1. What is the average cell cycle span for a mammalian cell?

Solution:

The average cell cycle span for a mammalian cell is 24 hours.

2. Distinguish cytokinesis from karyokinesis.

Solution:

Cytokinesis	Karyokinesis
It is the cell division of cytoplasm that occurs during the M phase of the cell cycle.	It is the separation of daughter chromosomes corresponding to the M phase of the cell cycle

3. Describe the events taking place during interphase.

Solution:

Events taking place during interphase are as follows:

- G_1 phase (Gap 1) – During this stage, the cell is metabolically active. It grows and prepares the DNA to replicate.
- S phase (Synthesis) – During this stage, the synthesis of DNA takes place. The DNA quantity doubles, whereas the number of chromosomes remains unchanged
- G_2 phase (Gap 2) – During this phase, the cell advances to grow and prepares itself for division. It is during this stage that the RNA and proteins that are required for mitosis are generated.

4. What is Go (quiescent phase) of cell cycle?

Solution:

In adult animals, some cells will not exhibit cell division, and many other cells occasionally divide when there is a need to replace cells that have been lost because of injury or cell death. These cells exit the G1 phase to enter an inactive stage of the cell cycle called the G_0 phase. Cells in the G_0 phase do not proliferate unless called on to do so. Hence, the cells in this phase tend to become inactive, stop dividing and become specialized through the differentiation process.

5. Why is mitosis called equational division?

Solution:

Mitosis is called equational division because the number of chromosomes in the parent and progeny cells is the same.

6. Name the stage of cell cycle at which one of the following events occur:

(i) Chromosomes are moved to spindle equator.

(ii) Centromere splits and chromatids separate.

(iii) Pairing between homologous chromosomes takes place.

(iv) Crossing over between homologous chromosomes takes place.

Solution:

i) Chromosomes are moved to the spindle equator in the Metaphase.

ii) Centrosomes split, and chromatids separate in the Anaphase

iii) Pairing between homologous chromosomes takes place in the Zygotene stage of prophase 1 in meiosis

iv) Crossing over between homologous chromosomes takes place during the Pachytene stage of prophase 1in meiosis

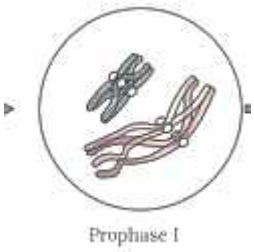
7. Describe the following:

(a) synapsis (b) bivalent (c) chiasmata

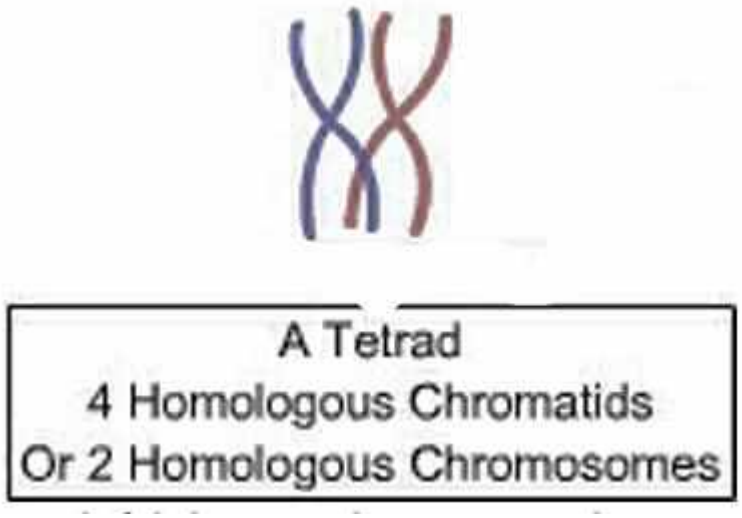
Draw a diagram to illustrate your answer.

Solution:

a) Synapsis – Homologous chromosomes pair together during Zygotene of prophase-I of meiosis. This pairing is called synapsis.



b) Bivalent or tetrad is the pair of complexes formed by a pair of synapsed homologous chromosomes during the zygotene of prophase I of meiosis.



c) Chiasmata

During diplotene, the paired chromosomes form an X-shaped structure known as chiasmata. At chiasmata, the crossing over between two non-sister chromatids takes place.

8. How does cytokinesis in plant cells differ from that in animal cells?

Solution:

Plant cytokinesis	**Animals cytokinesis**
Occurs by cell plate formation	Takes place by cleavage
Cell plate moves to the centre and extends towards the exterior	Cleavage begins at the periphery and advances inwards
The fusion of vesicles originates in cell plate formation	Cleavage starts with the contraction of a peripheral ring of microfilaments
Midbody is not formed	Midbody is formed with dense material in the middle of the cell.

9. Find examples where the four daughter cells from meiosis are equal in size and where they are found unequal in size.

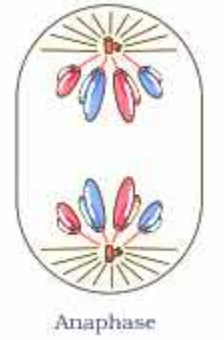
Solution:

During the formation of male gametes in human beings (sperms), the four daughter cells formed during meiosis are equal in size. The formation of the female gamete (ovum) during meiosis results in the formation of four daughter cells, unequal in size. The unequal daughter cells are – one big mature ovum and 3 small polar bodies.

10. Distinguish anaphase of mitosis from anaphase I of meiosis.

Solution:

The differences are as follows:

Anaphase of mitosis	**Anaphase I of meiosis**
Centromere splits and chromatids separate	centromere does not split, and sister chromatids remain associated at their centromere
 Anaphase	 Anaphase 1

11. List the main differences between mitosis and meiosis.

Solution:

The differences are as follows:

Mitosis	**Meiosis**
Occurs in somatic cells	Occurs in germ cells
The number of chromosomes stays the same as the parent cell	The number of chromosomes gets halved in comparison to parent cells.
Two daughter cells are formed	Four daughter cells are formed

Chromosomes replicate before each mitotic division	Chromosomes do not replicate before each meiotic division

12. What is the significance of meiosis?

Solution:

Significances of Meiosis:

- It conserves the specific chromosome numbers of each species achieved across generations.
- Enhances the genetic variability in the population of organisms from generation to generation. These variations are significant for the evolution process.
- It produces gametes for sexual reproduction
- Promotes crossing over. It introduces a new combination of variations or traits
- Chromosomal mutations can occur due to abnormalities during meiosis. A few of these can be beneficial to organisms.

13. Discuss with your teacher about

(i) haploid insects and lower plants where cell division occurs.

(ii) some haploid cells in higher plants where cell division does not occur.

Solution:

i) Haploid insects where cell division occurs are drones of the honey bee, and lower plants are Spirogyra, Chlamydomonous, and Pteridophytes. These haploid gametes are produced by them through mitosis and not meiosis.

ii) Spermatozoa and ova of higher animals and microspores of higher plants will not undergo cell division.

14. Can there be mitosis without DNA replication in the 'S' phase?

Solution:

During the S phase, DNA synthesis or replication of DNA takes place. DNA replication is essential for cell division.

Without DNA replication, cell division will not take place.

15. Can there be DNA replication without cell division?

Solution:

Yes, DNA replication can take place without cell division. In order to prepare for cell division, DNA replication is necessary. Cell division is the succeeding logical step that occurs post cell division.

16. Analyse the events during every stage of the cell cycle and notice how the following two parameters change

(i) the number of chromosomes (N) per cell

(ii) the amount of DNA content (C) per cell

Solution:

i) Yes, DNA replication can take place in the G1 phase of the cell cycle. The number of chromosomes remains the same, and each chromosome is formed from one chromatid. In the S phase, a chromosome is formed by two sister chromatids joined at the centromere. Similar conditions continue in the G2 phase, while in the M phase, sister chromatids separate and move to different cells. The number of chromosomes stays the same in mitosis.

ii) Amount of DNA content in the cell remains the same in the G_1 phase, but in the S phase, it doubles as the DNA replication takes place. It remains double in the G_2 phase but halved in the M phase of the cell cycle.