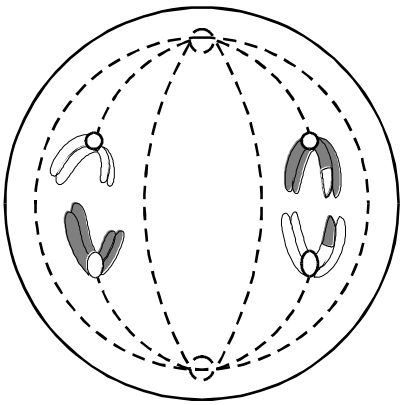
1. (a) When a cell divides, the genetic material can divide by mitosis, by meiosis or by neither of these processes. Complete the table with a tick to show the process by which you would expect the genetic material to divide in each of these examples.

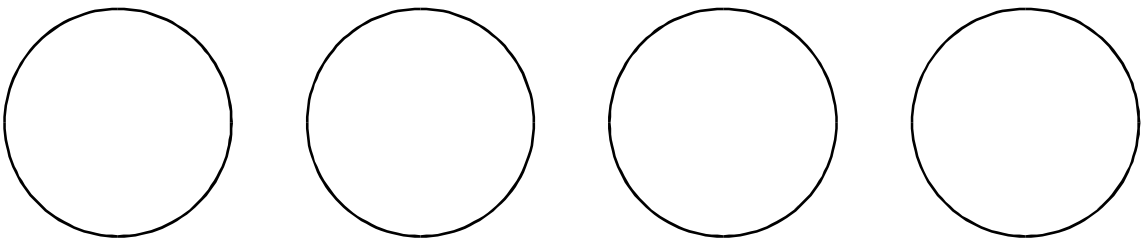
	mitosis	**meiosis**	**neither**
The division of plasmids in bacterial reproduction.			
The stage in the formation of male gametes in a plant in which haploid daughter cells are formed from a haploid parent cell.			
Cell division which takes place in the growth of a human testis between birth and five years of age.			
The stage in the lifecycle of a protoctistan in which a large number of genetically different spores are produced.			

(2)

(b) The diagram shows a cell during the first division of meiosis.



Complete the diagram below to show the appearance of the chromosomes in each of the four daughter cells formed at the end of the second division of meiosis.



(2)

(c) In an insect, 16 chromatids were visible in a cell at the start of the first division of meiosis. How many chromosomes would there be in a normal body cell from this insect?

.....

(1)

(Total 5 marks)

2. The table shows some statements about mitosis and the two divisions of meiosis. Put a tick in each box where the statement is true.

Statement	Mitosis	Meiosis I	Meiosis II
homologous chromosomes pair together			
centromeres divide and sister chromatids are pulled apart by spindle fibres			
homologous chromosomes are pulled apart by spindle fibres			
occurs in prokaryotic cells			

(Total 4 marks)

3. (a) The table contains descriptions of events that occur during meiosis.
Complete the table to show whether each event occurs during the first division (meiosis I) or during the second division (meiosis II). Also give the phase in which each event occurs.

Event	Division I or II	Phase (anaphase, metaphase, prophase or telophase)
1. The chromosomes, each in the form of a pair of chromatids, have arrived at the poles of the spindle and have started to uncoil.		
2. Homologous chromosomes form bivalents with chiasmata.		
3. Sister chromatids move towards opposite poles of the spindle.		
4. Pairs of homologous chromosomes line up at the equator of the spindle.		

(4)

(b) A cell during early prophase I of meiosis contained 12 picograms of DNA in the nucleus. How much DNA would be present in the nucleus of a gamete which was formed from this cell?

Answer ..... picograms

(1)

(Total 5 marks)

4. (a) Describe what happens to chromosomes in meiosis.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6)

(b) Meiosis results in genetic variation in the gametes which leads to variation in the offspring formed by sexual reproduction. Describe how meiosis causes this variation and explain the advantage of variation to the species.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(5)

(c) An old form of wheat, emmer wheat (*Triticum turgidum*), has a diploid chromosome number of 28 (2n = 28). A wild wheat, einkorn wheat (*Triticum tauschii*), has a diploid chromosome number of 14 (2n = 14). These two species occasionally crossed and produced sterile hybrid plants. Due to an error during cell division, one of these hybrid plants formed male and female gametes with 21 chromosomes. Fusion of these gametes resulted in viable offspring. These plants were a new species, *Triticum aestivum* (2n = 42), our modern bread wheat.

(i) How many chromosomes would there have been in each of the cells of the hybrid plant produced by crossing *Triticum turgidum* with *Triticum tauschii*?

.....

(1)

(ii) Explain why *Triticum aestivum* is fertile while the majority of hybrid plants were not.

.....

.....

.....

.....

.....

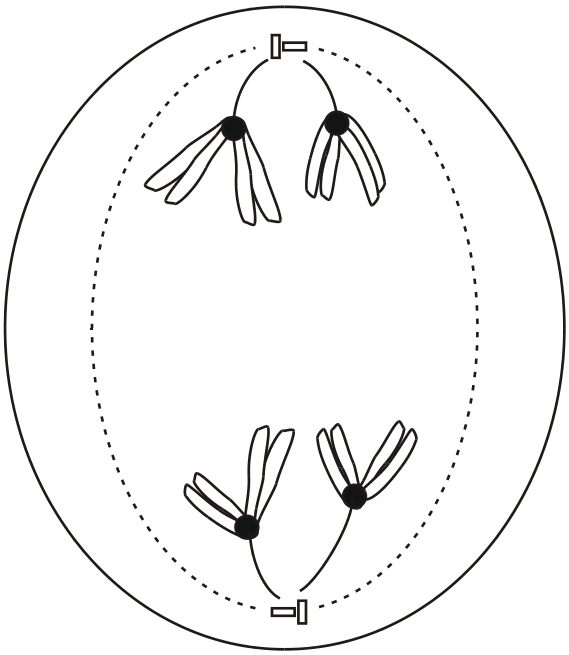
.....

.....

(3)

(Total 15 marks)

5. (a) The diagram shows a cell undergoing cell division.



Identify the type and stage of cell division shown. Give evidence from the diagram to support your answer.

.....

.....

.....

.....

.....

.....

(3)

(b) Describe how crossing over occurs during meiosis I.

.....

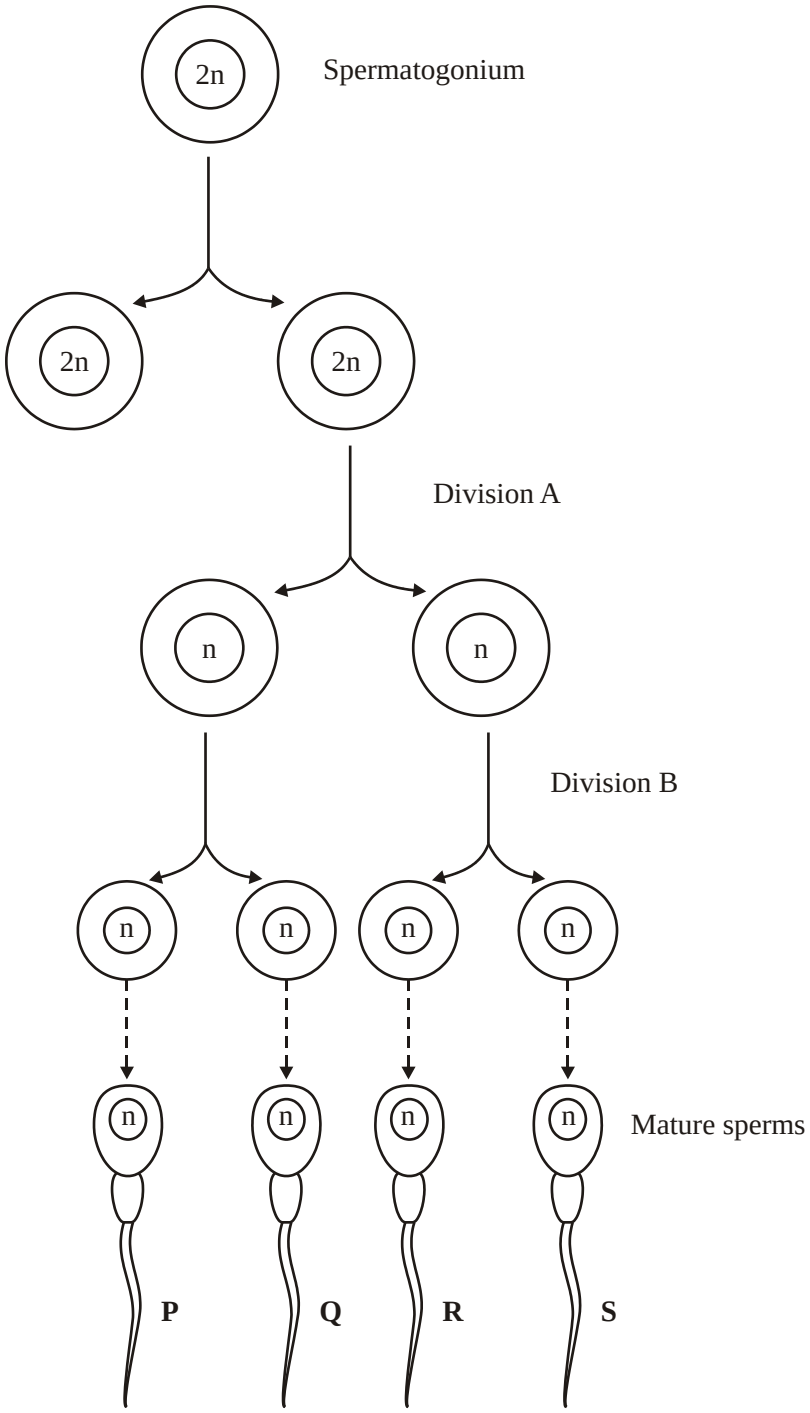
.....

.....

.....

(2)
(Total 5 marks)

6. The diagram shows the main stages in the formation of sperms in a human testis.



(a) Describe **two** ways, other than size, in which cells at anaphase of division **A** would differ from cells at anaphase in division **B**.

1 .....

.....

2 .....

.....

(2)

(b) Give **two** ways in which meiosis contributes to genetic variation in the mature sperms.

1 .....

.....

2 .....

.....

(2)
(Total 4 marks)