

Unit 2: Body Systems, Genetics, Microorganisms and Health

2.5 Variation and natural selection

Content - CCEA Double Award Biology 2 - Fort Hill Integrated College HW Booklet Name: _____	Got it	Nearly	Haven't a clue
2.5 Variation and natural selection			
Types of Variation			
<p>Can you describe how to investigate variation in living things and display data using appropriate graphical techniques, including:</p> <ul style="list-style-type: none"> • height and length as examples of continuous variation (histogram); and • tongue rolling and hand dominance as examples of discontinuous variation (bar chart); 			
<p>Can you demonstrate knowledge and understanding that variation in living organisms has:</p> <ul style="list-style-type: none"> • a genetic basis - mutations (random changes in the number of chromosomes or the structure of a gene) and sexual reproduction produce different phenotypes in a population; and • an environmental basis influencing the development of a phenotype (for example height in humans); and 			
Natural selection			
<p>Can you demonstrate knowledge and understanding of how variation and natural selection may lead to evolution or extinction, including:</p> <ul style="list-style-type: none"> • variation in the phenotypes of a population; • competition for resources often leading to differential survival of the best adapted phenotypes, for example antibiotic resistance; • surviving phenotypes are more likely to reproduce and pass on their genes to the next generation; • the theory of evolution as a continuing process of natural selection 			

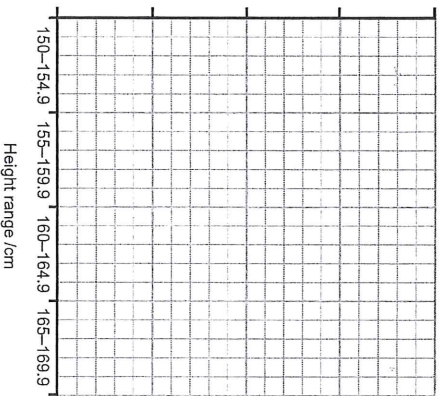
<p>that leads to gradual changes in organisms over time, which may result in the formation of a new species; and</p> <ul style="list-style-type: none"> • extinction of a species over time as a consequence of failure to adapt to environmental change. 			
<p>Selective breeding</p>			
<p>Can you explain selective breeding in food plants and domesticated animals as a process in which:</p> <ul style="list-style-type: none"> • humans select individual plants or animals for their desirable genetic characteristics, for example appearance, increased food quantity or quality or disease resistance, and breed them to produce offspring; and • repeated selection and breeding over many generations causes all the offspring to show the desired characteristic. 			

1.

(a) Twenty girls had their height measured on their sixteenth birthday. The number of girls in each height range is given in the table below.

Height range /cm	Number of girls
150–154.9	2
155–159.9	6
160–164.9	8
165–169.9	4

(i) On the grid below, plot a histogram using the data in the table. Add a label and a scale to the y-axis.



(ii) Which height range is the most common for these girls?

_____ cm

[1]

(iii) The difference in height is an example of variation. Give the two factors that cause variation in height.

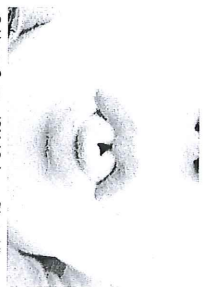
1. _____
2. _____

[2]

Examiner Only
Marks Remark

(b) The same twenty girls were tested to see if they could roll their tongues.

The photograph shows a girl who can roll her tongue.



© Herve Conge, ISM / Science Photo Library

60% of the girls were able to roll their tongues.

(i) What percentage of the girls were not able to roll their tongues?

_____ % [1]

(ii) How many of the twenty girls were not able to roll their tongues?

Show your working.

_____ [2]

(c) What type of variation is shown by the girls being able or not able to roll their tongues?

Underline the correct answer from the list below.

continuous normal discontinuous [1]

(Marking for Improvement)

2.

Peony plants have plain red or red striped flowers. The photograph shows a red striped peony flower.



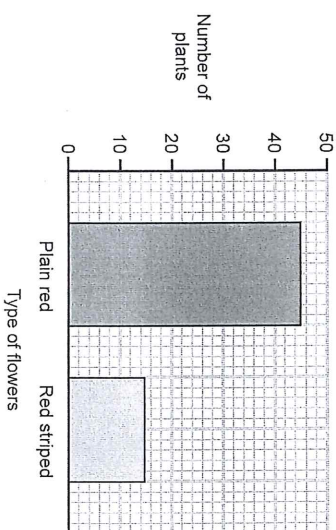
@ Ian Gowland / Science Photo Library

In peony flowers the allele **R** for plain red colour is dominant. The allele **r** for red striped flowers is recessive.

(a) A peony plant, homozygous for plain red flowers, is crossed with a heterozygous peony plant. Draw a Punnett square to show the genotypes of the flowers that would be produced from this cross.

[4]

(b) Seeds were collected from another peony plant. When plants were grown from these seeds the types of flowers produced were counted. The bar graph shows the results.



(i) Use the graph to give the ratio of plain red flowers to red striped flowers produced from these seeds.

_____ to _____ [1]

(ii) Use the graph to give the type of variation shown by these flowers.

_____ [1]

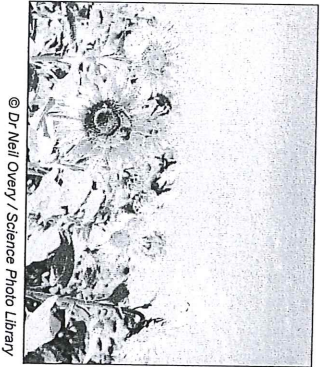
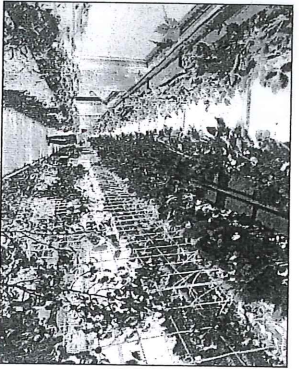
(iii) Name a human characteristic that shows this type of variation.

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

3.

The photographs show strawberry plants and sunflowers.



(a) The strawberry plants reproduced asexually to give clones.

(i) What is a clone?

_____ [1]

The clones were not exactly the same height.

(ii) Suggest why the cloned strawberry plants were not exactly the same height.

_____ [1]

(iii) What type of cell division occurs as plants grow?

_____ [1]

(b) (i) The sunflower plants reproduced by sexual reproduction. The offspring when grown had many different heights.

Explain the reason for this variation in height.

_____ [1]

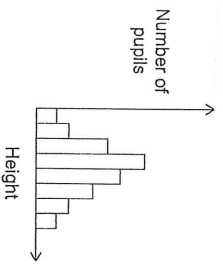
(ii) What type of variation is shown by the heights of the offspring sunflowers?

_____ [1]

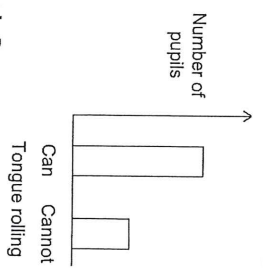
4.

The graphs show data relating to three characteristics of pupils in a class.

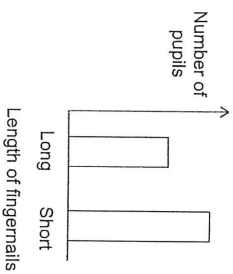
Graph A



Graph B



Graph C



(a) Some characteristics are controlled by genes. What is a gene?

_____ [2]

(b) Name one characteristic shown in the graphs which is not normally controlled by genes.

_____ [1]

(c) Name one characteristic shown in the graphs which is controlled by genes and the environment.

_____ [1]

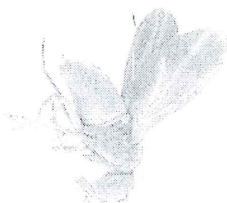
(d) Name the type of variation shown by height.

_____ [1]

5.

(a) Fruit flies are often used in genetic studies.

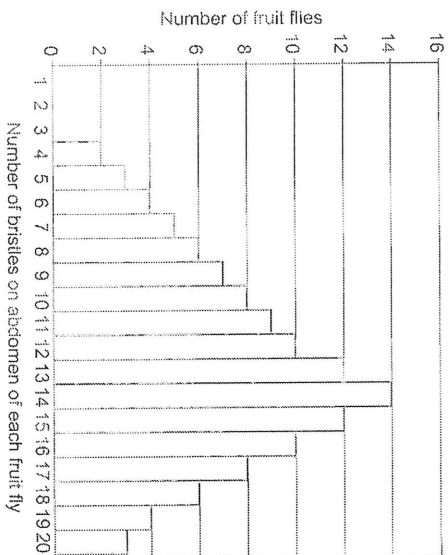
Fruit flies have bristles (small hairs) on their abdomens. These bristles act as touch sensors. The photograph shows a fruit fly.



Source: modified from Sciencephoto C0046457

In a study of fruit flies the number of bristles on the abdomen of each fly was counted.

The graph shows the results of the study.



Source: modified from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1569512/>

Use the information given opposite to answer the following questions.

(i) What is the range of the number of bristles on the abdomens of these fruit flies?

_____ to _____

[1]

(ii) How many fruit flies in this study have 15 or more bristles?

Show your working.

_____ [2]

(iii) Suggest why it is an advantage for the fruit flies to have a larger number of bristles.

_____ [2]

(b) Most fruit flies have red eyes. Some fruit flies have purple eyes. The allele **R** for red eyes in fruit flies is dominant to the allele **r** for purple eyes.

(i) Fruit flies with red eyes can have two different genotypes. Give these genotypes.

_____ and _____ [2]

A fruit fly that is homozygous for red eyes is crossed with a fruit fly with purple eyes.

(ii) Use a Punnett square to show the genotypes of the offspring that would be produced from this cross.

[4]

(iii) Give the eye colour of the offspring produced by this cross.

_____ [1]

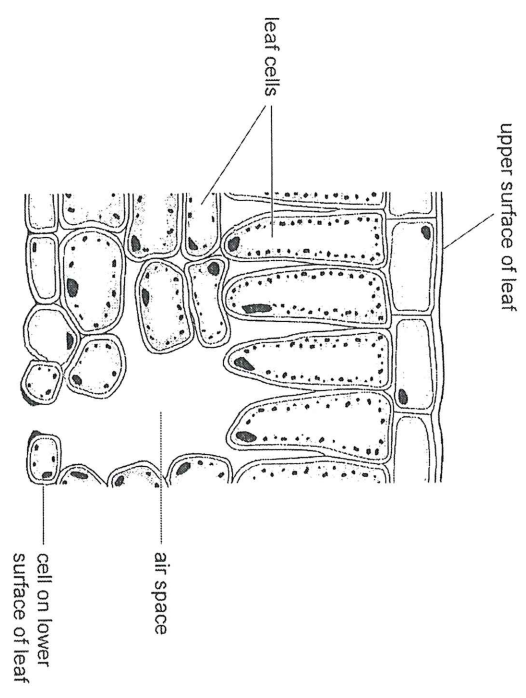
6.

(a) Plants lose water from their leaves. The water evaporates from the leaf cells and then diffuses out through stomata. Most plants have more stomata on the lower surface of their leaves.

(i) Name the process described above.

_____ [1]

The diagram shows a section through a leaf.



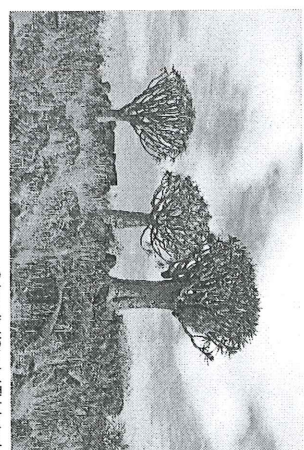
© GCSE Biology for CCEA by Rose McKelvie and James Napier, ISBN: 9780340686257.
Reproduced by permission of Hodder Education.

(ii) Use the information above and your knowledge to draw arrows on the diagram to show the pathway of water out of the leaf. [2]

10147

(b) Water that is lost from leaves is usually replaced by water from the soil. In drought conditions water may not be available in the soil to replace the water lost.

Plants in desert regions have become adapted to survive long periods of drought. The photograph shows quiver trees from the Namib desert in Africa.



© Iwanik / iStock / Thinkstock

During long periods of drought these trees can drop all of their leaves. Suggest how dropping all of their leaves can help quiver trees to survive long periods of drought.

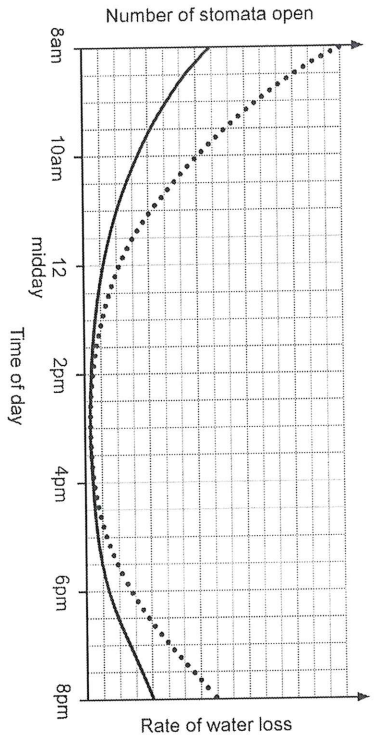
_____ [2]

10147

Turn over

(c) Another desert plant, called the unarmed saltwort, closes its stomata to prevent water loss.

The graph gives information about the number of stomata open and the rate of water loss in the unarmed saltwort over a 12 hour period.



Key:
 number of stomata open _____ rate of water loss

Source: Principal Examiner

Use the graph and your knowledge to answer the following questions.

(i) During which four hour period is the least number of stomata open?
 _____ to _____ [1]

(ii) Use the graph to describe the relationship between the number of stomata open and the rate of water loss in the plant.

 _____ [1]

(iii) Draw a line on the graph to show the rate of water loss that would be expected if the stomata did not close over the 12 hour period. [2]

(iv) Over a long period of time some species of desert plant became extinct as the desert became drier. The unarmed saltwort survived.

Use your knowledge of **natural selection** to explain why the unarmed saltwort survived but these other species of desert plant became extinct.

 _____ [3]

[Turn over

7.

In a grassland there were equal numbers of brown and white rabbits. A farmer changed the use of this land from grassland to woodland.

Several years after the change in land use he surveyed the rabbit population. The results showed that there was the same number of rabbits but the number of brown rabbits had increased while the number of white rabbits had decreased.

Foxes hunt and eat rabbits. The population of foxes in the area did not change.

(a) Describe how natural selection can account for the **Increase** in the number of brown rabbits in the rabbit population as a result of the change in land use.

_____ [4]

(b) Suggest two changes that could cause the number of white rabbits in the population to increase in the future.

1. _____
2. _____ [2]

Examiner Only
Marks Remark

8.

Individuals who are carriers for sickle cell anaemia have a natural protection against malaria.

Malaria is carried by mosquitoes. It causes more than one million deaths per year.

Use the theory of natural selection and the information above to explain why there is a higher percentage of the population who are carriers for sickle cell anaemia in areas where malaria is common.

_____ [3]