
	<b>INDIAN SCHOOL AL WADI AL KABIR</b>	
<b>Class: XI</b>	<b>Department: SCIENCE 2021 -2022</b> <b>SUBJECT: BIOLOGY</b>	<b>Date of submission:9/06/2021</b>
<b>Worksheet no.2 with answers</b>	<b>CHAPTER: Cell Cycle and Cell Division</b>	<b>Note:</b> <b>A4 FILE FORMAT</b>
<b>NAME OF THE STUDENT</b>	<b>CLASS &amp; SEC:</b>	<b>ROLL NO.</b>

### Case Study

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.

1. During Cell Cycle the following events takes place

- a. Cell duplicates its genome,
- b Synthesises the other constituents of the cell
- c. Divides into two daughter cells
- d. All of these

2. Assertion: During the S-phase the chromosomal number doubles.

Reason: The DNA synthesised takes doubles the content and the number of chromosomes.

- a Both assertion and reason are true, and the reason is the correct explanation of the assertion.
- b. Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

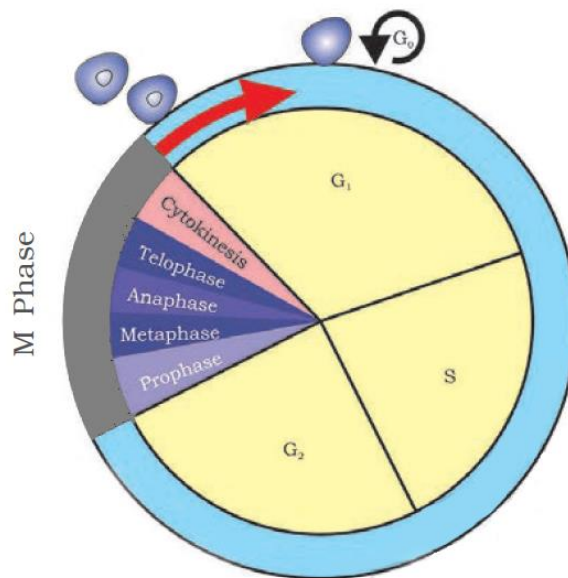
- c. Assertion is true but reason is false.
- d. Both assertion and reason are false

3. Select the correct statement about G<sub>1</sub> phase

- a. Cell is metabolically inactive
- b. DNA in the cell does not replicate
- c. It is not a phase of synthesis of macromolecules
- d. Cell stops growing

4. From the picture given below the longest phase of the Cell cycle is M-phase

- a. True
- b. False



5. Mitosis is characterised by

- a. Reduction division
- b. Equal division
- c. Both reduction and equal division
- d. None of the above

### Objective Answer Type Questions (1 mark)

- 1. Meiosis results in
  - a. Production of gametes
  - b. Reduction in the number of chromosomes
  - c. Introduction of variation
  - d. all of the above

2. At which stage of meiosis does the genetic constitution of gametes is finally decided
  - a. Metaphase I
  - b. Anaphase II
  - c. Metaphase II
  - d. Anaphase I
3. Meiosis occurs in organisms during
  - a. Sexual reproduction
  - b. Vegetative reproduction
  - c. Both sexual and vegetative reproduction
  - d. None of the above
4. During anaphase-I of meiosis
  - a. Homologous chromosomes separate
  - b. Non-homologous autosomes separate
  - c. Sister chromatids separate
  - d. Non-sister chromatids separate
5. 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
6. Cells which are not dividing are likely to be at
  - a. G1
  - b. G2
  - c. Go
  - d. S phase
7. Which of the events listed below is not observed during mitosis?
  - a. Chromatin condensation
  - b. Movement of centrioles to opposite poles
  - c. Appearance of chromosomes with two chromatids joined together at the centromere.
  - d. Crossing over
8. Identify the wrong statement about meiosis
  - a. Pairing of homologous chromosomes
  - b. Four haploid cells are formed
  - c. At the end of meiosis the number of chromosomes are reduced to half
  - d. Two cycle of DNA replication occurs

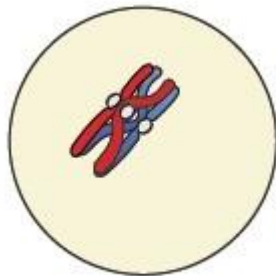
9. In which phase of meiosis are the following formed? Choose the answers from hint points given below.

- a. Synaptonemal complex \_\_\_\_\_
- b. Recombination nodules \_\_\_\_\_
- c. Appearance/activation of enzyme recombinase \_\_\_\_\_
- d. Termination of chiasmata \_\_\_\_\_
- e. Interkinesis \_\_\_\_\_
- f. Formation of dyad of cells \_\_\_\_\_

Hints : 1) Zygotene, 2) Pachytene, 3) Pachytene, 4) Diakinesis, 5) After Telophase-I /before Meiosis-II, 6) Telophase-I /After Meiosis-I.

### Short Answer Type Questions (2 mark)

- 1. a) Between a prokaryote and a eukaryote, which cell has a shorter cell division time?  
b) Which of the phases of cell cycle is of longest duration?
- 2. Which tissue of animals and plants exhibits meiosis? Give reason for your answer.
- 3. a) Given that the average duplication time of E.coli is 20 minutes, how much time will two E.coli cells take to become 32 cells?  
b) What attributes does a chromatid require to be classified a chromosome?
- 4. a) The diagram shows a bivalent at prophase-I of meiosis. Which of the four chromatids can cross over? Briefly explain the process.

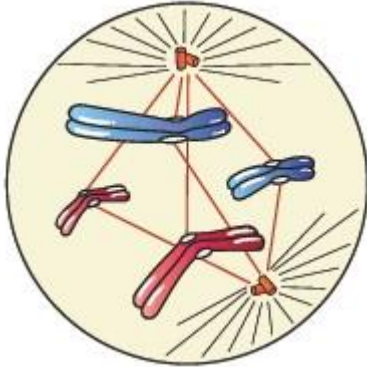


Prophase I

- 5. a) If a tissue has at a given time 1024 cells, how many cycles of mitosis had the original parental single cell undergone?  
b) An anther has 1200 pollen grains. How many pollen mother cells must have been there to produce them?
- 6. a) At what stage of cell cycle does DNA synthesis take place?  
b) It is said that the one cycle of cell division in human cells (eukaryotic cells) takes 24 hours. Which phase of the cycle, do you think occupies the maximum part of cell cycle?
- 7. It is observed that heart cells do not exhibit cell division. Such cells do not divide further and exit \_\_\_\_\_ phase to enter an inactive stage called \_\_\_\_\_ of cell cycle.
- 8. Comment on the statement – Telophase is reverse of prophase

### Long Answer Type Questions (3 mark)

- State the role of centrioles in cell division.
  - Mitochondria and plastids have their own DNA (genetic material). What is known about their fate during nuclear division like mitosis?
- Label the diagram and also determine the stage and any two features of this stage.



- 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.
- The following events occur during the various phases of the cell cycle, Name the phase against each of the events.
  - Disintegration of nuclear membrane \_\_\_\_\_
  - Appearance of nucleolus \_\_\_\_\_
  - Division of centromere \_\_\_\_\_
  - Replication of DNA \_\_\_\_\_
  - Appearance of Synaptonemal complex \_\_\_\_\_
  - Chiasmata formation \_\_\_\_\_
- Mitosis results in producing two cells which are similar to each other. What would be the consequence if each of the following irregularities occur during mitosis?
  - Duplication of DNA does not occur
  - Centromeres do not divide
  - Cytokinesis does not occur.
- Name the two key events that take place, during S phase in animal cells
  - In which parts of the cell does the DNA replication and duplication of centriole events occur?
- Comment on the statement taking Humans as an example – Meiosis enables the conservation of specific chromosome number of each species even though the process per se, results in reduction of chromosome number.
- Name a cell that is found arrested in diplotene stage for months and years.
  - How does cytokinesis in plant cells differ from that in animal cells?

### Very Long Answer Type Questions (5 marks)

1. What are the various stages of meiotic prophase-I? Enumerate the chromosomal events during each stage with the help of diagrams.
2. a) Differentiate between mitosis and meiosis  
b) Write brief note on the following
  - i. Synaptonemal complex
  - ii. Metaphase plate
3. a) Write briefly the significance of mitosis and meiosis in multicellular organism.  
b) An organism has two pair of chromosomes (i.e., chromosome number = 4). Diagrammatically represent the chromosomal arrangement during different phases of meiosis-II.

### Answers and Hints to some questions

#### Multiple Choice Questions

1-d	2- d	3- a	4-a
5-c	6-c	7-d	8-d

#### Short Answer Type Questions

- 1.a) Prokaryotes
- b) Interphase
2. Germ cells or meiocytes- to form gametes with half the no. of chromosomes (unpaired) – gametes fertilise to form Zygote (paired) -chromosomal no. retained.
- 4.(Top two) Non-sister chromatids- Exchange of genetic material between two homologous chromosomes
- 6.a) Interphase-S phase
- b) Interphase
7.  $G_1$  and  $G_0$  (quiescent stage)
8. Prophase-Chromosome formation -Disappearance of nuclear membrane and many cell organelles  
Telophase- Chromosome identity lost (chromatin formation) -Appearance of nuclear membrane and cell organelles

#### Long Answer Type Questions

1.a) Help in spindle fibre formation

b) In mitosis only nuclear DNA takes part, Mitochondria and plastids have their own DNA but they are extra chromosomal DNA

2. a) Metaphase, the sister chromatids align along the equator of the cell by attaching their centromeres to the spindle fibres.

b) N, 2C

3.a) Prophase \_\_ b) Telophase\_ c) Prophase\_ d) Interphase (S Phase) \_ d) Zygotene (Prophase I)\_\_\_ e)Diplotene (Prophase I)

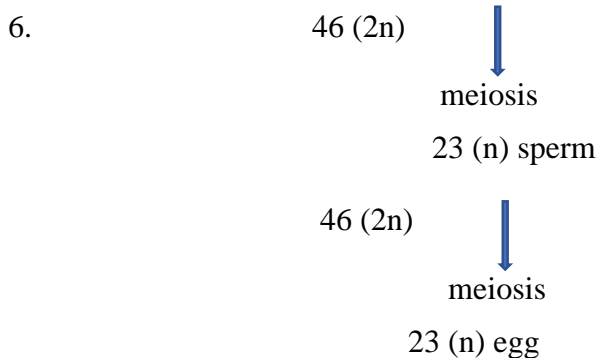
4.a) Daughter cells will not receive DNA

b) No formation of centrioles -no spindle fibre formation

c)Polyploidy (Extra set of Chromosomes)

5.a) Duplication of parental chromosome during S phase, Centrioles duplicate in the cytoplasm.

b) DNA replication-----Nucleus and duplication of centriole-----Cytoplasm



23 (n) sperm + 23 (n) egg= Zygote 46 (2n) ----hence chromosomal no. retained.

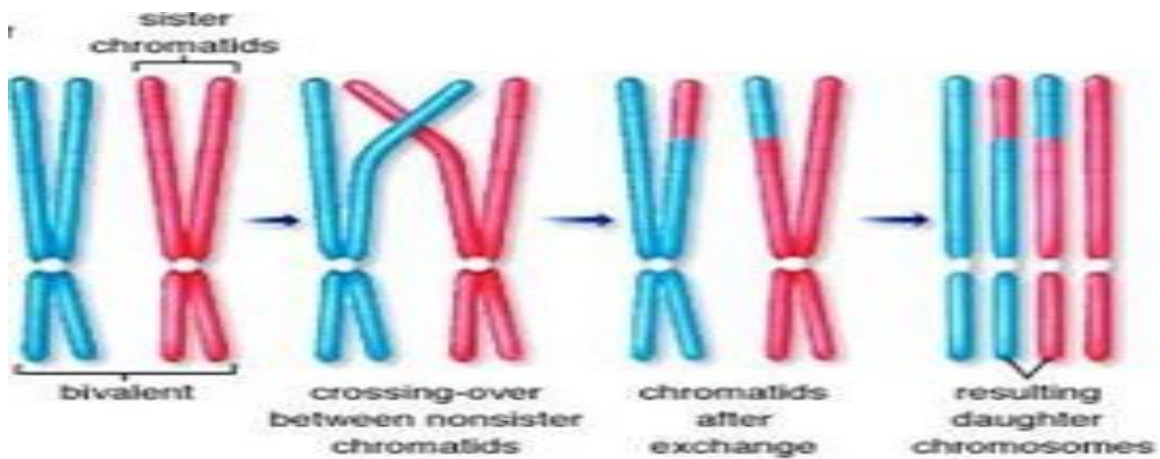
7.a) Oocytes of some vertebrates (eg Humans)

b)

— Animal Cells — cleavage furrow — indentation at middle of cell, signals beginning of cytokinesis  
— Plant Cells — Cell plate begins to form between new cells, signals beginning of cytokinesis

## Very Long Answer Type Questions

1.



2.a)

Mitosis	Meiosis
Equational division	Reductional division
Growth, repair	Gametogenesis
Makes Exact copies	Brings genetic diversity

b) i) Synaptonemal complex-Formed after the pairing of homologous chromosomes- bivalent or tetrad- a complex structure

ii. Metaphase plate-A plane in the equatorial region of the spindle in the dividing cells where chromosomes become arranged during metaphase.

3a Significance-Meiosis-Conservation of species chromosomal no.—Increases genetic variability

Mitosis- Growth, Cell repair-- Makes identical copies of daughter cells.

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