

Variation and selection practice questions

20 questions • 56 marks • mark scheme at the back

For Cambridge IGCSE Biology 0610 (and 0970, which has the same content). **Supplement** is Extended content, only examined on Papers 2 and 4.

Name

Total / 56

Variation Spec 18.1.1-18.1.10

1 Which feature shows discontinuous variation? [1 mark]

- A. ☐ Body mass
- B. ☐ ABO blood group
- C. ☐ Body length
- D. ☐ Leaf length

2 (a) Describe what is meant by variation. [1] (b) State what is meant by continuous variation. [3 marks]
[1] (c) Give one example of continuous variation in humans. [1]

3 Body mass shows continuous variation. ABO blood group shows discontinuous variation. [3 marks]
Explain the difference in the causes of these two types of variation.

- 4** A student measured the length of 40 leaves from one tree and recorded the results in the table. (a) State the type of variation shown. [1] (b) State the modal class. [1] (c) Explain how the data support your answer to (a). [2] **[4 marks]**

Leaf length of 40 leaves	
leaf length / mm	number of leaves
20-24	3
25-29	8
30-34	16
35-39	9
40-44	4

.....

.....

.....

.....

.....

.....

.....

- 5** (a) Define the term mutation. [1] (b) State what mutations produce in a population. [1] (c) Name one factor that increases the rate of mutation. [1] **[3 marks]**

.....

.....

.....

.....

.....

- 6** **Supplement** **[4 marks]**

(a) Describe gene mutation. [2] (b) State two other sources of genetic variation in a population. [2]

.....

.....

.....

.....

.....

.....

7 **Supplement** [1 mark]

Which statement about gene mutation is correct?

- A. ☐ It is a planned change to a gene
- B. ☐ It is a random change in the base sequence of DNA
- C. ☐ It only occurs in gametes
- D. ☐ It always produces harmful features

Adaptive features **Spec 18.2.1-18.2.3**

8 Which is the best definition of an adaptive feature? [1 mark]

- A. ☐ A feature an organism learns during its life
- B. ☐ An inherited feature that helps an organism to survive and reproduce in its environment
- C. ☐ A feature that only appears in a mutated organism
- D. ☐ Any difference between two species

9 A polar bear has white fur and a thick layer of fat under its skin. Describe how each feature helps the polar bear to survive in the Arctic. [3 marks]

.....

.....

.....

.....

.....

10 A cactus lives in a hot desert. Its leaves are reduced to spines and its stem is thick. [2 marks]
Suggest how these features help the cactus to survive.

.....

.....

.....

.....

11 **Supplement** [4 marks]

Marram grass is a xerophyte. Its leaves roll up and have hairs that trap air, and its stomata are in pits. Explain how these features help marram grass to survive in dry, windy sand dunes.

.....

.....

.....

.....

.....

.....

.....

.....

16 A farmer wants to breed cattle that produce more milk. Outline how the farmer can do this by selective breeding. **[4 marks]**

[illegible]

17 A herd of cows had a mean milk yield of 4000 dm^3 per year. After many generations of selective breeding, the mean yield is 5200 dm^3 per year. Calculate the percentage increase in milk yield. **[3 marks]**

Answer =

[illegible]

18 **Supplement** [2 marks]
Define the term adaptation.

```
.....
.....
.....
```

19 **Supplement** **[5 marks]**

Doctors treat a bacterial infection with an antibiotic. Over several years a strain of the bacteria that is resistant to the antibiotic becomes common. Explain, using the idea of natural selection, how this happens.

```
=====
```

Outline three differences between natural selection and artificial selection.

Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

B B (1)

2. [3]

- (a) differences between individuals of the same species (1)
- (b) results in a range of phenotypes between two extremes (1)
- (c) body length / body mass (1) allow height; reject blood group

3. [3]

- blood group / discontinuous variation is caused by genes only (1)
- body mass / continuous variation is caused by genes and the environment (1)
- environmental factor named for body mass, e.g. diet / amount of exercise (1)

4. [4]

- (a) continuous (variation) (1)
- (b) 30–34 mm (1)
- (c) a range of lengths between two extremes / from 20 mm to 44 mm (1)
- many intermediate lengths / no separate categories / length can take any value (1)
- most leaves in the middle classes and fewest at the extremes (1)
- Max 2 for (c)

5. [3]

- (a) genetic change (1)
- (b) new alleles (1)
- (c) ionising radiation / X-rays / gamma rays / (some) chemicals, e.g. chemicals in tobacco smoke (1)
reject heat

6. [4] **Supplement**

- (a) random (change) (1)
- change in the base sequence of DNA (1)
- (b) any two from: meiosis (1)
- random mating (1)
- random fertilisation (1)
- reject mutation in (b); ignore environment
- Max 4

7. [1] **Supplement**

B B (1)

8. [1]

B B (1)

9. [3]

- white fur gives camouflage (1)
- against the snow, so prey cannot see it / the bear can hunt (1)
- fat is insulation / reduces heat loss (1) ignore keeps it warm on its own

10. [2]

- spines have a small surface area, so less water is lost (by transpiration) (1)
- thick stem stores water (1)
- spines protect the cactus from being eaten by animals (1)
- Max 2

11. [4] Supplement

- rolled leaves reduce the exposed surface area (1)
- trap a layer of humid air / water vapour (1)
- which reduces the concentration gradient of water vapour out of the leaf (1)
- stomata in pits reduce water vapour loss / transpiration (1)
- hairs reduce air movement over the stomata (1)
- Max 4

12. [3] Supplement

- stomata on the upper surface because the lower surface is in contact with water (1)
- so gas exchange can occur with the air (1)
- air spaces make the leaf float / provide buoyancy, so it receives more light (1)
- air spaces store oxygen or carbon dioxide for gas exchange (1)
- Max 3

13. [1] Supplement

C C (1)

14. [1]

B B (1)

15. [5]

- variation in fur colour / alleles for fur colour (1)
- mice produce many offspring (1)
- struggle for survival / competition / predation (1)
- dark mice are better adapted / harder to see so more likely to survive and reproduce (1)
- they pass on their alleles for dark fur to the next generation (1)
- proportion of dark mice increases over generations (1)
- Max 5

16. [4]

- select cows with the highest milk yield (and a bull from a high-yielding line) (1)
- cross / breed them together (1)
- select offspring that produce the most milk (1)
- repeat for many generations (1)

17. [3]

- increase = $5200 - 4000 = 1200$ (1)
- $(1200 \div 4000) \times 100$ (1)
- 30% (1) correct answer with no working scores 3

18. [2] Supplement

- the process, resulting from natural selection (1)
- by which populations become more suited to their environment over many generations (1)

19. [5] Supplement

- mutation (in a bacterium) produces a resistance allele (1)
- antibiotic kills non-resistant bacteria (1)
- resistant bacteria survive (1)
- resistant bacteria reproduce (1)
- and pass on the resistance allele to the next generation (1)
- proportion of resistant bacteria increases (1)
- Max 5

20. [3] Supplement

- natural: the environment selects; artificial: humans select (1)
- natural: features that help survival and reproduction; artificial: features wanted by humans (1)
- natural: organisms become better adapted to the environment; artificial: improves crops / domesticated animals for human use (1)
- natural is usually slower / artificial is usually faster (1)
- Max 3