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NZQA

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Level 1 Science, 2016

90948 Demonstrate understanding of biological ideas relating to genetic variation

9.30 a.m. Monday 14 November 2016
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of biological ideas relating to genetic variation.	Demonstrate in-depth understanding of biological ideas relating to genetic variation.	Demonstrate comprehensive understanding of biological ideas relating to genetic variation.

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 room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–8 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.

Excellence

TOTAL 20

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Paper annotation

SCORE 20

EXCELLENCE

Question	Grade	Annotation
1	M5	The candidate used the idea that if photic sneezing was recessive They have however did not say why 13 could be AA or Aa. Then there is no way the parents can have a child with a dominant trait. The candidate gave expected and observed ratios plus the idea of chance but no phenotypes for the observed ratios were given. They also failed to mention sample size as a reason for the difference.
2	E8	The candidate mentioned how a change in the gene code gives new alleles with new phenotypes for the observed ratios. They also stated how sample size was a reason for the difference between observed and expected ratios.
3	E7	Candidate described sexual reproduction and how it explained the phenotype of the offspring. They failed to discuss how the feature is passed onto the next generation. Candidate fully explained how DNA is useful in inheritable variation but not in non-inheritable variation. This was related to the two phenotypes.

QUESTION ONE

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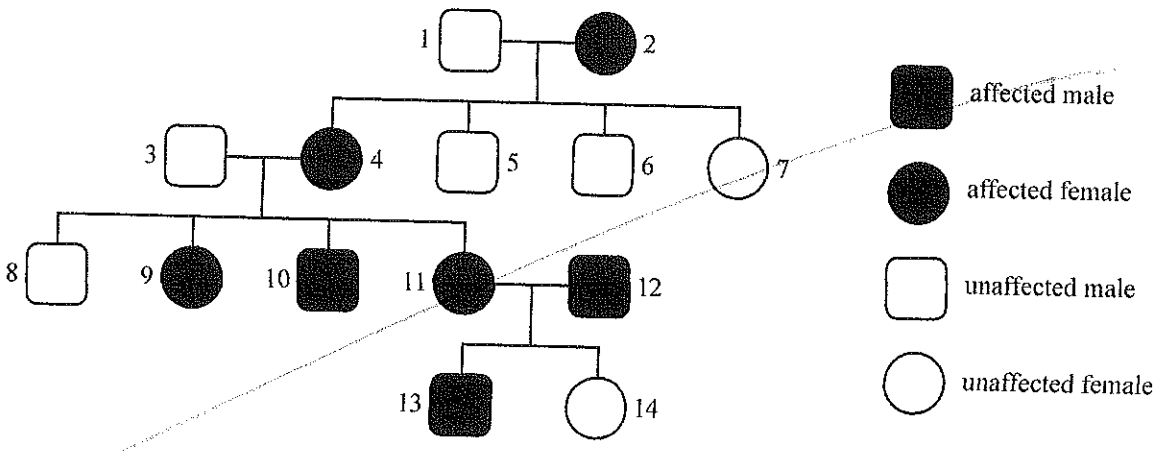
Photic sneezing is a condition which causes affected people to sneeze due to bright light. It can be traced through a family, as shown in the pedigree chart. Photic sneezing (A) is dominant to unaffected (a).



(a) Work out the genotypes of the following four individuals:

1 ~~Heterozygous~~ Homozygous recessive

2 Heterozygous

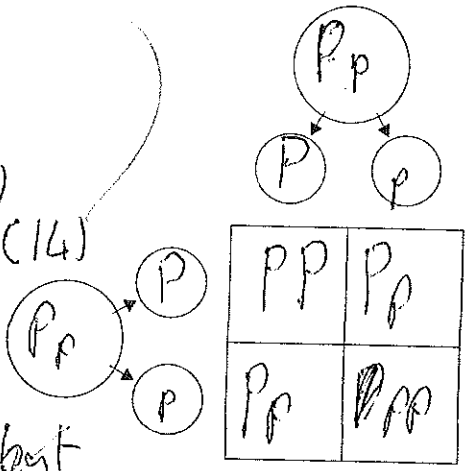
11 Heterozygous

12 Heterozygous

(b) Explain how the pedigree chart can be used to show that Photic sneezing is dominant, but it cannot be used to determine the genotype of individual 13.

You may use the Punnett square.

We know that Photic sneezing is dominant as in person 11 and 12 both show the trait but they are able to have a child (14) who does not show it. If it was recessive neither 11 or twelve would show it but their child (14 would both 11 and 12 would be homozygous recessive so would not be able to have a child with the dominant trait. We can not tell what geno type 13 is as he shows the dominant trait so one of the alleles must be recessive but we cannot tell the other cause he has no children



(c) The cross between 1 and 2 in the pedigree chart has **one affected sneezing** offspring.
The cross between 3 and 4 in the pedigree chart has **three affected sneezing** offspring.

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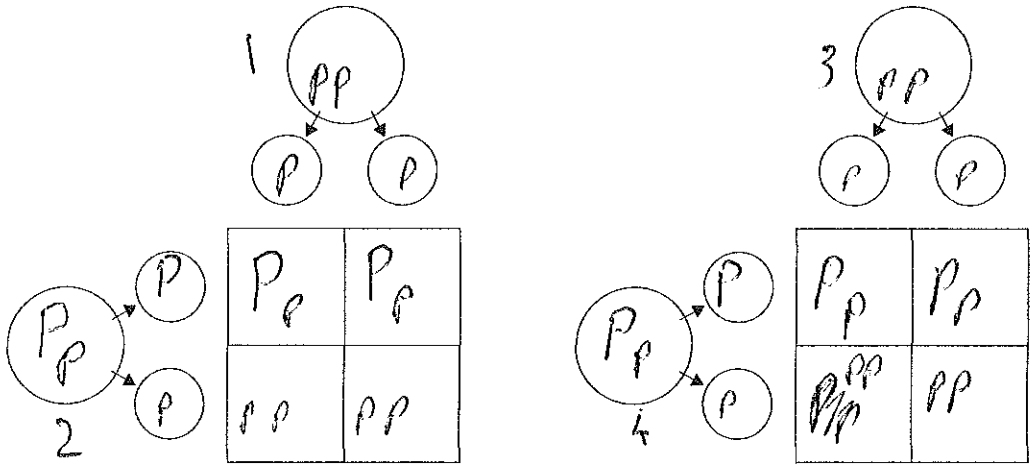
Explain the difference in the number of affected offspring (photic sneezers) in these 2 crosses.
In your answer you should:

- complete Punnett squares
- give the expected phenotype ratio for each cross
- account for any difference between the expected ratio and the actual phenotype ratio for each of the crosses.



The expected ratio for each set of parents should be 1:1 so an equal amount of affected and unaffected. But as we can see there are 3:1 for parents 1 and 2 and 1:3 in parents 3 and 4. This is because the ratio for phenotypes is statically what should occur but because it is still random chance the ratio could be anything* not only 1:1

* in reality

QUESTION TWO

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Rock pocket mice can have dark fur or light fur, as shown below.

www.discoverlife.org/mp/20q?search=Chaetodipus+intermedius&mobile=close&flags=glean;

www.flickriver.com/photos/tags/broadcanyonbioblitz/interesting/

(a) Using the example of rock pocket mouse fur colour, explain how information carried on the DNA controls the appearance.

In your answer you should refer to DNA base sequence, genes and alleles.

DNA is a long double helix made of bases, sugars and phosphates. Specific base sequences (order of the 4 bases) code for different things. A gene is a section of DNA the controls a certain trait/characteristic e.g. fur colour. An alleles are the different versions of a gene e.g. dark fur or light fur. The base sequences in the gene determine which allele it is.

(b) In rock pocket mice, dark fur colour (D) is dominant to light fur colour (d).

Each mouse has two alleles for fur colour.

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Explain how they inherit these two alleles, and explain how the two alleles interact to produce different phenotypes.

In your answer you should:

- define phenotype and genotype
- explain how the alleles are inherited from the parents
- state the three possible fur colour genotypes for rock pocket mice.

A genotype is a set of alleles given to you by your parents. The different alleles you recieve determine your genotype. A phenotype is a physical trait or characteristic that has been determined by the genotype. e.g. dark or light fur. There are three different genotypes. Homozygous dominant is when both alleles are the dominant sort. This would cause the off spring to be dark furred. Heterozygous is when one allele is dominant but the other is recessive. As the dominant allele will always take priority over a recessive allele if they are both present a heterozygous mouse will have dark fur. Homozygous recessive is when both Alleles are the recessive sort. If a mouse is recessive it would be light furred.

You recieve one allele from each parent, when the sex cells, gametes, fuze together. Each sex cell has only 1 allele for each trait so whatever each gamete has is the combination the mouse gets.

E8

QUESTION THREE

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Venus flytraps (*Dionaea muscipula*) are plants that live in poor quality soils. They have specially adapted leaves that snap shut to catch insects.

The plants reproduce sexually, involving the production of flowers.

www.flickr.com/photos/david_jones/5256437760

(a) Discuss the advantages of sexual reproduction.

In your answer you should:

- define sexual reproduction
- explain how ONE important process in sexual reproduction helps to produce variation in offspring
- explain how variation as a result of sexual reproduction can benefit the Venus flytrap plant population over generations.

Sexual reproduction is when one organism requires another organism from its species to reproduce. One important process in sexual reproduction is the natural selection of gametes. Depending on which gamete fuses with the other parents gamete changes what the offspring will look like. eg. two gametes might hold DNA coding for offspring using complete opposite alleles depending on which on fuses with the other parents gamete changes what the offspring will look like.

Variation as a result of sexual reproduction as it varies the genepool and good traits such as immunities to some diesieses gets passed on to some offspring. Meaning if that specific diesiese effects the plant it means it will survive whereas others might not

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(b) The Venus flytrap plants come in a number of different types, such as the "B-52" with a red leaf.

A teacher brought two identical plants to class and put them in different parts of the classroom. The Venus flytrap put near a window grew short leaves and the Venus flytrap in the shade grew long leaves.

https://commons.wikimedia.org/wiki/File:Venus_Flytrap_-_B-52.jpg

Colour variation in the leaves of the Venus flytraps can be passed on to a plant's offspring, but the different leaf length cannot. **Explain why.**

In your answer you should:

- define inheritable and non-inheritable variation
- explain what causes inheritable and non-inheritable variations.

Inheritable variation is when the variation/ mutation occurs in the sex cells of the plant. This variation is able to be passed on to the off spring of the original plant.
Non inheritable variation is a variation that can not be passed on to its offspring and often is caused by a mutation in cells of the parents that arent gametes. or because of the enviroment.
Colour variation of leaves can be passed on to a plants off spring as it is coded into the plants dNA and Genes so it is inheritable where as leaf length was a result of the different light levels of each enviroment which is not coded into the plants DNA.//

Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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