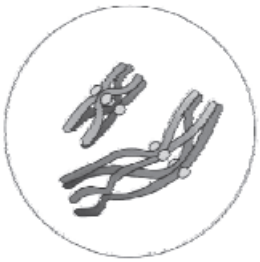
	INDIAN SCHOOL AL WADI AL KABIR	
Class: XI	**DEPARTMENT OF SCIENCE 2026– 2027** **SUBJECT: BIOLOGY**	**Date: 20/04/2026**
Worksheet: 02	**UNIT- 3 Cell structure and functions** **CHAPTER:10- Cell Cycle and Cell Division**	**Note:** **A4 FILE FORMAT**
CLASS & SEC:	**NAME OF THE STUDENT:**	**ROLL NO.**

I. MULTIPLE CHOICE QUESTIONS (1M)

1. The correct sequence of phases of the cell cycle is
   A. M → G1 → G2 → S
   B. G1 → G2 → S → M
   C. S → G1 → G2 → M
   D. G1 → S → G2 → M
2. At what phase of meiosis are homologous chromosomes separated?
   A. Anaphase-II
   B. Prophase-I
   C. Prophase-II
   D. Anaphase-I
3. Pick out the correct statements:
   a) Synapsis of homologous chromosomes takes place during prophase I of meiosis
   b) Division of centromeres takes place during anaphase I of meiosis
   c) Spindle fibres disappear completely in telophase of mitosis
   d) Nucleoli reappear at telophase I of meiosis.
   A. A only
   B. C only
   C. A and B only
   D. A, C and D only
4. Given below is the representation of a certain event at a particular stage of a type of cell division. Which is this stage?



   A. Both prophase and metaphase of mitosis

B. Prophase-I during meiosis
C. Prophase-II during meiosis
D. Prophase of Mitosis

5. The plane of alignment of the chromosomes at metaphase is referred to as the
   A. Metaphasic alignment
   B. Chromosome alignment
   C. Metaphase plate
   D. All of the above
6. Which is unique to mitosis and does not occur in meiosis?
   A. Homologous chromosomes cross over
   B. Homologous chromosomes pair and form bivalent
   C. Homologous chromosomes behave independently
   D. Chromatids are separated during anaphase
7. What is the requirement of equational division in meiosis?
   A. Formation of four gametes
   B. Segregation of replicated chromosomes
   C. Equal distribution of haploid chromosomes
   D. Equal distribution of genes on chromosomes
8. Which of the following options gives the correct sequence of events during mitosis?
   A. Condensation → Nuclear membrane disassembly →Crossing over → Segregation → Telophase
   B. Condensation → Nuclear membrane disassembly →Arrangement at equator → Centromere division →Segregation → Telophase
   C. Condensation → Crossing over → Nuclear membrane disassembly → Segregation → Telophase
   D. Condensation → Arrangement at equator →Centromere division → Segregation → Telophase
9. Meiosis occurs in organisms during
   A. Sexual reproduction
   B. Vegetative reproduction
   C. Both sexual and vegetative reproduction
   D. None of these
10. A bivalent of meiosis-I consists of:
   A. Two chromatids and one centromere
   B. Two chromatids and two centromeres
   C. Four chromatids and two centromeres
   D. Four chromatids and four centromeres

Two statements are given - one labelled as **Assertion (A)** and the other labelled as **Reason (R)**. Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(C) Assertion (A) is true, Reason (R) is false.
(D) Assertion (A) is false, Reason (R) is true.

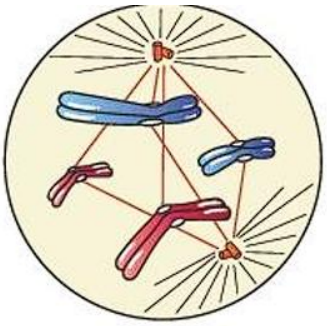
11. **Assertion (A):** Cell growth is a continuous process in terms of cytoplasmic increase.
    Reason (R): DNA synthesis occurs only during two specific stages in the cell cycle.
12. **Assertion(A):** Cell division is a very important process in all the living organisms.
    Reason(R): During cell division, DNA replication and cell growth also takes place.
13. **Assertion(A):** In animal cells, cytokinesis is marked by the appearance of a furrow in the plasma membrane.
    Reason(R): In plant cells, the formation of the new cell wall starts with the formation of simple precursor called cell plate.
14. **Assertion(A):** During metaphase, the chromosome has two chromatids.
    Reason(R): Replication of DNA takes place in the S-phase of interphase.

II. VERY SHORT ANSWER TYPE QUESTIONS(2M)

15. How does cytokinesis in plant cells differ from that in animal cells?
16. Differentiate between metaphase of mitosis and metaphase-I of meiosis.
17. i) Distinguish between a prokaryote and a eukaryote, which cell has a shorter cell division time?
    ii) Which of the phases of cell cycle is of longest duration?
18. What happens to the DNA of the plastids and mitochondria during nuclear divisions such as mitosis?
19. What is the quiescent phase in the cell cycle? During which phase of the cell cycle does this occur?

III. SHORT ANSWER TYPE QUESTIONS (3M)

20. What are homologous chromosomes? What happens to homologous chromosomes during meiosis?
21. An organism has two pair of chromosomes (i.e., chromosome number = 4). Diagrammatically represent the chromosomal arrangement during different phases of meiosis-II.
22. Write the phases of the cell cycle against each of the events
    i) The disintegration of the nuclear membrane
    ii) The appearance of the nucleolus
    iii) Division of centromere
    iv) Replication of DNA
23. i) Label the diagram and determine the stage and any two features of this stage.



ii) A cell has 32 chromosomes. It undergoes mitotic division. What will be the chromosome number (N) during metaphase? What would be the DNA content (C) during anaphase? Give

reasons for each answer.

24. i) Name the two key events that take place, during S phase in animal cells.
    ii) In which parts of the cell do the DNA replication and duplication of centriole events occur?
25. Distinguish between the Anaphase of mitosis and the Anaphase of meiosis I.

IV. CASE STUDY BASED QUESTIONS (4M)

26. Cell division is a very important process in all living organisms. During the division of a cell, DNA replication and cell growth also take place. All these processes, i.e., cell division, DNA replication, and cell growth, hence, have to take place in a coordinated way to ensure correct division and formation of progeny cells containing intact genomes. The sequence of events by which a cell duplicates its genome, synthesises the other constituents of the cell and eventually divides into two daughter cells is termed cell cycle. Although cell growth (in terms of cytoplasmic increase) is a continuous process, DNA synthesis occurs only during one specific stage in the cell cycle. The replicated chromosomes (DNA) are then distributed to daughter nuclei by a complex series of events during cell division. These events are themselves under genetic control.
    A. What is the cell cycle?
    B. Why must DNA replication, cell growth, and cell division be coordinated?
    C. During which stage of the cell cycle does DNA synthesis occur?

    OR

    D. What are the major processes that occur during cell division?

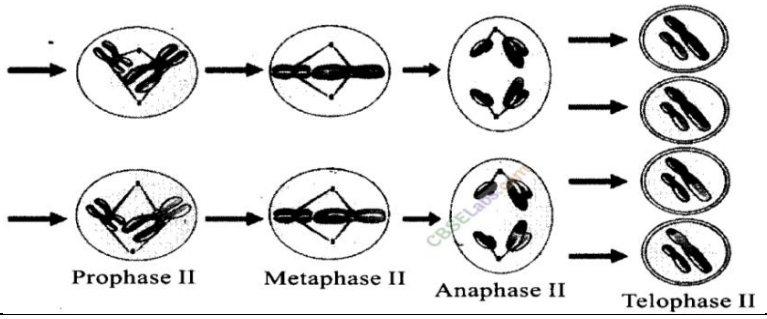
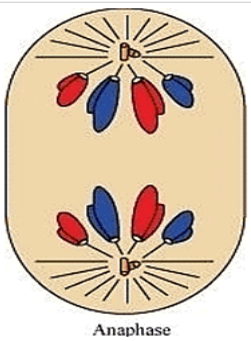
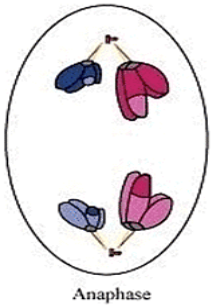
V. LONG ANSWER TYPE QUESTIONS (5M)

27. Describe the cell cycle, emphasising the events that occur during interphase. Why is interphase considered a vital preparatory phase for cell division?
28. What are the various stages of meiotic prophase-I?
29. i) Differentiate between mitosis and meiosis
    ii) Write brief note on the following:
    a) Synaptonemal complex
    b) Metaphase plate
30. i) Write briefly the significance of mitosis and meiosis in multicellular organism.
    ii) Diagrammatically represent the chromosomal arrangement during different phases of meiosis II.

Answer Key

Q. No.	Answer
I.	**MULTIPLE CHOICE QUESTIONS (1M)**
1	D. G1 → S → G2 → M
2	D. Anaphase-I
3	D. A, C and D only
4	B. Prophase-I during meiosis
5	C. Metaphase plate
6.	**C.** Homologous chromosomes behave independently
7.	**A.** Formation of four gametes
8.	**B.** Condensation → Nuclear membrane disassembly →Arrangement at equator → Centromere division →Segregation → Telophase
9.	**A.** Sexual reproduction

<table>
<tr><td>10</td><td>A. Four chromatids and two centromeres</td></tr>
<tr><td></td><td>ASSERTION & REASONING</td></tr>
<tr><td>11</td><td>C. Assertion (A) is true, Reason (R) is false.</td></tr>
<tr><td>12</td><td>A. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).</td></tr>
<tr><td>13</td><td>A. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).</td></tr>
<tr><td>14</td><td>A. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).</td></tr>
<tr><td>II</td><td>VERY SHORT ANSWER TYPE QUESTIONS(2M)</td></tr>
<tr><td>15.</td><td>In an animal cell, cytokinesis is achieved by the appearance of a furrow in the plasma membrane. The furrow gradually deepens and ultimately joins in the centre dividing the cell cytoplasm into two.
Plant cells however, are enclosed by a relatively inexte’nsible cell wall, therefore they undergo cytokinesis by a different mechanism. In plant cells, wall formation starts in the centre of the cell and grows outward to meet the existing lateral walls. The formation of the new cell wall begins with the formation of a simple precursor, called the cell-plate that represents the middle lamella between the walls of two adjacent cells.</td></tr>
<tr><td>16.</td><td>• Metaphase of Mitosis: Individual chromosomes align at the equatorial plate, and sister chromatids separate.
• Metaphase-I of Meiosis: Homologous chromosome pairs (bivalents) align at the equator, and whole chromosomes move to opposite poles</td></tr>
<tr><td>17.</td><td>
<table>
<tr><th>Feature</th><th>Prokaryotic Cell</th><th>Eukaryotic Cell</th></tr>
<tr><td>Nucleus</td><td>Absent (DNA is in the nucleoid)</td><td>Present (DNA enclosed in a nuclear membrane)</td></tr>
<tr><td>Cell Type</td><td>Unicellular</td><td>Unicellular or Multicellular</td></tr>
<tr><td>DNA Organization</td><td>Circular, lacks histones</td><td>Linear, associated with histones</td></tr>
<tr><td>Membrane-bound Organelles</td><td>Absent</td><td>Present (e.g., mitochondria, ER, Golgi)</td></tr>
<tr><td>Cell Division</td><td>Binary fission (asexual)</td><td>Mitosis and Meiosis</td></tr>
<tr><td>Example Organisms</td><td>Bacteria, Archaea</td><td>Plants, Animals, Fungi, Protists</td></tr>
</table>
ii) Prokaryotic cells have a shorter cell division time because they divide through a simple process called binary fission, which is faster than mitosis in eukaryotes.
In favorable conditions, some bacteria can divide every 20–30 minutes, whereas eukaryotic cells take several hours to complete the cell cycle.</td></tr>
<tr><td>18</td><td>Chloroplasts and mitochondria possess DNA in the form of extrachromosomal DNA and have no role in nuclear division. Only nuclear DNA takes part in mitosis.</td></tr>
<tr><td>19</td><td>Some dividing cells at the end of the mitotic phase exit the cell cycle and enter into a vegetative inactive stage, also called the quiescent phase. This occurs during the G1 phase of the cell cycle.</td></tr>
<tr><td>III</td><td>SHORT ANSWER TYPE QUESTIONS (3M)</td></tr>
<tr><td>20.</td><td>Homologous chromosomes are defined as pairs of similar chromosomes having corresponding genes governing the same set of traits.
During the heterotypic division of meiosis in leptotene, the chromosomes are thread-shaped and are coiled. During zygotene, homologous chromosomes start pairing. In pachytene,</td></tr>
</table>

<table>
<tr><td></td><td>chromosomes show both- thickening and shortening. Diplotene is marked by the cessation of attraction force between the two homologous chromosomes. Uncoiling of the homologous chromosomes separate them from each other but also remains attached at chiasmata. During diakinesis, the separation of the homologous chromosome is complete. Exchange of parts between chromatids of homologous chromosomes may take place. During Anaphase I, centromeres of homologous compounds of bivalents repel each other post the separation of the centromere. The homologous chromosomes start to move apart, in telophase-I, chromosomes reach poles and become shortened.</td></tr>
<tr><td>21.</td><td> 
</td></tr>
<tr><td>22</td><td>i) Prophase. ii) Telophase. iii Anaphase. iv) S-phase.</td></tr>
<tr><td>23</td><td>i) Metaphase, spindle fibres attach to kinetochores of chromosomes and chromosomes are moved to spindle equator and get aligned along metaphase plate through spindle fibres.
ii) The mitotic cell divison occurs in somatic cells of an organism. The chromosome number in the daughter cells remain same as that of the parent (dividing) cell, so even at metaphase or anaphase, the chromosome number does not change.
The DNA content gets double at the synthetic phase of interphase and gets divided at anaphase but the chromosome number remains same.</td></tr>
<tr><td>24</td><td>i) Duplication of parental chromosome during S phase, Centrioles duplicate in the cytoplasm.
ii) DNA replication------Nucleus and duplication of centriole----------Cytoplasm</td></tr>
<tr><td>25</td><td>
<table>
<tr><th>Anaphase of mitosis</th><th>Anaphase I of meiosis</th></tr>
<tr><td>1. The centromere of every chromosome divides.</td><td>1. The centromere do not divide.</td></tr>
<tr><td>2. Separation of sister chromatids takes place.</td><td>2. Homologous chromosomes are separated.</td></tr>
<tr><td>3. Only one chromatid of every chromosome moves to the pole.</td><td>3. Each homologous pair of chromosomes moves to the pole with both the chromatids.</td></tr>
<tr><td>4. The chromatids moving to one pole are genetically identical to those moving to the opposite pole.</td><td>4. The chromosomes moving to one pole are not genetically identical to those moving to the opposite pole.</td></tr>
<tr><td> 
Anaphase</td><td> 
Anaphase</td></tr>
</table>
</td></tr>
</table>

IV	CASE STUDY BASED QUESTIONS (4M)
26	A. The cell cycle is the sequence of events by which a cell duplicates its genome, synthesizes other cellular components, and eventually divides into two daughter cells. B. These processes must be coordinated to ensure the correct division of the cell and the formation of progeny cells containing intact genomes, preventing errors that could lead to mutations or cell malfunction. C. DNA synthesis occurs only during a specific stage called the **S phase** (Synthesis phase) of the cell cycle. OR D. The major processes during cell division include DNA replication, cell growth, and the distribution of replicated chromosomes to daughter cells.
V	**LONG ANSWER TYPE QUESTIONS (5M)**
27	The cell cycle is an ordered sequence of events by which a cell grows, duplicates its contents, and divides into two daughter cells. It consists of two major phases: 1. Interphase (Preparatory phase) 2. M Phase (Mitotic phase – cell division) Interphase – The Most Crucial Phase Interphase is the longest phase of the cell cycle (about 90–95% of the total time) and is divided into three stages: (i) G_1 Phase (Gap 1)-Cell grows in size, Synthesis of RNA, proteins, and enzymes, Cell becomes metabolically active, Preparation begins for DNA replication (ii) S Phase (Synthesis Phase)-DNA replication occurs, Each chromosome duplicates into two sister chromatids , Histone proteins are synthesized ,DNA content doubles (but chromosome number remains the same) (iii) G_2 Phase (Gap 2)-Further growth of the cell, Synthesis of proteins required for mitosis (like spindle fibers) , Checking and repair of DNA errors ,Final preparation for cell division. Interphase is considered essential because: DNA duplication ensures genetic continuity, Cell growth ensures adequate size and resources, Protein and organelle synthesis prepares the cell for division ,Error checking and repair mechanisms maintain genetic stability, Energy accumulation (ATP) supports division.
28	**Leptotene:** • Chromosomes begin to condense and become visible. • Each chromosome consists of two sister chromatids. • Chromosomes attach to the nuclear membrane via **telomeres**. **Zygotene:** • Homologous chromosomes start pairing in a process called **synapsis**. • This pairing forms a structure called the **synaptonemal complex**. **Pachytene:** • Crossing over occurs between non-sister chromatids of homologous chromosomes. • This exchange of genetic material increases genetic variation. • Recombined chromosomes are held together at crossover points called **chiasmata**. **Diplotene:** • Synaptonemal complex dissolves, but homologous chromosomes remain attached at chiasmata. • Chromosomes begin to separate but remain connected at chiasmata.

<table>
<tr><td></td><td>
In some species, oocytes are arrested at this stage until ovulation.
Diakinesis:
Chromosomes condense further and become highly coiled.
The nuclear membrane and nucleolus disintegrate.
Spindle fibers start forming to prepare for metaphase-I.
</td></tr>
<tr><td>29</td><td>i)
<table>
<tr><td>Mitosis</td><td>Meiosis</td></tr>
<tr><td>Equational division</td><td>Reductional division</td></tr>
<tr><td>Growth, repair</td><td>Gametogenesis</td></tr>
<tr><td>Makes Exact copies</td><td>Brings genetic diversity</td></tr>
</table>
ii) a) Synaptonemal complex-Formed after the pairing of homologous chromosomes- bivalent or tetrad- a complex structure
b) Metaphase plate-A plane in the equatorial region of the spindle in the dividing cells where chromosomes become arranged during metaphase.</td></tr>
<tr><td>30</td><td>i) Significance of Mitosis
(i) Multicellular plants and animals start life as single cells. The process of mitosis give rise to many cells which differentiate to form tissues, organ-systems of the organism.
(ii) It results in increase in size and growth of an organ.
(iii) Mitosis is also involved in asexual reproduction in some organisms like in unicellular. Amoeba and multicellular Hydra as well as in vegetative reproduction in plants.
Significance of meiosis
(i) Meiosis is the mechanism by which conservation of specific chromosome number of each species is achieved across generations in sexually reproducing organisms.
(ii) Meiosis also increases the genetic variability in the population of organisms from one generation to the next. Variations are very important for the process of evolution.
iii) FIG 10.4 FROM NCERT</td></tr>
</table>

Prepared by: *Ms Ranjana Sangtani*	*Checked by:* *HOD Science*