Cell Cycle and Cell Division
SOLUTIONS

LEVEL-I (★CLASS WORK)

INTRODUCTION TO PHASES OF CELL CYCLE

1. Select the incorrect statement
(1) Yeast can progress through the cell cycle in about 90 minutes
(2) DNA synthesis is a continuous process in cell cycle
(3) Duration of I-phase in the cell cycle is more than 95%
(4) Events of cell cycle are under genetic control

DNA synthesis takes place only during S-phase of Interphase.

2. A typical eukaryotic cell cycle is illustrated by human cells in culture. These cells divide once in approximately every
(1) 24 hours
(2) 90 minutes
(3) 20 minutes
(4) 9 hours

A typical eukaryotic cell cycle is illustrated by human cells in culture. These cells divide once in approximately every 24 hours

INTERPHASE

3. Select the correct statement
(1) Chromosoms decondense and lose their individuality during anaphase
(2) Spindle fibres attach to kinetochores of chromosomes during early prophase
(3) Centriole begins to move towards opposite poles of the cell during metaphase
(4) DNA is replicated during S-phase of cell cycle

The correct statement -DNA synthesis takes place only during S-phase of Interphase.

4. Cells that do not divide further exit G_1 phase to enter an inactive stage called
(1) G_2 phase
(2) G_0 stage
(3) S-phase
(4) M-phase

Cells that do not divide further exit G_1 phase to enter an inactive stage called G_0 stage.

5. Choose incorrect statement w.r.t. cell cycle
(1) Duration of cell cycle can vary from organism to organism
(2) Duration of cell cycle is uniform in different cell types of an organism
(3) Events of cell cycle are under genetic control
(4) It is divided into two basic phases

Duration of cell cycle can vary from organism to organism and also from cell type to cell type.

6. Choose the correct sequence w.r.t. different phases of cell cycle
(1) G_1, S, G_2, M
(2) G_1, G_2, S, M
(3) M, G_2, G_1, S
(4) S, M, G_2, G_1

Correct sequence w.r.t. different phases of cell cycle G_1, S, G_2, M

7. Human nerve cells do not divide after birth and they remain throughout their life in which phase of cell cycle?
(1) M-phase
(2) G_1 phase
(3) G_0 phase
(4) Invisible phase

Human nerve cells do not divide after birth and they remain throughout their life in G_0 phase.

8. Various phases of cell cycle are controlled by

(1) Cyclin proteins
(2) Cyclin dependent protein kinases
(3) Phosphorylation of cyclin dependent protein kinases
(4) More than one option is correct

Various phases of cell cycle are controlled by Cyclin dependent protein kinases and its phosphorylation.

9. Amount of DNA and Number of chromosomes in G_2 phase of cell cycle would be
(1) Double and equal to that of in G_1 phase respectively
(2) Half and equal to that of in G_1 phase respectively
(3) Equal and half to that of in G_1 phase respectively
(4) Double and double to that of in G_1 phase respectively

Amount of DNA and Number of chromosomes in G_2 phase of cell cycle would be Double and equal to that of in G_1 phase respectively as it has crossed the S-phase wherein DNA replication occurs.

10. Select the correct statement
(1) Human cells divide once in approximately every 24 hours
(2) Centrioles duplicates in the cytoplasm during G_2 – phase
(3) In the quiescent stage cells remain metabolically inactive
(4) During G_1 – stage cell is metabolically active but does not grow

Centrioles duplicates in the cytoplasm during S – phase
In the quiescent stage cells remain metabolically active
During G_1 – stage cell is metabolically active and also grows.

11. In which of the following stage, cells remain metabolically active but no longer proliferate unless called on to do so depending on the requirement of the organism?
(1) G_1 (2) S
(3) G_2 (4) G_0

In G_0 phase,cells remain metabolically active but no longer proliferate unless called on to do so depending on the requirement of the organism.

MITOSIS

12. (1) Most dramatic period of cell cycle involving a major reorganization of virtually all components of the cell
(2) It represents the phase when the actual cell division occurs
These statements (A & B) are concerned with
(1) S-phase (2) G_1-phase
(3) M-phase (4) G_2-phase

Both statements are related to M-phase.

13. Select the odd one out w.r.t. mitosis
(1) It helps the organisms in both sexual and asexual reproduction
(2) It is called equational division
(3) It takes place only in diploid cells of plants
(4) It helps in cell repair

Mitosis is also seen in haploid cells.

14. Nuclear envelope, nucleolus, endoplasmic reticulum and golgi complex disappear from a dividing cell at the
(1) Early prophase (2) Start of anaphase
(3) End of telophase (4) Late prophase

Nuclear envelope, nucleolus, endoplasmic reticulum and golgi complex disappear from a dividing cell at the late prophase.

15. Chromosomes clusters at spindle poles and their identify is lost as discrete elements during
(1) Interphase (2) Prophase
(3) Anaphase (4) Telophase
Chromosomes clusters at spindle poles and their identify is lost as discrete elements during Telophase.

16. The attachment of spindle fibre to kinetochores of chromosomes is the key feature of
(1) Metaphase (2) Anaphase
(3) Early prophase (4) Telophase
The attachment of spindle fibre to kinetochores of chromosomes is the key feature of Metaphase.

MEIOSIS

17. Interkinesis stage of cell cycle
(1) Is generally short lived (2) Shows DNA duplication
(3) Is generally long lived (4) Is followed by prophase-I
Interkinesis stage of cell cycle is generally short lived.

18. Select the mismatched pair
(1) Leptotene – Compaction of chromosomes continued
(2) Zygotene – Appearance of recombination nodules
(3) Diplotene – beginning of dissolution of synaptonemal complex
(4) Diakinesis – Complete terminalisation of chiasmata
Zygotene – Appearance of Synaptonemal complex

19. Microtubules from opposite poles of the spindle attach to the pairs of homologous chromosomes during
(1) Pachytene (2) Metaphase – I
(3) Metaphase – II (4) Early prophase
Microtubules from opposite poles of the spindle attach to the pairs of homologous chromosomes during Metaphase – II

20. Exchange of genetic material between two homologous chromosomes occurs in
(1) Leptotene (2) Diakinesis
(3) Pachytene (4) Diplotene
Exchange of genetic material between two homologous chromosomes occurs in Pachytene

21. How many meiotic divisions are required to produce 50 wheat grains?
(1) 100 (2) 200
(3) 25 (4) 63
To produce a seed or grain or embryo or zygote the number of meiotic divisions required are n+n/4.
Thus for 50 wheat grains,63 meiotic divisions are required.

22. Read the following four statements 1, 2, 3 & 4 and select the right option having both correct statements.
1. First two stages of prophase I are relatively short lived compared to pachytene
2. Meiosis II is initiated immediately after karyokinesis of meiosis I
3. Meiosis increases the genetic variability in the population of organisms from one generation to the next
4. In plants, mitotic cell division is only seen in diploid cells
(1) 2 & 3 (2) 3 & 4
(3) 1 & 3 (4) 2 & 4
The correct statements are -

1.First two stages of prophase I are relatively short lived compared to pachytene.
3.Meiosis increases the genetic variability in the population of organisms from one generation to the next.

23. Exchange of genetic material between non-sister chromatids of homologous chromosomes in pachytene stage is facilitated by
(1) Dynein (2) Recombinase
(3) Chiasmata (4) Calmodulin
Exchange of genetic material between non-sister chromatids of homologous chromosomes in pachytene stage is facilitated by Recombinase.

24. How many meiotic divisions are required to form 16 grains of wheat?
(1) 4 (2) 20 (3) 15 (4) 32
To produce a seed or grain or embryo or zygote the number of meiotic divisions required are n+n/4.
Thus for 16 wheat grains,20 meiotic divisions are required.

25. Final stage of meiotic prophase I
(1) Is marked by terminalisation of chiasmata
(2) Represents chiasmata formation
(3) Can last for months or years in oocytes of some vertebrates
(4) Involves the development of synaptonemal complex
Final stage of meiotic prophase I (Diakinesis) is marked by terminalisation of chiasmata

26. Chromatid separation, shape of chromosome and karyotype can be observed respectively in
(1) Anaphase I,Anaphase II and Metaphase
(2) Anaphase, Metaphase and Metaphase
(3) Anaphase and Anaphase I
(4) Metaphase and Anaphase
Chromatid separation is seen during Anaphase and Anaphase II; Shape of chromosome and karyotype can be seen during Metaphase.

27. Crossing over is an enzyme dependent process and the enzyme complex involved is called as
(1) Cyclin dependent kinase (2) Nitrogenase
(3) Recombinase (4) Adenylate kinase
Crossing over is an enzyme dependent process and the enzyme complex involved is called as Recombinase

28. If microspore of an angiospermic plant has 7 pg of DNA in its nucleus. How much DNA would be microspore mother cell of this plant have in the diakinesis stage of meiosis?
(1) 14 pg (2) 28 pg (3) 7 pg (4) 56 pg
Microspore is haploid.
n = 7pg of DNA
2n cell should have 14pg of DNA,but during Diakinesis as the DNA content is double,thus, DNA content is 28pg.

29. Synaptonemal complex is
(1) Required for synapsis (2) Formed in zygotene
(3) Formed between sister chromatids (4) More than one option is correct
Synaptonemal complex is- formed in zygotene between sister chromatids and is required for Synapsis.

30. Match the following

Column I	Column II

1. Spireme stage	i) Telophase
2. Decondensation	ii) Metaphase
3. Movement of chromatids	iii) Prophase
4. Congression	vi) Anaphase
(1) 1 – i, 2 – ii, 3 – iii, 4 – iv	(2) 1 – i, 2 – iii, 3 – iv, 4 – ii
(3) 1 – iii, 2 – i, 3 – iv, 4 – ii	(4) 1 – iii, 2 – ii, 3 – iv, 4 – i

Prophase shows spireme stage;Decondensation is seen during Telophase;Movement of chromatids is seen during Anaphase;Congression is seen during Metaphase.

31. Double metaphasic plate in meiosis develops during

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

Double metaphasic plate in meiosis develops during Metaphase I

32. During pole ward movement of separated daughter chromosomes at anaphase

(1) Their ends are toward poles and centromere toward equator
(2) Their ends are toward equator and centromere toward pole
(3) Interzonal fibres contract and pull chromosomes
(4) Sister chromatids are pulled on same pole by kinetochore fibre

During pole ward movement of separated daughter chromosomes at anaphase, their ends are toward equator and centromere toward pole.

33. How many meiotic divisions are required to produce 100 seeds in typical dicot plant?

(1) 125	(2) 126
(3) 127	(4) 128

To produce a seed or grain or embryo or zygote the number of meiotic divisions required are n+n/4.
Thus for 100 seeds,125 meiotic divisions are required.

CYTOKINESIS

34. Plant cells do not divide their cytoplasm by forming a furrow in cell membrane like animal cells rather they divide by cell plate because

(1) Plant cell do not have centrioles
(2) Cell wall formation beings with formation of cell plate
(3) Cell plate represents middle lamella between the walls of two adjacent cells
(4) Plant cells are enclosed by a relatively inextensible wall

Plant cells do not divide their cytoplasm by forming a furrow in cell membrane like animal cells rather they divide by cell plate because, plant cells are enclosed by a relatively inextensible wall

LEVEL-II (☞HOME WORK)

INTRODUCTION TO CELL CYCLE

1. Cell division proper lasts for only about one hour out of the average duration of 24 hours of cell cycle in humans, where

(1) The interphase lasts more than 95% of the duration
(2) The M-phase lasts more than 95% of the duration
(3) The interphase lasts less than 5% of the duration
(4) The G_1 phase last for about 95% of the duration

Cell division proper lasts for only about one hour out of the average duration of 24 hours of cell cycle in humans, where the interphase lasts more than 95% of the duration.

INTERPHASE

2. Cells in _____ remain metabolically active but no longer proliferate unless called on to do so, depending on the requirement of the organism

(1) G_1 phase (2) G_0 stage
(3) Quiescent stage (4) More than one option is correct

Cells in G_0 stage or Quiescent stage remain metabolically active but no longer proliferate unless called on to do so, depending on the requirement of the organism.

3. In complete cell cycle of a human cell, the time taken by mitotic phase is approximately
(1) 25% of total time (2) 50% of total time
(3) 95% of total time (4) 5% of the total time

In complete cell cycle of a human cell, the time taken by mitotic phase is approximately 5% of the total time.

4. If the initial amount of DNA in G_1 phase of a dividing cell is 2C then it becomes 4C in S phase of cell cycle, which results in
(1) Increase in chromosome number by two times
(2) No change in chromosome number
(3) Decrease in chromosome number
(4) Increase in chromosome number by four times

If the initial amount of DNA in G_1 phase of a dividing cell is 2C then it becomes 4C in S phase of cell cycle, which results in no change in chromosome number.

5. After S-phase of interphase
(1) Amount of both chromosomes and DNA get doubled
(2) Amount of chromosomes double but that of DNA remains same
(3) Amount of chromosomes remain same but that of DNA gets doubled
(4) Amount of both DNA and chromosomes reduce to half

After S-phase of interphase, amount of chromosomes double but that of DNA remains same.

6. G_0 or quiescent stage is concerned with which one of the features?
(1) Cells are proliferating at slow rate
(2) Appears after S-phase
(3) Cells do not proliferate unless called on to do so dependent on requirement of organism.
(4) Meristematically and metabolically inactive cells

In G_0 or quiescent stage cells, do not proliferate unless called on to do so dependent on requirement of organism.

7. Most dramatic phase of cell cycle is
(1) G_1 (2) S (3) G_2 (4) M

Most dramatic phase of cell cycle is M-phase.

MITOSIS

8. Longest phase of cell division is
(1) Prophase (2) Anaphase
(3) Metaphase (4) Telophase

Longest phase of cell division is Prophase

9. Which stage of cell division is preferred to study the shape of chromosomes?
(1) Metaphase (2) Anaphase
(3) Telophase (4) Prophase

Metaphase is preferred to study the shape of chromosomes

10. Identity of chromosomes is lost as discrete element in
(1) Telophase (2) Anaphase
(3) Metaphase (4) Prophase

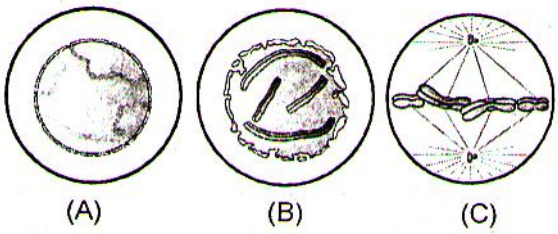
In Telophase, chromosomes is lost as discrete element.

11. Which phase is regarded as reverse of prophase?

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

Telophase is regarded as reverse of prophase

12. Identify A, B, C and D stages of mitosis in the figure given below



(1) A – Late prophase; B – Early prophase; C – Transition to metaphase
(2) A – Early prophase; B – Late prophase; C – Metaphase
(3) A – Early prophase; B – Anaphase; C – Metaphase
(4) A – Interphase; B – Prophase; C – Metaphase

The correct labelling is as mentioned in option 2.

13. Identify the stage of cell division shown in given figure

(1) Early prophase
(2) Transition stage between G_2 and early prophase
(3) Prophase – I
(4) Late prophase

The given diagram is of late prophase.

MEIOSIS

14. Diplotene stage is initiated by

(1) Synaptonemal complex development
(2) Dissolution of synaptonemal complex
(3) Disappearance of nuclear membrane and nucleolus completely
(4) Starting of spindle formation

Diplotene stage is initiated by dissolution of synaptonemal complex.

15. Find odd one w.r.t. meiotic cell cycle

(1) DNA replication occurs once only i.e., before Gap – 2
(2) Karyokinesis occurs twice
(3) Reduction of ploidy at metaphase – I
(4) Crossing over in tetrad stage

Reduction of ploidy occurs at anaphase – I

16. How many meiosis are required to form 80 seeds in a dicotyledonous plant?

(1) 80 (2) 100
(3) 160 (4) 20

To produce a seed or grain or embryo or zygote the number of meiotic divisions required are n+n/4.
Thus for 80 seeds,100 meiotic divisions are required.

17. The final stage of meiotic prophase I is marked by

(1) Terminalisation of chiasma

(2) Disappearance of nuclear envelope and nucleolus
(3) No synthesis of RNA
(4) More than one option is correct

The final stage of meiotic prophase I is marked by Terminalisation of chiasma and Disappearance of nuclear envelope and nucleolus.

18. Select an incorrect match
(1) Leptotene – Chromatid appears
(2) Zygotene – Synapsis occurs
(3) Pachytene – Tetrad appears
(4) Diplotene – Chiasmata appears

Leptotene – condensation of chromosome is seen

19. The diad of cells is visible at
(1) Anaphase – I
(2) Telophase – I
(3) Metaphase – I
(4) Telophase – II

The two haploid cells are visible during Telophase -1

20. During meiotic division
(1) Two cycles of nuclear and cellular division occur
(2) Two turns of DNA replication occur
(3) Four diploid cells occur at the end of meiosis –II
(4) Separation of homologues occurs at anaphase – II

During meiotic division, Two cycles of nuclear and cellular division occur

21. Find the number of chromosomes and content value respectively of DNA in a daughter of meiosis – II, if the cell entering meiosis has 20 chromosomes and 20 picogram DNA
(1) 20, 10
(2) 10, 20
(3) 10, 5
(4) 10, 10

Cell entering meiosis(2n cell) chromosome -20;thus the haploid end product will be with 10 chromosomes.
Cell entering meiosis has 20 pg of DNA, thus during S-phase DNA content will double to 40pg and eventually divided amongst 4 cells as 10 pg each.

22. Meiosis differs from mitosis in
(1) Not having two cytokinesis
(2) Showing half the number of chromosomes at anaphase – I
(3) Showing no splitting of centromere
(4) No disappearance of nucleolus and NM

Meiosis differs from mitosis in Showing half the number of chromosomes at anaphase – I

23. During meiosis II
(1) Sister chromatids separates
(2) Crossing over occurs
(3) Homologous chromosomes separate
(4) DNA synthesis occurs

During meiosis II - Sister chromatids separates.

24. If the DNA content of a spore is 2 picogram, then the DNA content in its spore mother cell (2n) at G_2 phase will be
(1) 2 picogram
(2) 1 picogram
(3) 4 picogram
(4) 8 picogram

Haploid cell has 2pg DNA content.
Its diploid cell will have 4pg DNA content when it enters the Meiosis,which will be doubled during S-phase,thus during G2 phase its DNA content will be 8 pg.

25. An event not associated with anaphase I of meiosis is
(1) Polar movement of bivalent chromosomes
(2) Division of centromere
(3) Chromosomal movement along tractile fibres
(4) Sister chromatids remain associated at their centromeres.

During Anaphase I,homologous chromosomes separate.

26. During which phase of meiosis recombination nodules are observed?
(1) Pachytene (2) Zygotene
(3) Diplotene (4) diakinesis

Recombination nodules are observed during Pachytene.

CYTOKINESIS

27. In plant cytokinesis, cell plate grows
(1) Centripetally (2) Centrifugally
(3) Terminally (4) At random

In plant cytokinesis, cell plate grows Centrifugally.

28. Position of future cell plate formation is determined by
(1) Non contractile hollow filaments of acidic proteins
(2) Intermediate filaments
(3) Microtubules
(4) Microfilaments

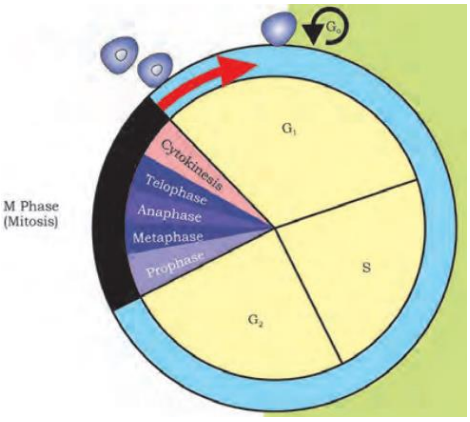
Position of future cell plate formation is determined by Microtubules

MISCELLANEOUS

29. (1) Cell plate represents middle lamella between the secondary walls of adjacent plant cells
(2) In some lower plants and some social insects, haploid cells divide by mitosis
(3) Mitosis occurs in meristematic cells
(1) (1), (3) are incorrect (2) (2), (3) are correct
(3) All are incorrect (4) (1), (2) are correct

Cell plate represents middle lamella between the walls of adjacent plant cells.

30. Examine the figure given below and select the part correctly matched with its function
(1) Part (B) : G_2 – synthesis of DNA
(2) Part (D) : G_0 – cell differentiation
(3) Part (A) : G_1 – replication of DNA
(4) Part (C) : cytokinesis – Formation of cell plate in plant cells.



Part C represents Cytokinesis,wherein cell plate formation is observed.

PREVIOUS YEARS QUESTIONS (☞HOME WORK)

1. In 'S' phase of the cell cycle **[AIPMT 2014]**
(1) Chromosome number is increased.
(2) Amount of DNA is reduced to-half in each cell.

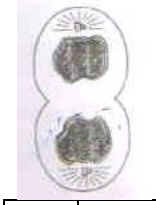
(3) Amount of DNA doubles in each cell.
(4) Amount of DNA remains same in each cell.

In 'S' phase of the cell cycle,DNA replication takes place.

2. The enzyme recombinase is required at which state of meiosis **[AIPMT 2014]**
(1) Diplotene (2) Diakinesis (3) Pachytene (4) Zygotene

Recombinase is required during Pachytene.

3. A stage in cell division is shown in the figure. Select the answer which gives correct identification of the stage with its characteristics. **[AIPMT 2013]**



(1)	Telophase	Endoplasmic reticulum and nucleolus not reformed yet.
(2)	Telophase	Nuclear envelop reforms
(3)	Late anaphase	Chromosomes move away from equatorial plate, golgi complex not present
(4)	Cytokinesis	Cell plate formed, mitochondria distributed between two daughter cells.

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4. Meiosis takes place in **[AIPMT 2013]**
(1) Megaspore (2) Meiocyte
(3) Conidia (4) Gemmule

Meiosis takes place in Meiocyte

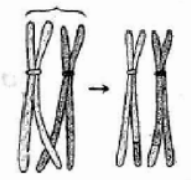
5. The complex formed by a pair of synpased homologous chromosomes is called **[AIPMT 2013]**
(1) Axoneme (2) Equatorial plate
(3) Kinetochore (4) Bivalent

The complex formed by a pair of synpased homologous chromosomes is called Bivalent.

6. Identify the meiotic stage in which the homologous chromosomes separate while the sister chromatids remain associated at their centromeres. **[AIPMT 2012]**
(1) Metaphase I (2) Metaphase II
(3) Anaphase I (4) Anaphase II

The meiotic stage in which the homologous chromosomes separate while the sister chromatids remain associated at their centromeres Anaphase I.

7. Given below is the representation of a certain event at a particular stage of a type of cell division. Which is this stage? **[AIPMT 2012]**



(1) Both prophase and metaphase of mitosis
(2) Prophase I during meiosis

(3) Prophase II during meiosis
(4) Prophase of Mitosis

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8. During gamete formation, the enzyme recombinase participates during **[AIPMT 2012]**
(1) Prophase – II (2) Metaphse – I
(3) Anaphase – II (4) Prophase – I

During gamete formation, the enzyme recombinase participates in Prophase – I.

9. How many chromosomes will the cell have at G_1, after S and after M-phase respectively, if it has 14 chromosomes at interphase? **[DUMET 2011]**
(1) 14, 14, 7 (2) 14, 14, 14
(3) 7, 7, 7 (4) 7, 14, 14.

After S phase,DNA content doubles but chromosome number remains the same.

10. Colchicine arrests spindle at **[OJEE 2011]**
(1) Anaphase (2) Prophase
(3) Telophase (4) Metaphase

Colchicine arrests spindle at Metaphase.

11. Which of the protein is found in spindle fibre? **[OJEE 2011]**
(1) Tubulin (2) Albumin
(3) Mucin (4) Hemoglobin.

Tubulin protein is found in spindle fibre.

12. Chromatid formation takes place in **[OJEE 2011]**
(1) S-phase (2) Metaphase
(3) G_1 – phase (4) G_2 – phase.

Chromatid formation takes place in S-phase.

13. Centriole duplication takes place in the cytoplasm during
(1) G_1 – phase (2) G_2 – phase
c) G_0 – phase (4) S-phase.

Centriole duplication takes place in the cytoplasm during S-phase.

14. Select the correct option with respect to mitosis. **[CBSE AIPMT 2011]**
(1) Chromatids start moving towards opposite poles in telophase
(2) Golgi complex and endoplasmic reticulum are still visible at the end of prophase
(3) Chromosomes move to the spindle equator and get aligned along equatorial plate in metaphase
(4) Chromatids separate but remains in the centre of the cell in anaphase

The correct statement is chromosomes move to the spindle equator and get aligned along equatorial plate in metaphase.

15. Mitotic stages are not observed in **[KCET 2011]**
(1) *Cosmarium* (2) *E. coli*
(3) *Saccharomyces* (4) *Chlorella*

E. coli lacks a well defined nucleus.

16. Meiosis in a plant occurs when there is a change **[UP CPMT 2011]**
(1) From gametophyte to sporophyte (2) From sporophyte to gametophyte
(3) From gametophyte to gametophyte (4) From sporophyte to sporophyte

Meiosis in a plant occurs when there is a change from diploid sporophyte to haploid gametophyte.

17. Synaptonemal complex is formed during **[OJEE 2011]**
(1) Pachytene (2) Zygotene
(3) Leptotene (4) Diplotene

Synaptonemal complex is formed during Zygotene

18. 56 cells are produced in meiosis where first division is **[OJEE 2011]**
(1) Equal (2) Reduction
(3) Mitosis (4) None of these

In Meiosis,first division is reductional.

19. Longest phase of meiosis, is **[WB JEE 2011]**
(1) Prophase-I (2) Prophase-II
(3) Anaphase-I (4) Metaphase-II

Longest phase of meiosis, is Prophase-I.

20. In which stage of the first meiotic division, two sister chromatids are visible? **[WB JEE 2011]**
(1) Leptotene (2) Zygotene
(3) Pachytene (4) Diplotene

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21. Crossing over is the exchange of genetic material between **[J&K CET 2011]**
(1) Non-sister chromatids of the homologous chromosomes
(2) Sister chromatids of the homologous chromosome
(3) chromatids of non-homologous chromosomes
(4) the genes those are completely linked

NCERT XI Pg.no.166

22. Which of the given matches are correct? **[Kerala CEE 2011]**
I. S-phase — DNA replication
II. Zygotene — Synapsis
III. Diplotene — Crossing over
IV. Meiosis — Both haploid and diploid cells
V. G_2-phase — Quiescent stage
(1) I and II only (2) III and IV only
(3) III and V only (4) I, III and V only

Only 1 and 2 are the correct matches.

23. The stage between two meiotic division is called **[Kerala CEE 2011]**
(1) Interphase (2) Cytokinesis
(3) Interkinesis (4) Karyokinesis

The stage between two meiotic division is called Interkinesis.

24. During meiosis, the alleles of the parental pair separate or segregated from each other. How many allele(s) is/are then transmitted to a gamete? **[Kerala CEE 2011]**
(1) Four (2) Two
(3) Six (4) One

Only one allele is transferred in a gamete.

25. In which phase, DNA content will be doubled? **[OJEE 2010]**
(1) Interphase (2) Anaphase

(3) Prophase (4) Telophase

DNA content will be doubled during S phase of interphase.

26. Which phase comes in between the G_1, and G_2 phases of cell cycle? **[WB JEE 2010]**

(1) M-phase (2) G_0-phase

(3) S-phase (4) Interphase

S-phase comes in between the G_1, and G_2 phases of cell cycle.

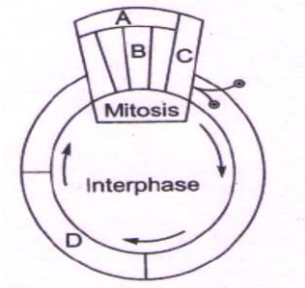
27. Cell division cannot be stopped in which phase of the cell cycle? **[WB JEE 2010]**

(1) G_1 -phase (2) G_2-phase

(3) S-phase (4) Prophase

DNA content will be doubled during S phase of interphase,thus M phase must necessarily be followed.

28. Given below is a schematic break-up of the phases/stages of cell cycle.



Which one of the following is the correct indication of the stage/phase in the cell cycle? **[CBSE AIPMT 2010]**

(1) B—Metaphase (2) C—Karyokinesis

(3) D—Synthetic phase (4) A—Cytokinesis

D—Synthetic phase is the correct option.

29. Cell plate grows from

(1) Centre to the wall (2) Wall to centre

(3) One wall to another (4) Furrowing of wall

Cell plate grows from Centre to the wall.

30. In which phase, proteins for spindle fibre are synthesized? **[AMU 2010]**

(1) G_1 -phase (2) G_2 -phase

(3) S-phase (4) Anaphase

Proteins for spindle fibre are synthesized during G2 phase.

31. Which one of the following precedes re-formation of the nuclear envelope during M-phase of the cell cycle? **[JCECE 2010]**

(1) Decondensation from chromosome and reassembly of the nuclear lamina

(2) Transcription from chromosomes and reassembly of the nuclear lamina

(3) Formation of the contractile ring and formation of the phragmoplast

(4) Formation of the contractile ring and transcription from chromosomes

Before re-formation of nuclear envelope decondensation from chromosome and reassembly of the

nuclear lamina is seen.

32. Cells in G_0-phase of cell cycle **[WBJEE 2010]**

(1) Exit cell cycle (2) Enter cell cycle

(3) Suspend cell cycle (4) Terminate cell cycle

Cells in G_0-phase of cell cycle exit cell cycle.

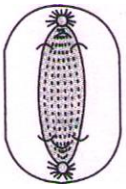
33. During mitosis, ER and nucleolus begin to disappear at **[CBSE AIPMT 2010]**

(1) Late prophase (2) Early metaphase

(3) Late metaphase (4) Early prophase

During mitosis, ER and nucleolus begin to disappear at

34. Which stages of cell division do the following figures 'A' and 'B' represent respectively?



(1) Metaphase — Telophase **[CBSE AIPMT 2010]**

(2) Telophase — Metaphase

(3) Late Anaphase — Prophase

(4) Prophase — Anaphase

The diagram is of late anaphase and prophase.

35. During meiosis-I, the bivalent chromosomes clearly appear as tetrads during

(1) Diakinesis (2) Diplotene **[Kerala CEE 2010]**

(3) Leptotene (4) Pachytene

During meiosis-I, the bivalent chromosomes clearly appear as tetrads during Pachytene.

36. Small disc-shaped structures at the surface of the centromeres that appear during metaphase are

(1) Kinetochores (2) Metaphase plate **[AFMC 2009]**

(3) Spindle fibres (4) Chromatid

Small disc-shaped structures at the surface of the centromeres that appear during metaphase are Kinetochores.

37. What is the correct sequence of the steps given here? Also work out the process depicted in the steps?

I. Homologous chromosomes move toward opposite poles of the cell; chromatids do not separate.

II. Chromosomes gather together at the two poles of the cell and the nuclear membranes reform.

III. Homologous chromosomes pair and exchanges segments.

IV. Homologous chromosomes align on a central plate.

V. The haploid cells separate completely. **[AIIMS 2009]**

(1) The correct sequence is III → IV→I→II→V and the process is meiosis-I

(2) The correct sequence is II→I→V→IV→III and the process is mitosis

(3) The correct sequence is IV→I→III→ II→V and the process is meiosis-I
(4) The correct sequence is II→V→V→I→II and the process is mitosis

The correct sequence is III → IV→I→II→V and the process is meiosis-I

38. Chromosomes are arranged along the equator during
(1) Prophase (2) Metaphase **[BHU 2009]**
(3) Anaphase (4) Telophase

Chromosomes are arranged along the equator during Metaphase.

39. Which of the following character is not related with telophase? **[BHU 2009]**
(1) Formation of nuclear membrane (2) Formation of nucleolus
(3) Elongation of chromosome (4) Formation of two daughter cells

Formation of two daughter cells is seen during Telophase.

40. In which stage of cell division, chromosomes are most condensed? **[WB JEE 2009]**
(1) Prophase (2) Metaphase
(3) Anaphase (4) Telophase

Chromosomes are most condensed during Metaphase.

41. Synapsis occurs between **[CBSE AIPMT 2009]**
(1) A male and a female gamete (2) mRNA and ribosomes
(3) Spindle fibres and centromere (4) Two homologous chromosomes

Synapsis occurs between two homologous chromosomes.

42. Crossing over occurs at **[UP CPMT 2009]**
(1) Single strand stage (2) Two strand stage
(3) Four strand stage (4) Eight strand stage

Crossing over occurs at Four strand stage.

43. Crossing over occurs during **[BHU 2009]**
(1) Leptotene (2) Diplotene
(3) Pachytene (4) Zygotene

Crossing over occurs during Pachytene.

44. Recombination is involved in the process of **[DUMET 2009]**
(1) Cytokinesis (2) Spindle formation
(3) Crossing over (4) Chromosome duplication

Recombination is involved in the process of Crossing over.

45. Which of the following is unique to mitosis and not a part of meiosis? **[DUMET 2009]**
(1) Homologous chromosomes behave independently
(2) Chromatids are separated during anaphase
(3) Homologous chromosomes pair and form bivalents
(4) Homologous chromosomes crossover

Homologous chromosomes behave independently during Mitosis.

46. The non-sister chromatids twist around and exchange segments with each other during
(1) Diplotene (2) Diakinesis **[Kerala CEE 2009]**
(3) Leptotene (4) Pachytene

The non-sister chromatids twist around and exchange segments with each other during Pachytene.

47. When synapsis is complete all along the chromosome, the cell is said to have entered a stage called **[JCECE 2009]**
(1) Zygotene (2) Pachytene
(3) Diplotene (4) Diakinesis
When synapsis is complete all along the chromosome, the cell is said to have entered a stage called Pachytene.

48. Pick out the correct statements. **[Kerala CEE 2009]**
I. Mitosis takes place in the somatic cells and meiosis takes place in the germ cells.
II. During mitosis, the DNA replicates once for one cell division and in meiosis the DNA replicates twice for two cell divisions.
III. Mitosis and meiosis occur both in sexually and asexually reproducing organisms.
(1) I only (2) II only (3) III only (4) I and II only
The correct statement is Mitosis takes place in the somatic cells and meiosis takes place in the germ cells.

49. The proteins involved in the movement of chromosomes towards the poles during cell division are **[EAMCET 2009]**
(1) Actin (2) Myosin
(3) Tubulin (4) Elastin
The proteins involved in the movement of chromosomes towards the poles during cell division are Tubulin.

50. From the following, identify the two correct statements with reference to meiosis.
I. Bead-like structures are absent on chromosomes.
II. Displacement of chiasmata occurs in diakinesis.
III. Separation of two basic sets of chromosomes.
IV. No division of centromere. **[EAMCET 2009]**
(1) II, III (2) II, IV
(3) III, IV (4) I, III
The two correct statements with reference to meiosis are-
Displacement of chiasmata occurs in diakinesis.
And Separation of two basic sets of chromosomes.

51. During which stage of meiosis, do the sister chromatids begin to move towards the poles? **[Haryana PMT 2009]**
(1) Prophase-I (2) Telophase-I
(3) Anaphase-II (4) Anaphase-I
During Anaphase-II of meiosis, do the sister chromatids begin to move towards the poles.

52. In cell cycle, during which phase chromosomes are arranged at equatorial plate?
(1) Metaphase (2) Anaphase **[UP CPMT 2008]**
(3) Telophase (4) Prophase
In cell cycle, during Metaphase chromosomes are arranged at equatorial plate.

53. Replication of centriole occurs during **[BHU 2008]**
(1) Interphase (2) Prophase
(3) Late prophase (4) Late telophase
Replication of centriole occurs during Interphase.

54. Chromosome number can be doubled by using which of the following? **[Punjab PMET 2008]**

(1) Indole acetic acid (2) GA
(3) Zeatin (4) Colchicine

Chromosome number can be doubled by using Colchicine.

55. Which of the following events occurs during G_1 -phase? **[Punjab PMET 2008]**
(1) DNA replication (2) Growth and normal function of cell
(3) Mutation (4) Fertilization

Growth and normal function of cell occurs during G_1 -phase.

56. Chromosomes are visible with chromatids at which phase of mitosis? **[J&K CET 2008]**
(1) Interphase (2) Prophase
(3) Metaphase (4) Anaphase

Chromosomes are visible with chromatids during Metaphase.

57. Differentiated cell remains at which stage? **[DUMET 2007]**
(1) G_1 (2) G_2
(3) G_0 (4) M.

Differentiated cell remains in G_0.

58. A cell plate is laid down during **[UP CPMT 2007]**
(1) Cytokinesis (2) Karyokinesis
(3) Interphase (4) None of these

A cell plate is laid down during Cytokinesis.

59. Congression is a phenomenon of **[AMU 2007]**
(1) Movement of sister chromatids towards the poles
(2) Pairing of homologous chromosomes
(3) Separation of paired chromosomes
(4) Bringing the chromosomes on equator of spindle apparatus

Congression is a phenomenon of bringing the chromosomes on equator of spindle apparatus.

60. Phragmoplast is **[Punjab PMET 2007]**
(1) Proplastid in cytoplasm of dividing cells
(2) Cell plate formed by vesicles of ER and dictyosomes during cytokinesis
(3) Cell plate formed by ER, dictyosomes, secretory vesicles and spindle fibre
(4) None of the above

Phragmoplast is cell plate formed by ER, dictyosomes, secretory vesicles and spindle fibre

61. Mitosis is a process by which eukaryotic cells **[Punjab PMET 2007]**
(1) Grow (2) Get specialized in structure
(3) Multiply (4) Expose the genes

Mitosis is a process by which eukaryotic cells Multiply.

62. The number of mitotic cell divisions required to produce 256 cells from single cell would be
(1) 10 (2) 12 **[KCET 2007]**
(3) 6 (4) 8

The number of mitotic cell divisions required to produce 256 cells from single cell would be $2^n = 256$. Thus n= 8.

63. In meiosis, chromosome number becomes **[UP CPMT 2007]**
(1) Half of its parent chromosome (2) Same as that of parent chromosome
(3) One fourth of its parent chromosome (4) None of the above

In meiosis, chromosome number becomes One fourth of its parent chromosome.

64. In which of the following stages, the chromosome is single thin and like long thread?
(1) Leptotene (2) Zygotene **[AMU 2007]**
(3) Pachytene (4) Diakinesis

The chromosome is single thin and like long thread Leptotene.

65. In meiosis-I, a bivalent is an association of **[Kerala CEE 2007]**
(1) Four chromatids and four centromeres (2) Two chromatids and two centromeres
(3) Two chromatids and one centromere (4) Four chromatids and two centromeres

In meiosis-I, a bivalent is an association of Four chromatids and two centromeres.

66. Crossing over that results in genetic recombination in higher organisms occurs between **[Manipal 2007]**
(1) Sister chromatids of bivalent (2) Non-sister chromatids of a bivalent
(3) Two daughter nuclei (4) Two different bivalents

Crossing over that results in genetic recombination in higher organisms occurs between non-sister chromatids of a bivalent.

67. Characteristic of meiosis is **[Haryana PMT 2007]**
(1) Two nuclear and two chromosome divisions
(2) Two nuclear and one chromosome division
(3) One nuclear and two chromosome divisions
(4) One nuclear and one chromosome division

Characteristic of meiosis is two nuclear and one chromosome division.

68. A material, which arrests cell division, is obtained from **[MHTCET 2006]**
(1) *Crocus* (2) *Colchicum*
(3) *Dalbergia* (4) *Chrysanthemum*

A material, which arrests cell division, is obtained from *Colchicum.*

69. Sequence of four phases of cell cycle is **[MHT CET 2006]**
(1) $G_1 \rightarrow S \rightarrow G_2 \rightarrow M$ (2) $G_1 \rightarrow G_2 \rightarrow S \rightarrow M$
(3) $S \rightarrow G_1 \rightarrow G_2 \rightarrow M$ (4) $M \rightarrow G_1 \rightarrow G_2 \rightarrow S$

Sequence of four phases of cell cycle is $G_1 \rightarrow S \rightarrow G_2 \rightarrow M$

70. The number of DNA strands in chromosome at G2-stage is **[J&K CET 2006]**
(1) One (2) Two (3) Four (4) Eight

The number of DNA strands in chromosome at G2-stage is Four

71. What is not seen during mitosis in somatic cells? **[DUMET 2006]**
(1) Spindle fibres (2) Chromosome movement
(3) Disappearance of nucleolus (4) Synapsis

Synapsis is not seen during Mitosis.

72. The major event that occurs during the anaphase of mitosis, which brings about the equal distribution of chromosomes is **[KCET 2006]**
(1) Replication of the genetic material (2) Splitting of the chromatids
(3) Splitting of the centromeres (4) Condensation of the chromatin

The major event that occurs during the anaphase of mitosis, which brings about the equal distribution of chromosomes is Splitting of the centromeres.

73. An egg cell has 5 pico gram of DNA in its nucleus. How much amount of DNA will be, in this animal, at the end of G 2-phase of mitosis? **[Manipal 2006]**

(1) 2.5 pico gram (2) 5 pico gram
(3) 5 g (4) 20 pico gram

Egg cell (n)=5pg
Animal somatic cell (2n)=10pg
But after S-phase DNA content doubles hence 20pg

74. Cleavage is a unique form of mitotic cell division in which **[MHT CET 2006]**

(1) There is no growth of cells
(2) The nucleus does not participate
(3) No spindle develops to guide the cells
(4) The plasma membranes of daughter cells do not separate

Cleavage is a unique form of mitotic cell division in which No spindle develops to guide the cells

75. If we ignore the effect of crossing over, how many different haploid cells arise by meiosis in a diploid cell having 2n = 12? **[AFMC 2006]**

(1) 8 (2) 16 (3) 32 (4) 64

In a meiotic cell division, the different types of haploid cells produced will be 2^n, where n is the haploid chromosome number. In case, the diploid chromosome number is 12, the haploid chromosome number n will be 6. Thus different types of cells produced will be equal to 2^6 or 64 types.So, the correct answer is '64'

76. Chiasmata are formed due to **[Punjab PMET 2006]**

(1) Crossing over of same part between homologous chromosomes
(2) Crossing over of same part between non-homologous chromosomes
(3) Duplication of homologous and non-homologous chromosomes
(4) Loss of some part of chromosomes

Chiasmata are formed due to crossing over of same part between homologous chromosomes.

77. Which is correct for meiotic metaphase-I? **[Punjab PMET 2006]**

(1) Bivalents are arranged at equator
(2) Univalents are arranged at equator
(3) Non-homologous chromosomes form pair
(4) Spindle fibres are attached at chromomere

During Metaphase -I bivalents are arranged at equator.

78. Genetic recombination is due to **[MHT CET 2006]**

(1) Fertilization and meiosis (2) Mitosis and meiosis
(3) Fertilization and mitosis (4) None of these

Genetic recombination is due to Fertilization and meiosis.

79. The number of chromosomes becomes half in **[RPMT 2006]**

(1) Anaphase-I (2) Anaphase-II
(3) Telophase-I (4) Telophase-II

The number of chromosomes becomes half in Anaphase-I.

80. Meiosis can be observed in **[BCECE 2006]**

(1) Tapetal cells (2) Megaspores
(3) Micropores (4) Spore mother cells

Meiosis can be observed in Spore mother cells.

81. Significance of meiosis lies in **[BCECE 2006]**
(1) Reduction of chromosome number to one half
(2) Maintaining consistency of chromosome number during sexual reproduction
(3) Production of genetic variability
(4) All of the above
All the statements mentioned are correct.

82. The S-phase of cell cycle is characterized by **[UP CPMT 2005]**
(1) Duplication of chromosome (2) Shortening of chromosome
(3) Duplication of DNA (4) Duplication of centriole
The S-phase of cell cycle is characterized by duplication of DNA.

83. Most cytogenic activities occur during **[UP CPMT 2005]**
(1) Interphase (2) Telophase
(3) Prophase (4) Anaphase
Most cytogenic activities occur during Interphase.

84. A plant cell has 12 chromosomes at the end of mitosis. How many chromosomes would it have in the G_2-phase: of its next cell cycle? **[Punjab PMET 2005]**
(1) 6 (2) 8
(3) 12 (4) 24
Chromosome number does not double.

85. In animal cells, cytokinesis involves **[Punjab PMET 2005]**
(1) The separation of sister chromatids
(2) The contraction of the contractile ring of micro filament
(3) Depolymerization of kinetochore microtubules
(4) A protein kinase that phosphorylates other enzymes
In animal cells, cytokinesis involves contraction of the contractile ring of micro filament.

86. Which of the following serves as mitotic spindle poison? **[DUMET 2005]**
(1) Ca^{2+} (2) Mg^{2+}
(3) Tubulin (4) Colchicine
Colchicine serves as mitotic spindle poison.

87. During mitosis, number of chromosomes in a cell **[DUMET 2005]**
(1) Gets changed (2) Does not change
(3) May be changed if cell is mature (4) May be changed if cell is immature
During mitosis, number of chromosomes in a cell does not change.

88. A diploid living organism develops from zygote by which type of the following repeated cell divisions? **[J&K CET 2005]**
(1) Meiosis (2) Amitosis
(3) Mitosis (4) Segmentation
A diploid living organism develops from zygote by Mitosis.

89. In meiosis, the daughter cells are not similar to that of parent because of **[AFMC 2005]**
(1) Crossing over (2) Synapsis
(3) Both (1) and (2) (4) None of these
In meiosis, the daughter cells are not similar to that of parent because of Crossing over.

90. Among the following, which one is longest phase in prophase of meiosis? **[AMU 2005]**
(1) Leptotene (2) Zygotene
(3) Pachytene (4) Diplotene
Diplotene is longest phase in prophase of meiosis.

91. During meiotic division, the **[BHU 2005]**
(1) Homologous chromosomes are separated
(2) The non-homologous chromosomes form chiasmata
(3) The homologous chromosomes do not segregate
(4) All of the above
During meiotic division, the homologous chromosomes are separated.

92. Pick out the correct statements. **[Kerala CEE 2005]**
I. Synapsis of homologous chromosomes takes place during prophase-I of meiosis.
II. Division of centromeres takes place during anaphase-I of meiosis.
III. Spindle fibres disappear completely in telophase of mitosis.
IV. Nucleoli reappear at telophase I of meiosis.
(1) 1 only (2) III only
(3) I and II only (4) I, III and IV only
I, III and IV only are correct statements.

93. Arrange the following events of meiosis in the correct sequence. **[EAMCET 2005]**
1. Terminalization 2. Crossing over
3. Synapsis 4. Disjunction of genomes
The correct sequence is
(1) 4, 3, 2, 1 (2) 3, 2, 1, 4
(3) 2, 1, 4, 3 (4) 1, 4, 3, 2
3, 2, 1, 4 is the correct meiotic sequence.

94. During cell division, chromosome attaches with spindle's **[Manipal 2005]**
(1) Kinetochore (2) Centrosome
(3) Centriole (4) Secondary constriction
During cell division, chromosome attaches with spindle's Kinetochore.

95. In meiosis, division is **[Haryana PMT 2005]**
(1) I reductional and II equational (2) I equational and II reductional
(3) Both reductional (4) Bothequational
In meiosis, division I is reductional and II equational.

96. Which type of chromosomes segregates when a cell undergoes meiosis? **[JCECE 2005]**
(1) Homologous chromosomes (2) Non-homologous chromosomes
(3) Both (1) and (2) (4) Centric and acentric chromosomes
Homologous chromosomes segregates when a cell undergoes meiosis.

97. In the somatic cell cycle, **[CBSE AIPMT 2004]**
(1) In G_1 -phase, DNA content is double the amount of DNA present in the original cell
(2) DNA replication takes place in S-phase
(3) A short interphase is followed by a long mitotic phase
(4) G_2 -phase follows mitotic phase
In the somatic cell cycle, DNA replication takes place in S-phase.

98. If you are provided with root-tips of onion in your class and are asked to count the chromosomes, which of the following stages can you most conveniently look into? **[CBSE AIPMT 2004]**

(1) Metaphase (2) Telephase
(3) Anaphase (4) Prophase.

During Metaphase chromosomes are distinctly visible.

99. Chiasmata are most appropriately observed in meiosis during **[UP CPMT 2004]**

(1) Diakinesis (2) Diplotene
(3) Metaphase-II (4) Pachytene

Chiasmata are most appropriately observed in meiosis during Diplotene.

100. During cell division, sometimes there will be failure of separation of sister chromatids. This event is called **[Kerala CEE 2004]**

(1) Interference (2) Complementation
(3) Non-disjunction (4) Coincidence

During cell division, sometimes there will be failure of separation of sister chromatids. This event is called Non-disjunction.

101. The second meiotic division leads to **[Haryana PMT 2004]**

(1) Separation of sex chromosomes (2) Fresh DNA synthesis
(3) Separation of chromatids and centromere (4) Separation of homologous chromosomes

The second meiotic division leads to Separation of chromatids and centromere.

102. Synapsis occurs in _____ phase of meiosis. **[BCECE 2004]**

(1) Zygotene (2) Diplotene
(3) Pachytene (4) Leptotene

Synapsis occurs in Zygotene phase of meiosis.

103. When number of chromosomes is already reduced to half in the first reductional division of meiosis, what is the necessity of second meiotic division? **[J&K CET 2004]**

(1) The division is required for the formation of four gametes
(2) Division ensures equal distribution of haploid chromosomes
(3) Division ensures equal distribution of genes on chromosomes
(4) Division is required for segregation of replicated chromosomes

When number of chromosomes is already reduced to half in the first reductional division of meiosis, the necessity of second meiotic division is for segregation of replicated chromosomes.

104. G_0-phase is **[AMU 2003]**

(1) Phase after G_2-phase
(2) Phase after M-phase, in which daughter cell enters new cell cycle
(3) Arrest of cell cycle on the onset of differentiation
(4) All of the above

G_0-phase is Arrest of cell cycle on the onset of differentiation.

105. At which stage of mitosis, chromatids separate and pass to different poles? **[DUMET 2003]**

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

During Anaphase chromatids separate and pass to different poles.

106. The two chromatids of a metaphase chromosome represent **[KCET 2003]**
(1) Replicated chromosomes to be separated at anaphase
(2) Homologous chromosomes of a diploid set
(3) Non-homologous chromosomes joined at the centromere
(4) Maternal and paternal chromosomes joined at the centromere

The two chromatids of a metaphase chromosome represent replicated chromosomes to be separated at anaphase.

107. The process of cytokinesis refers to the division of **[MHT CET 2003]**
(1) Nucleus (2) Chromosomes
(3) Cytoplasm (4) None of these

The process of cytokinesis refers to the division of Cytoplasm.

108. Alleles of different genes that are on the same chromosome may occasionally separated by a phenomenon known as **[AMU 2003]**
(1) Pleiotropy (2) Epistasis
(3) Continuous variation (4) Crossing over

Alleles of different genes that are on the same chromosome may occasionally separated by a phenomenon known as Crossing over.

109. Chiasma shows the sites of **[MHT CET 2003]**
(1) Spindle formation (2) Synapsis
(3) Crossing over (4) None of these

Chiasma shows the sites of Crossing over.

110. Meiosis in AaBb will produce gametes **[Haryana PMT 2003]**
(1) AB, aB, Ab, ab (2) AB, ab
(3) Aa, bb (4) Aa, Bb

Meiosis in AaBb will produce gametes AB, aB, Ab, ab.

111. During which stage of meiosis, do tetrads line up at the equator? **[Haryana PMT 2003]**
(1) Prophase-I (2) Telophase-I
(3) Metaphase-I (4) Anaphase-I

During Metaphase-I of meiosis, do tetrads line up at the equator.

112. Phenomenon of crossing over in diploid organisms is responsible for **[J&K CET 2003]**
(1) Linkages between genes (2) Recombination between genes
(3) Segregation between genes (4) Dominance of gene

Phenomenon of crossing over in diploid organisms is responsible for recombination between genes.

113. Select the correct option: **[AIPMT 2015]**

	I		II
(1)	Synapsis aligns homologous chromosomes	(i)	Anaphase-II
(2)	Synthesis of RNA and protein	(ii)	Zygotene
(3)	Action of enzyme recombinase	(iii)	G2-phase
(4)	Centromeres do not separate but chromatids move towards opposite poles	(iv)	Anaphase-I
		(v)	Pachytene

	(1)	(2)	(3)	(4)
(1)	(ii)	(iii)	(v)	(iv)
(2)	(i)	(ii)	(v)	(iv)

(3) (ii) (iii) (iv) (v)
(4) (ii) (i) (ii) (iv)

The given match is correct.

114. A somatic cell that has just completed the S phase of its cell cycle, as compared to gamete of the same species, has **[AIPMT 2015]**

(1) Same number of chromosomes but twice the amount of DNA
(2) Twice the number of chromosomes and four times the amount of DNA
(3) Four times the number of chromosomes and twice the amount of DNA
(4) Twice the number of chromosomes and twice the amount of DNA

A somatic cell that has just completed the S phase of its cell cycle, as compared to gamete of the same species, has twice the number of chromosomes and four times the amount of DNA.

115. Arrange the following events of meiosis in correct sequence **[RE AIPMT 2015]**

(1) Crossing over (2) Synapsis
(3) Terminalisation of chiasmata (4) Disappearance of nucleolus

(1) (2), (3), (4), (1) (2) (2), (1), (4), (3) (3) (2), (1), (3), (4) (4) (1), (2), (3), (4)

The correct meiotic sequence is (2), (1), (3), (4)

116. In meiosis crossing over is initiated at **[NEET-I 2016]**

(1) Diplotene (2) Pachytene (3) Leptotene (4) Zygotene

In meiosis crossing over is initiated at Pachytene.

117. During cell growth, DNA synthesis takes place in **[NEET-II 2016]**

(1) S phase (2) G1 phase (3) G, phase (4) M phase

DNA synthesis takes place in S phase.

118. Anaphase Promoting Complex (APC) is a protein degradation machinery necessary for proper mitosis of animals cells. If APC is defective in a human cells, which of the following is expected to Occur? **[NEET 2017]**

(1) Chromosomes will not condense
(2) Chromosomes will be fragmented
(3) Chromosomes will not segregate
(4) Recombination of chromosome arms will occur

If anaphase promoting complex is defective in a human cell, the chromosomes will not segregate during anaphase of mitosis. APC triggers the transition from metaphase to anaphase by tagging specific proteins for degradation. Concept Enhancer Anaphase stage of mitosis is characterised by two events
(a) Splitting of centromeres and segregation of chromosomes.
(b) Movement of chromatids towards the opposite poles.

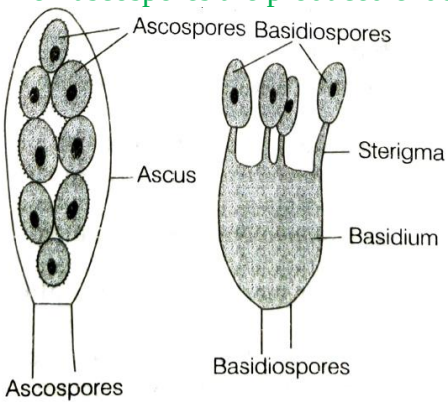
119. Which of the following options gives the correct sequences of events during mitosis ? **[NEET 2017]**

(1) Condensation → nuclear membrane disassembly → crossing over → segregation → telophase
(2) Condensation → nuclear membrane disassembly → arrangement at equator → centromere division → segregation → telophase
(3) Condensation → crossing over → nuclear membrane disassembly → segregation → telophase
(4) Condensation → arrangement at equator → centromere division → segregation → telophase

During mitosis following events occurs as follows Condensation of chromosomal material, which takes place at an early prophase stage. During late prophase nuclear membrane disintegrates Then chromosomes get arranged at equator in the metaphase stage. After that

splitting of centromere and segregation of chromosomes occur in the anaphase stage. In telophase stage chromosomes move to opposite poles of the cell. It is last stage of mitosis.

120. After karyogamy followed by meiosis, spores are produced exogenously in
(1) Agaricus (2) Alternaria (3) Neurospora (4) Saccharomyces
Agaricus Meiospores are produced exogenously after karyogamy and meiosis. It belongs to Basidiomycetes. Alternaria belongs to the Deuteromycetes class of fungi. The fungi of this class lack sexual reproduction. Therefore, sexual spores are not formed. Neurospora and Saccharomyces belong to Ascomycetes class of fungi. They produce ascopores as meiospores. Their ascospores are produced endogenously.



121. Cells in G_0 phase **[NEET (National) 2019]**
(1) enter the cell cycle (2) suspend the cell cycle
(3) terminate the cell cycle (4) exit the cell cycle
G_0 phase is the stage in which the cells exit the cell cycle. It is the resting or quiescent phase in which the cells do not divide. It is the permanent state for some cells, e.g., neurons.

122. The correct sequence of phases of cell cycle is **[NEET (National) 2019]**
(1) $G_1 \rightarrow G_2 \rightarrow S \rightarrow M$ (2) $S \rightarrow G_1 \rightarrow G_2 \rightarrow M$
(3) $G_1 \rightarrow S \rightarrow G_2 \rightarrow M$ (4) $M \rightarrow G_1 \rightarrow G_2 \rightarrow S$
The correct sequence of phases of cell cycle is
$G_1 \rightarrow S \rightarrow G_2 \rightarrow M$
Here G_1 and G_2 represent first and second growth phase, respectively. S-phase represents synthesis phase during which DNA replicates. M-phase is mitotic phase during which cell begins to divide.

123. After meiosis-I, the resultant daughter cells have **[NEET (Odisha) 2019]**
(1) same amount of DNA as in the parent cell in S-phase
(2) twice the amount of DNA in Comparison to haploid gamete
(3) same amount of DNA in Comparison to haploid gamete
(4) four times the amount of DNA in Comparison to haploid gamete
After meiosis-I, the resultant daughter cells have twice the amount of DNA in comparison to haploid gamete. Meiosis-I causes segregation of homologous pairs of chromosomes. However, each chromosome is double-stranded, having two sister chromatids due to DNA replication before meiosis began.

124. Attachment of spindle fibres to kinetochores of chromosomes becomes evident in **[NEET (Oct.) 2020]**
(1) anaphase (2) telophase (3) prophase (4) metaphase
During the metaphase stage of cell cycle, spindle fibres originating from the centrosomes attaches to the kinetochore of chromosomes. Kinetochore is a disc-shaped structure at the surface of centromere through which the sister chromatids are held together. During

metaphase, the chromosomes arrange themselves at the equator on metaphasic plate. Due to this arrangement, the attachment of spindle fibres to kinetochore is clearly visible.

125. Identify the correct statement with regard to G_1-phase (Gap 1) of interphase. **[NEET (Sep.) 2020]**

(1) Reorganisation of all cell components, takes place
(2) Cell is metabolically active, grows but does not replicate its DNA
(3) Nuclear division takes place
(4) DNA synthesis or replication takes place

The statement in option (2) is correct with regard to G_1- phase of interphase because during G_1 - phase the cell is metabolically active and continuously grows but does not replicate its DNA. DNA synthesis takes place in S-phase. Nuclear division occurs during karyokinesis. Reorganisation of all cell components takes place in M-phase.

126. Some dividing cells exist the cell cycle and enter vegetative inactive stage. This is called quiescent stage (G_0). This process Occurs at the end of **[NEET (Sep.) 2020]**

(1) G-phase (2) S-phase (3) G-phase (4) M-phase

Some dividing cells exit the cell cycle and enter vegetative inactive stage, called quiescent stage(G_0).This process occurs at the end of M-phase and beginning of G_1-phase. Cells enter G_0 for varying amounts of time, and Some cells enter the G_0-phase and stay there forever. This is because once they reach maturity, like nerve and heart cells they do not divide again, so they stay in the G_0-phase.

127. In a mitotic cycle, the correct sequence of phases is **[NEET (Oct.) 2020]**

(1) S,G_1,G_2,M (2) G_1,S.G_2,M (3) M, G_1, G_2, S (4) G_1, G_2, S, M

In a mitotic cycle, the correct sequence of phases is G_1, S, G_2, M. The first three phases, i.e. G_1, S, G_2, occurring during interphase whereas the M-phase is the period of actual cell division. The major event occurring in each phase is tabulated below

Phases	Activities
G_1-phase	Cell becomes metabolically active, enzymes and proteins required for replication are synthesised.
S-phase	Synthesis or replication of DNA occurs so that amount of DNA per cell gets doubled.
G_2-phase	Proteins required for mitosis are synthesised while the growth of cell continues.
M-phase	Cell divides to form daughter cells.

128. Match the following (Columns) events that occur in their respective phases of cell cycle and select the correct option from the codes given below. **[NEET (Oct.) 2020]**

	Column I		Column II
A.	G_1-phase	1.	Cell grows and organelle duplication
B.	S phase	2.	DNA replication and chromosome duplication

C.	G_2-phase	3.	Cytoplasmic growth
D.	Metaphase in M-phase	4.	Alignment of chromosomes

Codes

	A	B	C	D
(1)	2	3	4	1
(2)	3	4	1	2
(3)	4	1	2	3
(4)	1	2	3	4

(4)

129. During meiosis 1, in which stage synapsis takes place? **[NEET (Oct) 2020]**

(1) Pachytene (2) Zygotene (3) Diplotene (4) Leptotene

During zygotene stage of meiosis-l, chromosomes start pairing together and this process of association is called synapsis. Such paired chromosomes are called homologous chromosomes.

130. Dissolution of the synaptonemal complex occurs during **[NEET (Sep.) 2020]**

(1) zygotene (2) diplotene (3) leptotene (4) pachytene

(2)

Dissolution of the synaptonemal complex occurs during diplotene stage of prophase-l of meiosis-I. Prophase of meiosis-l is long and complex. It is comprised of leptotene, zygotene, pachytene, diplotene and diakinesis. During diplotene, at most places synaptonemal complex dissolves.

131. Match the following columns with respect to meiosis. **[NEET (Sep.) 2020]**

	Column I		**Column II**
A.	Zygotene	1.	Terminalisation
B.	Pachytene	2.	Chiasmata
C.	Diplotene	3.	Crossing over
D.	Diakinesis	4.	Synapsis

Select the correct option

	A	B	C	D
(1)	4	3	2	1
(2)	1	2	4	3
(3)	2	4	3	1
(4)	3	4	1	2

The correct option is (1). It can be explained as follows

During zygotene phase the homologous chromosomes pair or come together and forms synapsis. Crossing over takes place during pachytene stage and at each point of crossing over a chiasma is formed between non-sister chromatiads of homologous chromosomes. Chiasmata is the point of contact between the two non sister chromatids of homologous chromosomes, chiasmata becomes visible during diplotene stage. Terminalisation of chiasmata gets completed during diakinesis phase where chromosomes gets freely distributed in the cytoplasm.

132. The centriole undergoes duplication during **[NEET 2021]**

(1) S–phasse (2) prophase (3) metaphase (4) G_2–phase

During S phase or synthesis phase of interphase replication of DNA and synthesis of histone protein, centromere and centrioles occur. During the S phase, DNA replication begins in the nucleus, and the centriole duplicates in the cytoplasm of the cell.

133. Match the List-I with List-II. **[NEET 2021]**

	List – I		List – II
A.	S-Phase	1.	Proteins are synthesised
B.	G_2-phase	2.	Inactive phase
C.	Quiescent stage	3.	Interval between mitosis and initiation of DNA replication
D.	G_1-phase	4.	DNA replication

Choose the correct answer from the options given below.

	A	B	C	D
(1)	3	2	1	4
(2)	4	2	3	1
(3)	4	1	2	3
(4)	2	4	3	1

(A)–(4), (B)–(1), (C)–(2), (D)–(3)

During DNA replication, the unwinding of strands leaves a single strand Vulnerable. In the eukaryotic cell cycle, chromosome duplication occurs during S phase' (the phase of DNA synthesis) and chromosome segregation occurs during 'M phase' (the mitosis phase). During the 6, phase, extra protein is often synthesised, and the organelles multiply until there are enough for two cells. Other cell materials such as lipids for the membrane may also be produced. The cell is in a quiescent (inactive) stage that occurs when cells exit the cell cycle. Some cells enter G temporarily until an external signal triggers the onset of G_0. Other cells that never or rarely divide, such as mature cardiac muscle and nerve cells, remain in G_0 permanently. G_1 phase corresponds to the interval between mitosis and initiation of DNA replication. During G_1 phase the cell is metabolically active and continuously grows but does not replicate its DNA.

134. The fruit fly has 8 chromosomes (2n) in each cell. During interphase of mitosis, if the number of chromosomes at G,-phase is 8, what would be the number of chromosomes after S-phase ? **[NEET 2021]**

(1) 8 (2) 6 (3) 4 (4) 32

During S phase or synthetic phase of interphase, replication of DNA and synthesis of histone protein centromere and centrioles occur, but the number of chromosomes remains same from beginning till the end of S phase. Hence, number of chromosome will remain 8 after the S phase in fruitfly.

135. Which stage of meiotic prophase shows terminalisation of chiasmata as its distinctive feature? **[NEET 2021]**

(1) Leptotene (2) Zygotene (3) Diakinesis (4) Pachytene

Diakinesis is the final'stage of meiotic prophase 1. In this stage the two homologous chromosomes do not separate completely but remain attached together at one or more points as indicated by'X arrangement known as chiasmata. The displacement of chiasmata is termed as terminalisation of chiasmata which is completed in diakinesis phase.

136. Which of the following stages of meiosis involves division of centromere? **[NEET 2021]**

(1) Metaphase- (2) Metaphase-II (3) Anaphase-II (4) Telophase-II

During anaphase II, each pair of chromosomes is separated into two identical, independent chromosomes. The chromosomes are separated by a structure called the mitotic spindle made up of many long proteins called microtubules, which are attached to a chromosome at one end

and to the pole of a cell at the other end. The sister chromatids are separated simultaneously at their centromeres. In separated chromosomes are then pulled by the spindle to opposite poles of the cell. Thus, the centromere splits, freeing the sister chromatids from each other. Other options can be explained as: In metaphase I, the homologous pair of chromosomes align on either side of the equatorial plate. During metaphase II, the centromeres of the paired chromatids align along the equatorial plate in both cells. During telophase II, the two groups of chromosome once again get enclosed by nuclear envelope.

137. Which one of the following never occurs during mitotic cell division? **[NEET 2022]**
(1) Movement of centrioles towards opposite poles
(2) Pairing of homologous chromosomes
(3) Coiling and condensation of the chromatids
(4) Spindle fibres attach to kinetochores of chromosomes
XI pairing of homologous chromosome occurs during meiosis

138. The appearance of recombination nodules on homologous chromosomes during meiosis characterizes : **[NEET 2022]**
(1) Bivalent (2) Sites at which crossing over occurs
(3) Terminalization (4) Synaptonemal complex
XII Recombination nodules show the sites at which crossing over occurred

139. Regarding Meiosis, which of the statements is incorrect? **[NEET 2022]**
(1) DNA replication occurs in S phase of Meiosis – II
(2) Pairing of homologous chromosomes and recombination occurs in Meiosis- I
(3) Four haploid cells are formed at the end of Meiosis – II
(4) There are two stages in Meiosis, Meiosis- I and II
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140. Among eukaryotes, replication of DNA takes place in **[NEET 2023]**
(1) S phase (2) G_1 phase (3) G_2 phase (4) M Phase
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141. Which of the following stages of meiosis involves division of centromere? **[NEET 2023]**
(1) Metaphase II (2) Anaphase II (3) Telophase (4) Metaphase I
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142. The process of appearance of recombination nodules occurs at which sub stage of prophase I in meiosis? **[NEET 2023]**
(1) Pachytene (2) Diplotene (3) Diakinesis (4) Zygotene
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143. Match **List** I with **List II**: **[NEET 2023]**

	List I		**List** I
A.	M Phase	I.	Proteins are synthesized
B.	G_2 Phase	II.	Inactive phase
C.	Quiescent stage	III.	Interval between mitosis and initiation of DNA replication
D.	G_1 Phase	IV.	Equational division

Choose the correct answer from the options given below:
(1) A-IV, B-II, C-I, D-III (2) A-IV, B-I, C-II, D-III
(3) A-II, B-IV, C-I, D-III (4) A-III, B-II, C-IV, D-I
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144. Match List I with List II: **[NEET 2023]**

LIST I(Interaction)	LIST II(Species A and B)
(A) Mutualism	(I) +(A), O(B)
(B) Commensalism	(II) $-(A), O(B)$
(C) Amensalism	(III) $+(A).-(B)$
(D) Parasitism	(IV) $+(A), +(B)$

Choose the correct answer from the options given below:

(1) $A-IV, B-I, C-II, D-III$ (2) $A-IV, B-III, C-I, D-II$

(3) $A-III, B-I, C-IV, D-II$ (4) $A-IV, B-II, C-I, D-III$

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—♦—♦—♦—