9. Find examples where the four daughter cells from meiosis are equal in size and where they are found unequal in size.
Solution: During formation of male gametes (i.e., spermatozoa) in a typical mammal (i.e., human being), the four daughter cells formed from meiosis are equal in size. On the other hand, during formation of female gamete (i.e., ovum) in a typical mammal (i.e., human being), the four daughter cells are unequal in size.

10. Can there be DNA replication without cell division?
Solution: Yes. Endomitosis is the multiplication of chromosomes present in a set in nucleus without karyokinesis and cytokinesis result-ing in numerous copies within each cell. It is of 2 types.
Polyteny: Here chromosomes divide and redivide without separation of chromatids so that such chromosomes become multistranded with many copies of DNA. Such polytene (many stranded) chromosomes remain in permanent prophase stage and do not undergo cell cycle e.g., polytene (salivary glands) chromosome of Drosophila has 512- 1024 chromatids. Here number of sets of chromosomes does not change.
Polyploidy (endoduplication) : Here all chromosomes in a set divide and its chromatids separate but nucleus does not divide. This results in an increase in number of sets of chromosomes in the nucleus (4x, 8x....). This increase in sets of chromosomes is called polyploidy. It can be induced by colchicine and granosan. These chromosomes are normal and undergo cell cycle.

11. List the main differences between mitosis and meiosis.
Solution:

	Mitosis	Meiosis
(i)	It occurs in all somatic cells and may continue throughout life.	It occurs in reproductive cells and at specific times.
(ii)	It involves a single division, resulting in two daughter cells only.	It involves two successive divisions, resulting in four daughter cells.
(iii)	Subsequent mitotic divisions are similar to the earlier ones.	Two meiotic divisions are dissimilar, first is reductional while the second is equational.
(iv)	Prophase is relatively short and simple.	Prophase I is very long and elaborate, comprising 5 subphases.
(v)	There is no pairing of homologous chromosomes.	Homologous chromosomes pair and often undergo crossing over in prophase I.
(vi)	Chromatids are genetically similar to chromosomes they arise from.	Chromatids may differ genetically from the chromosomes they arise from due to crossing over.
(vii)	No synaptonemal complex forms.	Synaptonemal complex forms between synapsed homologous chromosomes.
(viii)	Chromosomes do not unfold, and no transcription and protein synthesis occur in prophase.	Chromosomes unfold, and transcription and protein synthesis may occur in diplotene of prophase I (oocytes of certain animals).
(ix)	Daughter cells have diploid number (2N) of chromosomes like the parent cell.	Daughter cells have haploid number (N) of chromosomes unlike the parent cell.

12. Distinguish anaphase of mitosis from anaphase I of meiosis.
Solution: Anaphase of mitosis : It is the phase of shortest duration. APC (anaphase promoting complex) develops. It degenerates proteins -binding the two chromatids in the region of centromere. As a result, the centromere of each chromosome divides. This converts the two chromatids into daughter chromosomes each being attached to the spindle pole of its side by independent chromosomal fibre. The chromosomes move towards the spindle

poles with the centromeres projecting towards the poles and the limbs trailing behind. There is corresponding shortening of chromosome fibres. The two pole-ward moving chromosomes of each type remain attached to each other by interzonal fibres. Ultimately, two groups of chromosomes come to lie at the spindle poles.

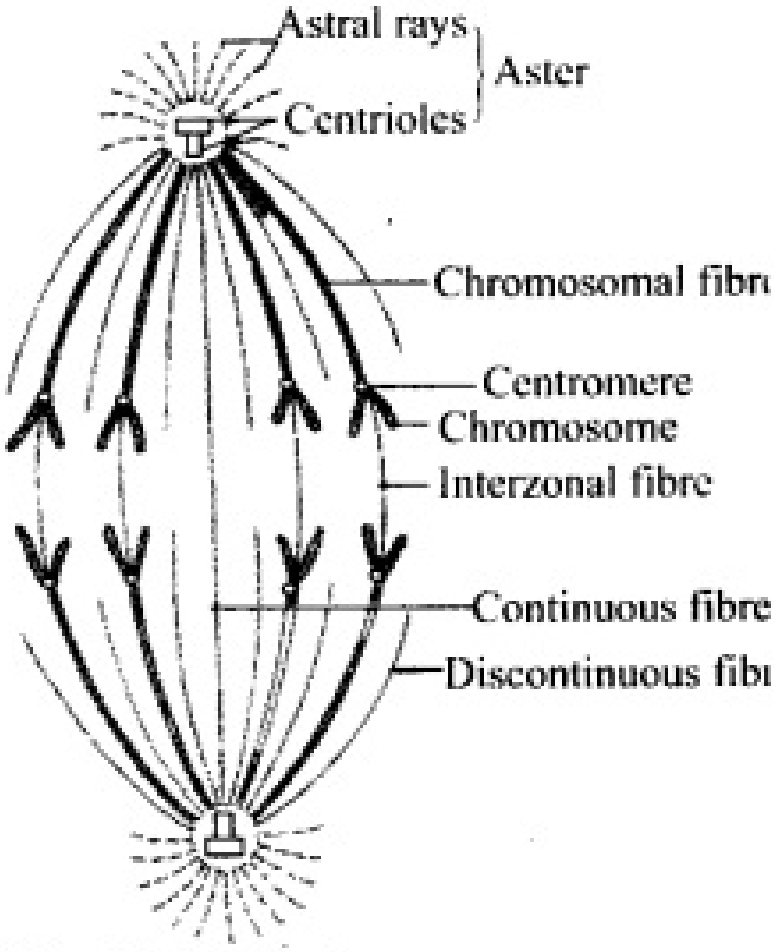

Fig.: Mitotic anaphase.

Anaphase I of meiosis: Chiasmata disappear completely and the homologous chromosomes separate. The process is called disjunction. The separated chromosomes (univalents) show divergent chromatids and are called dyads. They move towards the spindle poles and ultimately form two groups of haploid chromosomes.

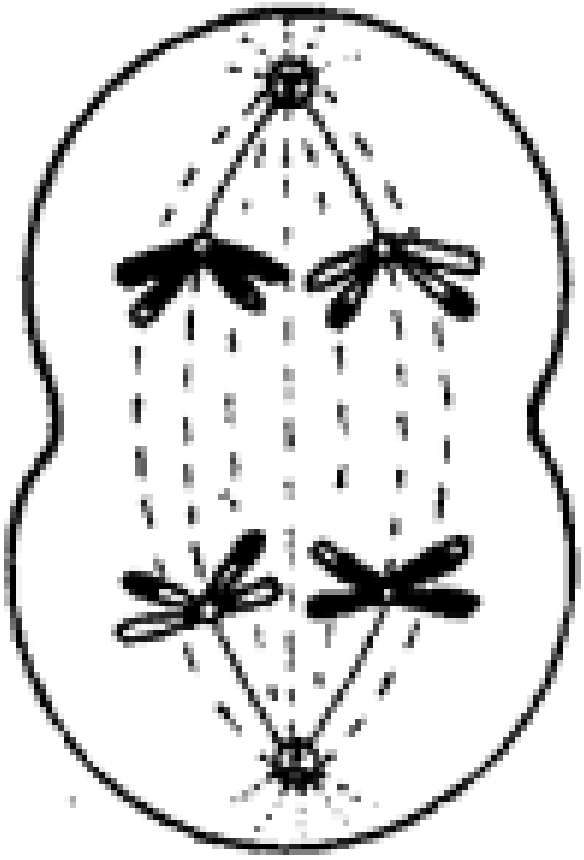

Fig.: Meiotic anaphase I

13. What is the significance of meiosis?
Solution: The significance of meiosis is given below:
(i) Formation of gametes - Meiosis forms gametes that are essential for sexual reproduction.
(ii) Genetic information - It switches on the genetic information for the development of gametes or gametophytes and switches off the sporophytic information. '
(iii) Maintenance of chromosome number - Meiosis maintains the fixed number of chromosomes in sexually reproducing organisms by halving the same. It is essential since the chromosome number becomes double after fertilisation.
(iv) Assortment of chromosomes - In meiosis paternal and maternal chromosomes assort independently. It causes reshuffling of chromosomes and the traits controlled by them. The variations help the breeders in improving the races of useful plants and animals.
(v) Crossing over - It introduces new combination of traits or variations.
(vi) Mutations - Chromosomal and genomic mutations can take place by irregularities of meiotic divisions. Some of these mutations are useful to the organism and are perpetuated by natural selection.
(vii) Evidence of basic relationship of organisms - Details of meiosis are essentially similar in the majority of organisms showing their basic similarity and relationship.

14. Discuss with your teacher about
(i) haploid insects and lower plants where cell division occurs, and
(ii) some haploid cells in higher plants where cell division does not occur.
Solution:
(i) Cell division occurs in haploid insect, such as drones of honey bee and lower plant like gametophyte of algae, bryophytes, and pteridophytes.

(ii) Synergids and antipodals in embryo sac of ovule are haploid cells where cell division does not occur.

15. Can there be mitosis without DNA replication in'S'phase?
Solution: No there cannot be any mitotic division without-DNA replication in 'S' phase.

16. Analyse the events during every stage of ceil cycle and notice how the following two parameters change.
(i) number of chromosomes (N) per cell
(ii) amount of DNA content (C) per cell
Solution: Number of chromosomes and amount of DNA change during S-phase and anaphase of cell cycle. S or synthesis phase marks the period during which DNA synthesis or replication takes place. During this time the amount of DNA per cell doubles. If the initial amount of DNA is denoted as 2C then it increases to 4C. However, there is no increase in the chromosome number; if the cell had diploid or 2N number of chromosomes at G„ even after S phase the number of chromosomes remains the same, i.e., 2N.
In mitotic anaphase, number of chromosomes remains the same. It is only sister chromatids which move towards their respective poles. DNA content remains unchanged. In anaphase I of meiosis, number of chromosomes are reduced to half, i.e., from 2N to IN and also DNA content decrease to one half i.e., from 4C to 2C. In anaphase II of meiosis II DNA content decreases to one half from 2C to 1C but chromosome number remain same.

********** END **********