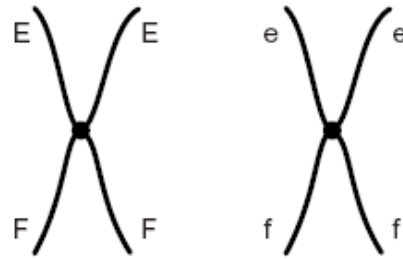


Q1. **Figure 1** shows a pair of chromosomes at the start of meiosis. The letters represent alleles.

Figure 1



(a) What is an allele?

.....

(1)

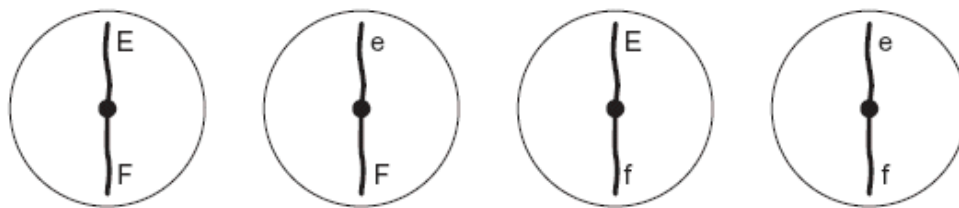
(b) Explain the appearance of one of the chromosomes in **Figure 1**.

.....

(2)

(c) The cell containing this pair of chromosomes divided by meiosis. **Figure 2** shows the distribution of chromosomes from this pair in four of the gametes produced.

Figure 2



(i) Some of the gametes formed during meiosis have new combinations of alleles.

Explain how the gametes with the combinations of alleles Ef and eF have been produced.

.....

(2)

- (ii) Only a few gametes have the new combination of alleles Ef and eF. Most gametes have the combination of alleles EF and ef. Suggest why only a few gametes have the new combination of alleles, Ef and eF.

.....

(1)

- (d) **Figure 3** shows a cell with six chromosomes.

Figure 3



- (i) This cell produces gametes by meiosis. Draw a diagram to show the chromosomes in one of the gametes.

(2)

- (ii) How many different types of gametes could be produced from this cell as a result of different combinations of maternal and paternal chromosomes?

(1)

(Total 9 marks)

Q2. The diagram shows a short sequence of DNA bases.

TTTGTATACTAGTCTACTTCGTTAATA

- (a) (i) What is the maximum number of amino acids for which this sequence of DNA bases could code?

(1)

(ii) The number of amino acids coded for could be fewer than your answer to part (a)(i).

Give **one** reason why.

.....
.....

(1)

(b) Explain how a change in the DNA base sequence for a protein may result in a change in the structure of the protein.

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

(Extra space)

.....
.....

(3)

(c) A piece of DNA consisted of 74 base pairs. The two strands of the DNA, strands **A** and **B**, were analysed to find the **number** of bases of each type that were present. Some of the results are shown in the table.

	Number of bases			
	C	G	A	T
Strand A	26			
Strand B	19		9	

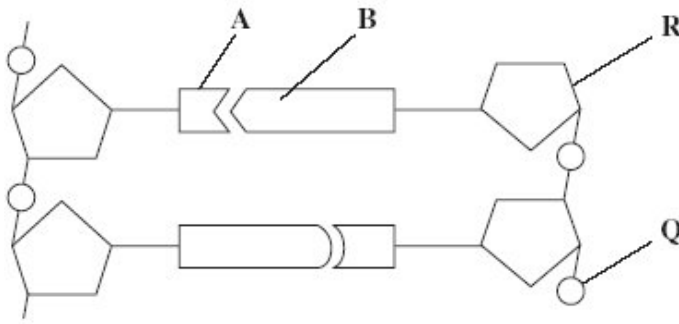
Complete the table by writing in the missing values.

(2)

(Total 7 marks)

Q3. Figure 1 shows a short section of a DNA molecule.

Figure 1



(a) Name parts **R** and **Q**.

(i) **R**

(ii) **Q**

(2)

(b) Name the bonds that join **A** and **B**.

.....

(1)

(c) Ribonuclease is an enzyme. It is 127 amino acids long.

What is the minimum number of DNA bases needed to code for ribonuclease?

(1)

- (d) **Figure 2** shows the sequence of DNA bases coding for seven amino acids in the enzyme ribonuclease.

Figure 2

G T T T A C T A C T C T T C T T C T T T A

The number of each type of amino acid coded for by this sequence of DNA bases is shown in the table.

Amino acid	Number present
Arg	3
Met	2
Gln	1
Asn	1

Use the table and **Figure 2** to work out the sequence of amino acids in this part of the enzyme. Write your answer in the boxes below.

Gln						
-----	--	--	--	--	--	--

(1)

- (e) Explain how a change in a sequence of DNA bases could result in a non-functional enzyme.

.....

.....

.....

.....

.....

.....

(3)

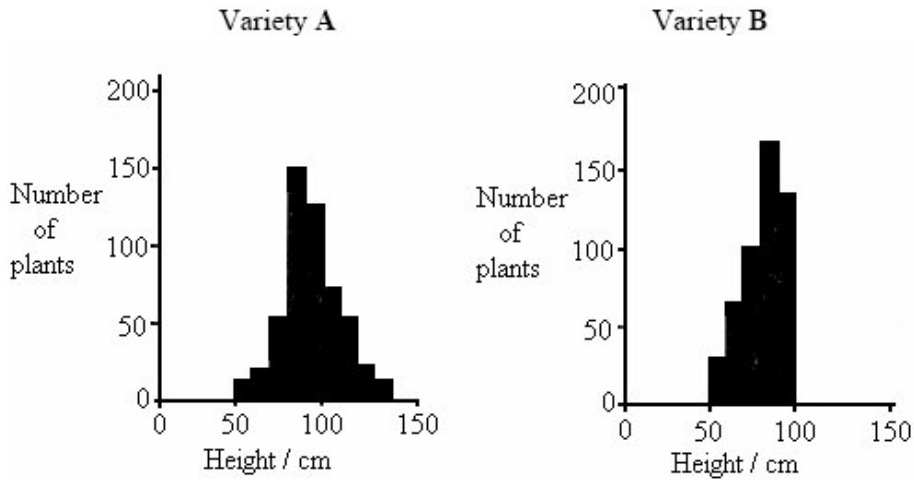
(Total 8 marks)

Q4. (a) Meiosis results in variation between individuals within a population. Describe and explain one way the production of gametes by meiosis contributes to this variation.

.....

(2)

(b) **A** and **B** are varieties of wheat. Scientists grew both varieties in identical conditions and measured the heights of the fully grown plants. The results are shown in the diagram.



(i) Describe **two** ways in which the results for variety **A** differ from the results for variety **B**.

1

 2

(2)

(ii) Suggest the advantage to a farmer of growing variety **B** rather than variety **A**.

.....

(2)

- (c) The effect of global warming on the environment is uncertain. It is important to keep seeds of the old varieties. Suggest why.

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

(2)
(Total 8 marks)

Q5. A student investigated the stages of mitosis in a garlic root. The root tip was placed on a microscope slide with a stain. A cover slip was placed on top and the root tip was firmly squashed.

- (a) Explain why

- (i) a root tip was used;

.....
.....

(1)

- (ii) a stain was used;

.....
.....

(1)

- (iii) the root tip was firmly squashed.

.....
.....

(1)

- (b) The student examined the cells in the garlic root tip under the microscope, and obtained the following data.

Stage	Number of cells
Interphase	872
Prophase	74
Metaphase	18
Anaphase	10
Telophase	8

- (i) Calculate the percentage of these cells in which the chromosomes are visible and would consist of a pair of chromatids joined together. Show your working.

Answer

(2)

- (ii) A different set of results was obtained when the count was repeated on another occasion with a different garlic root tip. Give **two** reasons for the difference in results.

1

.....

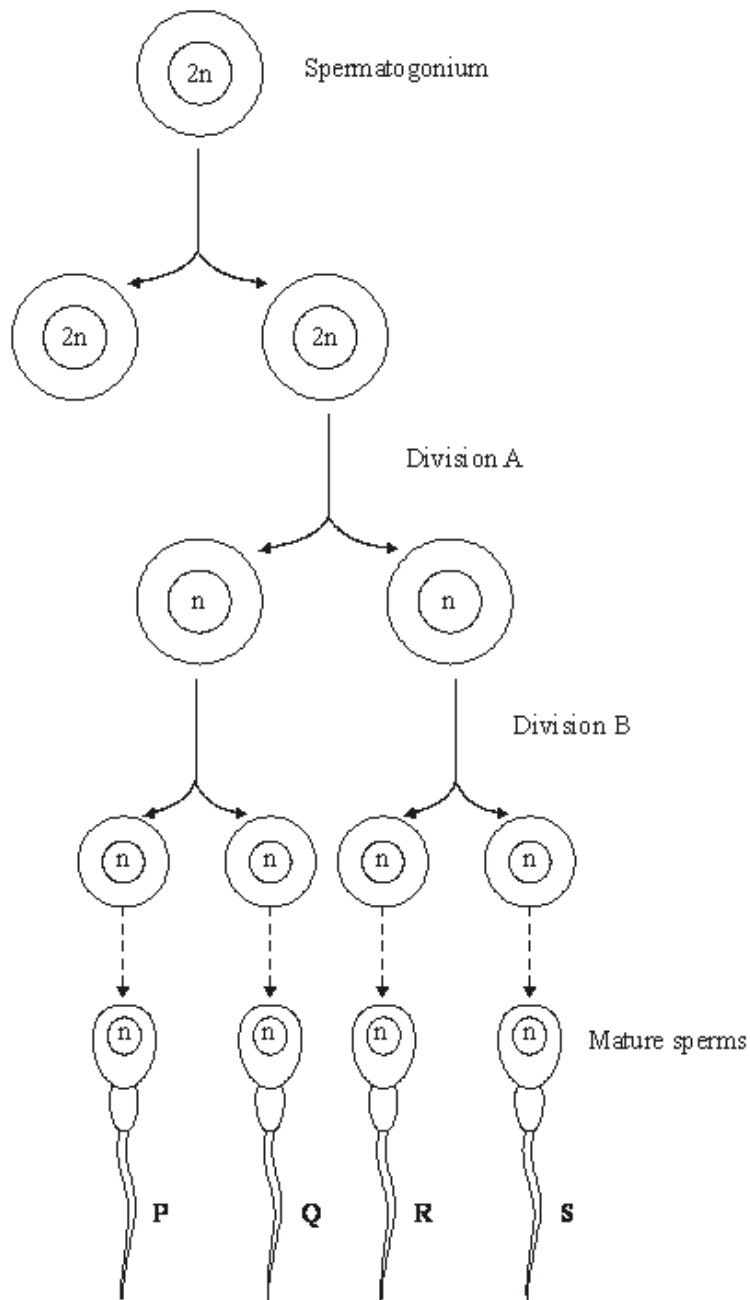
2

.....

(2)

(Total 7 marks)

Q6. 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

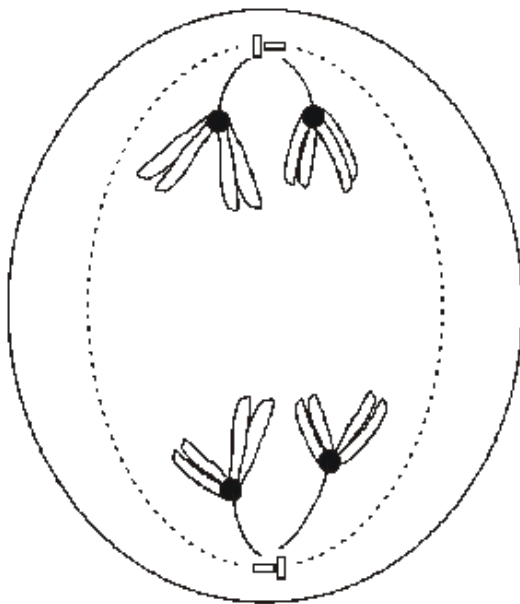
.....

2

.....

(2)
(Total 4 marks)

Q7. (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.

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

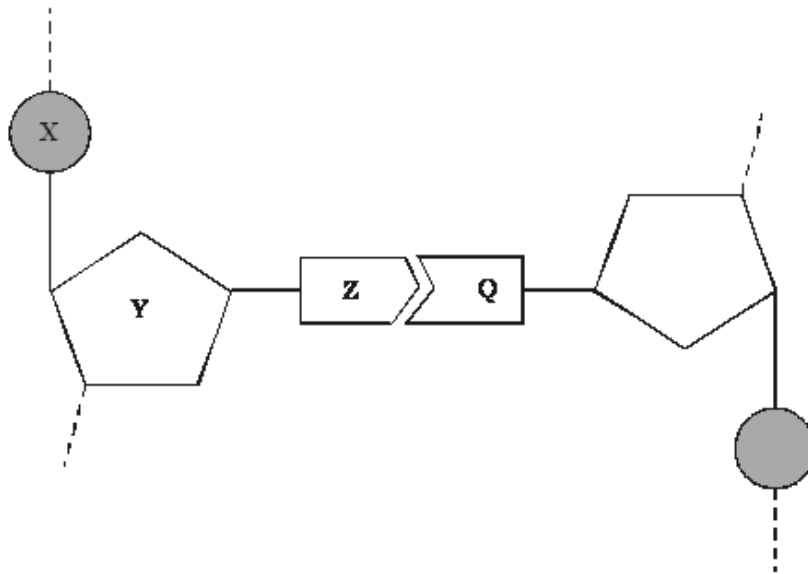
(3)

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

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

(2)
(Total 5 marks)

Q8. The diagram shows one nucleotide pair of a DNA molecule.



(a) Name the parts of the nucleotide labelled **X**, **Y** and **Z**.

X

Y

Z

(3)

(b) What type of bond holds **Z** and **Q** together?

.....

(1)

- (c) A sample of DNA was analysed. 28% of the nucleotides contained thymine. Calculate the percentage of nucleotides which contained cytosine. Show your working.

Answer %

(2)
(Total 6 marks)

Q9. Division of the nucleus by meiosis produces haploid cells from a diploid cell. Nuclei produced by mitosis have the same number of chromosomes as the parent nucleus.

- (a) What is the biological importance of reducing the chromosome number when the cell divides by meiosis?

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

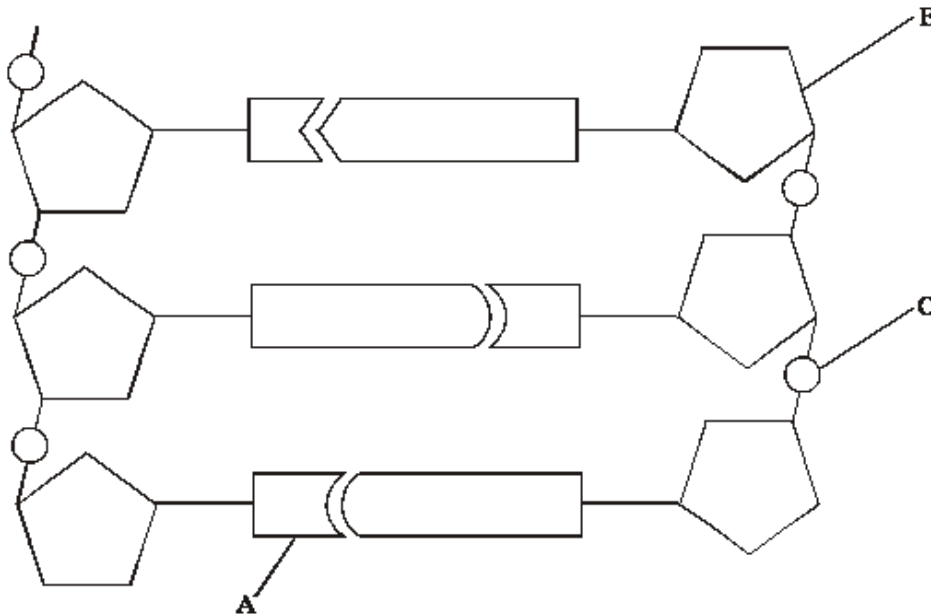
(2)

- (b) The table gives one difference between meiosis and mitosis. Complete the table by giving **three** further differences.

	Meiosis	Mitosis
1	Reduces the chromosome number	Maintains the same chromosome number as in the parent nucleus
2		
3		
4		

(3)
(Total 5 marks)

- Q10.** The diagram shows a short section of a DNA molecule.



- (a) On the diagram draw a box round **one** nucleotide.

(1)

(b) Use the letters in the diagram to indicate a part of the molecule which

(i) is **not** a base and is different in an RNA molecule;

.....

(ii) contains nitrogen.

.....

(2)

(c) (i) The sequence of bases on one strand of DNA is important for protein synthesis. What is its role?

.....

.....

(1)

(ii) How are the two strands of the DNA molecule held together?

.....

(1)

(iii) Give **one** advantage of DNA molecules having two strands.

.....

.....

(1)

(Total 6 marks)

