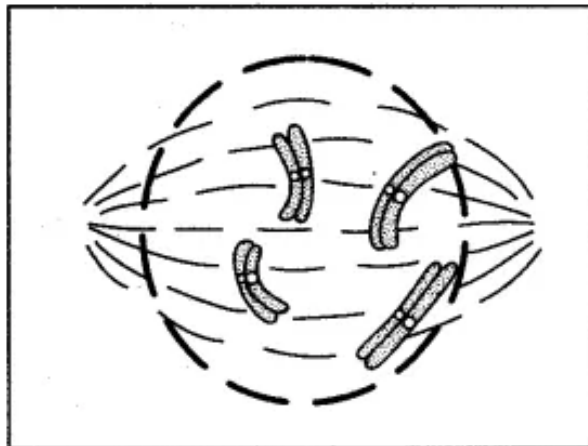


Question 6: In the given diagram name the parts labeled 1, 2, 3, 4 and 5 and describe about them in short.



- Answer:**
1. **Pellicie:** The matrix of chromosome is enclosed in a sheath called as pellicle.
 2. **Matrix:** The chromatin of chromosome is embedded in the achromatic substance known as matrix.
 3. **Chromatin:** Chromatin is the heredity material made-up of long fibres of DNA combined with proteins.
 4. **Centromere:** A narrow constriction is seen in the chromosome at metaphase or anaphase is called primary constriction. The distinct area of light colour inside the primary constriction is called centromere.
 5. **Chromatids:** Each metaphase chromosome consists of two sister chromatids.

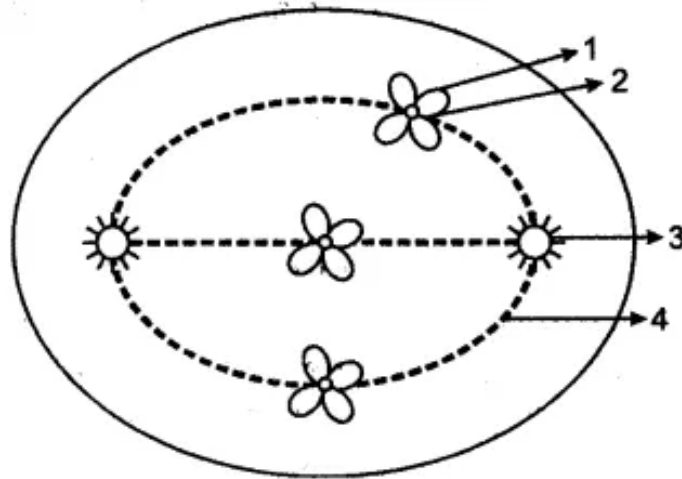
Question 7: Given below is a diagram representing a stage during mitotic cell division. Study it carefully and answer the questions that follow:



- (i) Is it a plant cell or an animal cell? Give a reason to support your answer.
- (ii) Identify the stage shown.
- (iii) Name the stage that follows the one shown here. How is that stage identified?
- (iv) How will you differentiate between mitosis and meiosis on the basis of the chromosome number in the daughter cells?

- Answer:**
- (i) It is plant cell, because centrosome is absent and spindle apparatus not connected to it
 - (ii) Prophase.
 - (iii) **Metaphase:** In this stage the chromosome lie in one plane at equator and gets attached to a spindle fibre by its centromere.
 - (iv) **Mitosis:** Same diploid number of chromosomes are present in the daughter cell.
Meiosis: Haploid number of chromosomes are present in the daughter cells.

Question 8: The figure below shows a certain stage of mitosis:



- (i) Name the stage,
- (ii) Label the parts-4
- (iii) How many chromosomes are shown here?

Answer: (i) Metaphase

(ii) 1. Chromatid

2. Centromere

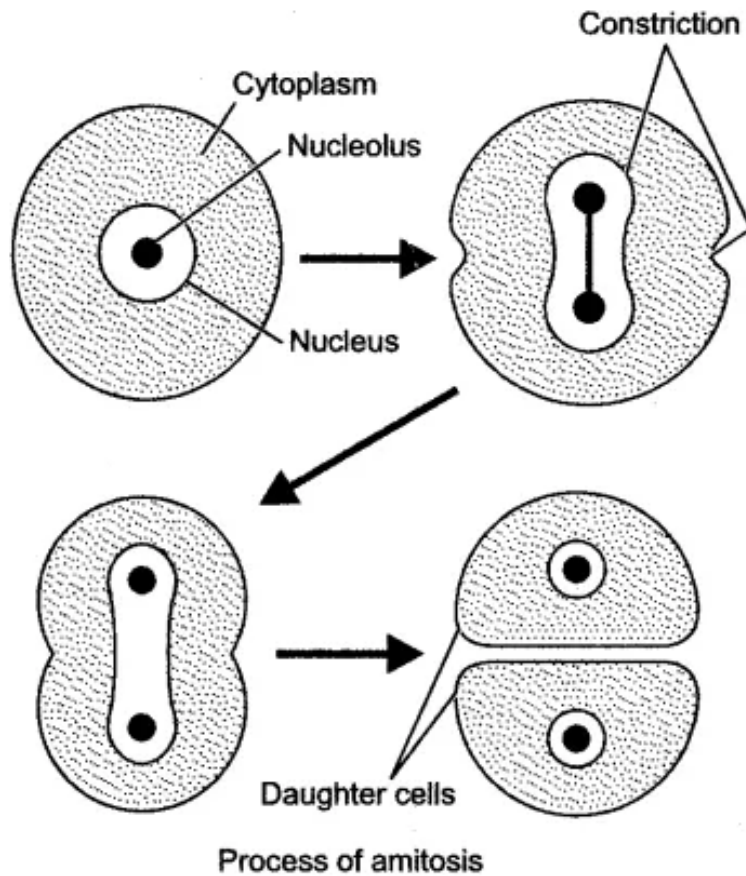
3. Centriole

4. Spindle fibre

Sketch and Label the Diagram

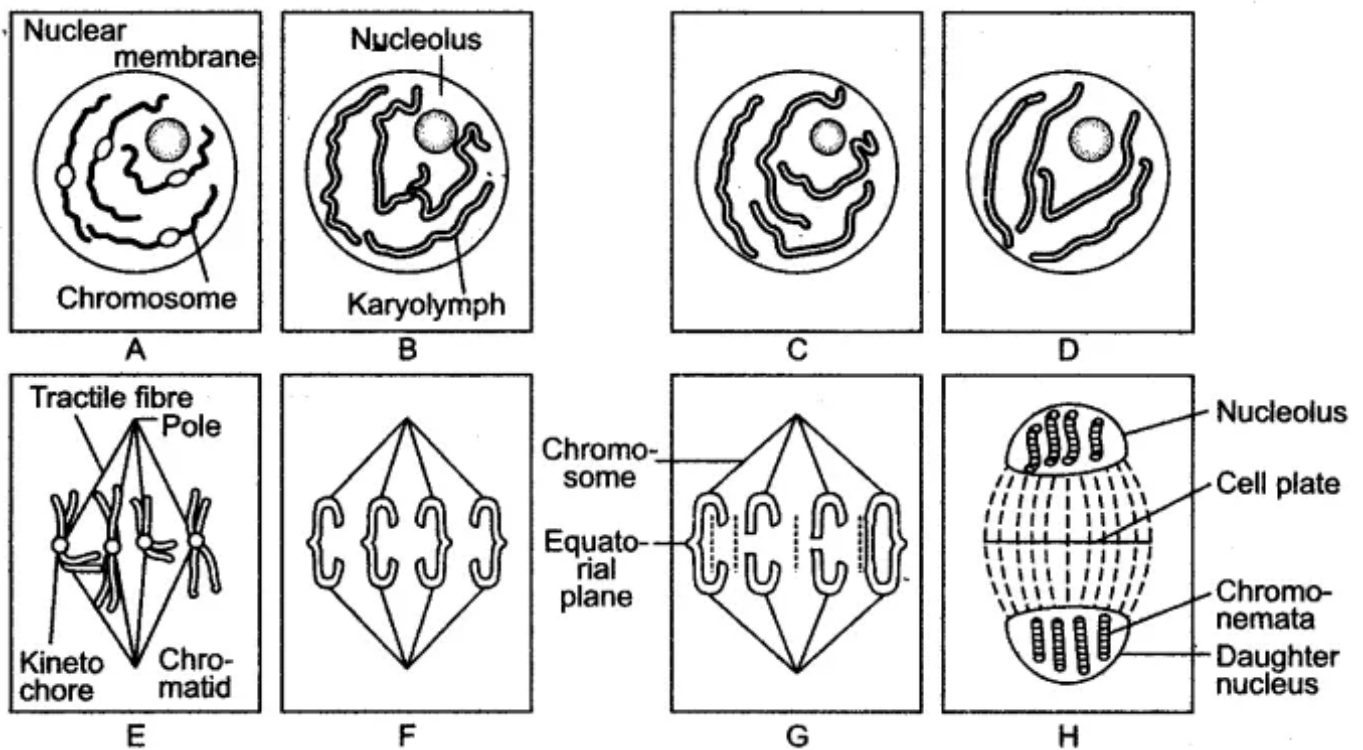
Question 1: Give a labeled diagram to illustrate amitosis.

Answer:



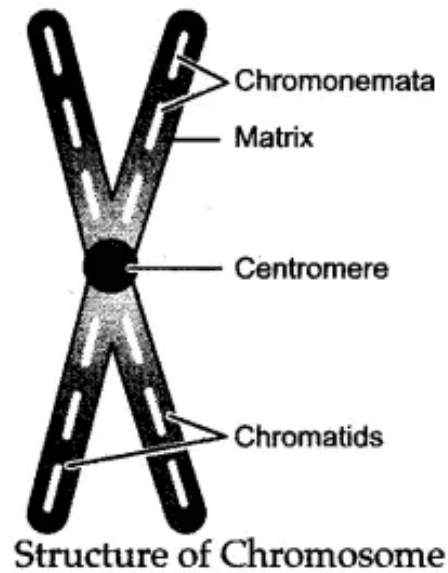
Question 2: Draw a labeled schematic representation of mitosis cell division.

Answer:



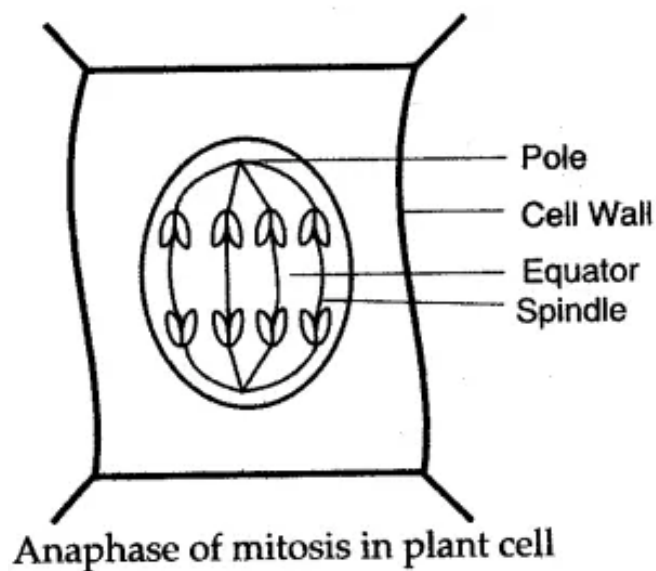
Question 3: Draw a duplicate chromosome and label its part.

Answer:



Question 4: Draw a well labelled diagram to show the anaphase stage of mitosis in arplant cell having four chromosomes.

Answer:



Explain the Terms

Question:

1. Leptotene
2. Zygotene
3. Pachytene
4. Diplotene
5. Diakinesis
6. Cell division
7. Chromatids
8. Centromeres

9. Centrioles
10. Spindle
11. Cell Plate
12. Cleavage furrow
13. Chromosomes
14. Chromatin

Answer:

1. **Leptotene:** Th this step the chromosomes become visible as single threads.
2. **Zygotene:** Pairing of homologous chromosomes (synapsis) occur in this stage. Each pair is a bivalent.
3. **Pachytene:** The crossing-over begins at the end of this stage.
4. **Diplotene:** Crossing-over continues and two homologous chromosomes in each pair begin to separate. They are held together at chiasmata.
5. **Diakinesis:** In this stage nuclear membrane and nucleolus disappear. Spindle begins to be formed at the end of this stage.
6. **Cell division:** Process by which a cell divides into two new daughter cells.
7. **Chromatids:** Two identical parts of a chromosome called "sister" chromatids.
8. **Centromeres:** Part of a chromosome. Located near the middle of the chromatids. (Some lie at the ends)
9. **Centrioles:** Two tiny structures located in the cytoplasm near the nuclear envelope (membrane that surrounds the nucleus).
10. **Spindle:** A fanlike microtubule structure that helps separate the chromosomes.
11. **Cell plate:** Structure that forms in plant cells when the cytoplasm divides during cytokinesis.
12. **Cleavage furrow:** Structure that forms in animal cells when the cytoplasm divides during cytokinesis.
13. **Chromosomes:** Made up of DNA. Carry genetic information.
14. **Chromatin:** Material in the nucleus that condenses during cell division to form chromosomes.

Name the Following

Question:

1. The process by which cell divides into two equal daughter cells.
2. The type of cell division present in unicellular organisms.
3. The two kinds of cell division found in living organisms.
4. Mitosis takes place in which cells.
5. Replacement of dead cells is accomplished by which process.
6. The kind of division normally seen at the tip of root and shoot system.
7. Microtubules form bipolar spindle in which stage.
8. The structure responsible for initiating cell division in animal cells.
9. The part of the cell associated with heredity.
10. Process by which gametes are produced by. .
11. The process responsible for variation.
12. The kind of division takes place in the reproductive tissues.
13. The largest phase of a normal cell cycle.

14. The stage when chromosomes arrange at the equator.
15. Separation of sister chromatids takes place in which stage.
16. Stage in which the crossing-over takes place.
17. The point at which the explicated chromosomes are joined.
18. Name the stage during which nuclear membrane and nucleoids reappear.
19. 'V' shaped chromosome having the centromere at the centre.
20. Nuclear envelope and nucleoli reappear in which stage.
21. Result of uncontrolled cell division.

Answer:

1. Cell division
2. Amitosis
3. Mitosis, Meiosis
4. Somatic cells
5. Mitosis
6. Mitosis
7. Metaphase
8. Centrioles
9. Chromosome
10. Meiosis
11. Crossing-over
12. Meiosis
13. Prophase
14. Metaphase
15. Anaphase
16. pachytene
17. Centromere
18. Telophase
19. Metacentric
20. Telophase
21. Cancer

Give Technical Terms

Question:

1. The stage in mitosis when the nucleolus start disappearing.
2. The stage at which spindle fibres begin to be formed.
3. The shortest phase of mitosis.
4. The stage when sister chromosomes separate from their paired condition.
5. The period between two successive mitotic division.
6. Point at which two sister chromatids are held together.
7. The stage at which chromosomes occurs reach the opposite poles.
8. The process of cytoplasmic division.
9. Division of nucleus.
10. During cytokinesis when the cell plate begins in the centre and moves towards the wall.

11. The phase of the cell cycle during which the cell grows.
12. The phase of the cell cycle in which DNA replication takes place.
13. Division which brings about vegetative growth.
14. The largest phase of a normal cell cycle.
15. The stage at which progressive condensation and coiling of chromatin fibres.
16. The stage at which synapsis in chromosomes to form bivalents.
17. The stage at which formation of chiasmata occurs. .
18. Crossing over occurs during this stage of meiosis.
19. The stage at meiosis at which there are two cells, each with sister chromatids aligned at the equator.
20. The phase usually skipped in meiosis.
21. The phase of meiosis at which homologous chromosomes are separated.
22. The process during which the meiosis occurs in human beings.
23. Period between Meiosis-I and Meiosis-II.

Answer:

1. Prophase
2. Late prophase or early Metaphase
3. Anaphase
4. Anaphase
5. Interphase
6. Centromere
7. Anaphase
8. Cytokinesis
9. Karyokinesis
10. Centrifugal
11. G₁ phase
12. S phase
13. Mitosis
14. Interphase
15. Leptotene
16. Zygotene
17. Pachytene
18. Prophase I
19. Anaphase I
20. Telophase 1
21. Metaphase II
22. Gamete formation
23. Interkinesis

Fill in the Blanks

Complete the following sentences with appropriate words :

1. The type of cell division that occurs in apical meristem of plants is Mitosis.
2. Karyokinesis means splitting of nucleus.
3. The stage between Meiosis-I and Meiosis-II is called Interkinesis.

4. Colchicine arrests cell division at Metaphase.
5. Centromere is the point at which sister chromatids are held together.
6. The spindle fibres are made of Microtubules.
7. The pairing of homologous chromosomes is called Synapsis.
8. Chromosomes are Hereditary material.
9. Polytene chromosomes are found in Salivary glands of fly larvae.

True & False

Mention, if the following statements are True or False. If false rewrite the wrong statement in its correct form:

1. Somatic cells of a multicellular organisms arise from a single cell by mitosis. **(True)**
2. Mitosis results in four daughter cells. **(False, meiosis results in four daughter cells)**
3. Mitosis keeps the chromosome number constant through the generations. **(False, meiosis keeps the chromosome number constant through the generations.)**
4. Germ cells divide meiotically to produce gametes. **(True)**
5. The alkaloid coichicine inhibits formation of mitotic spindle. **(True)**
6. Asexual reproduction is accomplished through mitosis. **(True)**
7. Chromosomes other than sex-chromosomes are autonomous. **(True)**
8. Cytokinesis takes place through cleavage furrow in animal cells. **(True)**
9. Chromosomes are arranged in the form of chromatids at the equator in prophase. **(False, chromosomes are arranged in the form of chromatids at the equator in metaphase.)**
10. Chromosomes are the thickest and shortest in telophase. **(False, chromosomes are thickest and shortest in anaphase.)**
11. Meiosis is also called heterotypic division. **(True)**
12. Prophase of meiosis-I has five sub-stages. **(True)**
13. Meiosis leads to recombination of characters. **(True)**

State the Location

Name	Location
Asters	Around the centriole at each pole
Cell plate	In the centre of the cell.
Chromosomes	In nucleus, mitochondria and chloroplast.

Polytene chromosome

In salivary glands of fly Larur.

State the Function

Write the functional activity of the following structures:

Name	Function
Chromosome	Heredity, i.e., transmission of characters from parents to offsprings.
Spindle fibres	Support chromosomes at the time of cell division.
Chiasmata	Crossing-over, in which genes are transferred from one part to another.
Colchicine.	It inhibits the formation of mitotic spindle.

Choose the Odd One Out

1. Amitosis, Mitosis, Meiosis, Cell cycle. **(Cell cycle)**
2. Prophase, Metaphase, Anaphase, Telophase, Meiosis. **(Meiosis)**
3. Leptotene, Zygotene, Pachytene, Diplotene, Telophase. **(Telophase)**

Multiple Choice Questions

1. Cytokinesis is the division of:

- (a) Cell
- (b) Cytoplasm**
- (c) Cell wall
- (d) Nucleus

2. Karyokinesis is the division of:

- (a) Cytoplasm
- (b) Nucleus**
- (c) Celiwall
- (d) Pollen grains

3. Cell division occurring in somatic cells is:

- (a) Mitosis**
- (b) Meiosis
- (c) Diplotene
- (d) Diakinesis

4. In meiotic cell division four daughter cells are produced by two successive divisions in which:

- (a) First division is equational and second is reductional

(b) First division is reductional and second is equational

(c) Both divisions are reductional

(d) Both divisions are equational.

5. Duplication of DNA occurs in:

(a) G₁-phase

(b) G₂-phase

(c) S-phase

(d) M-phase

6. The nuclear membrane disappears in:

(a) Prophase

(b) Anaphase

(c) Zygotene

(d) Pachytene

7. How many chromosomes are found in a cell of human?

(a) 20 Pairs

(b) 46

(c) 23

(d) 46 Pairs

8. The nuclear membrane and nucleolus become indistinguishable during:

(a) Telophase

(b) Metaphase

(c) Prophase

(d) Interphase

9. The disappearance of spindle and uncoiling of chromosomes takes place in:

(a) Anaphase

(b) Telophase

(c) Pachytene

(d) Meiosis

10. The regions where crossing-over takes place are called:

(a) Chiasmata

(b) Cell plate

(c) Spindle fibres

(d) Chromosomes

11. Duplicated chromosomes are joined at a point termed:

(a) Centrosome

(b) Centromere

(c) Centriole

(d) Chromatid

12. The centromere divides into two in:

(a) Prophase

(b) Metaphase

- (c) Anaphase
- (d) Telophase

13. After mitotic cell division, a female human cell will have:

(a) yy + xx chromosome

- (b) yy + xy chromosome
- (c) 22 + x chromosome
- (d) 22 + y chromosome

14. The period between two successive mitotic divisions is:

(b) Interphase

- (c) Anaphase
- (d) Mitosis

15. The term meiosis was coined by:

(a) Farmer and Moore

- (b) Winiwarter
- (c) Flemming
- (d) Strasburger

16. Meiosis is also known as:

(b) Reductional division

- (c) Direct cell division
- (d) All of the above

17. Meiosis occurs in:

(b) Reproductive cells

- (c) Meristematic cells
- (d) None of the above

18. The process of meiosis takes place to produce:

- (a) Cells of the body
- (b) Cells of the brain
- (c) Sperms and ova**
- (d) Testis and ovary

19. Leptotene, Zygotene and Diplotene phases are found in:

(b) Prophase of Meiosis-I

- (c) Interphase
- (d) Prophase of Meiosis-U

Match the Column

Column 'II' is a list of items related to ideas in Column 'I'. Match the term in Column 'II' with the suitable idea given in Column 'I'.

Column I	Column II
(i) Anaphase	(a) Chromosomes become arranged in a horizontal plane at the equator.
(ii) Prophase	(b) Daughter chromosomes move to opposite poles of the spindle.
(iii) Telophase	(c) Chromosomes become visible as fine, long threads.
(iv) Metaphase	(d) Chromosomes lose their distinctiveness and gradually become transformed into chromatin network.

Answer: (i) (b) (ii) (c) (iii) (d) (iv) (a)