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NZQA

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Level 2 Biology, 2015

91157 Demonstrate understanding of genetic variation and change

9.30 a.m. Monday 16 November 2015
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of genetic variation and change.	Demonstrate in-depth understanding of genetic variation and change.	Demonstrate comprehensive understanding of genetic variation and change.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Not Achieved

TOTAL 5

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QUESTION ONE: BLACK ROBINS

http://nzbirdsonline.org.nz/species/black-robin

Introduced species such as cats and rats caused the Chatham Island black robin (*Petroica traversi*) population to plummet to five individuals in 1980. Due to intensive conservation efforts, the species now has over 250 individuals in the gene pool.

(a) Describe the term gene pool.

All the allels present in a population.

(b) Explain how genetic drift affects the black robin's gene pool.

Because the black robin has gone through a dramatic genetic drift leaving a mer 5 individuals left, it would have ~~that~~ also limited there gene pool dramatically leaving not much biodiversity within the population.

(c) Female black robins usually lay eggs inside their nests. However, conservationists found some birds laid eggs on the rims of nests, where the eggs could not survive. So, they pushed the eggs back into the nests where they could be incubated and hatch successfully. However, this selection pressure from humans caused the rim laying allele to increase to 50% in the black robin population. They decided to stop pushing eggs back into the nests to prevent the behaviour from spreading throughout the population. In 2011 only 9% of the population laid eggs on the rims of nests.

Nest showing egg laid on rim.
www.math.canterbury.ac.nz/~r.sainudiin/preprints/plos_br_preprint.pdf

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Discuss why some female black robins lay eggs on the rims of nests, while most lay eggs inside the nests, and how humans affected this behaviour.

In your answer include:

- a description of what allele and allele frequency mean
- an explanation of what selection pressures are, and how they affect natural selection
- a discussion of natural selection using the black robin egg laying example
- a discussion of why the rim laying behaviour increased with human intervention, then decreased once the intervention stopped.

A allel is an alternative to an allel, and allel frequency is how often the allel occurs in a population. Selection pressures are when we (humans) selectively interfear with a species and put pressure on the population doing so, instead of leaving the species to do there own natural selection. As an example these selection pressures caused the blacke robin to take behavioural impacts of each othere in a case of where the thought more of there eggs would survive if they lay them on the rim, but this was not the case it was because they put selection pressure on the robin by pushing the eggs backe into the nest.

There is more space for your answer to this question on the following page.

This behaviour of laying eggs on the rim of the nest rather then in, increased due to human intervention because the other birds thought more of the birds eggs who lay them on the rim are surviving, ~~then~~ And so on it spread. This bahiour obviously decreased as soon as the human intervention stoped because all the eggs would of started to die again.

QUESTION TWO: BLOOD TYPE

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There are multiple alleles that determine a human's blood type. These are known as I^A, I^B and i^O. Alleles I^A and I^B are dominant over i^O. However, when I^A and I^B are inherited together, they show co-dominance.

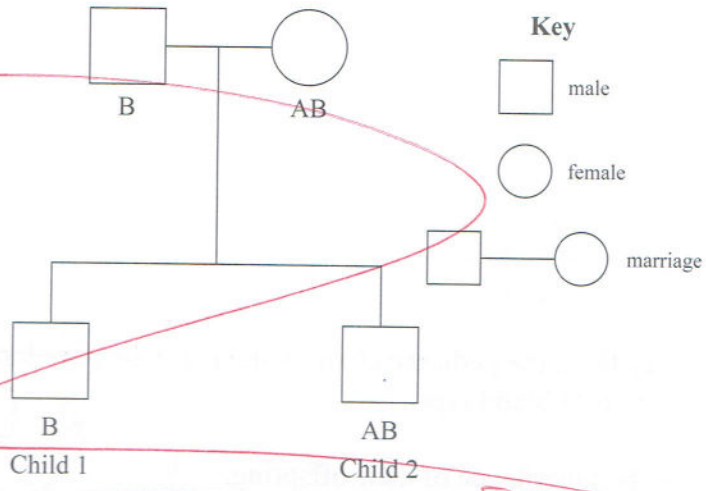
(a) Describe what multiple alleles are.

multiple alleles are alleles ~~of~~ that consist of more then two alleles, so in this case 3 I^A, I^B, i^O.

(b) The pedigree chart below shows the two children and their phenotypes that result from a male with phenotype B and a female with phenotype AB.

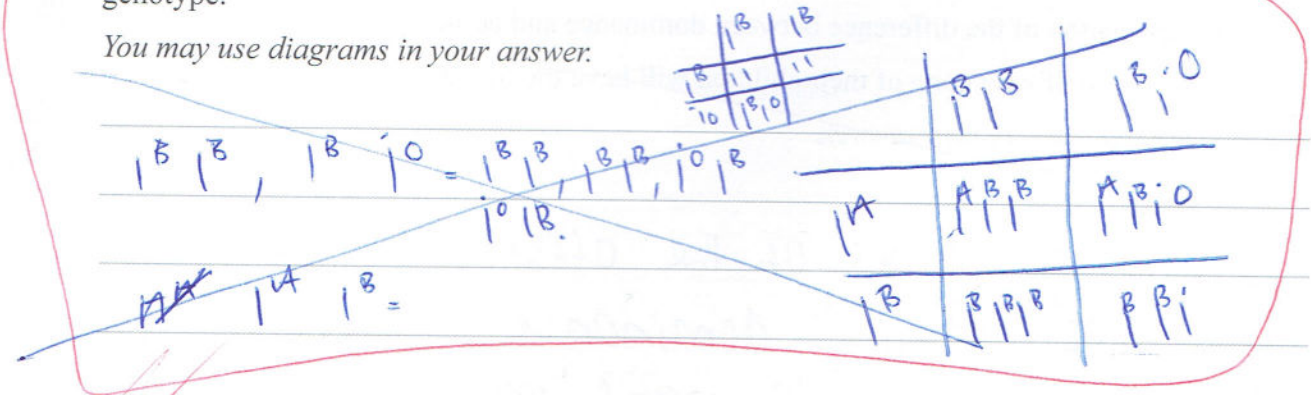
Blood Types

Phenotype	Genotype
A	$I^A I^A$, $I^A i^O$
B	$I^B I^B$, $I^B i^O$
AB	$I^A I^B$
O	$i^O i^O$



Explain why Child 1 has two possible genotypes while Child 2 has only one possible genotype.

You may use diagrams in your answer.



(O dominance = is the dominance of two alleles together

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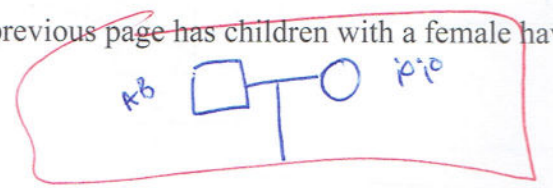
~~because on~~ Because the mother in this case has the phenotype AB (I^A, I^B) and it is complete dominance it leaves only one possible outcome for child' and over rides his phenotype and ensures he has to be (I^A, I^B) also.

(c) Child 2 (AB) in the pedigree chart on the previous page has children with a female having homozygous O blood type.



Discuss the inheritance of their offspring.

In your answer include:

- the possible phenotypes AND genotypes of the offspring
- an explanation of the difference between dominance and co-dominance
- a discussion of why none of their children will have the blood type O or AB.

You may use diagrams in your answer.

possible genotypes of the offspring could be blood type A, or B. dominance is where there is just one dominant allele where as co-dominance is two dominant alleis. The children will not have any of the two parents blood types as the are both

examples of dominance, so the offspring will more then likely be blood type A, B. ✓

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QUESTION THREE: COAT COLOUR

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In 1905, Lucien Cuénot observed unusual ratios when studying inheritance of coat colour in mice. After mating two heterozygous yellow mice (Yy), he observed that the offspring never showed a normal 3:1 phenotypic ratio. Instead, he always observed a 2:1 ratio, with two yellow mice for every grey mouse. He concluded that yellow coat colour (Y) was dominant over grey coat colour (y), and by using test crosses he showed that all his yellow mice were heterozygotes. However, from his many crosses, Cuénot never produced a single homozygous dominant yellow mouse.

www.themouseconnection.org/t955-what-are-these-sooty-colors

Subsequently, it was confirmed that no homozygous dominant yellow mice were present because of a lethal allele.

(a) Describe a lethal allele(s).

caused by mutation

~~lethal alleles are alels that do not carry over and can be potentialy thretening to a species.~~ lethal alleles are alleles that cause death or a harmful to a species, in this case the dominant yellow mouse carried lethal alleles and always died.

dead ~~dead~~.

(b) Discuss how Cuénot used test crosses to determine that all the live yellow mice were heterozygous.

In your answer include:

- a description of homozygous AND heterozygous
- an explanation of what a test cross is
- a discussion of how Cuénot used the test crosses to observe a 2:1 ratio (two yellow mice for every grey mouse), and determine that all live yellow mice were heterozygous.

You may use diagrams in your answer.

homozygous means two same alleles where as heterozygous means two different alleles. A test cross is a way of mating two individuals to distinguish possible allels in this case 'Lucien Cuenot' used two heterozygous yellow mice to work out there where no dominant yellow mice ever produced.

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(c) The genetic disease cystic fibrosis is caused by lethal alleles. An affected individual is homozygous recessive, however heterozygous individuals are carriers of the lethal allele. Lethal alleles are caused by mutations. The mutation for cystic fibrosis occurs in the gametes.

Discuss how mutations cause lethal alleles, AND why cystic fibrosis alleles remain in the population.

In your answer include:

- a description of what a mutation is
- an explanation of the difference between a gametic mutation and a somatic mutation
- a discussion of why the cystic fibrosis lethal allele remains in the human population.

~~A mutation is the change in the DNA base sequence causing a mutation~~ // A mutation is a change in the base sequence of DNA, with is usally causing a harmful or deadly change in a gene but can also be good. (rare). Cystic fibrosis remains in the human population because you do not have to have cystic fibroses to carry it ~~or~~ (the alleles) so you could be carrying the alleles for cystic fibroses //

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but not actually have it and pass it of to your offspring.

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Annotated Exemplar Template

Not Achieved exemplar for 91157 - 2015			Total score	05
Q	**Grade score**	**Annotation**		
1	2	Provides only 2 definitions for "Gene pool and allele frequency." The rest of the answer lacks evidence towards sufficient description or either natural selection or the rim laying behaviour.		
2	0	Information provided lacks relevance to the question. Definitions are incomplete without examples.		
3	3	Defines 3 of the definitions in each of (a) (b) and (c)		