
BIOLOGY VCE UNITS 3&4 DIAGNOSTIC TOPIC TESTS 2017

TEST 7: CHANGES IN THE GENETIC MAKEUP OF A POPULATION AND CHANGES IN BIODIVERSITY OVER TIME

SUGGESTED SOLUTIONS AND MARKING SCHEME

SECTION A – MULTIPLE-CHOICE QUESTIONS

Question 1 **A**

Option **B** is a biochemical variation, option **C** is a behavioural variation and option **D** is a developmental variation.

Question 2 **C**

Option **C** is the only example of continuous variation, the other options are all discrete variations or have finite numbers.

Question 3 **D**

They can all cause deformed limbs in newborn children.

Question 4 **C**

The ABO is a single monogenic gene and shows discrete variations or blood types due to the three alleles. Most polygenic genes show continuous variation.

Question 5 **A**

Options **B** and **C** are both monogenic discrete traits. Lactose intolerance is caused by a mutation of the single gene LCT which codes for the lactase enzyme.

Question 6 **B**

Increasing the normal diploid number of chromosomes, traits with polygenes and having a great amount of generations with long time span all increase the chance of genetic variation.

Question 7 **B**

The genetic information in an individual is their genotype represented by a maximum of two alleles per gene loci, while the genetic information in a population is a gene pool. A gene pool is described in terms of the allele frequencies (proportions) of each gene and the total number of alleles is double the number of individuals in that population.

Question 8 A

If subspecies from different populations still retain their ability to interbreed and produce viable and fertile offspring when brought together, they are still the one species. Mating and producing offspring does not qualify as belonging to the same species.

Question 9 D

Carbon 14 dating is considered the most reliable form of absolute dating on natural (carbon containing) materials under 50 000 years of age. The other options are considered as relative dating, Argon/Argon and Potassium/Argon dating of surrounding rocks.

Question 10 A

The different regulation leads to different expression of master genes in different species. It is this different expression in different species that results in phenotypic differences.

Question 11 B

Mass extinction events can be predicted by natural disaster evidence. Evidence in support of the punctuated equilibrium model of evolution comes from the fossil record.

Question 12 C

Parallel evolution is the response of a species with a common evolutionary heritage and similar environmental demands through the evolution of structural similarities. Convergent evolution is natural selection that acts on distantly related species to produce superficial similarities that are not due to a shared ancestry but reflect the fact that the species are adapted to a similar way of life. Special creation was termed by Darwin when describing creatures without obvious ancestors, for example, platypus.

Question 13 C

All options other than C are the opposite of what would occur under artificial selection.

Question 14 D

Identical twins are genetically identical, so their biochemistry and physiology are the same. Environmental differences can switch genes on and off or cause lifestyle choices that have a significant impact on phenotype, such as diet and health.

Question 15 B

The finches are unique to the islands and related to each other, but this high variation is due to divergent evolution and speciation. Adaptive convergence is when organisms develop similar features even though they are unrelated. Coevolution occurs between organisms that have some relationship, for example, a parasite and host.

SECTION B – SHORT-ANSWER QUESTIONS

Question 1 (7 marks)

- a. looking at different morphological structures and comparing them between fossils and modern horses 1 mark
- b. poor quality of some fossils and inability to make fossil horses interbreed to see if they can produce fertile, viable offspring 1 mark
- c. they cannot interbreed under natural conditions to produce fertile, viable offspring 1 mark
- d. The environmental conditions have changed many times over the last 60 million years, so the horse has evolved with the changing environment, hence the many different species. 1 mark
- e. Many descendant species have evolved from one common ancestor. 1 mark
- f. adaptive radiation 1 mark

Question 2 (2 marks)

- a. Resistance to the antibiotic could develop. This would make *all* bacteria resistant as the antibiotic is not needed, but still been given. 1 mark
- b. In most cases, no, as bacteria are specific to the species they infect. However, if the bacteria are zoonotic (can cross the species barrier) then this could influence other species, including humans. 1 mark

Question 3 (1 mark)

Population geneticists look at gene pools to observe and compare the relative frequency of one allele compared to other alleles.

Question 4 (1 mark)

It is **true** that mutation is the only event that can create new genes as other events, such as crossing over, only leads to new combinations of alleles.

Question 5 (4 marks)

- a. Most insect pests living in their natural environment (pesticide free) do not have any resistance to pesticides when they are first applied, therefore the number of insect pests in each population will decline when the pesticide is used. 1 mark
- b. In any population of insects, there is genetic variation between individuals. Not all insect pests are killed when the pesticide is applied because some will have a genetic variation that confers resistance. They survive, breed and pass on resistance to their offspring, so over time the population of resistant insects increases. 1 mark
- c. Insects have bred up over many generations so that most individuals now have the genetic variation the confers resistance. Thus, different pesticides need to be used to be effective at killing the insects. 1 mark

d. disagree with scientists

Extinction means there are no living individuals of a species. Insecticides only reduce numbers, but do not kill all individuals of any given species. There are always individuals with genetic variation that enables them to be resistant to insecticides.

1 mark

Question 6 (5 marks)

a. A species is a group of individuals that can interbreed under natural conditions to produce fertile, viable offspring.

1 mark

b. Genetic variation is when individuals within a given species are similar looking but not identical (unless identical twins or clones). There are differences in genotype due to mutations, crossing over, independent assortment and random fusion of gametes.

1 mark

c. *Any one of:*

- high winds
- cold temperatures
- presence of snow
- soil type

1 mark

d. If the variation is environmental, then all the seeds will result in tall trees when grown at 1000 metres and if the variation is genetic then the 1000 metres seeds will result in tall trees and the 2000 metres seeds will result in short trees when grown at 1000 metres.

1 mark

e. The height of the trees at 2000 metres is due to environmental selection pressures not genotype, thus at the lower altitude with different environmental selection pressures they grow taller.

1 mark

Question 7 (2 marks)

incorrect

1 mark

The introduction of antibiotics did not cause bacteria to mutate. Within the bacterial population there would have been genetic variation. The antibiotics acted as the selecting agent, resulting in resistant bacteria being selected for and non-resistant bacteria being selected against. The resistant bacteria survived and passed on their resistance to their offspring. Over many generations most of the bacteria would be resistant to the antibiotics.

1 mark

Question 8 (3 marks)

Genetic bottleneck is a reduction in the genetic variation within a population due to a reduction in population size.

1 mark

The founder effect is due to a non-random sample of the original population forming a new population and breeding up over time. This population has reduced genetic diversity.

1 mark

This is a case of genetic drift, which is the altering of allele frequencies in a population due to chance.

1 mark