Unit 4 Biology

Revision Booklet 15

Topics

Human Intervention in Evolution

Name: .....

Question 7

Embryonic studies of zebra fish and humans have shown common features exist. DNA studies have shown there are common genes for particular traits, such as body pigments. The nucleotide sequence of the zebra fish and human gene coding for body pigment are about 70% identical.

a. Explain why zebra fish and humans have a gene coding for the same trait but have variation within the gene.

2 marks

In Victoria, regulations require fishermen who catch golden perch fish (*Macquaria ambigua*) to return small fish to the water. Only medium-sized and large fish can be kept. In a Biology class, some students stated that returning small fish to the water was an example of selective breeding. Other students thought it was an example of natural selection.

b. Explain the difference between selective breeding and natural selection.

2 marks

Salmon is a species of fish. A biotechnology company has engineered a faster-growing salmon by splicing genes from another species of fish into the salmon DNA.

c. What general name is given to an organism that contains genes from other species?

1 mark

Question 9

Long before the development of agricultural crops, hunter-gatherers in southern Africa would pick the tastiest nutty fruits of the marula tree and scatter them around their camps. These would germinate and grow into fruit-bearing trees. The best seeds would be chosen from these trees and the process would be repeated.

a. Explain how this practice is an example of selective breeding. In your answer include the selective agent and the phenotypic characteristic being acted on.

_____

_____

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_____

2 marks

Current domestication processes include marcotting. This involves peeling away bark from a branch, stimulating the branch to produce roots. The branch is then cut and planted in soil.

b. **i.** What can you infer about the genotype of trees propagated through marcotting?

_____

ii. Outline one disadvantage of a plantation of marula trees grown through marcotting compared to a natural population of marula trees.

_____

_____

_____

1 + 1 = 2 marks

c. Should the fruit from marcotted marula trees be labelled as genetically modified (GM)? Explain why.

_____

_____

_____

1 mark

Total 5 marks

END OF QUESTION AND ANSWER BOOK

Question 5

'CC' for Carbon Copy is the name of the first cloned kitten born in 2001. The nucleus of a cat's egg cell was removed. It was replaced by a nucleus from a somatic cell of a donor female cat. Once development commenced the egg cell was transferred into a surrogate female.

a. What is meant by the term cloning?

1 mark

The diploid number of a cat is 38.

b. **i.** How many chromosomes would have been in the nucleus that was removed from the egg cell?

ii. Is CC male or female? Explain.

1 + 1 = 2 marks

To determine if CC was in fact a true clone, studies were made of specific variable regions in the DNA of the donor, CC and surrogate.

The results are shown in the table.

DNA variable region	Donor DNA (size in base pairs)	CC DNA (size in base pairs)	Surrogate DNA (size in base pairs)
1	164/164	164/164	166/166
2	222/222	222/222	218/218
3	196/198	196/198	194/200
4	154/160	154/160	160/162

c. For each region of DNA there are two values, for example, 164/164. Suggest a reason for this.

1 mark

d. In the case of DNA variable region 4 in the donor DNA, why are the pairs of values different?

1 mark

e. From the data it was concluded that CC was a true clone. Explain the evidence in the table that supports this claim.

1 mark

Total 6 marks

Question 6

Cabbage (*Brassica oleracea*) and radish (*Raphanus sativus*) both have a diploid number of 18. However they do not naturally hybridise with each other.

a. How many chromosomes would be expected in the gametes of the cabbage?

_____

1 mark

In the laboratory, the two species can be forced to mate and produce offspring. The offspring are sterile.

b. **i.** What would be the diploid number of the hybrid?

_____

ii. Explain why the hybrid of the cabbage and radish is sterile.

_____

_____

_____

_____

1 + 1 = 2 marks

An occasional spontaneous event produces a doubling of each chromosome set in the hybrid. The new plants are able to grow and produce fertile offspring.

c. What term is used to describe cells with more than two sets of chromosomes?

_____

1 mark

d. Explain, with reference to the events of meiosis, why the new plants are fertile.

_____

_____

_____

_____

1 mark

Selective breeding has been used to improve the milk yield of cattle herds in Australia.

e. Identify a key difference between selective breeding and random mating in a herd of cattle.

1 mark

f. What is the impact of selective breeding on genetic variability in a herd of cattle?

1 mark

The quality and yield of milk in cattle has been improved by artificial insemination in which semen from a selected bull is used.

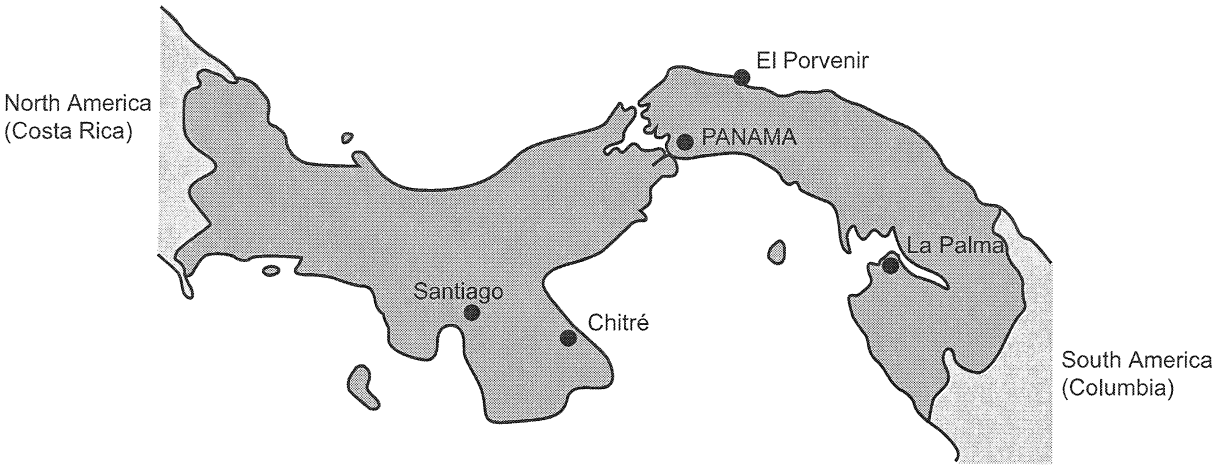
g. Explain how the use of artificial insemination may intervene in the evolutionary process.

1 mark

Total 8 marks

Question 8

The Isthmus of Panama is a narrow strip of land that joins North and South America.
The land bridge formed approximately 3 million years ago.



Snapping shrimps, genus *Alpheus*, can be found on either side of the land bridge. The two groups are phenotypically similar. However when the males and females from either side of the land bridge were brought together they snapped aggressively at each other and would not mate. They are now considered to be two different species.

a. Why is the inability to mate sufficient evidence to call the two groups different species?

_____

_____

1 mark

b. What type of speciation has occurred in the snapping shrimp?

_____

1 mark

c. Explain how the differences between the shrimp on either side of the land bridge could have arisen.

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2 marks

Thylacinus cyanocephalus (Tasmanian tiger) was the largest living marsupial carnivore in Australia at the time of European settlement. The thylacine is believed to have become extinct on 7 September 1936 when the last captive thylacine died in the Hobart Zoo.

There are thylacine fossils found in Tasmania and mainland Australia, but when Europeans arrived in Australia living thylacines were only found in Tasmania.

d. Suggest why thylacines were not found in mainland Australia at the time of European settlement.

1 mark

Since 1936 there have been many reported sightings of thylacines in Tasmania and along the southern coast of Victoria.

e. Explain why scientists still believe thylacines are extinct.

1 mark

The dingo is a eutherian mammal and the thylacine is a marsupial mammal. Scientists regard these two carnivores as an example of convergent evolution.

f. Explain why scientists would regard the thylacine and the dingo as an example of convergent evolution.

1 mark

Total 7 marks

END OF QUESTION AND ANSWER BOOK

Question 6

A patient with tuberculosis had a persistent cough, fever and weakness. The patient was treated with antibiotic X and began to improve after finishing the course of antibiotics. However the cough and other symptoms returned.

a. Explain the most likely reason why the course of antibiotics was not successful.

3 marks

Transgenic bacteria have been produced by inserting a gene or genes from another organism.

Particular species of transgenic bacteria have been developed to break down plastic compounds. Before releasing these bacteria into the environment scientists made extensive studies regarding the conditions in which the bacteria grew.

b. Describe one important reason for this extensive study.

1 mark

c. What economic advantage would there be in releasing the transgenic bacteria into the environment?

1 mark

Total 5 marks