Q1 Find the correct match.

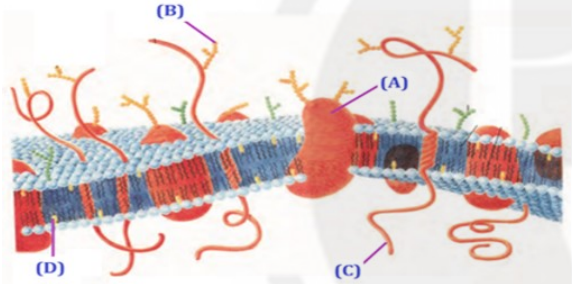
(A) Metacentric chromosome – Centromere forming two unequal arms of chromosome

(B) Telocentric chromosome – Centromere close to its end

(C) Acrocentric chromosome – Terminal centromere

(D) Sub-metacentric chromosome – Centromere slightly away from middle

Q2 The figure below shows the structure of plasma membrane with its four parts labelled (A), (B), (C) & (D). Select the part correctly matched with its function/character.



(A) (D) - Cholesterol - Also found in bacterial membrane

(B) (A) - Integral protein - Run throughout the protein bilayer

(C) (B) Form glycocalyx - Recognition centres

(D) (C) - Oligosaccharide - Act as antigens

Q3 A cell biologist isolates several membrane-bound organelles from a eukaryotic cell and observes that certain organelles function in a coordinated manner for synthesis, modification, packaging and intracellular transport of biomolecules. However, some organelles remain functionally independent of this network. Which group correctly represents the coordinated system involved in such intracellular trafficking?

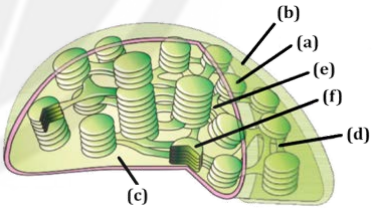
(A) Endoplasmic reticulum, Golgi apparatus, lysosomes and vacuoles

(B) Endoplasmic reticulum, mitochondria, lysosomes and peroxisomes

(C) Golgi apparatus, chloroplasts, mitochondria and vacuoles

(D) Endoplasmic reticulum, peroxisomes, mitochondria and Golgi apparatus

Q4 Select the correct statement for the sectional view of chloroplast which is given below.



(A) Part (d) Stroma lamellae lack NADP reductase enzyme

(B) Part (b) Outer membrane - less permeable

(C) Part (a) Inner membrane - contains porins

(D) Part (c) Stroma - contains small double stranded linear DNA always

Q5 Match the following

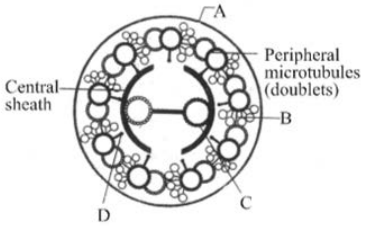
Column A (Nuclear Component)		Column B (Description)	
A	**Centrioles**	**i**	**Organization of microtubules**
B	**Nuclear lamina**	**ii**	**Dense region in nucleus**
C	**Nucleolus**	**iii**	**Protein mesh for support**
D	**Nuclear pores**	**iv**	**Regulates material passage**

(A) a- i, b- ii, c, - iii, d - iv
(B) a- ii, b- iii, c, - i, d - iv
(C) a- i, b- iii, c, - ii, d - iv
(D) a- i, b- ii, c, - iv, d - ii

Q6 In which of the following cell organelles ribosomes are present ?
(A) cytoplasm
(B) Mitochondria and chloroplast
(C) Nucleus, Mitochondria and chloroplast
(D) cytoplasm, Mitochondria and chloroplast

Q7 Statement 1: Nuclear pores are selectively permeable channels.
Statement 2: DNA passes freely through nuclear pores into the cytoplasm
Choose the correct option
(A) Both statements are correct
(B) Both statements are incorrect
(C) Statement 1 is correct, Statement 2 is incorrect
(D) Statement 1 is incorrect, Statement 2 is correct

Q8 Go through the section of cilia/flagella showing the different parts.
In which of the following options correct words for all the four labellings A, B, C and D are indicated ?



(A) A – Plasma membrane, B – Inter-doublet bridge, C – Central microtubule, D – Radial spoke
(B) A – Plasma membrane, B – Arm, C – Central microtubule, D – Radial spoke
(C) A – Plasma membrane, B – Inter-doublet bridge, C – Hub, D – Radial spoke
(D) A – Plasma membrane, B – Inter-doublet bridge, C – Hub, D – Arm

Q9 The functions of cell organelles that are not included in endomembrane system are
(a) Detoxification of drugs
(b) Carbon dioxide fixation
(c) Splitting of water molecule.
(d) Glycolipid formation
(A) All a, b, c and d
(B) Only a and b
(C) Only b, c and d
(D) Only b and c

Q10 Assertion: Rudolf Virchow modified the hypothesis of cell theory given by Schleiden and Schwann.
Reason : Cell theory says that all cells arise from preexisting cells.
(A) If both assertion and reason are true and reason is the correct explanation of assertion.
(B) If both assertion and reason are true but reason is not the correct explanation of assertion.
(C) If assertion is true but reason is false.
(D) If both assertion and reason are false.

Q11 A researcher attempts to reconstruct the logical development of the cell theory. Evaluate the following statements:
1. Schleiden concluded that plants consist of different kinds of cells forming tissues.
2. Schwann observed the plasma membrane while studying animal cells.
3. Virchow proposed that new cells arise from pre-existing cells through division.
4. The original formulation by Schleiden and Schwann explained the mechanism of formation of new cells.
5. Virchow modified the earlier hypothesis to give the modern form of the cell theory.
Which of the following is correct?
(A) 1, 2 and 3 only
(B) 1, 2, 3 and 5 only
(C) 2, 3 and 4 only
(D) 1, 3, 4 and 5 only

Q12 Match the following cell wall components with their characteristics:

Column I	Column II
A. Primary wall	1. Capable of growth
B. Secondary wall	2. Formed after cell maturation
C. Middle lamella	3. Cementing layer between adjacent cells
D. Plasmodesmata	4. Cytoplasmic connections between cells

Choose the correct combination.
(A) A-1, B-2, C-3, D-4
(B) A-2, B-1, C-3, D-4
(C) A-1, B-3, C-2, D-4
(D) A-3, B-2, C-1, D-4

Q13 Arrange the following cells in descending order of their size and choose the correct option.
Bacteria, Ostrich egg, Mycoplasma, Human RBC
(A) Ostrich egg > Bacteria > Human RBC > Mycoplasma
(B) Ostrich egg < Human RBC < Bacteria < Mycoplasma
(C) Mycoplasma < Bacteria < Human RBC < Ostrich egg
(D) Ostrich egg > Human RBC > Bacteria Mycoplasma

Q14 Identify the statements as true (T) or false (F) :

(I) Cells actively involved in protein synthesis have larger and more numerous nucleoli along with RER.

(II) Animal cells differ from plant cells in possessing a large central vacuole.

(III) Lysosomes are reservoirs of hydrolytic enzymes.

(IV) Chromatin contains DNA and histones.

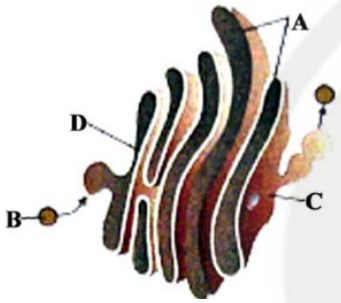
(A) I II III IV T F T T

(B) F F T T

(C) F T F F

(D) T F F T

Q15 Select the option with correct labelling of given structure.



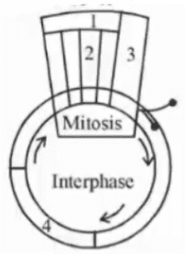
(A) A – Cisternae, B – Vesicle, C – Trans face, D – Cis face

(B) A – Cisternae, B – Vesicle, C – Cis face, D – Trans face

(C) A – Vesicle, B – Cisternae, C – Cis face, D – Trans face

(D) A – Tubules, B – Vesicle, C – Trans face, D – Cis face

Q16 Given below is a schematic break-up of the phases / stages of cell cycle with few parts labelled as $1, 2, 3$ & 4.



Which one of the following is the correct indication of the stage/phase in the cell cycle?

(A) 3 – Karyokinesis

(B) 4 – Synthetic phase

(C) 1 – Cytokinesis

(D) 2 – Metaphase

Q17 An onion root tip has 14 chromosomes in each cell. How many chromosomes the cell would have at G_1-phase?

(A) 28 (B) 14

(C) 62 (D) 7

Q18 In a diploid cell, if number of chromosomes is (2n = 8) in G_1 phase, then the number of chromosomes in G_2 phase is _____.

(A) 8 (B) 16

(C) 32 (D) 4

Q19 A cell has 20 chromosomes at G1. How many chromatids will it have during metaphase of mitosis?

(A) 20 (B) 40

(C) 10 (D) 80

Q20 A zoologist examined an intestine cell from a crayfish and counted 200 chromosomes, each consists of 2 chromatids, at metaphase of mitosis. What would he expect to see in each of the four cells at telophase II of meiosis if he looked in the crayfish ovary?

(A) 50 chromosomes, each consisting of 2 chromatids

(B) 50 chromosomes, each consisting of 1 chromatid

(C) 100 chromosomes, each consisting of 2 chromatids

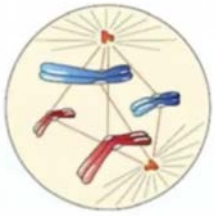
(D) 100 chromosomes, each consisting of 1 chromatid

Q21 A cell spends 10 hours in interphase, with G1 = 5 hours, S = 3 hours, and G2 = 2 hours. What is the ratio of time spent in DNA replication to total interphase?

(A) 1:2 (B) 3:10

(C) 2:5 (D) 3:7

Q22 A stage of mitosis is shown in the diagram. Which stage is it and what are its characteristics ?



(A) Anaphase - Chromatids move to opposite poles

(B) Metaphase - Spindle fibres attached to chromosome

(C) Late prophase - Nuclear membrane, nucleolus, golgi complexes and ER disappeared

(D) Transition to metaphase - Spindle fibres attached to kinetochores of chromosomes

Q23 Recognise the figure and find out the correct matching.

(a) (b) (c)

(A) a-Early prophase, b - late prophase, c - transition to metaphase

(B) b-Early prophase, c - late prophase, a - transition to metaphase

(C) c-Early prophase, a – late prophase, b - transition to metaphase

(D) b-Early prophase, a - late prophase, c - transition to metaphase

Q24 Identify the true statements:

1. Centrosome duplication begins in metaphase
2. Nuclear envelope reforms during telophase
3. Chromosome decondensation occurs during telophase
4. Cytokinesis always follows karyokinesis.

(A) II and III only

(B) I and IV only

(C) I, II and III only

(D) All are true

Q25 Read the following statements carefully and choose the incorrect option

(A) The complex formed by a pair of synapsed homologous chromosomes is called a chromonemata

(B) DNA synthesis occurs only during one specific stage in the cell cycle

(C) Cell division does not stop with the formation of the mature organism

(D) Bivalent chromosomes align on the double equatorial plate

Q26 Choose correct statement regarding meiosis from given statements.

(i) Each pole receives half of the total chromosome number of the parent cell during anaphase-I

(ii) Anaphase-II involves separation of chromatids

(iii) DNA synthesis takes place in interkinesis stage

(A) (i) & (ii) only

(B) (i) only

(C) (i) & (iii) only

(D) (i), (ii) & (iii)

Q27 A researcher observes a cultured human cell line in which the DNA content increases from 2C to 4C without any change in chromosome number. The investigator concludes that chromosome duplication must have occurred without cell division. Which interpretation best explains this observation in the context of the cell cycle?

(A) Chromosome number doubles during DNA replication

(B) DNA replication occurs without altering chromosome number

(C) Chromosome segregation occurs before DNA replication

(D) Cytokinesis occurs before DNA replication

Q28 Consider the following statements regarding prophase of mitosis:

1. Chromatin fibres condense to form visible chromosomes.

2. Each chromosome is composed of two chromatids attached at the centromere.

3. Nuclear envelope and nucleolus remain intact until telophase.

4. Centrosomes move toward opposite poles and form spindle apparatus.

Which combination of statements is correct?

(A) 1, 2 and 4 only

(B) 1 and 3 only

(C) 2, 3 and 4 only

(D) 1, 2, 3 and 4

Q29 What is the correct chronological order of Prophase I stages?

(A) Leptotene Zygotene Pachytene Diplotene Diakinesis

(B) Zygotene Leptotene Pachytene Diplotene Diakinesis

(C) Leptotene Pachytene Zygotene Diakinesis Diplotene

(D) Pachytene Diplotene Leptotene Diakinesis Zygotene

Q30 A laboratory tracks the progression of a mammalian cell through its cell cycle. The scientists note the following sequence of events:

• Continuous metabolic activity and growth occur.

• DNA replication begins in the nucleus.

• Centrioles duplicate in the cytoplasm.

• Proteins required for mitosis are synthesised before cell division.

Which sequence of phases best represents these observations?

(A) G1 S G2

(B) S G1 G2

(C) G2 G1 S

(D) G1 G2 S

Answer Key

Q1	D
Q2	C
Q3	A
Q4	A
Q5	C
Q6	D
Q7	C
Q8	A
Q9	D
Q10	B
Q11	B
Q12	A
Q13	D
Q14	A
Q15	A
Q16	B
Q17	B
Q18	A
Q19	B
Q20	D
Q21	B
Q22	D
Q23	A
Q24	A
Q25	A
Q26	A
Q27	B
Q28	A
Q29	A
Q30	A

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

D. Sub-metacentric chromosome – Centromere slightly away from middle

A. Metacentric chromosome – Centromere forming two unequal arms of chromosome: False. A metacentric chromosome has the centromere in the middle, forming two equal arms.

B. Telocentric chromosome – Centromere close to its end: False. A telocentric chromosome has the centromere at the very end.

C. Acrocentric chromosome – Terminal centromere: False. An acrocentric chromosome has the centromere near one end, creating one long arm and one very short arm, but not at the terminal end.

D. Sub-metacentric chromosome – Centromere slightly away from middle: True. A sub-metacentric chromosome has the centromere slightly off-center, leading to one arm being somewhat longer than the other.

Video Solution:

Q2 Text Solution:

C - (B) Form glycocalyx - Recognition centres

- Glycocalyx helps in cell recognition.
- Made up of oligosaccharides and glycoproteins.
- Located on the outer side of membrane.
- Forms recognition sites for hormones and antigens.
- Statement (C) is correct.

Video Solution:

Q3 Text Solution:

1. Certain membranous organelles work in coordination for synthesis, modification, packaging and transport of cellular materials.
2. This coordinated group is collectively referred to as the endomembrane system.
3. It includes endoplasmic reticulum, Golgi apparatus, lysosomes and vacuoles.
4. Their activities are functionally interrelated, especially in protein and membrane trafficking.
5. Mitochondria, chloroplasts and peroxisomes are excluded because their functions are not coordinated with this system.

Video Solution:

Q4 Text Solution:

A. Part (d) Stroma lamellae lack NADP reductase enzyme

NADP reductase enzyme is located in the thylakoid membrane, not the stroma lamellae. So, A is the correct option. while the other options are outer membrane more permeable due to the presence of porins , inner membrane is selectively permeable lacks porins and stroma contains ds circular DNA always.

Video Solution:

Q5 Text Solution:

(C) a- i, b- iii, c, - ii, d - iv

- Centrioles Not part of nucleus; related to cell division
- Nuclear lamina Protein mesh for nuclear support
- Nucleolus Dense region; rRNA synthesis

Video Solution:

Q6 Text Solution:

D. Cytoplasm, mitochondria, and chloroplast

- Ribosomes are universal, present in all cells.
- In eukaryotes, found in cytoplasm and attached to RER.
- Also present in semiautonomous organelles – mitochondria & chloroplasts.
- Absent in nucleus.

Video Solution:

Q7 Text Solution:

(C) Statement 1 is correct, Statement 2 is incorrect

- Pores are selectively permeable.
- Allow regulated exchange of materials.
- DNA does not pass freely to cytoplasm.
- RNA and specific proteins move via nuclear pores.
- Maintains nuclear integrity.

Video Solution:

Q8 Text Solution:

A: A – Plasma membrane, B – Inter-doublet bridge, C – Central microtubule, D – Radial spoke

- A – Plasma membrane: The outer boundary surrounding the cilium or flagellum.
- B – Inter-doublet bridge: The structure connecting adjacent outer doublets of microtubules.
- C – Central microtubule: The two microtubules at the center of the cilium or flagellum.
- D – Radial spoke: Connects the central microtubules to the outer doublets.

Video Solution:

Q9 Text Solution:

(D) Only b and c

Carbon fixation and splitting of water occur in chloroplasts.

Chloroplasts are not part of the endomembrane system.

They have their own DNA and double membrane.

They are involved in photosynthesis.

Hence, options b and c are correct.

Video Solution:

Q10 Text Solution:

B : If both assertion and reason are true but reason is not the correct explanation of assertion.

- Rudolf Virchow modified cell theory adding that cells come from pre-existing cells.
- This added a dynamic component to the theory.
- The assertion and reason are both true.
- But the reason is not a direct explanation of the assertion.
- Hence, option B is correct.

Video Solution:

Q11 Text Solution:

1. Schleiden studied a large number of plants and concluded that plant tissues are composed of cells.
2. Schwann studied animal cells and described the thin outer layer called the plasma membrane.
3. Rudolf Virchow later proposed that all cells arise from pre-existing cells through cell division.
4. The original cell theory of Schleiden and Schwann did not explain the origin of new cells.
5. Virchow modified their hypothesis, leading to the modern statement that all cells arise from pre-existing cells.

Video Solution:

Q12 Text Solution:

1. Primary cell wall is flexible and capable of expansion during cell growth.
2. Secondary cell wall forms later inside the primary wall when growth stops.
3. Middle lamella consists mainly of calcium pectate and acts as a cementing layer.
4. Plasmodesmata create cytoplasmic connections between neighbouring cells.
5. These structures facilitate communication and structural integrity in plant tissues.

Video Solution:

Q13 Text Solution:

D: Ostrich egg > Human RBC > Bacteria Mycoplasma

- Ostrich egg is largest (visible to naked eye).
- Human RBC > Bacteria > Mycoplasma.
- Mycoplasma is the smallest (0.1 μm).
- Thus, correct order is Ostrich > RBC > Bacteria > Mycoplasma.

Video Solution:

Q14 Text Solution:

A. I II III IV

T F T T

Let's analyze each statement:

(I) Cells actively involved in protein synthesis have larger and more numerous nucleoli along with RER: True. Nucleoli are involved in the production of ribosomes, which are essential for protein synthesis. Cells engaged in high levels of protein synthesis typically have prominent nucleoli and abundant rough endoplasmic reticulum (RER).

(II) Animal cells differ from plant cells in possessing a large central vacuole: False. Plant cells, not animal cells, typically have a large central vacuole.

(III) Lysosomes are reservoirs of hydrolytic enzymes: True. Lysosomes contain hydrolytic enzymes that are used to break down cellular waste and debris.

(IV) Chromatin contains DNA and histones: True. Chromatin is composed of DNA wrapped around histone proteins.

Video Solution:

Q15 Text Solution:

A : A – Cisternae, B – Vesicle, C – *Trans* face, D – *Cis* face

The Golgi apparatus, also known as the Golgi complex, is typically composed of flattened membrane-bound sacs called cisternae. Here's the correct identification:

- A – Cisternae: These are the flattened stacked membrane-bound sacs that make up the main body of the Golgi apparatus.
- B – Vesicle: These are small, membrane-bound sacs that transport materials to and from the Golgi apparatus.
- C – *Trans* face: This is the shipping side of the Golgi apparatus where vesicles bud off and transport processed materials to their final destinations.
- D – *Cis* face: This is the receiving side of the Golgi apparatus where vesicles from the endoplasmic reticulum (ER) fuse and deposit their cargo.

Video Solution:

Q16 Text Solution:

(B) 4 – Synthetic phase

Video Solution:

Q17 Text Solution:

(B) 14

- **G1-phase** is the first stage of the cell cycle, which occurs after mitosis. During this phase, the cell is in its normal state of growth and function. The chromosomes are not yet duplicated, and the cell has the **diploid** number of chromosomes.
- Since the onion root tip has 14 chromosomes in each cell, and it is in a diploid state, the number of chromosomes in G1-phase would be **14**, as chromosomes are not duplicated until the **S-phase** (synthesis phase) of the cell cycle.

Video Solution:

Q18 Text Solution:

A. 8

- G1 Phase: The cell has a normal diploid number of chromosomes, which is 2n = 8.
- S Phase: During the S phase, the DNA content is replicated, but the number of chromosomes remains the same. Each chromosome now consists of two sister chromatids.
- G2 Phase: The cell still has 8 chromosomes, each consisting of two sister chromatids. The chromosome number does not change; only the DNA content doubles.

Thus, the number of chromosomes in G2 phase remains 8.

Video Solution:

Q19 Text Solution:

(B) 40

- G1 has 20 chromosomes = 20 chromatids
- In S-phase, DNA replicates 20 chromosomes, but 40 chromatids
- During metaphase, chromosomes consist of 2 chromatids each.
- Hence, total 40 chromatids at metaphase.
- No increase in chromosome number.

Video Solution:

Q20 Text Solution:

(D) 100 chromosomes, each consisting of 1 chromatid

Explanation:

1. **Chromosome count in mitosis (somatic cells):**
   The crayfish has **200 chromosomes** in its diploid somatic cells, each consisting of two chromatids during metaphase.
2. **Chromosome behavior in meiosis:**
   - Meiosis involves two divisions:
     - **Meiosis I:** The homologous chromosomes separate, reducing the chromosome number by half.
     - **Meiosis II:** The sister chromatids of each chromosome separate.
3. **Telophase II of meiosis:**
   - At the end of **Meiosis II**, the resulting cells are **haploid**, with **half the original chromosome number** (200 ÷ 2 = 100)
   - Each chromosome consists of **a single chromatid** after separation in **Meiosis II**.

Video Solution:

Q21 Text Solution:

(B) 3:10

- Interphase = G1 (5h) + S (3h) + G2 (2h) = **10h**.
- DNA replication = **S phase** = 3h.
- Ratio = **3:10**.

Video Solution:

Q22 Text Solution:

(D) Transition to metaphase - Spindle fibers attached to kinetochores of chromosomes

This stage is between prophase and metaphase.

Chromosomes condense fully and align on the metaphase plate.

Spindle fibers attach to kinetochores of chromosomes.

This ensures equal chromosome distribution during anaphase.

Any defect in this stage can cause aneuploidy (abnormal chromosome numbers).

Video Solution:

Q23 Text Solution:

A. a-Early prophase, b - late prophase, c - transition to metaphase

Here's a brief overview of the stages of prophase leading into metaphase:

1. Early Prophase (a):

- Chromosomes begin to condense and become visible.
- The nucleolus starts to disappear.
- The mitotic spindle begins to form, extending from centrosomes that move to opposite poles of the cell.
- The nuclear envelope begins to break down.

2. Late Prophase (b):

- Chromosomes are fully condensed and become more distinct.
- The nuclear envelope breaks down completely.
- The mitotic spindle is fully formed, with microtubules attaching to the kinetochores of chromosomes.
- The centrosomes are at opposite poles of the cell.

3. Transition to Metaphase (c):

- Chromosomes align along the metaphase plate (equatorial plane) of the cell.
- Spindle fibers are fully attached to the kinetochores of the chromosomes.
- The chromosomes are maximally condensed and are ready for the alignment required for separation.

Video Solution:

Q24 Text Solution:

(A) II and III only

- Centrosome duplication starts in interphase, not metaphase.
- Nuclear envelope reforms in telophase.
- Chromosomes decondense in telophase.
- Cytokinesis **usually** follows karyokinesis, but not always.
- So only II and III are true.

Video Solution:

Q25 Text Solution:

(A) The complex formed by a pair of synapsed homologous chromosomes is called a chromonemata

1. **(A) Incorrect**:
   The complex formed by a pair of synapsed homologous chromosomes during **prophase I of meiosis** is called a **bivalent or tetrad**, not chromonemata. Chromonemata refers to the thread-like structures of chromatin observed in chromosomes.
2. **(B) Correct**:
   DNA synthesis occurs only during the **S phase** of the cell cycle, not at other phases.
3. **(C) Correct**:
   Cell division continues even after the organism matures, for example, during tissue repair, regeneration, or renewal.
4. **(D) Correct**:
   In meiosis I, bivalent chromosomes align on the **metaphase plate (double equatorial plate)** during metaphase I.

Video Solution:

Q26 Text Solution:

(A) (i) & (ii) only

In meiosis, homologous chromosomes separate during anaphase-I and sister chromatids separate during anaphase-II. DNA synthesis does not occur during interkinesis.

Video Solution:

Q27 Text Solution:

1. During the synthesis phase of the cell cycle, DNA replication occurs in the nucleus.
2. The amount of DNA in the cell increases from 2C to 4C due to replication.
3. Each chromosome forms two sister chromatids but remains attached at the centromere.
4. Because chromatids are still part of the same chromosome, the chromosome number does not change.
5. Thus, DNA quantity doubles while chromosome number remains constant until mitosis separates them.

Video Solution:

Q28 Text Solution:

1. During prophase chromatin material condenses into compact chromosomes.
2. Each chromosome consists of two sister chromatids joined at the centromere.
3. Nuclear envelope and nucleolus disappear by the end of prophase, so statement 3 is incorrect.
4. Centrosomes migrate to opposite poles and organise spindle fibres.
5. Therefore statements 1, 2 and 4 correctly describe prophase.

Video Solution:

Q29 Text Solution:

(A) Leptotene Zygotene Pachytene Diplotene Diakinesis

- These are five sub-stages of Prophase I.
- Each has specific events: condensation synapsis crossing over chiasmata terminalisation.
- Option A is correct.

Video Solution:

Q30 Text Solution:

1. The G1 phase occurs after mitosis and is characterised by metabolic activity and cellular growth.
2. DNA replication begins during the S phase in the nucleus.
3. In animal cells, centriole duplication also occurs during the S phase.
4. The G2 phase follows DNA replication and involves synthesis of proteins required for mitosis.
5. Thus the correct sequence of events is G1 followed by S phase and then G2 phase.

Video Solution: