18. Variation and selection

18.1 Variation

Paper 3 and 4

Question Paper

Paper 3

Questions are applicable for both core and extended candidates

1 **(b)** Scientists investigated the link between testis size and length of sperm in bird species.

Fig. 4.2 shows the results.

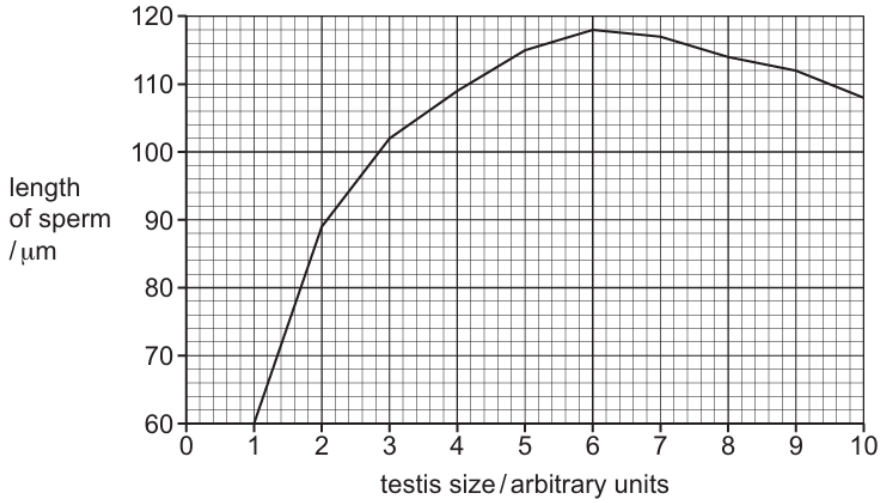


Fig. 4.2

Using the information shown in Fig. 4.2:

(i) Describe how the length of the sperm changes as the testis size increases.

.....

.....

..... [1]

(ii) Calculate the difference in length between the longest sperm and the shortest sperm.

..... μm [1]

(iii) State the testis size that has the longest sperm.

..... arbitrary units [1]

2 **(a)** **(i)** State the meaning of the term variation.

.....

.....

..... [2]

(ii) Table 6.1 shows some statements about variation.

Place ticks (✓) in the boxes to show which statements describe continuous and discontinuous variation.

Place **one** tick in each row.

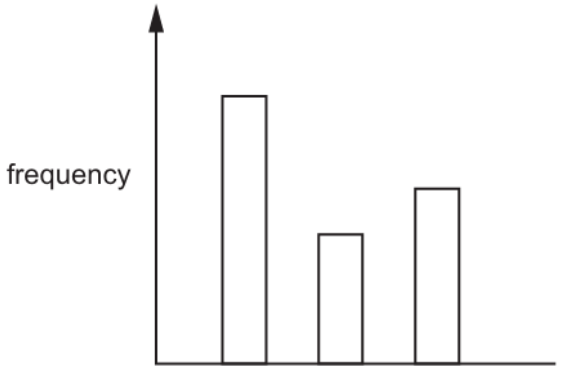
Table 6.1

statement	continuous variation	discontinuous variation
no intermediate phenotypes		
range of phenotypes between two extremes		
usually caused by genes and environment		

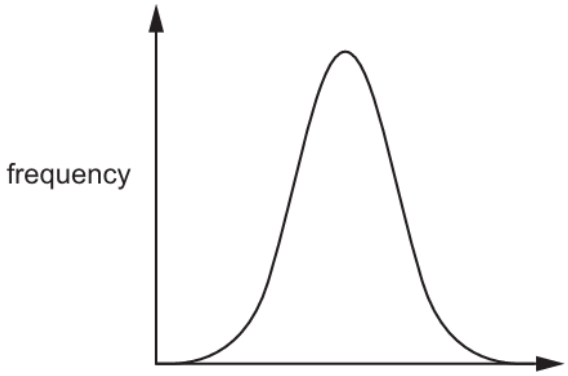
[3]

(iii) Fig. 6.1 shows graphs of two types of variation.

On Fig. 6.1, state an example of a phenotype for each type of variation shown.



example .....



example .....

Fig. 6.1

[2]

(b) Complete the statements about mutation.

Mutation is a ..... change in which new

..... are formed.

The rate of mutation is increased by some chemicals and by

..... radiation.

[3]

[Total: 10]

3 **(c)** Place a tick (✓) in the box that shows the meaning of variation.

Variation is an alternative form of a gene.	
Variation is the differences between individuals of the same species.	
Variation is the recessive allele in a genotype.	
Variation is the transmission of genetic information from generation to generation.	

[1]

4 **(a)** Blood group is inherited. There are four human blood groups: A, B, AB and O.

Surveys were carried out in two different countries to find out the percentage of the population in each blood group.

The results are shown in Fig. 5.1.

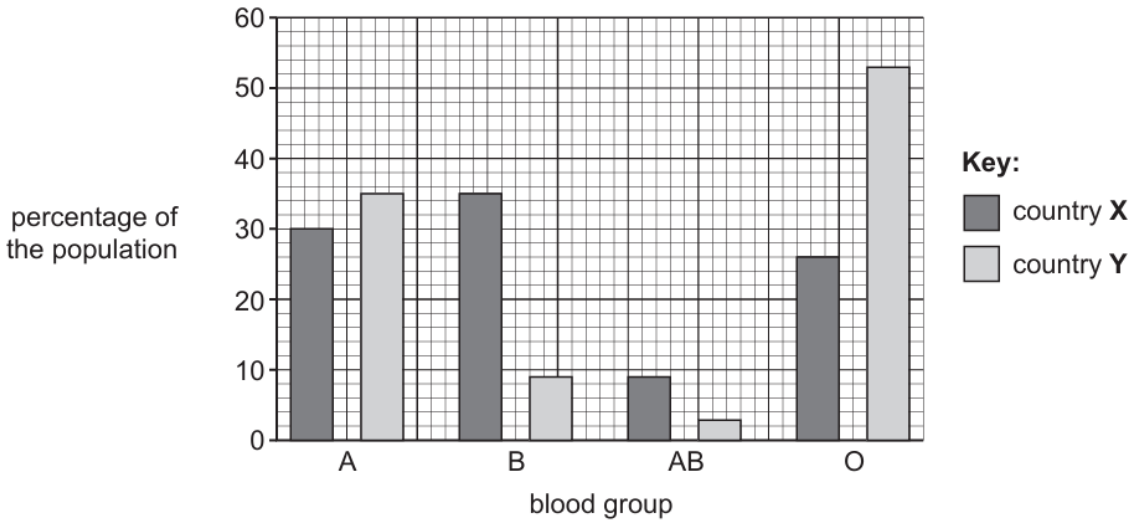


Fig. 5.1

(i) Complete the sentences that describe the data shown in Fig. 5.1.

The rarest blood group in both countries is ..... .

In country **X** blood group ..... is the most common but in country **Y** it is blood group ..... .

The percentage of the population of country **X** that has blood group **A** is .....%.

[4]

(ii) Suggest the type of variation shown in Fig. 5.1 and give a reason for your choice.

type of variation .....

reason .....

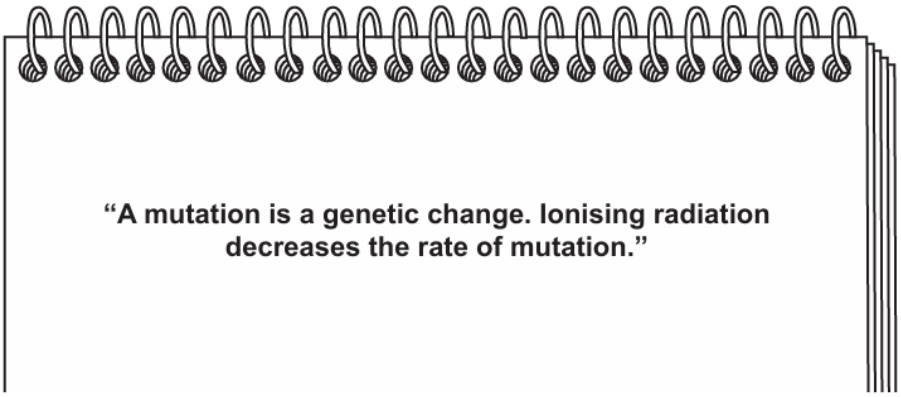
.....

.....

[2]

(b) Mutations can create variation.

A student made some statements about mutations in their notebook.



Identify **one** incorrect word in the sentences.

..... [1]

[Total: 7]

5 **(a)** Dimples are an indentation of the cheek visible when smiling.

Fig. 6.1 is a photograph showing a person with dimples.

Fig. 6.1

The number of male and female students in a class that had dimples was recorded.

The results are shown in Table 6.1.

Table 6.1

characteristic	sex	number of students
with dimples	male	4
	female	5
without dimples	male	13
	female	12

(i) Calculate the total number of male students in the class.

..... [1]

(ii) Calculate the difference in number between male and female students **with** dimples.

..... [1]

(iii) Describe the evidence from Table 6.1 that shows that dimples are a type of discontinuous variation.

.....

.....

.....

.....

..... [2]

(iv) State **one other** example of discontinuous variation in humans.

..... [1]

(v) State **one** example of continuous variation in humans.

..... [1]

(b) Variation can be caused by a mutation.

Complete the sentences about mutation using words from the list.

Each word can be used once, more than once or not at all.

alleles **decrease** **genetic** **impulses**

increase **ionising** **maintain** **physical** **stimuli**

A mutation is a ..... change.

Mutations form new ..... .

Some chemicals and ..... radiation can

..... the rate of mutation.

[4]

6 **(c)** Marmots and lynx are mammals that can live in a variety of environments.

The percentage of fat in the bodies of these two species was measured.
Measurements were taken from marmots and lynx living in Alaska and in Virginia. Alaska is a cold environment and Virginia is a warm environment.

The results are shown in Table 1.1.

Table 1.1

species	percentage of fat in the body		difference in the percentage of fat in the body
	in Alaska	in Virginia	
marmot	36	5	31
lynx	15	11	

(i) Complete Table 1.1 by calculating the difference in the percentage of fat in the body for the lynx.

Write your answer in Table 1.1. [1]

(ii) Describe the results shown in Table 1.1.

.....

.....

.....

.....

..... [2]

(iii) Explain the difference in the percentage of fat in the body between the mammals living in Alaska and Virginia.

.....

.....

.....

.....

..... [2]

7 Blood group is an example of discontinuous variation.

The blood groups of patients in a hospital were recorded.

Fig. 8.1 shows the results.

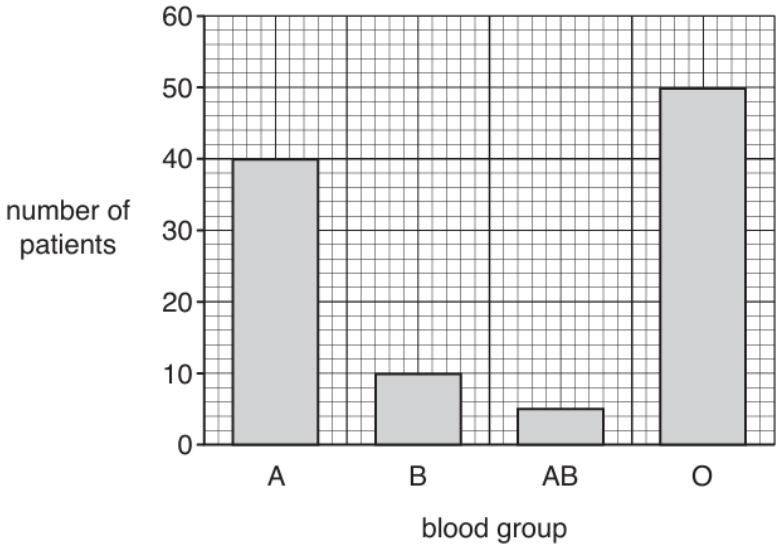


Fig. 8.1

(a) Explain how Fig. 8.1 shows that blood group is an example of discontinuous variation.

.....

.....

.....[1]

(b) Table 8.1 shows different examples of variation.

Tick all the boxes that show examples of discontinuous variation.

Table 8.1

attached or unattached earlobes	
foot length	
gender (male or female)	
height	
tongue rolling	
weight	

[3]

(c) Variation can be caused by mutation.

The word mutation can be connected to the words in the boxes on the right to make a complete sentence.

Draw **three** lines to join the word 'mutation' to the words in the boxes to make three correct sentences.

Mutation	is a genetic change.
	is a change in the environment.
	only occurs in plants.
	forms new alleles.
	changes your physical appearance only.
	can be caused by ionising radiation.

[3]

Paper 4

Questions are applicable for both core and extended candidates unless indicated in the question

8 **(c)** A gene mutation may be involved in the development of type 1 diabetes.

(i) Describe what is meant by a gene mutation. **(extended only)**

.....

.....

..... [2]

(ii) Outline the treatment of type 1 diabetes. **(extended only)**

.....

.....

.....

.....

.....

.....

..... [3]

9 **(b)** Explain how Fig. 5.1 shows that blood group is an example of discontinuous variation.

.....

.....

.....

.....

..... [2]

(c) State **one** example of discontinuous variation in **plants**.

..... [1]

10 **(b)** Mutations are a source of genetic variation in a population.

(i) Describe what is meant by a gene mutation. **(extended only)**

.....

.....

..... [2]

(ii) State **two** examples of how mutation rates can be increased.

1 .....

2 .....

[2]

11 **(e)** Mutation causes formation of new alleles which increases genetic variation.

State **two other** sources of genetic variation in populations. **(extended only)**

1 .....

2 .....

[2]