



Trial Examination 2021

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**Suggested solutions**

# **QCE Biology Units 3&4**

Paper 2

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## SECTION 1

### QUESTION 1 (4 marks)

Any four of:

- The new species disrupts food chains.
- The new species will reduce the number of organisms that occupy similar niches.
- They can over-consume prey species.
- The over-consumption of a prey species may reduce the availability of prey species for other consumers.
- They can over-consume a native predator.
- The over-consumption of a predator can lead to the loss of control on numbers of a prey species.
- The new species' impact will reduce biodiversity.
- They can lead to the extinction of some species.
- The new species may have no natural predators/control.

[4 marks]

### QUESTION 2 (4 marks)

- a) herbivore/primary consumer/first-order consumer [1 mark]

*Note: Second trophic level also is an acceptable answer, though it does not specifically show the feeding relationship.*

- b) Keystone species have a disproportionate effect on the biological community. [1 mark]

In this example, the removal of the sea bream (due to fishing) results in more sea urchins living in the area. [1 mark]

This significantly reduces the amount of seagrass in the area. [1 mark]

*Note: The response must be specific to the species within the given food chain to be awarded full marks.*

### QUESTION 3 (3 marks)

- a) pyramid of numbers [1 mark]

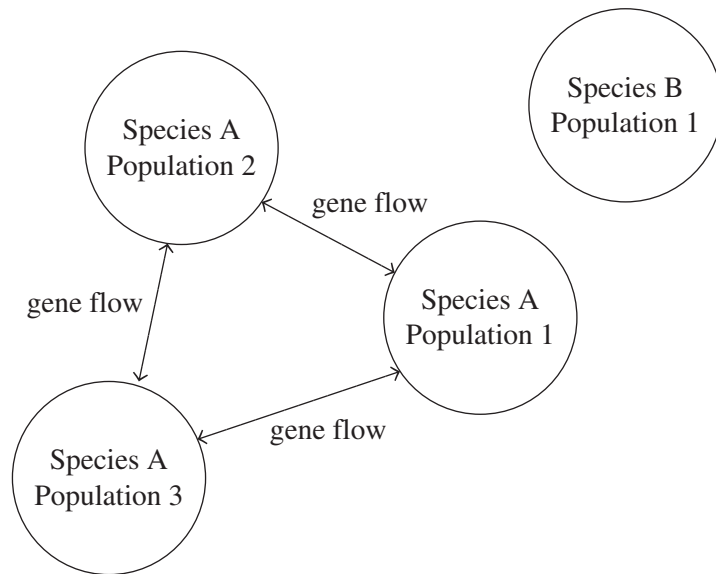
- b) The grassland ecosystem needs many individual grass plants to support the grasshopper population and upper trophic levels, so the lowest level of the graph is much wider than the upper levels. [1 mark]

In the forest ecosystem, one eucalypt tree can support large numbers of caterpillars and upper trophic levels, so the lowest level of the graph is much narrower than the upper levels. [1 mark]

**QUESTION 4 (6 marks)**

- a) A species is a group of similar organisms that can interbreed under natural conditions and produce viable fertile offspring. [1 mark]

b)



[2 marks]

1 mark for three gene pools of one species with gene flow occurring between them.  
1 mark for one gene pool of a different species with no gene flow to any of the other gene pools.

- c) differences in the amino acid sequences of the blood proteins [1 mark]
- d) deoxyribonucleic acid (DNA) hybridisation [1 mark]  
Heat and separate the DNA of two different types of possums. Mix the single-stranded DNA obtained together and determine the percentage of base-pairing. The greater the percentage of hybridisation, the closer the genetic relationship of the two types of possum. [1 mark]

**QUESTION 5 (14 marks)**

- a)  $50 - 12 = 38$  mm [1 mark]

$$\frac{38}{50} \times 100 = 78\% \quad [1 \text{ mark}]$$

b) For example:

*Sesamia* was most successfully controlled, as *Sesamia* caused the most damage to the control plants. [1 mark]

All types of genetically modified maize showed a significant decrease in damage caused by *Sesamia*. [1 mark]

In one instance, *Sesamia* even caused no damage (type E). [1 mark]

*Note: Acceptable responses may also refer to the fact that *Busseola* was not controlled by the genetically modified maize and caused the largest amount of damage, even increasing the damage caused in some varieties; and the fact that *Eldana* was controlled in some types of maize (B, C and D) but not others, and it caused the least damage in the control group.*

- c) males:  $440 - 325 = 115$  g [1 mark]  
*Note: Accept answers in the range of 105–125 g.*  
 females:  $268 - 215 = 53$  g [1 mark]  
*Note: Accept answers in the range of 51–57 g.*
- d) *Any two of:*
- Bt maize promotes the highest rate of growth at the start of the study, but tapers off later in the study.
  - Bt maize appears to cause less growth/mass gain than rat food (*or the inverse*).
  - There is a more pronounced difference in females than in males (*or the inverse*).
  - There is no difference in growth/mass gain between Bt and non-Bt maize.
- [2 marks]
- e) *Any one of:*
- Bt maize may not be as good as the commercially prepared rat food.
  - Bt maize appears to be as good a food source as non-Bt maize.
  - Bt maize appears to be an acceptable and safe food source.
- [1 mark]
- Note: Responses require a judgement about Bt maize as a food source rather than a description.*
- f) For both groups, overall biomasses were higher during flowering than harvest.  
 The microbial biomass for the Bt crop was (slightly) lower than for the non-Bt crops during flowering. [1 mark]  
 The microbial biomass for the Bt crop was (slightly) higher than for the non-Bt crops at harvest time. [1 mark]
- g) The data does not support the hypothesis. [1 mark]  
*Any one of:*
- There is little difference between the biomass found in the soil surrounding the roots of both the Bt and non-Bt maize at either time.
  - There is a slightly positive effect at harvest.
  - There is a slightly negative effect at flowering.
- [1 mark]

**QUESTION 6 (8 marks)**

- a) Carrying capacity is defined as a species' average population size supported in a habitat. (The species population size is limited by environmental factors like adequate food, shelter, water, and mates.) [1 mark]  
 100 individual rabbits [1 mark]
- b) No. [1 mark]  
 The fox population does not mirror the rabbit population. [1 mark]
- c) The rabbit population would increase. [1 mark]  
 The rabbits would have an increased food supply, allowing for more rabbits per unit area. [1 mark]
- d) birth rate [1 mark]  
 death rate [1 mark]

**QUESTION 7 (6 marks)**

*Response must include a discussion of any six of:*

- non-disjunction
- chromosomes/chromatids not separating/going to same pole
- non-separation of (homologous) chromosomes during anaphase I due to incorrect spindle attachment
- non-separation of chromatids during anaphase II due to centromeres not dividing
- occurring during gamete/sperm/egg formation
- less common in sperm than egg formation/function of parents' age
- extra chromosome 21
- sperm/egg/gamete receiving two chromosomes of same type
- zygote/offspring with three chromosomes of same type/trisomy/total 47 chromosomes

*For example:*

Down syndrome can occur when non-disjunction occurs during anaphase I or anaphase II in meiosis during formation of a gamete, typically an egg. Non-disjunction may occur due to the age of the eggs, which initiated formulation when the female was an eight-week-old embryo. Thus, increasing maternal age increases the chance of having a baby with Down syndrome. Sperm production may result in non-disjunction; however, these sperm are less likely to be the first to reach and fertilise an egg.

Non-disjunction can occur where homologous chromosomes move together at anaphase I in meiosis due to incorrect spindle fibre attachment. Non-disjunction can occur during anaphase II in meiosis where sister chromatids fail to separate at the centromere.

The eggs produced do not have the correct number of chromosomes; instead they have two copies of chromosome 21, so when they are fertilised by a sperm the resulting zygote has three copies of chromosome 21. This is trisomy 21, and the zygote has 47 chromosomes rather than 46. It is the extra chromosome (DNA) that causes the specific characteristics of Down syndrome.

*[6 marks]*