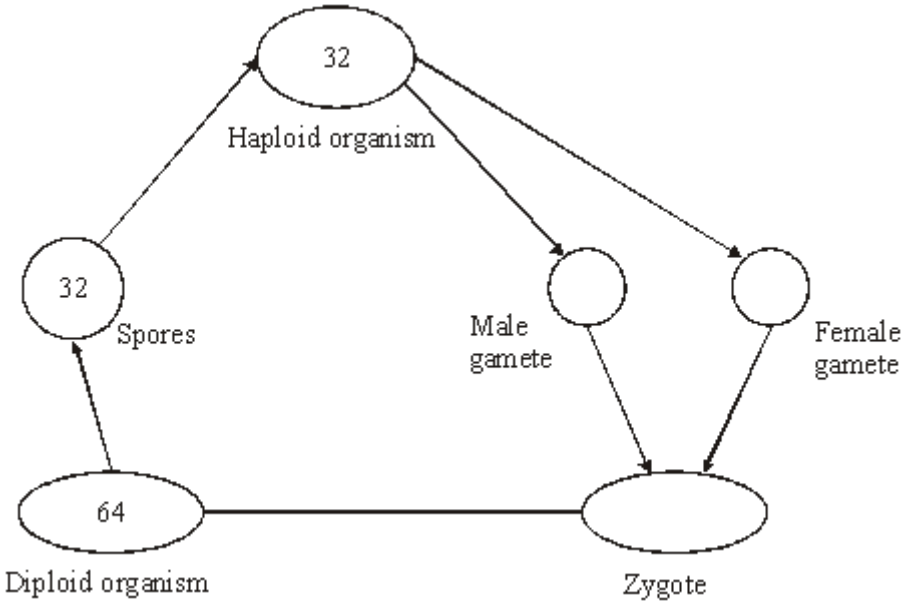
4.3 GENETIC DIVERSITY VIA MUTATION AND MEIOSIS (2) - QUESTIONS

Q1. (a) Complete the table to describe some of the events during the cell cycle.

Stage of cell cycle	Main event which takes place
Metaphase	
	Chromosomes coil and shorten
	Daughter chromosomes move to poles of the cell
S-phase	
	Nuclear envelope re-forms

(5)

(b) The diagram shows the life cycle of an organism. The numbers show how many chromosomes are present in one cell at each stage of the life cycle.



(i) Name the type of cell division that must be involved in producing the spores.

_____

(1)

(ii) How many chromosomes are there in a male gamete from this organism?

_____ **(1)**

(Total 7 marks)

Q2. (a) Meiosis results in cells that have the haploid number of chromosomes and show genetic variation. Explain how.

(6)

(b) In mice, two genes affecting coat colour are on different chromosomes.
One gene controls whether there is any black pigment in the hairs. The dominant allele of this gene, **B**, results in black fur. The recessive allele, **b**, results in white fur. The second gene controls banding of the fur. The dominant allele, **A**, causes a yellow band to develop on each hair. The resulting coat colour is called agouti. The recessive allele, **a**, results in hairs with no bands on them. This gene has no effect on mice with white fur; white mice do not develop bands, even if they have the **A** allele.

Breeders performed many crosses in which agouti mice were crossed with white mice, homozygous for both genes. They expected agouti, black and white mice in the offspring in a 1 : 1 : 2 ratio.

(i) Complete the genetic diagram to show how this ratio of phenotypes would be produced.

Parental phenotypes	Agouti	White
Parental genotypes		
Gamete genotypes		
Offspring genotypes		
Offspring phenotypes		

(4)

(ii) The actual numbers of offspring with each phenotype were

Agouti	34
Black	35
White	51

The x^2 test can be used to test the hypothesis that there is no significant difference between

these results and the expected 1 : 1 : 2 ratio. Complete the table to calculate the value of x^2 for these results.

Colour of offspring	Observed (O)	Expected (E)	(O - E)	$(O - E)^2$	$\frac{(O-E)^2}{E}$
Agouti	34				
Black	35				
White	51				
			$\sum \frac{(O-E)^2}{E}$ =		

(2)

(iii) The table shows values for x^2 at different levels of probability and for different degrees of freedom.

Degrees of freedom	Probability, p				
	0.2	**0.1**	**0.05**	**0.02**	**0.01**
1	1.64	2.71	3.84	5.41	6.64
2	3.22	4.61	5.99	7.82	9.21
3	4.64	6.25	7.82	9.84	11.35
4	5.99	7.78	9.49	11.67	13.28
5	7.29	9.24	11.07	13.39	15.09

What should the breeders conclude about the significance of their results? Explain your answer.

_____

_____

_____

_____

_____

_____ **(3)**

(Total 15 marks)

Q3. (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)

Q4. 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)

Q5. (a) The number of patients infected with the bacterium MRSA has increased in some hospitals. Scientists have suggested ways to reduce the transmission of MRSA in hospitals. Suggest **two** ways to reduce the transmission of MRSA in hospitals.

1. _____

_____

2. _____

_____

(2)

(b) The minimum inhibitory concentration (MIC) is the lowest concentration of a substance that prevents the growth of a microorganism.

When antibiotics are prescribed for treating patients, higher doses than the MIC are recommended. Suggest **two** reasons why.

1. _____

_____

2. _____

_____

(2)

Scientists tested a new group of drugs for their effectiveness against four species of bacteria. The scientists used MICs to compare the effectiveness of four drugs. The results are shown in the table.

	Minimum inhibitory concentration / μg cm^{-3}			
Drug	*Escherichia coli*	*Staphylococcus aureus*	*Enterococcus faecalis*	*Pseudomonas aeruginosa*
P	0.39	0.049	0.049	3.13
Q	1.54	0.049	0.195	3.13
R	0.39	0.049	0.195	1.56
S	1.56	0.098	0.390	12.50

(c) Which of the four drugs is

(i) most effective against *Enterococcus faecalis*?

☐

(1)

(ii) least effective against all the species of bacteria used?

(1)

(d) The effectiveness of these drugs was tested in double-blind trials using human volunteers. In a double-blind trial neither the volunteers nor the scientists know which treatment a particular volunteer is receiving.

(i) Suggest **two** ways in which a double-blind trial improves reliability.

1. _____

_____

2. _____

_____

(2)

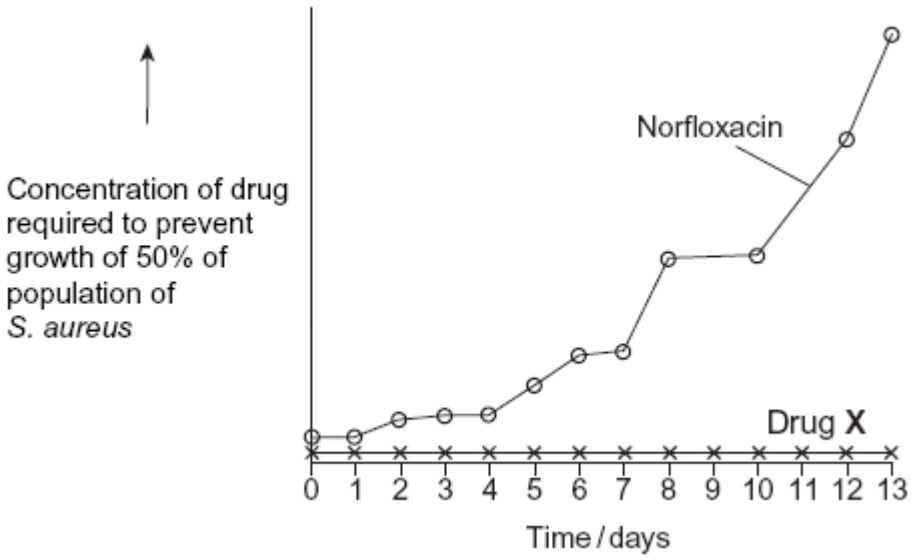
(ii) Suggest **two** factors the scientists should have considered when selecting adult volunteers for this trial.

1. _____

2. _____

(2)

(e) Scientists investigated resistance of the bacterium, *S. aureus* to the antibiotic Norfloxacin. They grew the bacteria in a medium containing a low concentration of Norfloxacin. The concentration of Norfloxacin that they added killed some of the bacteria. It did not kill all of them. Every 24 hours, they removed a sample of the bacteria from the culture. They tested the sample to find the concentration of Norfloxacin that prevented the growth of 50 % of the bacteria in the sample.
The scientists then used the same method to investigate the resistance of *S. aureus* to a new drug, drug **X**. The results of both investigations are shown in the graph.



Describe the results obtained with Norfloxacin.

_____

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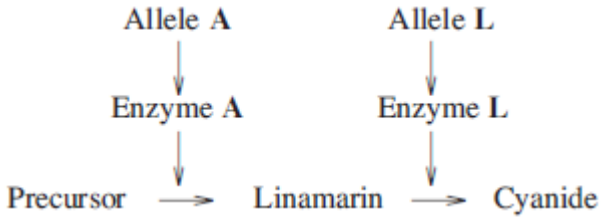
(1)

(Total 11 marks)

Q6. Cyanide is a poisonous substance. Cyanogenic clover plants produce cyanide when their tissues are damaged. The ability to produce cyanide is controlled by genes at loci on two different chromosomes. The dominant allele, **A**, of one gene controls the production of an enzyme which converts a precursor to linamarin. The dominant allele, **L**, of the second gene controls the production of an enzyme which converts linamarin to cyanide. This is summarised in the diagram.



(a) Acyanogenic clover plants cannot produce cyanide. Explain why a plant with the genotype **aaLl** cannot produce cyanide.

_____

_____

(1)

(b) A clover plant has the genotype **AaLl**.

(i) Give the genotypes of the male gametes which this plant can produce.

_____

(1)

(ii) Explain how meiosis results in this plant producing gametes with these genotypes.

_____

_____

_____

_____

(2)

(c) Two plants, heterozygous for both of these pairs of alleles, were crossed. What proportion of the plants produced from this cross would you expect to be acyanogenic but able to produce linamarin? Use a genetic diagram to explain your answer.

(3)

In an investigation, cyanogenic and acyanogenic plants were grown together in pots. Slugs were placed in each pot and records were kept of the number of leaves damaged by the feeding of the slugs over a period of 7 days. The results are shown in **Table 1**.

Table 1

	Undamaged	**Damaged**
Cyanogenic plants	160	120
Acyanogenic plants	88	192

(d) A x^2 test was carried out on the results.

(i) Suggest the null hypothesis that was tested.

_____

_____

(1)

(ii) x^2 was calculated. When this value was looked up in a table, it was found to correspond to a probability of less than 0.05. What conclusion can you draw from this?

_____

_____

_____

_____

_____

_____

(3)

A second investigation was carried out in a field of grass which had been undisturbed for many years. **Table 2** shows the population density of slugs and the numbers of cyanogenic and acyanogenic clover plants at various places in the field.

Table 2

Population density of slugs	**Number of acyanogenic clover plants per m²**	**Number of cyanogenic clover plants per m²**
Very low	26	10

Low	17	26
High	0	10
Very high	0	5

(e) Explain the proportions of the two types of clover plant in different parts of the field.

_____

_____

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_____

_____

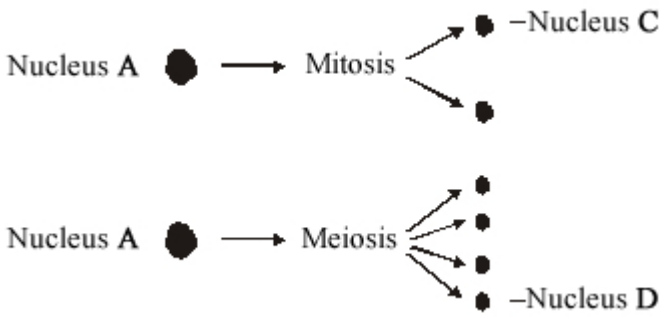
(Extra space) _____

_____

(4)

(Total 15 marks)

Q7. (a) Nucleus **A** and nucleus **B** come from the same organism. The diagram shows these nuclei immediately before division and the nuclei formed immediately after their division. The table gives information about some of the nuclei shown in the diagram.



Nucleus	Number of chromosomes	Mass of DNA / arbitrary units
A	8	600
B	8	600
C		

D		

Complete the table for nuclei **C** and **D**.

(2)

(b) A student investigated the process of meiosis by observing cells on a microscope slide. The cells on the slide had been stained.

(i) Name an organ from which the cells may have been obtained.

_____ **(1)**

(ii) Explain why a stain was used.

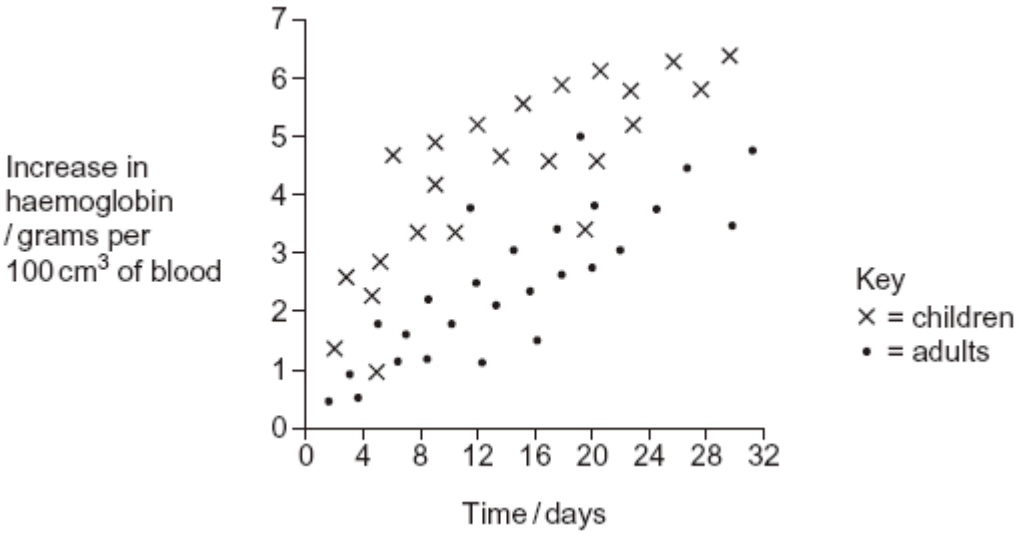
_____

_____ **(1)**

(Total 4 marks)

Q8. (a) Haemoglobin contains iron. One type of anaemia is caused by a lack of iron. This type of anaemia can be treated by taking tablets containing iron. A number of patients were given a daily dose of 120 mg of iron. **Figure 1** shows the effect of this treatment on the increase in the concentration of haemoglobin in their red blood cells.

Figure 1



(i) Give **one** difference in the response of adults and children to this treatment.

_____

_____ **(1)**

(ii) You could use the graph to predict the effect of this treatment on the increase in haemoglobin content of an adult after 40 days. Explain how.

_____

_____

_____

_____ **(2)**

(iii) Haemoglobin has a quaternary structure. Explain what is meant by a quaternary structure.

_____

_____ **(1)**

(b) (i) Pernicious anaemia is another type of anaemia. One method of identifying pernicious anaemia is to measure the diameter of the red blood cells in a sample of blood that has been diluted with an isotonic salt solution. Explain why an isotonic salt solution is used to dilute the blood sample.

_____

_____

_____

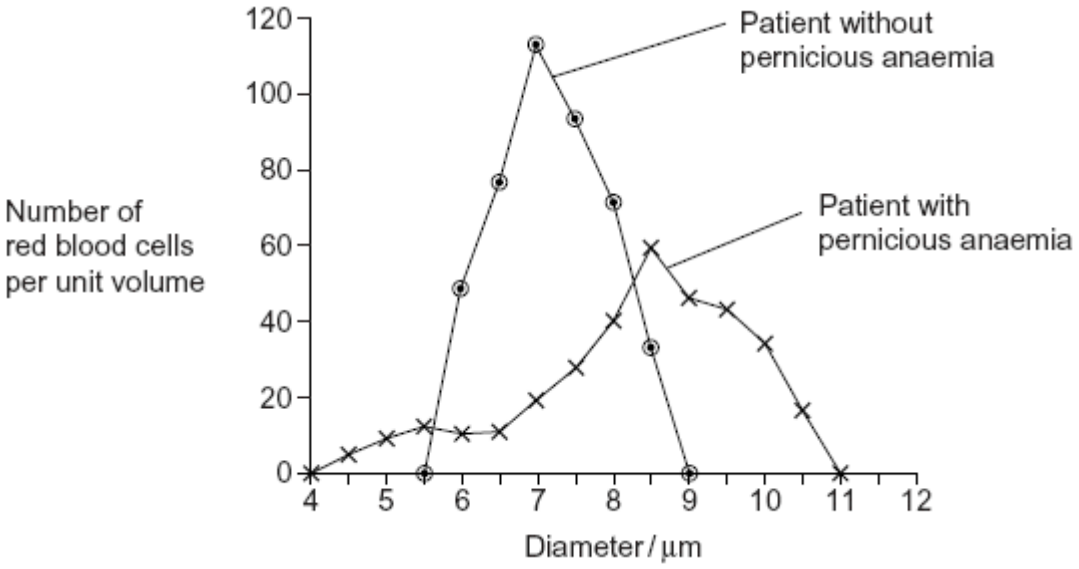
_____

_____

_____ **(3)**

(ii) A technician compared the red blood cells in two blood samples of equal volume. One sample was from a patient with pernicious anaemia, the other was from a patient who did not have pernicious anaemia. **Figure 2** shows some of the results she obtained.

Figure 2



Describe **two** differences between the blood samples.

1. _____

_____

2. _____

_____ **(2)**

(Total 9 marks)

Q9. Finches are small birds. Fourteen species of finch are found on the Galapagos Islands.

(a) What is a species?

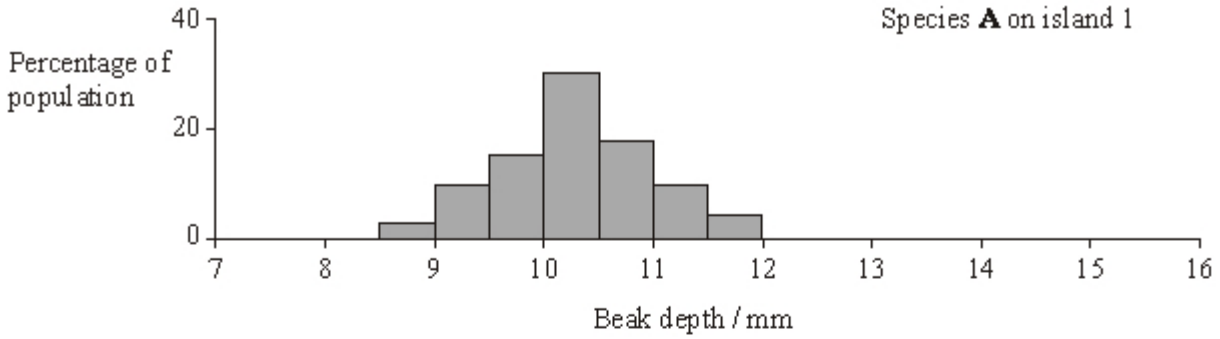
_____

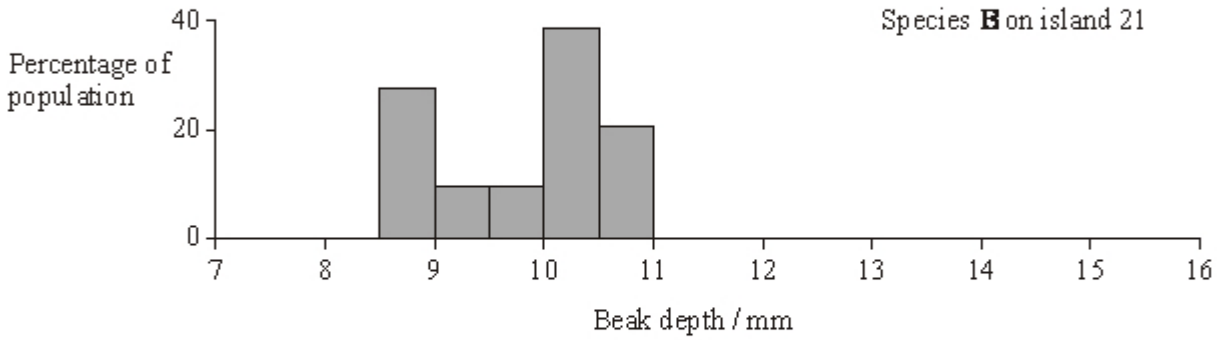
_____

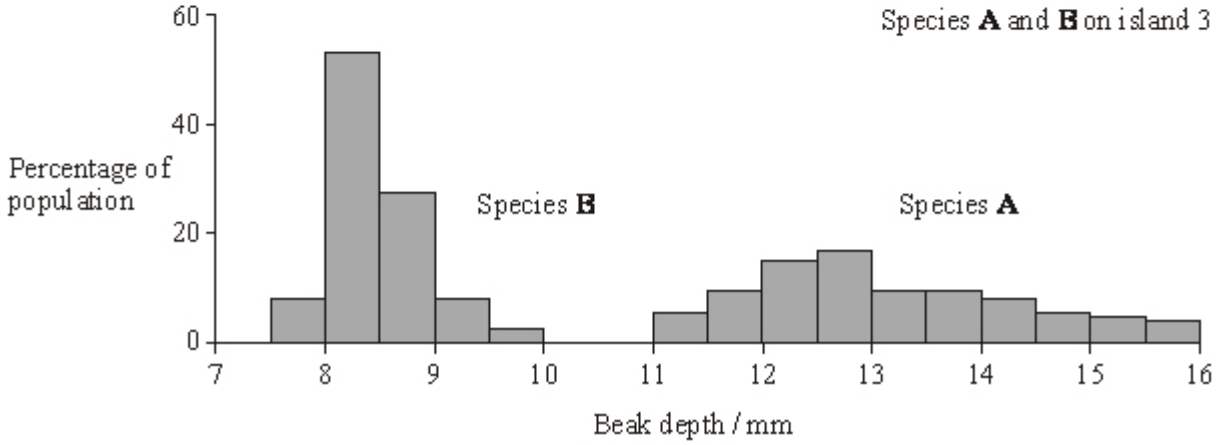
_____

_____ **(2)**

(b) Measurements were made of the beak depth of two species of finch (species **A** and species **B**) on different islands. Species **A** is found on island 1, species **B** is found on island 2. Both species are found on island 3. They are thought to have colonised island 3 from islands 1 and 2 respectively. The graphs show the ranges of beak depths of the two species on the different islands.







What type of natural selection took place in the populations of both species after they had colonised island 3? Explain your answer.

_____

_____

_____

_____

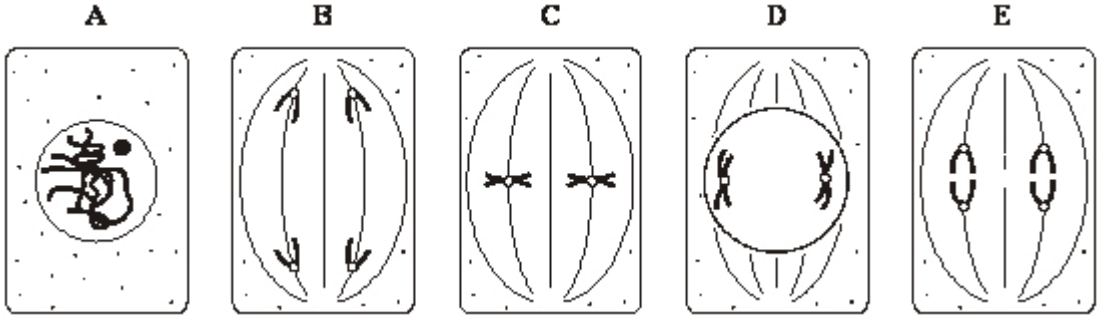
_____ **(3)**

(Total 5 marks)

Q10. (a) In which phase of the cell cycle does DNA replication take place?

_____ **(1)**

(b) The diagrams show five stages of mitosis.



List the stages **A** to **E** in the correct sequence, beginning with the earliest stage.

_____ _____ _____ _____ _____

(1)

(c) Describe the role of the spindle during mitosis.

_____

_____

_____

_____

(2)

(d) Meiosis also occurs during the life cycle of organisms. What is the importance of meiosis?

_____

_____

_____

_____

(2)

(Total 6 marks)

Q11. There is evidence that the first photosynthetic organisms were primitive water-dwelling bacteria. The very first of these lived near the surface of the water in lakes and contained a purple pigment that absorbed light most strongly in the green region of the spectrum. Later, other bacteria evolved that lived on the top of sediment at the bottom of the lakes (**Figure 1**). Gene mutations had enabled these bacteria to synthesise chlorophyll instead of the purple pigment present in the bacteria living near to the surface. Chlorophyll absorbs light most strongly in the blue and red regions of the spectrum (**Figure 2**).

Figure 1

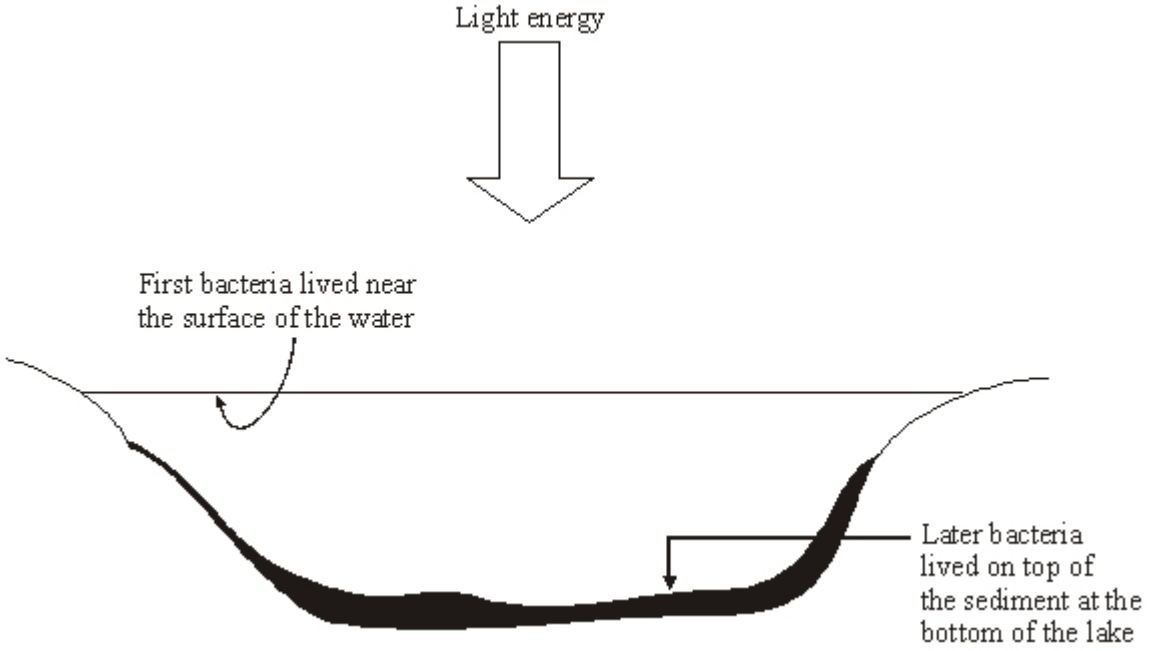
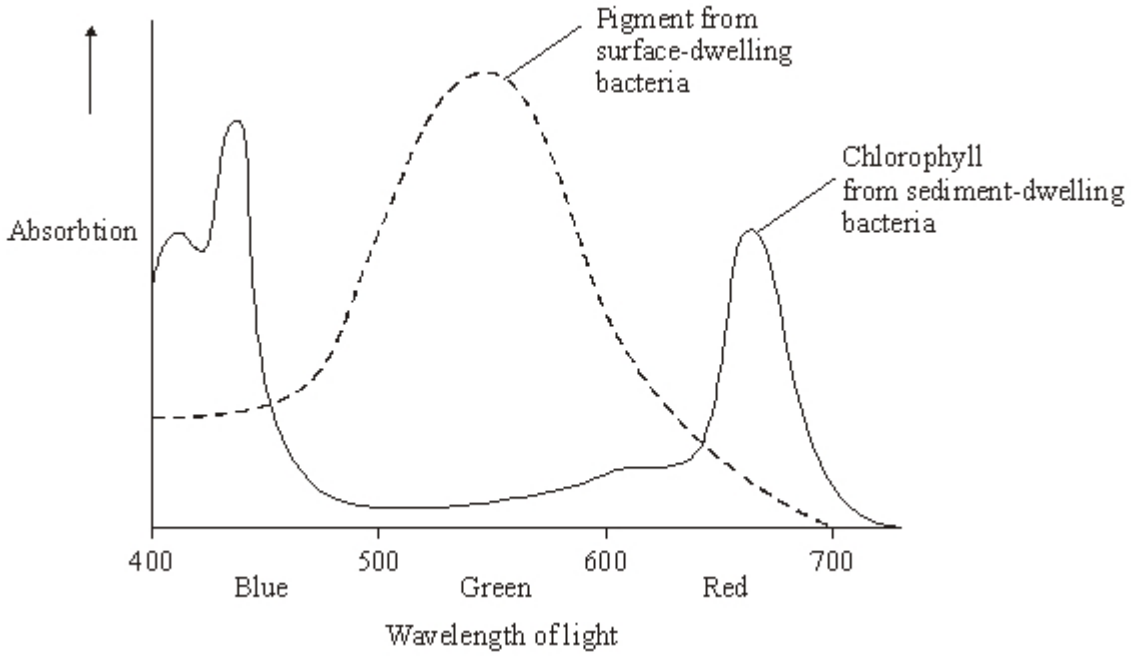


Figure 2



(a) Describe how light energy absorbed by chlorophyll molecules is used to synthesise ATP.

_____

_____

_____ **(5)**

(b) Use **Figure 2** to explain how natural selection would favour the evolution of sediment-dwelling bacteria containing a different photosynthetic pigment from those living near the surface of the water.

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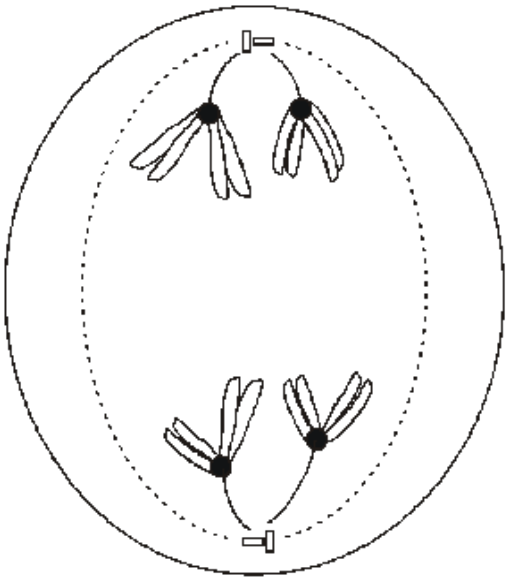
_____ **(6)**

(Total 11 marks)

Q12. (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.

_____

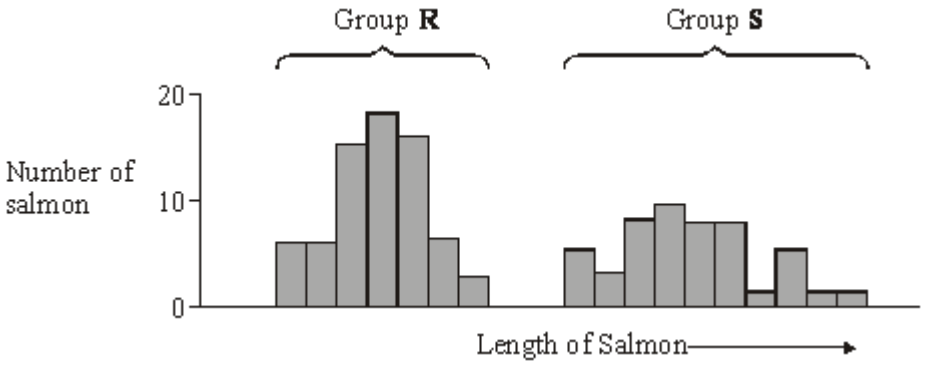
_____

_____

_____ **(2)**

(Total 5 marks)

Q13. The graph shows the variation in length of 86 Atlantic salmon.



(a) Give **two** possible causes of this variation that result from meiosis during gamete formation.

1. _____

_____

2. _____

_____ **(2)**

(b) When comparing variation in size between two groups of organisms, it is often considered more useful to compare standard deviations rather than ranges. Explain why.

_____

_____

_____

_____ **(2)**

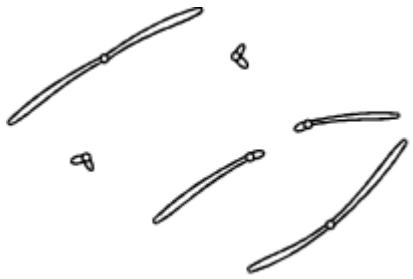
(Total 4 marks)

Q14. (a) Give **one** process which occurs in the nucleus of a cell during interphase which is necessary before cell division can take place.

_____

(1)

(b) The diagram shows the chromosomes from a cell with a diploid chromosome number of six.



Draw a diagram to show the chromosomes from one of the resulting cells if

(i) the cell divides by **mitosis**;

(2)

(ii) the cell divides by **meiosis**.

(2)

(c) Explain **one** advantage of cells lining the human gut dividing very frequently.

_____

_____

(1)

(Total 6 marks)

Q15. (a) Explain **one** way in which the behaviour of chromosomes during meiosis produces genetic variation in gametes.

_____

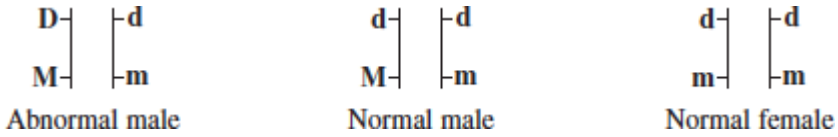
_____

_____

_____

(2)

(b) In mosquitoes, the sex of an individual is determined by one gene. Males have the genotype **Mm** and females **mm**.
Another gene is carried on the same chromosome. Normal males and females are homozygous **dd** for this gene. Abnormal males have a dominant **D** allele.
The possible genotypes are shown below. The vertical lines represent homologous chromosomes.



Abnormal male Normal male Normal female

During meiosis, allele **D** causes the homologous chromosome carrying the **m** allele to disintegrate. Cells lacking this chromosome do not develop further.

Complete the genetic diagram to show how allele **D** is transmitted from an abnormal male to his offspring.

Parental phenotypes Abnormal male Normal female

Parental genotypes

Gametes _____ _____

Offspring genotype(s) _____

Offspring phenotype(s) _____

(3)
(Total 5 marks)

Q16. (a) (i) What is the role of RNA polymerase in transcription?

_____

_____

(1)

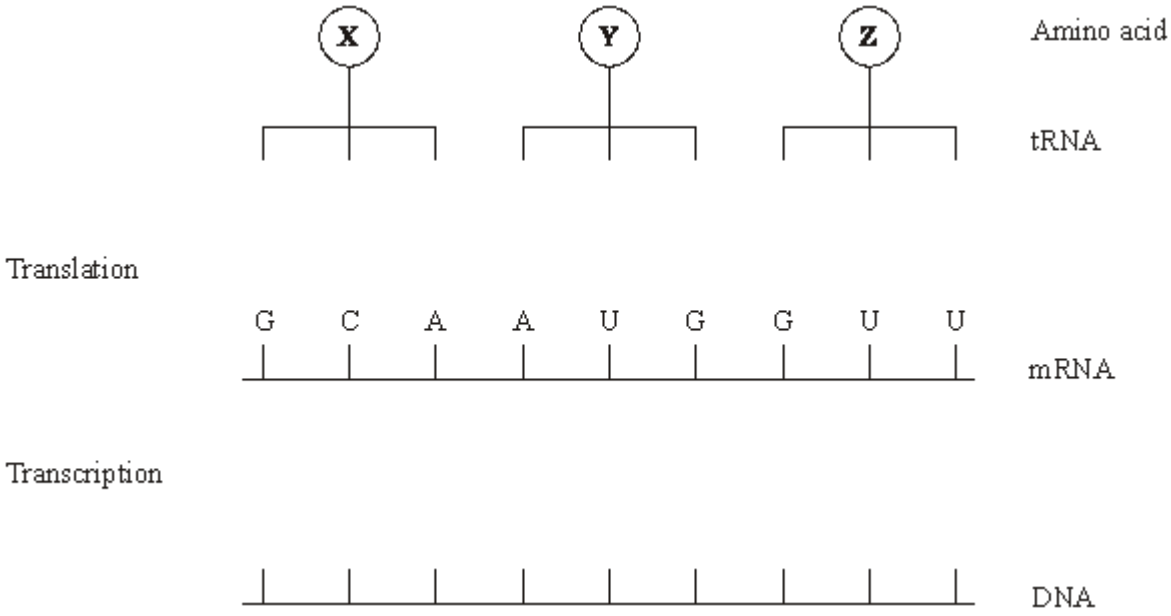
(ii) Name the organelle involved in translation.

_____

(1)

(b) **Figure 1** shows some molecules involved in protein synthesis.

Figure 1



Complete **Figure 1** to show

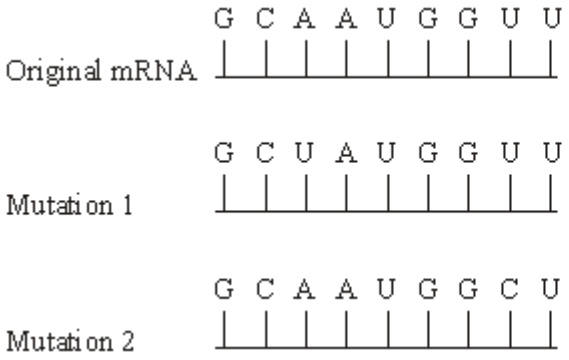
(i) the bases on the DNA strand from which the mRNA was transcribed;

(ii) the bases forming the anticodons of the tRNA molecules.

(2)

Figure 2 shows the effects of two different mutations of the DNA on the base sequence of the mRNA. The table shows the mRNA codons for three amino acids.

Figure 2



Amino acid	mRNA codon
methionine	AUG
valine	GUC GUU
alanine	GCA GCC GCU

(c) Name the type of mutation represented by mutation 1.

_____

(1)

(d) Use the information in the table to

(i) identify amino acid **X** in **Figure 1**;

_____

(1)

(ii) explain how each mutation may affect the polypeptide for which this section of DNA is part of the code.

Mutation 1 _____

_____

_____

_____

(2)

Mutation 2 _____

_____

_____

_____

(2)

(Total 10 marks)

Q17. (a) Apart from increasing genetic variation, explain why meiosis is important in organisms which reproduce sexually.

_____

_____

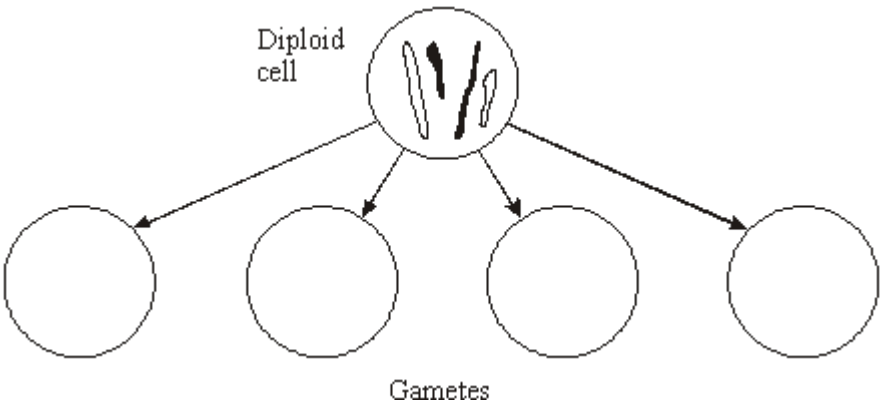
_____

_____

(2)

(b) **Figure 1** shows the chromosomes in a diploid cell.

Figure 1

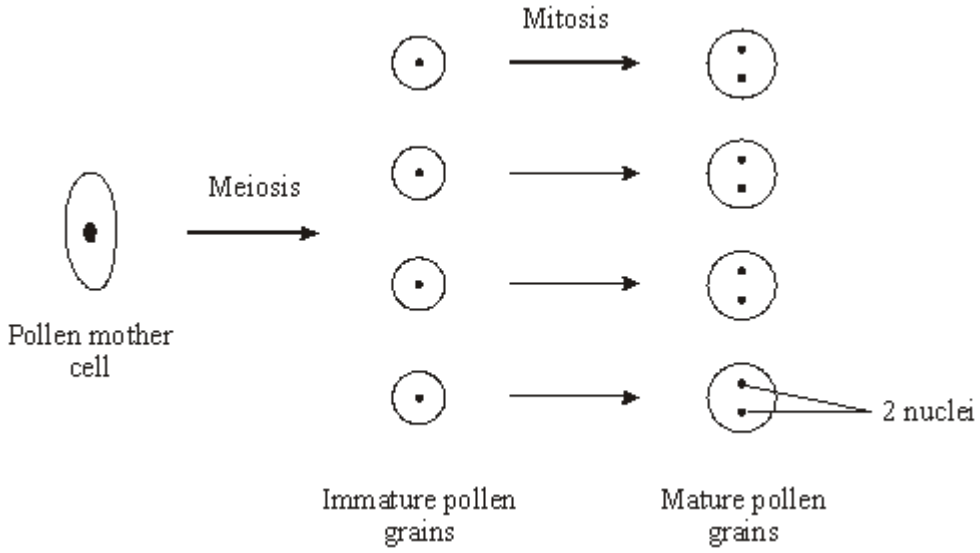


Complete **Figure 1** to show the four different combinations of these chromosomes in the gametes produced by meiosis.

(2)

(c) **Figure 2** shows the main stages in the production of pollen grains in a flowering plant.

Figure 2



The diploid number of chromosomes in this plant is sixteen. How many chromosomes would there be in

(i) the nucleus of an immature pollen grain;

_____

(ii) one of the nuclei of a mature pollen grain?

_____

(2)

(d) In tissues that produce gametes, there is a greater proportion of cells undergoing meiosis in male tissue than in female tissue. Suggest **one** advantage of this.

_____

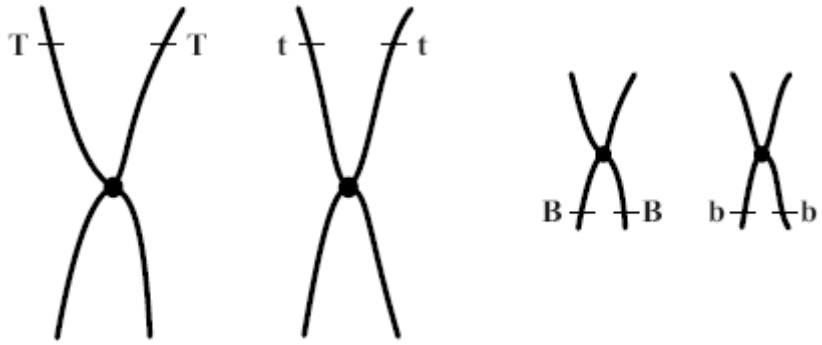
_____

(1)

(Total 7 marks)

Q18. (a) **Figure 1** shows two pairs of chromosomes from a plant cell. The letters represent alleles.

Figure 1



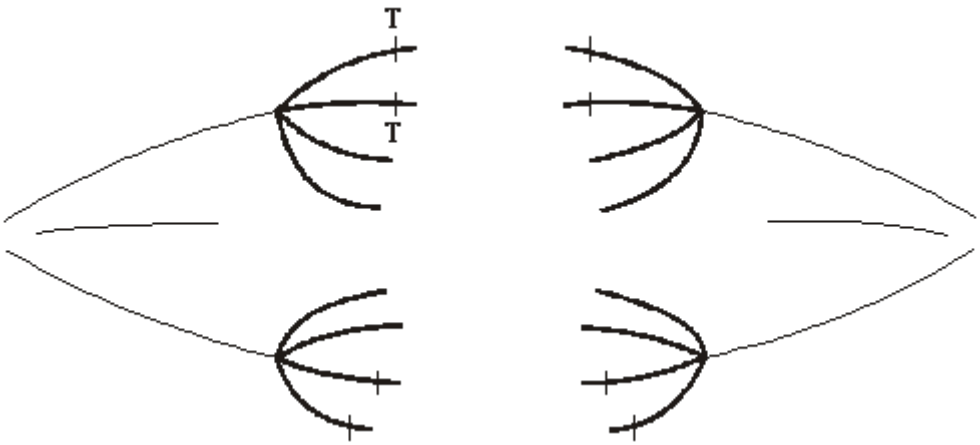
(i) Give all the different genotypes of the gametes which could be produced by this plant.

_____

(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?

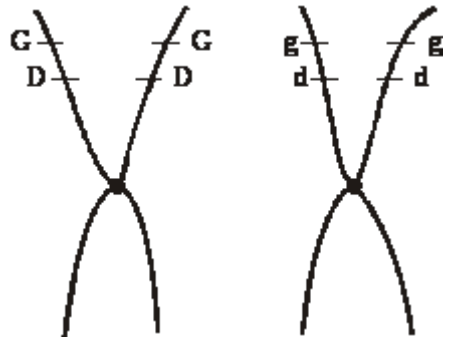
_____

_____

(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**.

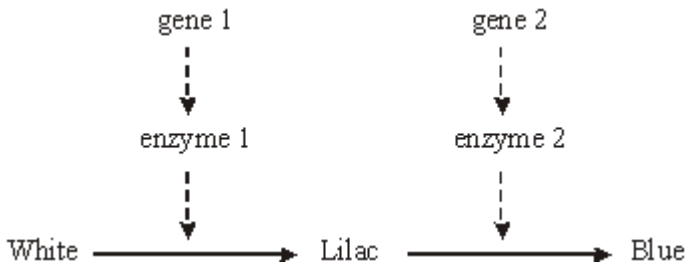
(1)

(Total 7 marks)

Q19. (a) Name **one** mutagenic agent.

(1)

(b) In flax plants the flowers are white, lilac or blue. The diagram shows the pathway by which the flower cells produce coloured pigments.



(i) A deletion mutation occurs in gene 1. Describe how a deletion mutation alters the structure of a gene.

(2)

(ii) Describe and explain how the altered gene could result in flax plants with white-coloured flowers.

_____

_____

_____

_____

_____

(4)

(iii) Electrophoresis was used to separate the enzymes involved in this pathway. When extracts of the differently coloured flax petals were analysed, four different patterns of bands were produced. In the table, only bands that contain functional enzymes are shown.

Result of electrophoresis	Colour of petal
	White
	
	
	

Complete the table to give the colour of the petal from which each extract was taken.

(2)

(Total 9 marks)

Q20. New alleles arise as a result of mutations in existing genes. These mutations may occur during DNA replication.

(a) Explain what is meant by an allele.

_____

_____ **(1)**

(b) Explain how DNA replicates.

_____

_____

_____

_____

_____

_____

_____

_____ **(4)**

(c) Explain why a mutation involving the deletion of a base may have a greater effect than one involving substitution of one base for another.

_____

_____

_____

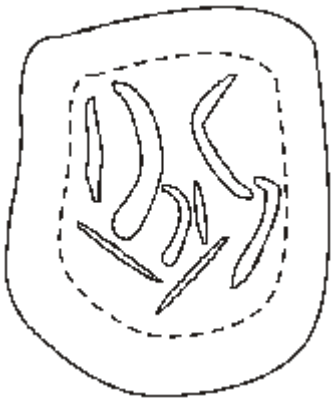
_____

_____

_____ **(3)**

(Total 8 marks)

Q21. The diagram represents a cell from a fruit fly in which the diploid number is eight.



(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.

(2)

(b) Explain why meiosis is important in sexual reproduction, apart from producing gametes that are genetically different.

_____

_____

_____

_____

(2)

(Total 6 marks)

Q22. 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.

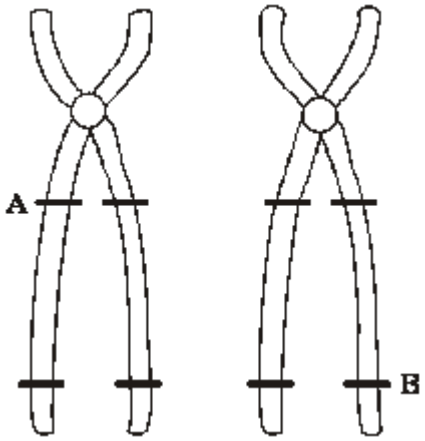


Figure 1

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

(1)

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

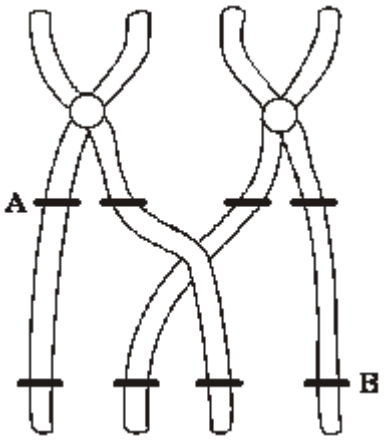


Figure 2

(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 _____

_____

Process _____

Explanation _____

_____

(4)

(Total 8 marks)

Q23. **Figure 1** and **Figure 2** show the chromosomes from a single cell at different stages of meiosis.

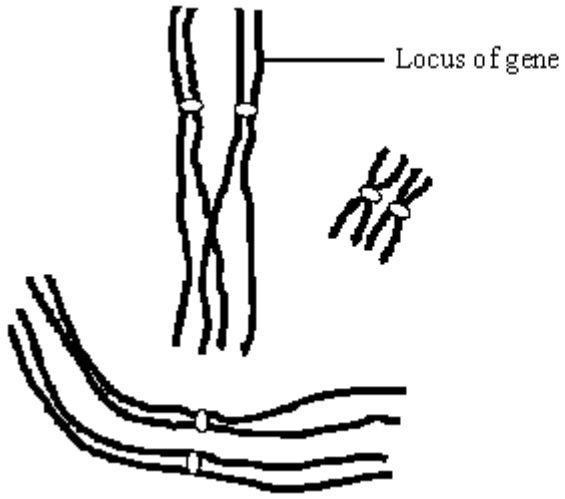


Figure 1

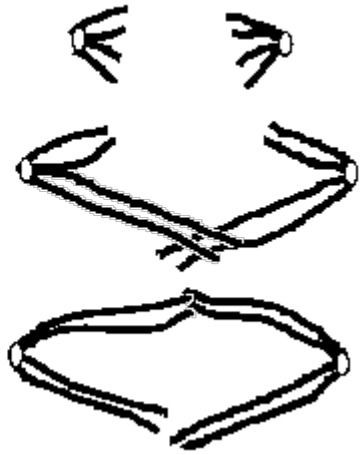


Figure 2

(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)

Q24. (a) Explain how crossing over can contribute to genetic variation.

_____

_____

_____

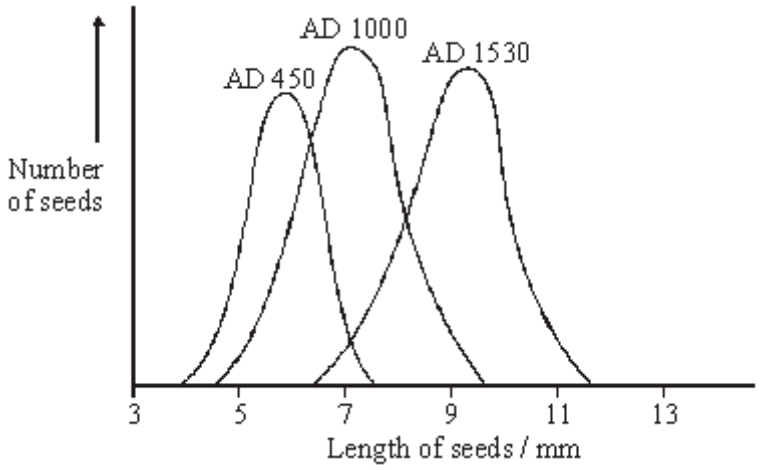
_____

_____

_____

(3)

(b) Maize seeds were an important food crop for the people who lived in Peru. The seeds could be kept for long periods. Each year, some were sown to grow the next crop. Archaeologists have found well-preserved stores. The graph shows the lengths of seeds collected from three stores of different ages.



(i) Within each store the maize seeds showed a range of different lengths. Explain **one** cause of this variation.

_____

_____

_____

_____

(2)

(ii) Use your knowledge of genetics and selection to explain the changes in the mean length of the seeds between AD 450 and AD 1530.

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 9 marks)

Q25. (a) During meiosis, one chromosome from each homologous pair goes to each of the cells produced. Explain why this is important.

_____

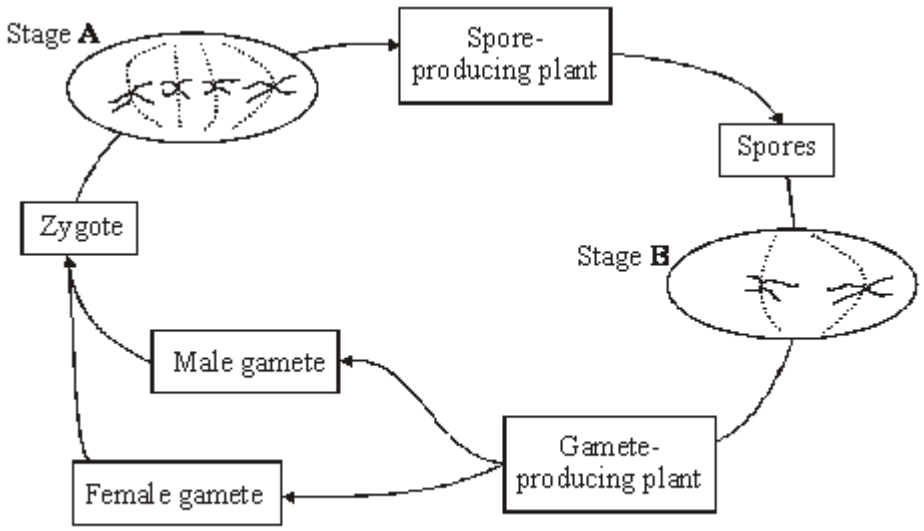
_____

_____

_____

(2)

(b) The diagram shows the life cycle of a fern plant. Drawings of the chromosomes during cell division are shown for the stages that give the spore-producing plant and the gamete-producing plant.



(i) What is the diploid number of chromosomes in this fern plant?

_____

(1)

(ii) Explain the difference in the number of chromosomes at stages **A** and **B**.

_____

_____

(1)

(iii) Are the male and female gametes produced by mitosis or meiosis?

Explain your answer.

_____

_____

_____

_____

(2)

(Total 6 marks)

Q26. The National Vegetable Research Station stores a collection of seeds from many species and varieties of vegetables. These include old and rare varieties.

(a) Why is it important to keep seeds from old and rare varieties of vegetables?

_____

_____

_____

_____

(2)

(b) Every few years, seeds of each variety in the collection are germinated and grown into mature plants. New seeds obtained from these plants are added to the collection.

(i) Suggest why it is necessary to obtain new seeds every few years.

_____

_____

(1)

(ii) Within each variety, the scientists cross plants with different genotypes. Explain the advantage of this.

_____

_____

_____

_____

(2)
(Total 5 marks)

Q27. (a) Explain the importance of meiosis in the life cycles of organisms which reproduce sexually.

_____

_____

_____

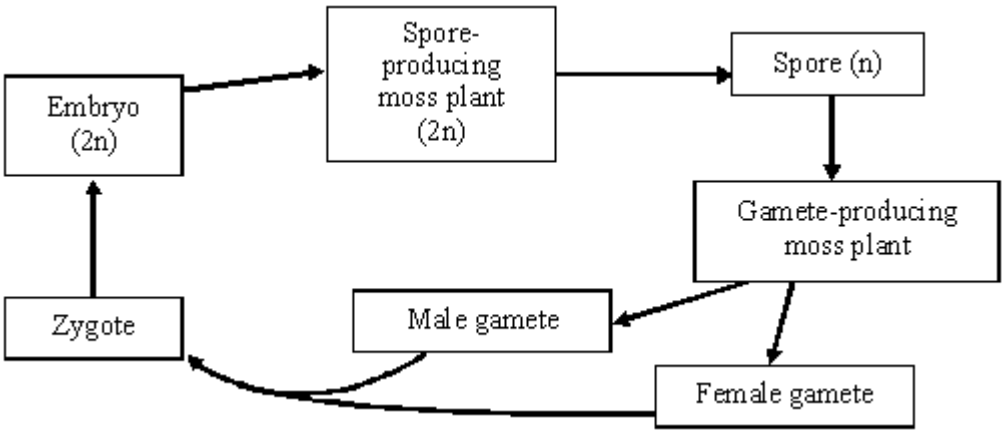
_____

_____

_____

(3)

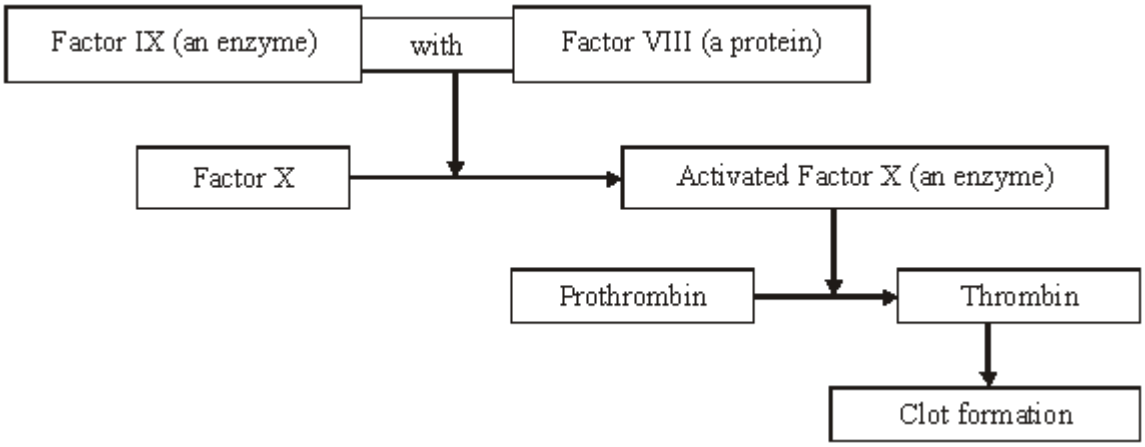
(b) The diagram shows the life cycle of a moss plant.



On the diagram mark with an **M** where meiosis takes place.

(1)
(Total 4 marks)

Q28. The diagram shows part of the metabolic pathway involved in the clotting of blood in response to an injury.



Haemophilia is a condition in which blood fails to clot. This is usually because of a mutant allele of the gene for Factor VIII.

(a) Explain how mutation could lead to faulty Factor VIII.

(2)

(b) Use information in the diagram to explain how faulty Factor VIII causes haemophilia.

(2)

(c) A boy had haemophilia caused by faulty Factor IX. When his blood was mixed with blood from a haemophiliac with faulty Factor VIII, the mixture clotted. Suggest an explanation for clotting of the mixture.

(2)

(Total 6 marks)