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1

90948



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## Level 1 Science, 2017

### 90948 Demonstrate understanding of biological ideas relating to genetic variation

9.30 a.m. Wednesday 15 November 2017

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.**

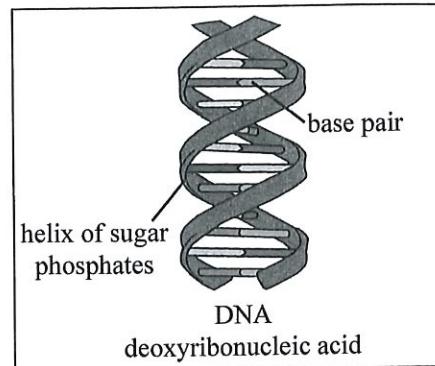
Excellence

TOTAL

21

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## QUESTION ONE



<https://pixabay.com/en/panter-leopard-black-spotted-359245/>

Adapted from: <https://commons.wikimedia.org/wiki/File:Dna-base-flipping.svg>

Some leopards or jaguars have a **mutation** causing them to have a black coat. These are known as "black panthers".

- (a) How can this **mutation** cause the coat colour to be different?

In your answer you should use the terms DNA, gene, allele, phenotype, and mutation to explain how this colour change occurs. The DNA diagram above may help you.

A mutation is a result of an extra base or incorrect pairing or an missing base in the structure of DNA. The structure of DNA involves a sugar, phosphate and a base (Adenine, Thymine, Cytosine, Guanine, A, T, C, G). The sugars and phosphate are the outside structures of DNA while the bases A, T and C, G are the middle section, joined by hydrogen bonds.

DNA is found in chromosomes which are found in the nucleus of every cell. A section of this chromosome is called a gene. This gene codes for a specific characteristic, the coding for that gene is in the DNA base sequence when an allele (a different form of gene) and a triplet of base sequence codes for an amino acid (protein).

A mutation of the black leopard would be an incorrect pairing, an missing base, or and extra base in the base sequence. Therefore the allele coded for (black skin) is a mutation of the original characteristic. The change in base sequence will coded for an alternative phenotype as the genetic coding has changed. The protein will grow into a black skin leopard phenotype.

| A T C | A C T | A

Incorrect pairing science 90948, 2017 resulting in

- (b) Leopards in the wild commonly have scars, especially around their faces.

Explain why the leopard cubs can be born with black coats but not with scars.

A mutation of a characteristic or trait can only be genetically passed down through the gametes (sex cells).

A leopard ~~cat~~ cub born with black skin will be a result of a mutation in the base sequence of DNA. It is not a genetically inherited trait. However the scars are a characteristic of the original leopard therefore it is a genetic trait (<sup>sex cells</sup>) passed down through the gametes. Therefore the black leopard ~~cannot~~ does not carry that genetic trait or characteristic that would be otherwise passed down through the gametes. If a leopard cub was to be born with normal coloured skin the scars would be a result of a genetic mutation ~~or~~ passed down genetically through the gamete.

[www.wilderness-safaris.com/media/blog/camp-news/chitabe-leopard-identikits/copy-of-01-mosadi-mogolo-web.jpg](http://www.wilderness-safaris.com/media/blog/camp-news/chitabe-leopard-identikits/copy-of-01-mosadi-mogolo-web.jpg)

EGBH  

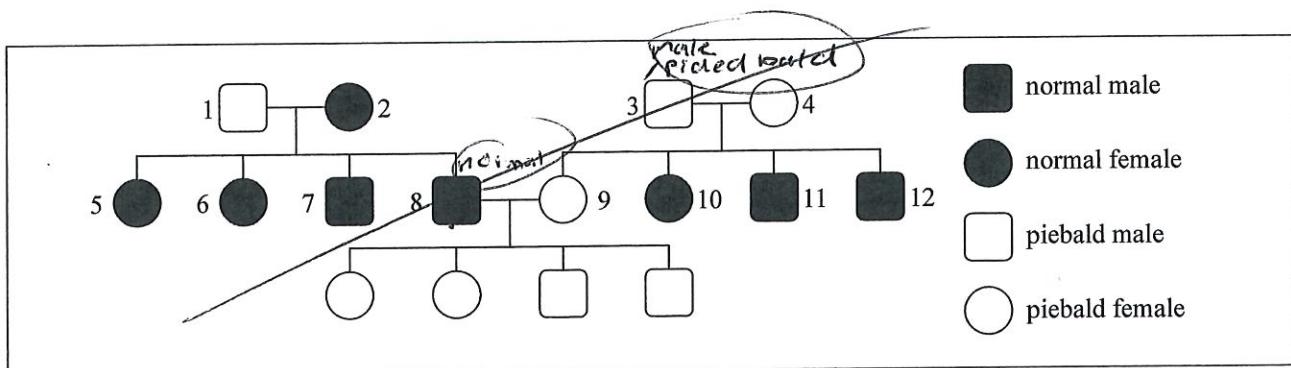

## QUESTION TWO

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[https://nz.pinterest.com/  
pin/255297872600783620/](https://nz.pinterest.com/pin/255297872600783620/)

[www.mybligr.com/wp-content/uploads/  
2017/02/beautiful-Black-horse-images-pictures-  
photos-13.jpg](http://www.mybligr.com/wp-content/uploads/2017/02/beautiful-Black-horse-images-pictures-photos-13.jpg)

Piebaldism is a genetic condition causing a white patch on the head and body of horses. In horses piebaldism is a **dominant** trait (H), and “normal” colour is recessive (h).



- (a) From the pedigree chart above, list **all** the possible phenotypes and genotypes of horses 3, 8, and 9.

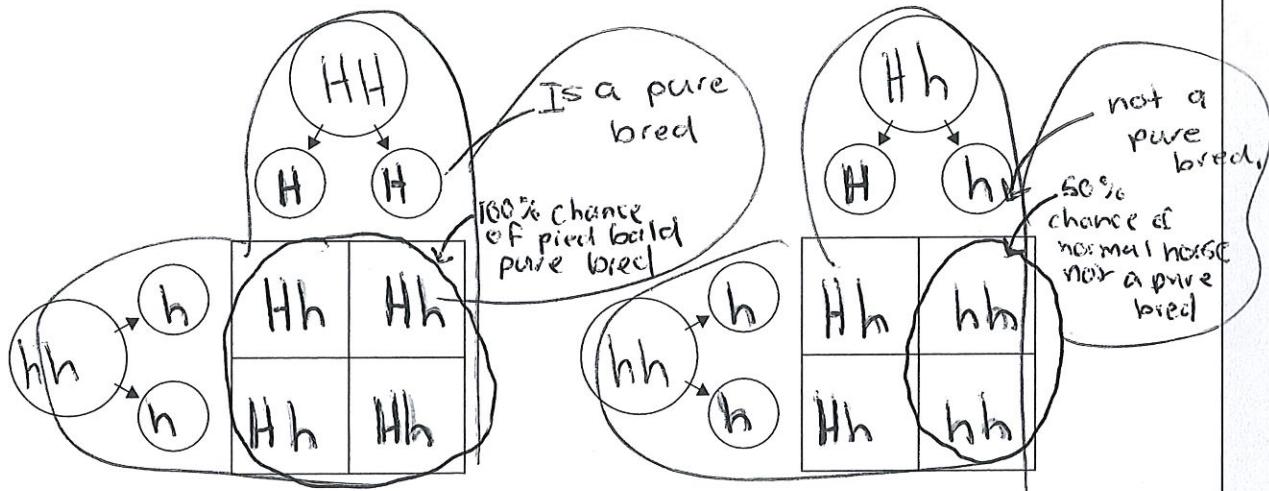
Use the letter H for the dominant trait and h for the recessive.

Individual	Phenotype (normal or piebald)	Genotype (HH, Hh, or hh)
3	Pied Piebald	HH, Hh heterozygous
8	normal	HH hh homozygous recessive
9	Piebald	HH homozygous dominant

- (b) A breeder wants to produce only **dominant** (piebald) offspring from a breeding pair of horses. The breeder has piebald and normal horses to breed from.

How could the breeder use crosses to make sure that the pair of horses were **pure breeding**?

Show crosses using Punnett squares to support your answer.



The breeder needs to go through a process of test cross in order to see if the piebald male is a bit pure bred (homozygous dominant). If the breeder crossed must cross the piebald with a normal horse with the genotype hh homozygous recessive. If the recessive trait is apparent in the offspring then the piebald's genotype must be homozygous heterozygous (Hh) because in order for the dominant trait to be crossed with the recessive and have the trait appear in the offspring then the dominant must carry the recessive alleles. However if the breeder crossed the pie dominant piebald over the normal recessive horse and no recessive trait was present then the horse must be a pure breed (Homozygous dominant). Because there is no recessive trait in the genotype. If the breeder wanted to continue to test the offspring they would need to repeat the process of test cross again. However the punnet squares above are only estimates of what the genotypes and phenotypes of the offspring could be. In order for the breeder to continue to produce a pure bred dominant piebald offspring they must continue to use the horse with the genotype HH homozygous dominant, of which was discovered in the test cross and the phenotypes of the resulting offspring.

E

## QUESTION THREE

Wild bananas, showing seeds.

<https://commons.wikimedia.org/w/index.php?curid=1867879>

A "banana pup" growing.

[www.promusa.org/Banana+sucker](http://www.promusa.org/Banana+sucker)

Wild bananas have large seeds, and reproduce sexually.

Farmed bananas are produced asexually, from suckers called "banana pups".

- (a) How does the production of gametes result in variation for the wild banana plants?

The production of gametes resulting in variation is because of a process called meiosis. Meiosis is when the cells split and divide to produce four new daughter cells with the same amount of chromosomes of which one will be either the egg or sperm used for fertilisation. In the process of meiosis the chromosomes first pair up with their homologous pairs ~~and~~ in the center of the nucleus. They ~~are then~~ During this process crossing over occurs. This results in variation within a species population. Crossing

over is when the ~~sections~~ of the chromosomes swap sections of their ~~their~~ This creates variation because the genetic coding for genetic information. The cells then divide into two. Phenotype is now different. The second stage of meiosis occurs metaphase where the chromosomes line up in random order in the center of the nucleus. This is known as independent assortment which also results in variation because of the random nature of how these chromosomes line up. The 2 new cells are then split into four daughter cells. These 4 new cells have different genetic information to each other which creates variation.

Variation is also the random nature of which sperm fertilises which egg and grows into a ~~zygote~~ wild banana plant.

- (b) Suggest a possible problem that may arise with farmed bananas (produced from suckers), and explain why this problem would not occur in wild bananas (produced sexually)?

Asexual reproduction is the process of reproduction where only one parent is required to produce offspring. However the offspring are clones of the parent with the same genetic make up. This results in no variation.

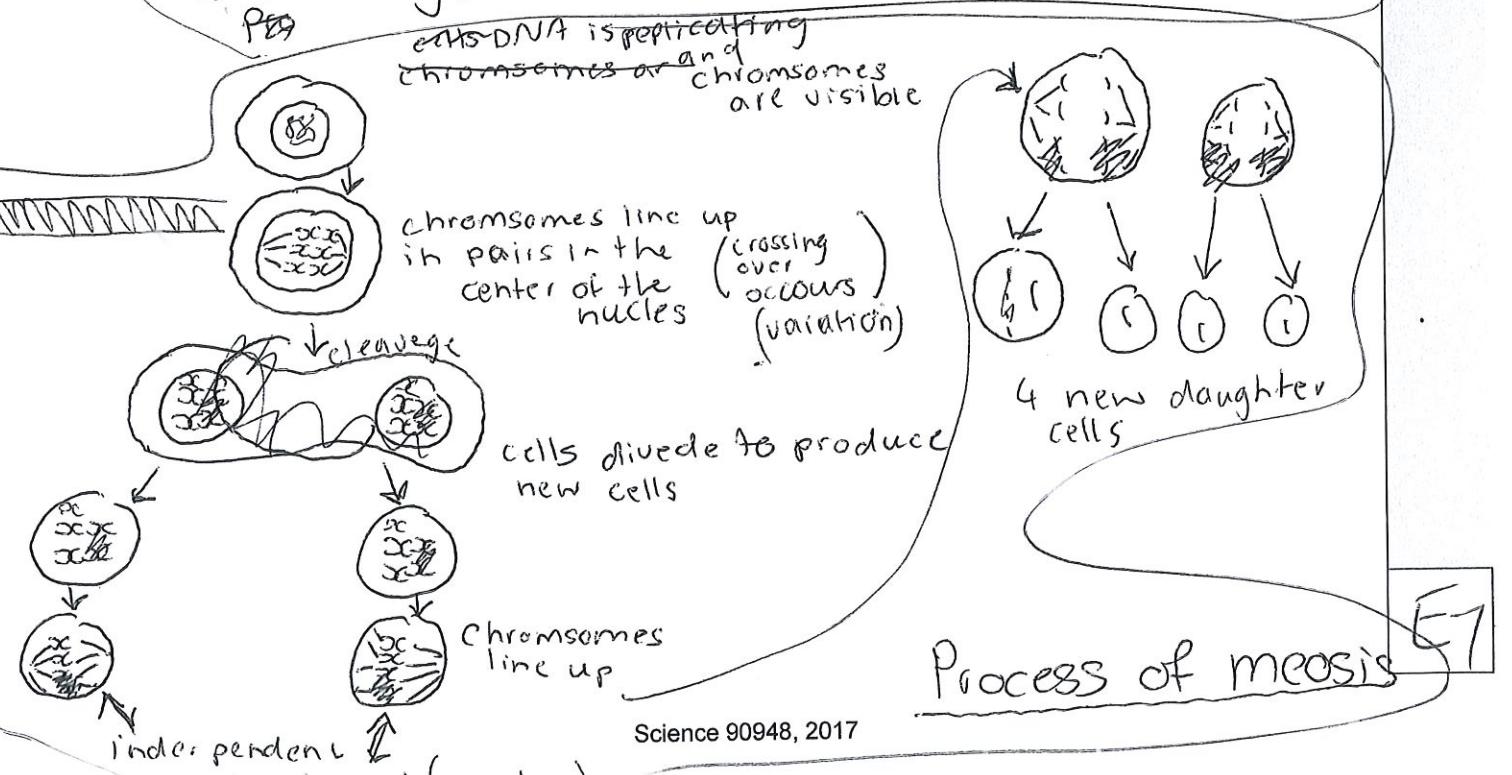
Whereas, through the process of meiosis in sexual reproduction because of crossing over and independent assortment variation occurs. ~~in the~~ Variation within a species

Population is essential for the species survival, if a natural cause such as disease went through the individuals that had the genetic make up to fight the disease would survive, while the others died off.

Still leaving a sample of the population to reproduce again. However asexual reproduction offers no variation, therefore if the disease went through the whole species would be killed because none had the genetic information to fight it. Therefore

there is no species left. Therefore to ensure the survival of a species, such as the banana sucker the most beneficial and sustainable form of reproduction is sexually where variation can occur.

PS:



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

(a)

3(b) Therefore if there was a disease outbreak and the bonita sucker was affected it is likely that the whole species will die because there is no variation amongst them to sustain the population. And therefore there would be no reproduction of the species.

90948

Excellence Exemplar for 90948. 2017			Total score	21
Q	Grade Score			
1	E7	<p>This is <b>an E7</b> because they have explained what a mutation is and then explained how the alteration to the base sequence causes black coat. They have explained what an allele is in context but not what a gene is in context. It is <b>not an E8</b> because they have not explained that a gene codes for a coat colour.</p> <p>Also (b) has said that scars are genetically based and black coat is non genetic.</p>		
2	E7	<p>This is an <b>E7</b> because the candidate has explained the use of a test cross to tell the difference between HH and Hh. They have said that Hh will give normal coats so it has two recessive alleles and it is not pure breeding. They have also stated that “they needed to repeat the process”. It is <b>not an E8</b> because they have not explained that the breeder can never be totally certain that it is HH because Hh can always produce a piebald horse even after many crosses.</p>		
3	E7	<p>This is an <b>E7</b> because in (a) they have explained the role of chromosome /genetic shuffling to get variation. They have not explained the role of fertilisation in increasing variation. They have in (b) fully explained that with farmed/asexual bananas that they are all clones with no genetic variation and may all be affected by a disease. Sexual/wild bananas have variation and that some individuals will survive.</p> <p>It is <b>not an E8</b> because they have not explained the role of fertilisation in the process of giving variation.</p>		