Level 1 Chemistry and Biology: practice paper 2026

AS 92022 Demonstrate understanding of genetic variation in relation to an identified characteristic · Vertex Academy practice paper, not an NZQA paper

Attempt ALL the questions. Show ALL working. Write your answers on lined paper, or in the space under each question.

QUESTION ONE

(a) Cystic fibrosis (CF) affects the lungs and digestion. It is caused by a recessive allele (f) of one gene; the dominant allele (F) gives normal lungs. Two parents who do not have CF have a child who does. Describe what is meant by a gene, an allele, dominant and recessive. Then use a Punnett square to show the chance of each of their children having CF.

	F	**f**
F	FF	Ff
f	Ff	ff

(b) Explain how two parents without CF can have a child with CF, referring to how alleles are passed on in gametes and at fertilisation.

(c) All newborn babies in New Zealand are screened for CF. Families with CF can also have DNA testing to find which relatives are carriers.
The couple in (a) already have one child with CF and are expecting another. Discuss the chance that the new baby will have CF, and how DNA testing and gene tracking (such as a pedigree) can help this family and their relatives.

QUESTION TWO

(a) Kākāpō are flightless, critically endangered parrots found only in New Zealand. Like all animals that reproduce sexually, each kākāpō chick is genetically different from its parents and from its brothers and sisters.

Describe three sources of genetic variation in a population.

(b) Explain why a kākāpō chick is genetically different from its parents and also from its brothers and sisters.

(c) By the 1990s only about 50 kākāpō were left, almost all descended from a small group on Stewart Island; Richard Henry was the only bird found on the mainland (Fiordland). Kākāpō have very low genetic diversity. In 2019 a fungal disease, aspergillosis, killed several birds. Every living kākāpō has had its whole genome sequenced, and conservation staff use this to choose which birds to pair for breeding.

Discuss why genetic variation matters for the survival of the kākāpō, and how genome sequencing helps conservation staff increase it.

QUESTION THREE

(a) In a model of a population of 500 rabbits in Central Otago, a gene has two alleles: R gives resistance to a virus, and r does not. There are 30 RR rabbits, 140 Rr rabbits and 330 rr rabbits.
Describe what is meant by a population and by allele frequency, and calculate the frequency of the R allele.

(b) The virus spreads through the population. Most rr rabbits die. The survivors are 28 RR, 112 Rr and 66 rr rabbits.
Calculate the new frequency of the R allele, and explain why it has changed.

(c) Discuss how natural selection could change the allele frequency of R in the rabbit population over many generations, and what might happen to the frequency of R if the virus disappeared.

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