Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Q1.

Read the following passage.

The wall gecko is a medium-sized lizard. In an isolated habitat of southern Italy, the wall gecko shows phenotypic diversity. Scientists investigated whether disruptive selection was leading to sympatric speciation in the wall gecko.

Pale geckos live only on walls and are nocturnal (active at night). Dark geckos live mainly on the dark trunks of olive trees and are diurnal (active during the day). These diurnal geckos can change skin colour when occupying different surfaces during the day.

Comparison of mitochondrial genes indicated that the diurnal geckos formed a distinct genetic group. This comparison also confirmed that all the geckos in the habitat were of the same species.

The scientists used the mark-release-recapture method to estimate the size of the population of geckos in the habitat.

Use the information in the passage and your own knowledge to answer the following questions.

(a) The wall gecko shows phenotypic diversity (lines 1–2).

Suggest **two** factors that have resulted in this phenotypic diversity.

1 _____

_____

_____

2 _____

_____

_____

(2)

(b) The ability of diurnal geckos to change skin colour (lines 7–8) is advantageous.

Explain why.

_____

_____

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(2)

(c) The scientists concluded that it was probable that disruptive selection was leading to sympatric speciation in the wall gecko.

Use the information in the passage to evaluate this conclusion.

(5)

(d) Explain how comparison of mitochondrial genes could indicate that the nocturnal geckos formed a distinct genetic group (lines 9–10).

In your answer, explain how new techniques enable the comparison of genes to be completed rapidly.

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(3)

(e) Describe and explain **two** precautions required to ensure that the estimate of the size of the population of geckos was valid (lines 12–13).

Do **not** include sample size as one of the required precautions.

In your answer, include the formula to estimate the size of the population using the mark-release-recapture method.

Precaution 1 _____

Precaution 2 _____

Formula _____

(3)

(Total 15 marks)

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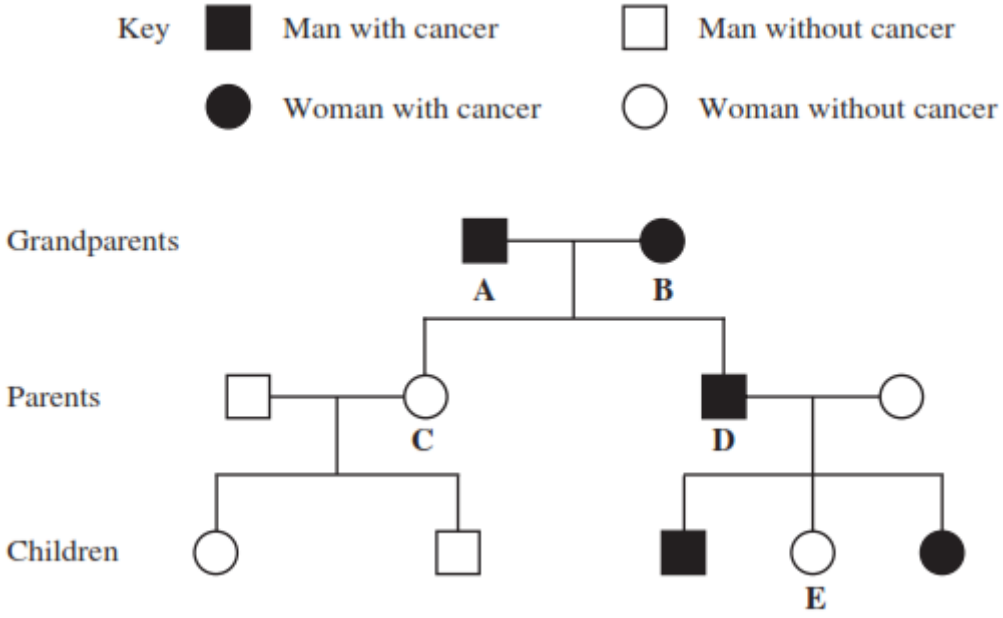
Q2.

Li-Fraumeni syndrome is a rare inherited condition. It makes someone much more likely to develop cancer at an early age. The diagram shows part of the family history of a family affected by Li-Fraumeni syndrome. Li-Fraumeni syndrome is caused by the dominant allele of a gene. The gene is not sex-linked.



The grandparents, **A** and **B**, had two children, girl **C** and boy **D**. Explain how the phenotypes of these children provide evidence that Li-Fraumeni syndrome is

(a) caused by a dominant allele

_____

_____

_____

_____

(2)

(b) **not** sex-linked.

_____

_____

_____

_____

(2)

(c) This family's history of cancer was investigated when person **E** asked for genetic counselling. At the time she was 25 years old. What advice could a genetic counsellor give her about her probability of developing cancer?

_____

_____

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(2)

(d) Li-Fraumeni syndrome is caused by a mutation affecting a tumour suppressor gene called TP53. This gene codes for a protein that initiates the death of cells where damaged DNA cannot be repaired. The mutated TP53 gene leads to the production of a non-functional protein. Suggest how the non-functional protein may lead to cancer.

(Extra space)

(3)

(Total 9 marks)

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