PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



EXAM QUESTION PACK

TOPIC 7: MODERN GENETICS

USING GENE SEQUENCING

SCORE	PERCENTAGE
/32	%

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Q1.

Tapirs are nocturnal mammals that are found in South America.

In 2013, the Journal of Mammalogy published an article describing the discovery of a new species of tapir, *Tapirus kabomani*.

Scientists already knew about the animal but thought that it was the same species as *Tapirus terrestris*.



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(a) Give **one** reason why scientists thought that *Tapirus kabomani* was the same species as *Tapirus terrestris*.

(1)

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(b) These two species of tapir can be distinguished using gene sequencing.

Describe how sufficient amounts of DNA could be obtained in preparation for gene sequencing.

(4)

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(c) Explain how distinguishing *Tapirus kabomani* as a separate species could affect the index of

diversity of the area.

(2)

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(Total for question = 7 marks)

Q2.

Chester Zoo has 12 000 animals from 400 different species.

Chester Zoo aims "to be a major force in conserving biodiversity worldwide".

Chester Zoo supports an *in-situ* rhinoceros conservation and monitoring project in Chyulu Hills National Park in Kenya.

It is difficult to find and count the black rhinoceros because they roam freely across a large area.

However, the DNA of a black rhinoceros can be obtained from its dung (faeces).

(i) Devise a method by which black rhinoceros dung could be used to estimate the number of black rhinoceros living in Chyulu Hills National Park.

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(ii) DNA from dung indicated that 14 black rhinoceros were present in the park.

Explain why 14 black rhinoceros could be an underestimate of the population.

(2)

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Q3.

The polar bear, *Ursus maritimus*, preys on seals and fish. Polar bears are adapted to live in cold Arctic regions.



Polar bear
Magnification ×0.04

A recent study has shown that all polar bears are descended from populations that diverged from the Irish brown bear, *Ursus arctos*, approximately 120 000 years ago.

In this study, DNA from modern polar bears, the remains of historic polar bears and the remains of Irish brown bears was analysed.

(a) The first part of the study involved the amplification of DNA to give large enough samples for analysis.

(i) Describe how small samples of DNA can be amplified.

(4)

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(ii) Name **one** technique that could be used to analyse the amplified DNA samples.

(1)

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(b) Suggest how the scientists who conducted the study had their results accepted by other

scientists.

(2)

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(c) Suggest how each of the following may have contributed towards the divergence of polar bears and Irish brown bears into two separate species.

(i) Separation of the Arctic and Irish regions by sea

(2)

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(ii) Genetic mutation

(2)

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(Total for question = 11 marks)

Q4.

Prothrombin is involved in the blood clotting process.

The *F*2 gene codes for the synthesis of prothrombin.

A mutation of the *F*2 gene causes thrombophilia, a condition that results in the production of excess prothrombin.

A genetic test can be used to find out if a person has thrombophilia.

The test involves using a restriction endonuclease to obtain genetic material from white blood cells.

This genetic material is then used in the polymerase chain reaction (PCR).

(i) State the role of a restriction endonuclease.

(1)

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(ii) Describe the process of PCR.

(3)

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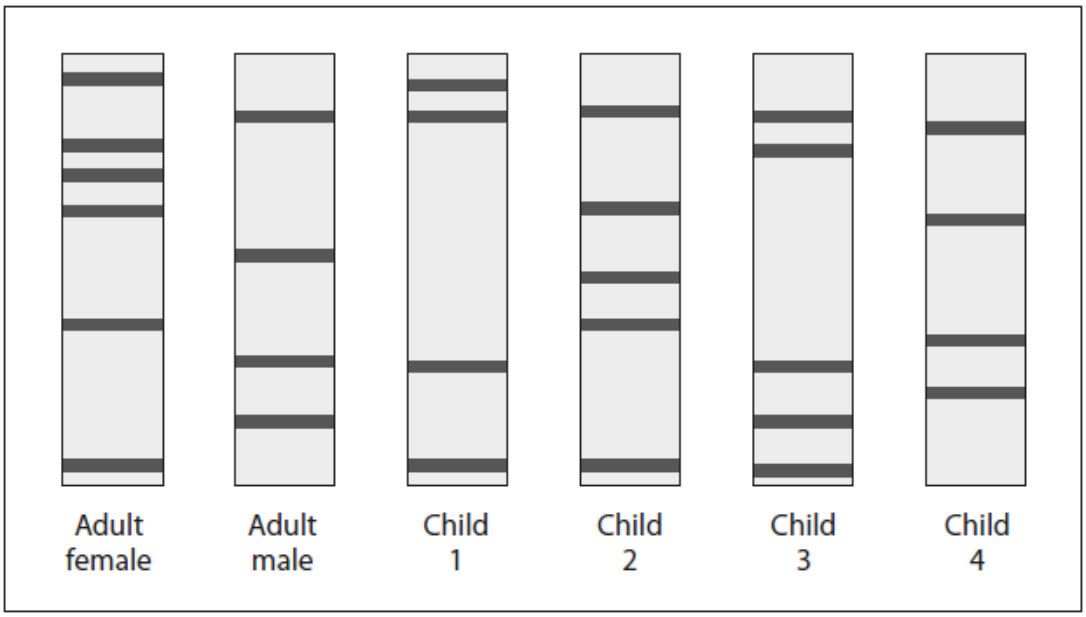
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(Total for question = 4 marks)

Q5.

The polymerase chain reaction (PCR) and gel electrophoresis are used to produce DNA profiles.

The diagram shows DNA profiles, from an adult female, an adult male and each of four children.



Explain why PCR is used before gel electrophoresis to produce these DNA profiles.

(2)

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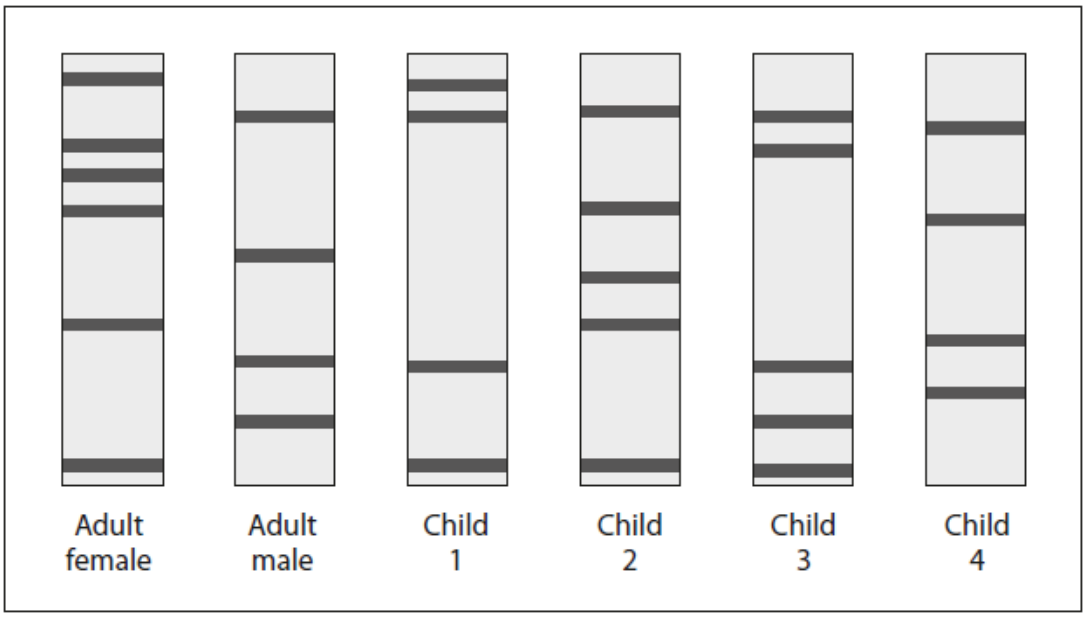
(Total for question = 2 marks)

Q6.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The polymerase chain reaction (PCR) and gel electrophoresis are used to produce DNA profiles.

The diagram shows DNA profiles, from an adult female, an adult male and each of four children.



Which of the children have both of these adults as their parents?

(1)

- ☒ **A** child **1** and child **2**
- ☒ **B** child **1** and child **3**
- ☒ **C** child **2** and child **3**
- ☒ **D** child **2** and child **4**

(Total for question = 1 mark)