EXEMPLAR

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NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 1 Biology, 2007

90163 Describe the transfer of genetic information

Credits: Three
9.30 am Tuesday 27 November 2007

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 answer 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 2–10 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.

For Assessor's use only	Achievement Criteria	
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Describe biological ideas relating to transfer of genetic information. ✓	Explain biological ideas relating to transfer of genetic information. ✓	Discuss biological ideas relating to transfer of genetic information. –
Overall Level of Performance M		

You are advised to spend 40 minutes answering the questions in this booklet.

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QUESTION ONE

Persian cats show an inherited condition called PKD (polycystic kidney disease). PKD is caused by a dominant allele D. The recessive allele is d.

(a) **Describe** what is meant by **'dominant allele'**.

~~A dominant allele is one whose characteristic~~ If there is a dominant allele ~~meant in the organism~~ the characteristic that that allele controls will always be displayed //

A

(b) **Describe** the **genotype(s)** of cats with PKD.

Cats with PKD can be ~~eg~~ either heterozygous (Dd) or Homozygous dominant (DD). //

A

Two Persian cats that are **heterozygous** for PKD, are mated together.

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(c) Complete the Punnett square to identify the proportion of kittens from this mating that can be expected to have PKD.

female

male Dd	D	d
D	DD	Dd
d	Dd	dd

A

The proportion of kittens that can be expected to have PKD is $\frac{3}{4}$. 75 .75, 3:1.

(d) **Explain** how two cats with PKD can have kittens that do NOT have PKD.

As shown in the above punnet square, if the two cats are heterozygous, they each have one recessive (non-PKD) allele and are dominant (diseased with PKD) allele. If both animals give their offspring recessive alleles, as shown in the bottom right square of the punnet square, no of the offspring will ~~be~~ not be diseased, as they will not have any of the disease causing alleles //

M

QUESTION TWO

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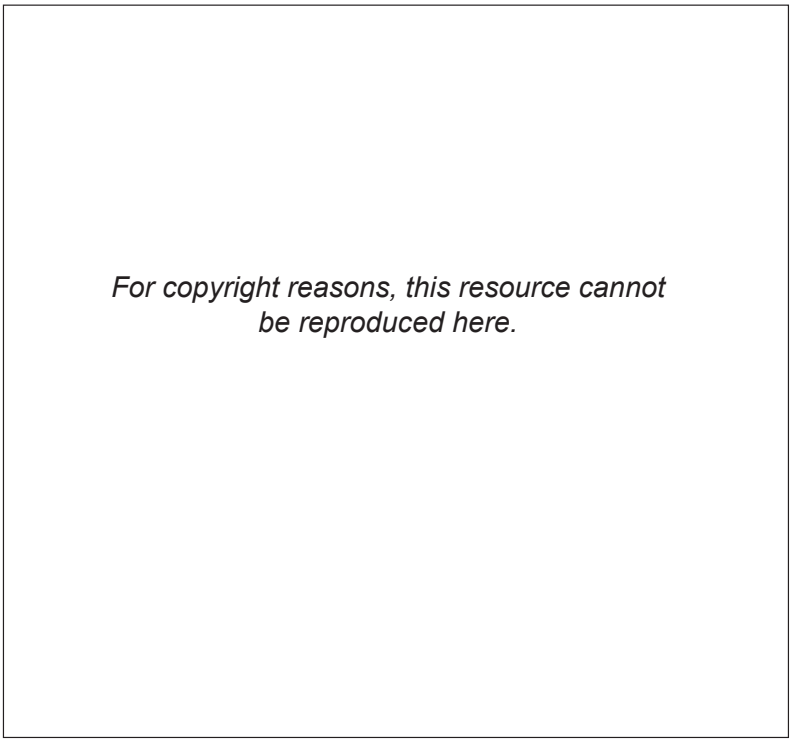
The diagram below shows a small section of DNA during replication.



Adapted from: http://www.accessexcellence.org/RC/AB/WYW/wkbooks/SFTS/SFTSg/7.gif

(a) **Describe** what a gene is.

A gene is a section of DNA that codes for a specific characteristic in an organism. This code is written in the order of the base pairs, and any slight variations in that order may cause the characteristic to change. Variations like this of the same gene are called alleles. (e.g. blue eyes & brown eyes)

A

(b) **Explain** how the process shown in the diagram above ensures accurate replication of DNA.

Bases are complimentary to one another, that is, ~~Adenine~~ A can only pair with ~~Thymine~~ T, and ~~Guanine~~ G can only pair with ~~Cytosine~~ C. When the DNA unzips during the process of replication, as shown in the diagram, loose bases in the cell will join with ~~the~~ each unzipped half strand of DNA. Because the bases are complimentary, only As can replace As and only Cs can replace Cs etc. This ensures accurate replication of the DNA

Has the idea of matching up to the parent strand.

M(?)

(c) **Discuss** the reasons why **accurate** replication of DNA is important for cell functions.

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Accurate replication of DNA is important because DNA contains the instructions for how that cell operates if one base is missing, changed, or if another base has been added, that DNA becomes unreadable. This is called mutation and is the cause of many genetic diseases. The outcome of mutation is that the organism will likely be deficient in some way, or

M

QUESTION THREE

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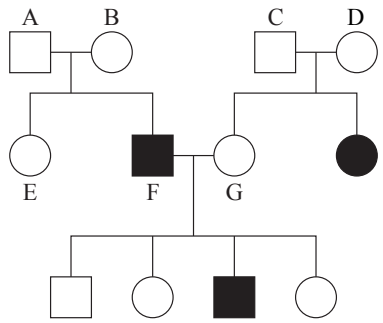
The pedigree diagram below shows the inheritance of a type of deafness in a family group.



	Female	Male
Deaf	●	■
Hearing	○	□

(a) **Describe** the **phenotype** of Individual F.

~~Ef~~ Individual F is displaying the deaf phenotype //

N

(b) **Explain** how the pedigree diagram above shows that this type of deafness is caused by a **recessive allele**.

Child's phenotype described as deaf.

Individual H is displaying the deaf phenotype. We know then that one or both of her parents must have the deafness allele, depending on whether it is dominant or recessive. If the allele was dominant, because we know it is present in at least one parent, one of the parents should be displaying the deaf phenotype. ~~Bee~~ However; they are not, and so we can deduce that deafness is caused by a recessive allele //

Parents identified as hearing.

A

(c) Determine the genotype of Individual G and use this to **discuss** the reasons for the proportion of children of F and G who ARE deaf.
Use the alleles H for hearing and h for deafness.
You may use a Punnett square.

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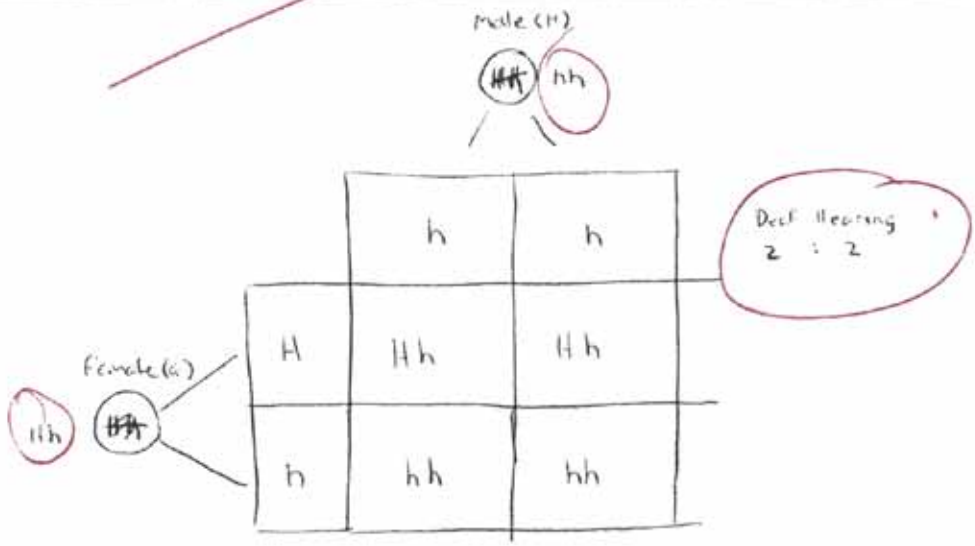
We know that F is homozygous recessive (hh), because he is displaying the deaf phenotype. In order to have deaf children, G must also have a deaf allele, but is not deaf herself, so she must be heterozygous (Hh). As the punnet square drawn below shows, the expected ~~amount~~ proportion of deaf children to hearing children is equal. In actuality ~~have the~~ However, the pedigree chart shows that the actual proportion of deaf to hearing is 1:3. ~~These two~~ This difference is because of chance. Every time the couple has a child the chance that it is deaf is 50%. Chance just so happened to make only one of their four children deaf. ~~If they were to~~ In this case



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QUESTION FOUR

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Potato plants can be reproduced either sexually from seeds, or asexually from the potato tuber or from stem cuttings.

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http://www.io.com/~hcexres/textbook/instrxx4c.html

Cells in some parts of the potato plant undergo meiosis.

(a) (i) Where does meiosis occur in the potato plant?

In the flower. //

(ii) **Describe** the purpose of meiosis.

The purpose of meiosis is to produce gametes (sex cells) with only half the normal number of chromosomes, so that the organism can reproduce. //

A

(b) **Explain** how asexual reproduction of potatoes is an advantage to the grower.

Asexual reproduction of potatoes ~~is an advantage to the grower because~~ means that all of the new potatoes are genetically ~~identical~~ identical to the parent potato. This is an advantage to the grower because it means they know what kind of potatoes will be produced and also the best conditions for that potato, because they will have learned ~~from~~ from experience with the parent. //

A

(c) **Discuss** how the genetic characteristics of the potato crop could be improved by selective breeding.
Consider both sexual and asexual reproduction methods in your answer.

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Selective breeding can improve the genetic and physical characteristics of the crop because growers can choose ~~desirable traits~~ to breed desirable traits. This can be done sexually by breeding two potatos who display desirable traits, preferably those who are homozygous for it. This is more natural and produces some variation but will still result in a good potato, who will display the desirable trait (whether it be size, colour, flesh consistency etc.)

Selective breeding can be done asexually by taking a cutting from a plant that displays desirable traits like a good size, colour and flavour, and then replanting it. ~~Because of the genetic~~ Because the parent and offspring are genetically identical the offspring should display all of the desirable traits of the parent. This will provide a consistently good potato plant. //

M