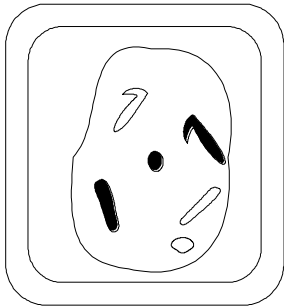


1. The diagram represents a plant cell in which the diploid number of chromosomes is six



(a) Draw a diagram to show

(i) this cell during anaphase of mitosis;

(2)

(ii) the chromosomes in a gamete produced from this cell by meiosis.

(1)

(b) Asexual reproduction involves only mitosis. Give **one** reason why offspring produced by asexual reproduction may vary in

(i) genotype;

.....

(1)

(ii) phenotype but not in genotype.

.....

(1)

(c) The formation of gametes during sexual reproduction involves meiosis. Give **two** ways in which meiosis results in genetic variation in the gametes produced.

1.

.....

2.

.....

(2)

(Total 7 marks)

2. (a) Use a genetic diagram to explain how equal numbers of male and female offspring are produced in humans.

(2)

(b) Explain why the sperms produced by a man are genetically different from each other.

.....

.....

.....

.....

(2)

(c) In honeybees the sex of the offspring is determined by the female parent, the queen. The queen honeybee mates early in her lifetime, and stores the sperm in her body for use during the rest of her life. She produces a female by fertilising an ovum as it passes the store of sperms. She produces a male by allowing an ovum to pass the store without releasing sperms onto it.

(i) Using this information, complete the table below to show which of the cells are haploid and which are diploid.

Female honeybee body cell	Diploid
Male honeybee body cell	
Honeybee ovum	
Honeybee sperm	

(2)

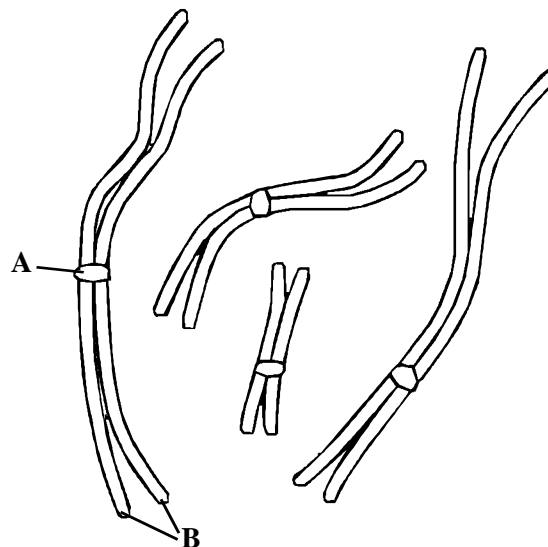
(ii) Explain why the sperms produced by a male honeybee are genetically identical to each other.

.....

(1)

(Total 7 marks)

3. The diagram shows the chromosomes in the nucleus of a plant cell at a certain stage of meiosis.



(a) (i) Name the structure labelled **A**. (1)

(ii) Describe the function of structure **A** during the separation of chromosomes.

.....
.....
.....

(1)

(b) Name the structures labelled **B**.

.....

(1)

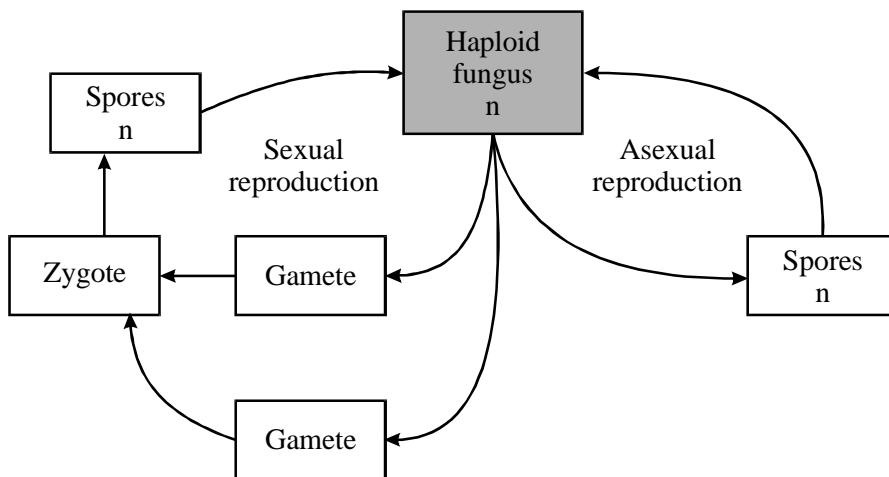
(c) Is the nucleus shown haploid or diploid? Explain your answer.

.....
.....
.....

(1)

(Total 4 marks)

4. The diagram shows the life cycle of a fungus. In favourable environmental conditions the fungus reproduces asexually but, when conditions worsen, sexual reproduction occurs. The advantage of sexual reproduction is that it introduces variation.



(i) On the diagram, mark with an **X** where meiosis occurs. (1)

(ii) Give **two** ways in which meiosis produces variation.

1

.....

2

.....

(2)

(iii) Suggest **one** advantage of sexual reproduction being stimulated by worsening environmental conditions.

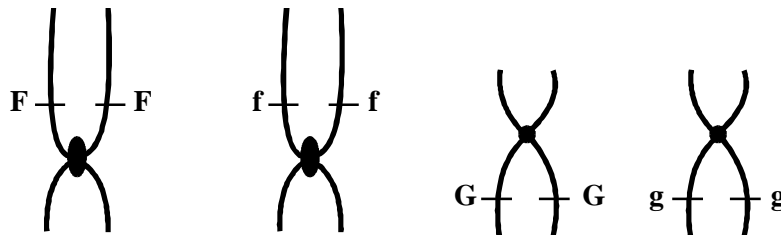
.....

.....

(1)

(Total 4 marks)

5. (a) The diagram shows the chromosomes in a cell at one stage of meiosis.



(i) What is the genotype of this cell?

.....

(1)

- (ii) Explain how there came to be two copies of each allele of each gene at this stage of meiosis.

.....

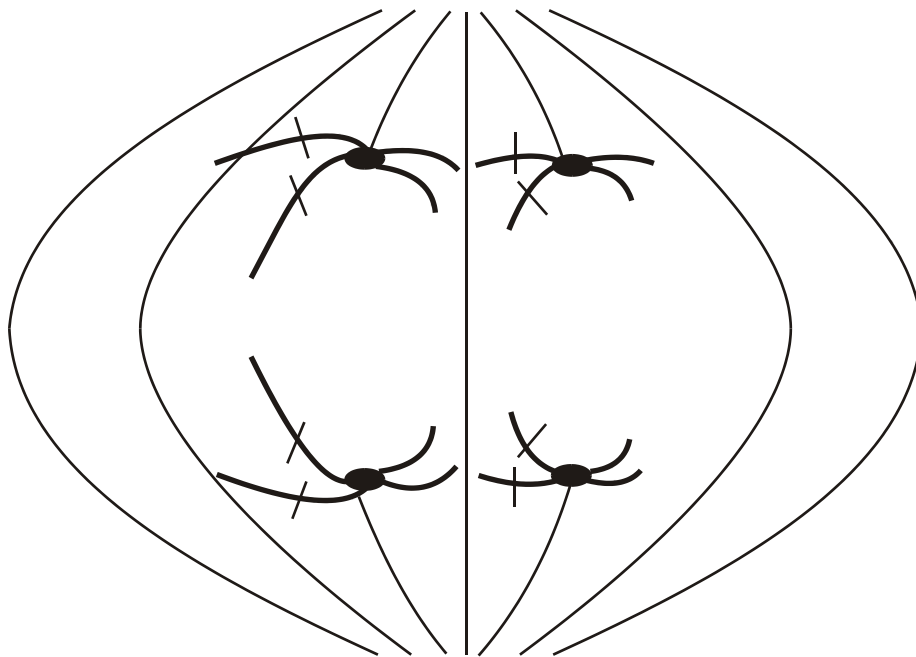
.....

.....

.....

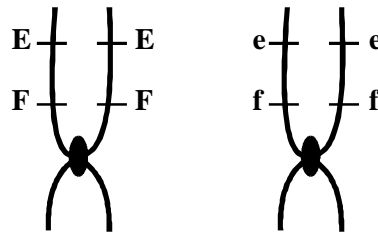
(2)

- (b) The diagram shows the same chromosomes on the spindle during meiosis. A gamete with the genotype **FG** was produced at the end of this meiotic division. Label the chromosomes to show the arrangement of the alleles that would lead to a gamete with the genotype **FG**.



(1)

(c) The chromosome carrying **F** also carries **E**, as shown in the diagram.



Most of the gametes formed in meiosis had **F** and **E** together and **f** and **e** together, as in the original chromosomes. A few gametes contained **F** and **e** together and **f** and **E** together. Draw diagrams to show how these new combinations of alleles were produced by crossing over.

(3)
(Total 7 marks)

6. **Figure 1** and **Figure 2** show the chromosomes from a single cell at different stages of meiosis.

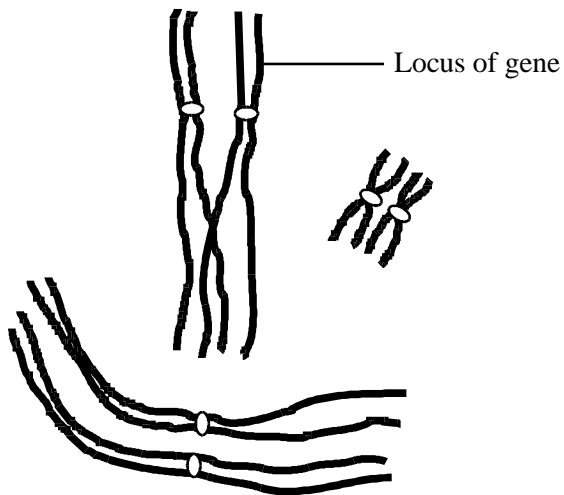


Figure 1

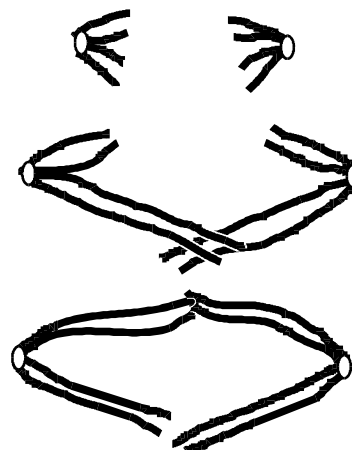


Figure 2

(a) What is the diploid number of chromosomes in the organism from which this cell was taken?

.....

(1)

(b) Describe what is happening to the chromosomes at the stage shown in

(i) **Figure 1;**

.....
.....
.....
.....

(2)

(ii) **Figure 2.**

.....
.....
.....
.....

(2)

(c) (i) The genotype of this organism is **Bb**. The locus of this pair of alleles is shown in **Figure 1**.

Label **two** chromosomes on **Figure 2** to show the location of the **B** allele and the location of the **b** allele.

(1)

- (ii) How many genetically different gametes can be produced by meiosis from a cell with the genotype, **Bb Cc Dd**? Assume these genes are located on different pairs of homologous chromosomes. Show your working.

.....

(2)

(Total 8 marks)

7. Two pairs of alleles **A** and **a**, and **B** and **b** are found on one pair of homologous chromosomes. A person has the genotype **AaBb**. **Figure 1** shows the chromosomes at an early stage of meiosis. The position of two of the alleles is shown.

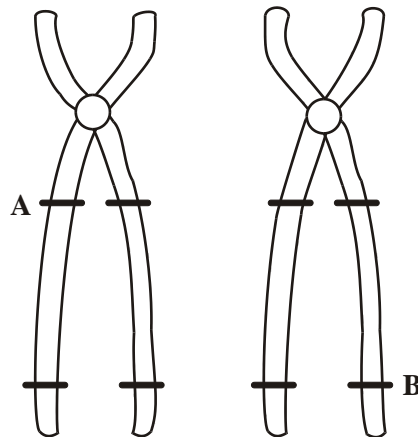


Figure 1

- (a) Complete **Figure 1** to show the alleles present at the other marked positions.

(1)

Crossing over occurs as shown in **Figure 2**.

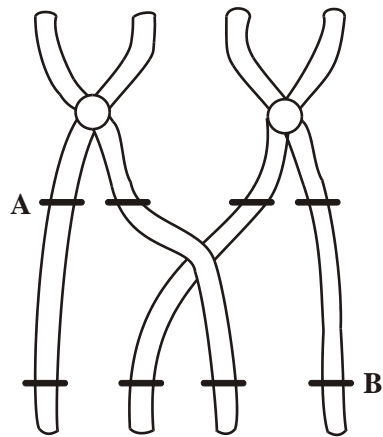


Figure 2

(b) What term is used to describe the pair of homologous chromosomes shown in **Figure 2**?

.....

(1)

(c) From **Figure 2**, give the genotypes of the gametes produced containing the chromatids

(i) that have **not** crossed over;

.....

(ii) that have crossed over.

.....

(2)

- (d) Give **two** processes, other than crossing over, which result in genetic variation. Explain how each process contributes to genetic variation.

Process

Explanation

.....

(2)

Process

Explanation

.....

(2)

(Total 8 marks)

8. (a) ABO blood groups in humans are an example of discontinuous variation, whereas height in humans is an example of continuous variation. Describe how discontinuous variation differs from continuous variation in terms of

- (i) genetic control;

.....

.....

- (ii) the effect of the environment;

.....

.....

- (iii) the range of phenotypes.

.....

.....

(3)

- (b) Genetically identical twins often show slight differences in their appearance at birth. Suggest **one** way in which these differences may have been caused.

.....
.....

(1)
(Total 4 marks)

9. IQ test scores have been used as a measure of intelligence. Genetic and environmental factors may both be involved in determining intelligence. In an investigation of families with adopted children, the mean IQ scores of the adopted children was closer to the mean IQ scores of their adoptive parents than to that of their biological parents.

- (a) Explain what the results of this investigation suggest about the importance of genetic and environmental factors in determining intelligence.

.....
.....

(1)

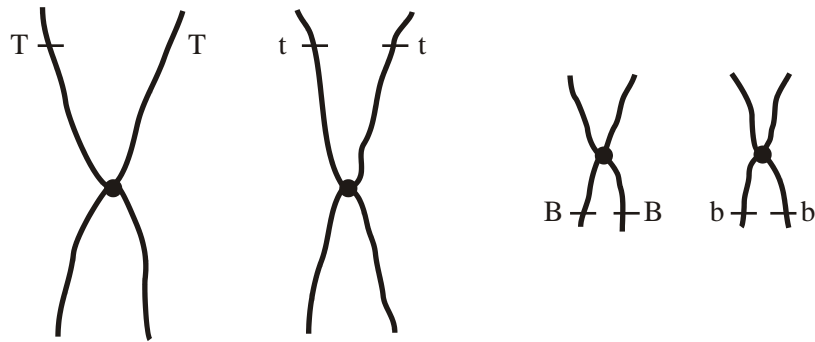
- (b) Explain how data from studies of identical twins and non-identical twins could provide further evidence about the genetic control of intelligence.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

(4)
(Total 5 marks)

10. (a) **Figure 1** shows two pairs of chromosomes from a plant cell. The letters represent alleles.

Figure 1



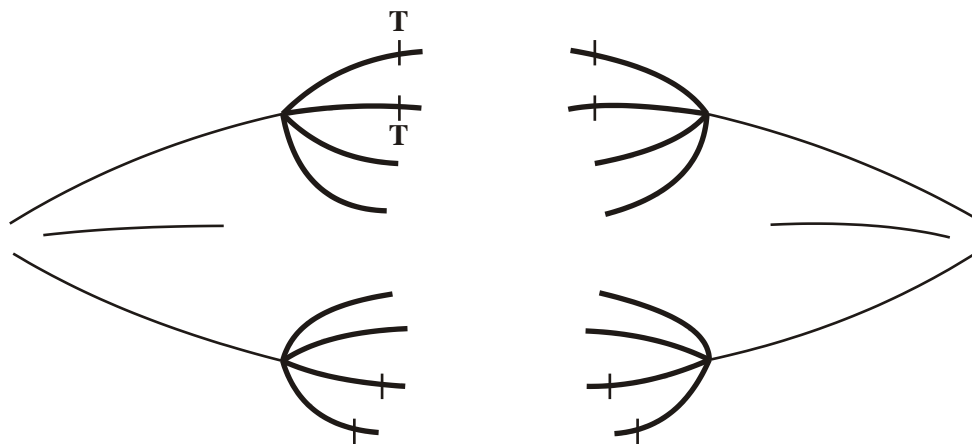
(i) Give all the different genotypes of the gametes which could be produced by this plant.

.....

(1)

(ii) **Figure 2** shows the same chromosomes on the spindle during meiosis. Complete the labelling of all the chromosomes to show the arrangement of the alleles that would result in the production of a gamete with the genotype **TB**.

Figure 2



(1)

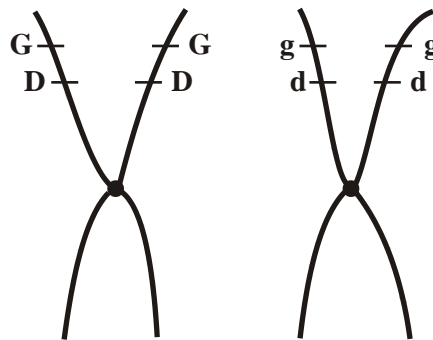
- (iii) One chromosome has two copies of allele **T**. What occurs during meiosis which results in only one copy of the allele **T** being present in a gamete?

.....

(1)

- (b) **Figure 3** shows another pair of chromosomes from the same plant cell. The table shows the numbers of gametes with each genotype produced by this plant.

Figure 3



Genotype of gametes	GD	gd	Gd	gD
Number of gametes	1096	1124	210	230

- (i) Describe what happens during meiosis, which results in the new combinations of alleles, **Gd** and **gD**.

.....

(3)

(ii) Suggest why there are fewer gametes with genotypes **Gd** and **gD** than **GD** and **gd**.

.....

.....

(1)

(Total 7 marks)