

BIOLOGY

UNIT 2

Student name

Student ID

Letter

Structure of book

Section	Number of questions	Number of marks
A	25	25
B	6	50
	Total	75

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.
- No calculators are allowed in this examination.

Materials supplied

- Question and answer book of 18 pages, with a detachable answer sheet for multiple-choice questions inside the front cover.

Instructions

- Detach the answer sheet for multiple-choice questions during reading time.
- Write your name and student ID in the space provided above on this page and on the answer sheet for multiple-choice questions.
- All written responses should be in English.

At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

STAV 2022

BIOLOGY

Unit 2 Trial Examination

MULTIPLE CHOICE ANSWER SHEET

STUDENT NAME:	
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INSTRUCTIONS: USE PENCIL ONLY

- Write your name in the space provided above.
- Use a **PENCIL** for **ALL** entries.
- If you make a mistake, **ERASE** it – **DO NOT** cross it out.
- Marks will **NOT** be deducted for incorrect answers.
- **NO MARK** will be given if more than **ONE** answer is completed for any question.
- Mark your answer by **SHADING** the letter of your choice.

	ONE ANSWER PER LINE		ONE ANSWER PER LINE
1	☐ A ☐ B ☐ C ☐ D	14	☐ A ☐ B ☐ C ☐ D
2	☐ A ☐ B ☐ C ☐ D	15	☐ A ☐ B ☐ C ☐ D
3	☐ A ☐ B ☐ C ☐ D	16	☐ A ☐ B ☐ C ☐ D
4	☐ A ☐ B ☐ C ☐ D	17	☐ A ☐ B ☐ C ☐ D
5	☐ A ☐ B ☐ C ☐ D	18	☐ A ☐ B ☐ C ☐ D
6	☐ A ☐ B ☐ C ☐ D	19	☐ A ☐ B ☐ C ☐ D
7	☐ A ☐ B ☐ C ☐ D	20	☐ A ☐ B ☐ C ☐ D
8	☐ A ☐ B ☐ C ☐ D	21	☐ A ☐ B ☐ C ☐ D
9	☐ A ☐ B ☐ C ☐ D	22	☐ A ☐ B ☐ C ☐ D
10	☐ A ☐ B ☐ C ☐ D	23	☐ A ☐ B ☐ C ☐ D
11	☐ A ☐ B ☐ C ☐ D	24	☐ A ☐ B ☐ C ☐ D
12	☐ A ☐ B ☐ C ☐ D	25	☐ A ☐ B ☐ C ☐ D
13	☐ A ☐ B ☐ C ☐ D		

SECTION A – Multiple-choice questions**Instructions for Section A**

Answer all questions on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1; an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1

A genome is

- A. a diploid set of chromosomes.
- B. a diploid set of genes in an individual.
- C. a haploid set of chromosomes in a cell.
- D. a haploid set of genes in an individual.

Question 2

Sex-linked traits are

- A. found in only one sex in a pedigree.
- B. produced by genes located on a sex chromosome.
- C. carried on an autosome but only expressed in females.
- D. dependent on whether the gene was inherited from the mother or the father.

Question 3

Pairs of homologous chromosomes

- A. are located in gametes.
- B. separate in the second stage of meiosis.
- C. have identical DNA sequences in their genes.
- D. have genes for the same characteristics at the same loci.

Question 4

A karyotype is

- A. the genotype of an individual
- B. the phenotype of an individual
- C. a unique combination of chromosomes found in a gamete
- D. a pictorial display used to identify chromosome abnormalities

Question 5

During the first division in meiosis (meiosis I)

- A. the chromosomes align in single file along the equator.
- B. the homologous chromosomes separate.
- C. the chromosome number remains the same.
- D. crossing over occurs between non-sister chromosomes.

Question 6

In a plant species, the alleles A, B, and C produce a dominant trait to the alleles a, b, and c. A plant with the genotype AABbcc will have the same phenotype as a plant with the genotype

- A. Aabbcc
- B. aabbcc
- C. AaBBcc
- D. AABBCc

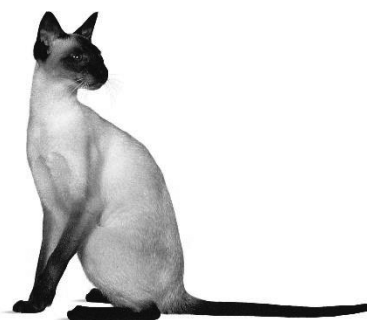
Question 7

Flower colour is an example of incomplete dominance. When a plant with red flowers is crossed with a white flowered plant, the F1 offspring develop pink flowers. If a plant with pink flowers is crossed with a plant with white flowers, the offspring will be

- A. 100% pink
- B. 100% white
- C. 50% pink, 50% white
- D. 25% red, 50% pink, 25% white

Question 8

Siamese cats (one is shown below) develop black fur on their limbs and ears as a result of exposure to cold environments.



This is an example of

- A. a specific phenotype.
- B. a specific genotype.
- C. an environmental or epigenetic factor.
- D. an example of independent assortment.

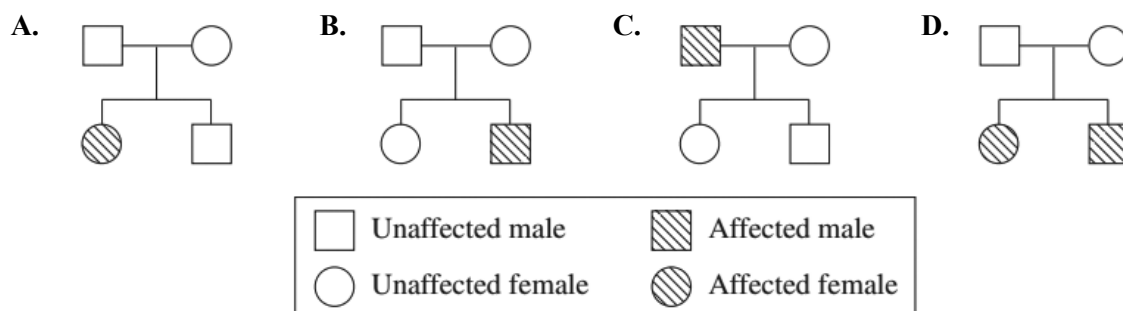
Question 9

The blood types in humans are determined by three different alleles known as I^A , I^B , and i . The I^A and I^B alleles are co-dominant and the i allele is recessive. The possible phenotypes for blood groups in humans are Type A, Type B, Type AB and Type O (genotype ii). If a woman and man with blood Type A were to have offspring with the blood Type O, which one of the following shows both of the parent's potential genotype?

- A. $I^A I^A$
- B. $I^A I^B$
- C. $I^B I^B$
- D. $I^A i$

Question 10

A doctor suspected that a child has red-green colour blindness (a recessive, X-linked trait). They developed an initial pedigree of the parents and children. Identify the pedigree that is most likely to reflect the inheritance of this condition.

**Question 11**

A rabbit with black fur was used in a test cross with a homozygous recessive white-haired rabbit. If the offspring had a 1:1 phenotypic ratio it suggests that the rabbit with black fur is

- A. heterozygous
- B. homologous
- C. homozygous recessive
- D. homozygous dominant

Question 12

In pea plants, smooth seeds are dominant to wrinkled seeds. If two heterozygous plants were crossed, identify the fraction of offspring that should have smooth seeds.

- A. none
- B. $\frac{1}{4}$
- C. $\frac{1}{2}$
- D. $\frac{3}{4}$

Question 13

Scientists have identified that the genes for grey bodies and long legs are linked in *Drosophila* flies. This means that

- A. the genes are inherited separately.
- B. the genes independently assort.
- C. a fly can inherit long legs and a black body.
- D. the genes are located on the same chromosome.

Question 14

Asexual reproduction involves

- A. only one parent.
- B. no fusion of gametes.
- C. fertilisation with gametes.
- D. no cell division by mitosis.

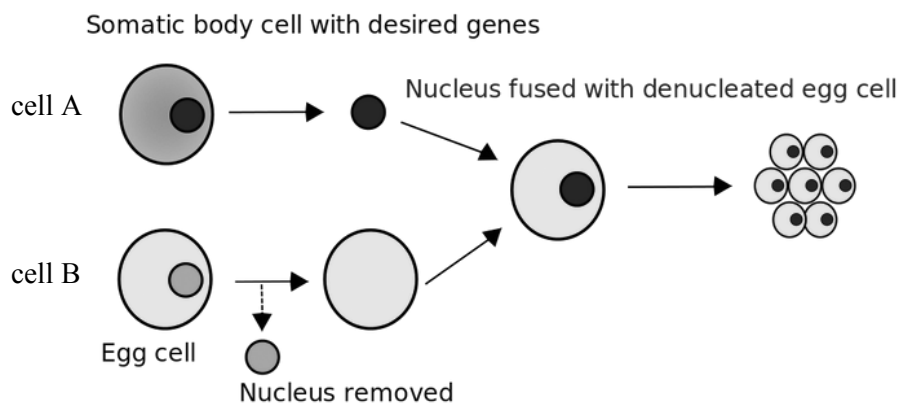
Question 15

Sexual reproduction in plants

- A. involves the production of gametes.
- B. reduces genetic diversity.
- C. reduces mixing of genetic material.
- D. produces genetically identical offspring.

Question 16

The diagram below shows an artificial reproductive technique.



The offspring cells of the process shown in the diagram above will

- A. be a clone of cell A.
- B. be a clone of cell B.
- C. have 50% of cell A genes.
- D. have a mix of genetic material of cells A and B.

Question 17

A medium sized population of Indomalayan pencil-tailed tree mice live on an isolated island in Indonesia. They could be at a greater risk of extinction because of

- A. reduced genetic diversity.
- B. increased number of mates.
- C. increased risk of predation.
- D. increased population distribution.

Question 18

Identify which one of the following is an example of a physiological adaptation.

- A. a snake biting when it is frightened
- B. a desert rat sleeping during the heat of the day
- C. a male seahorse looking after its young in its pouch
- D. a seal producing a chemical that helps it store extra oxygen for deep dives

Question 19

A frill necked lizard uses its frill to make itself look larger when it is frightened. This is an example of a

- A. structural adaptation.
- B. behavioural adaptation.
- C. physiological adaptation.
- D. environmental adaptation.

Question 20

The image below shows a cassowary.



The cassowary is considered a keystone species in the Daintree Rainforest because it

- A. migrates into other ecosystems.
- B. is domesticated compared to other species.
- C. doesn't affect its habitat in the Daintree Rainforest.
- D. affects a wide variety of species in the ecosystem.

Question 21

The population of rabbits in Australia is described as having a wide distribution. This means it has

- A. a number of organisms in farmlands.
- B. a number of organisms in a small area.
- C. a number of organisms spread over a large area.
- D. a number of organisms in the mountain ranges.

Question 22

An experiment that examined the effect of a drug used in cancer treatment in humans would need to consider the ethical concept of

- A. non-maleficence: that no undue harm occurred to the individuals in the test group.
- B. respect: the obligation that there was no unfair burden placed on the test group.
- C. integrity: the moral obligation to ensure that the test subjects were treated fairly.
- D. beneficence: ensuring that the people in the trial were able to make their own decisions.

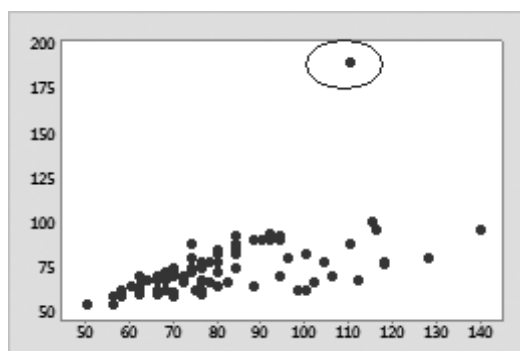
Question 23

A scientist prepared an experiment to determine if a drug affected the rate of meiosis in a germline cell culture. They found that the cultured cell line had a rate of meiosis of 5 hours when the drug was added. The scientific paper they wrote was rejected by peer review because it was

- A. not repeatable as the sample size was too small.
- B. not precise as the measurements were not close to the true values.
- C. inaccurate as the set of measurements varied from 3 hours to 7 hours.
- D. not valid as the experiment did not compare the rate to that of a control group.

Question 24

The graph below shows the results from an experiment.



The circled data point on the graph above could be described as

- A. an outlier.
- B. a random error.
- C. a personal error.
- D. a systematic error.

Question 25

Phillip Island was declared fox-free in 2017 after 25 years of systematically removing them in an attempt to protect the local penguin population. A visitor claimed they had seen a fox on Phillip Island recently. This sighting could be classified as

- A. data.
- B. evidence.
- C. an opinion.
- D. an anecdote.

END OF SECTION A

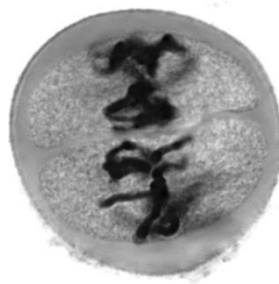
SECTION B**Instructions for Section B**

Answer **all** questions in the spaces provided.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (8 marks)

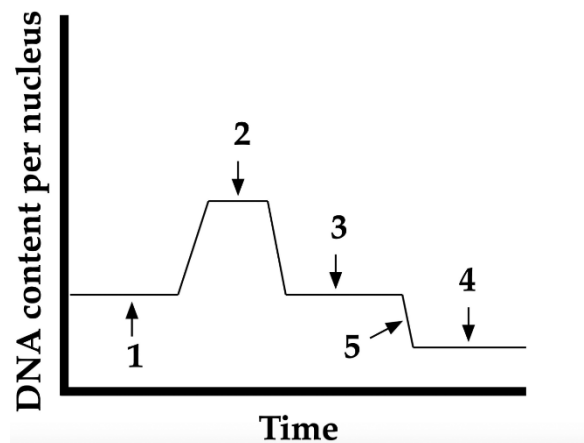
The image below shows a cell undergoing meiosis.



- a** Identify the stage shown in the image above.

1 mark

The graph below illustrates the amount of DNA present at each stage, before, during and after meiosis.



- b** Identify the stage represented by number 5.

1 mark

Meiosis results in the production of haploid gametes.

c Define the term 'haploid'.

1 mark

Between 1980 and 2013, the rate of pregnancies with an extra chromosome 21 (Down Syndrome) increased as a result of a greater proportion of women over the age of 35 starting a family.

d Identify the number of chromosomes that are normally found in a human somatic cell.

1 mark

e Describe how an infant could develop three copies of chromosome 21 in their cells.

3 marks

Despite the increase in pregnancies with Down Syndrome, the proportion of live-born infants with Down Syndrome reduced.

f Describe one reason why this may have occurred.

1 mark

Question 2 (10 marks)

Wheat is an important cereal grain that is used in the production of many breads. The grains are produced at the end of a long stem. Wheat that has a short stem allows the plant to put more energy into growing the grains instead of the stem. This means that the recessive trait of short stems (d) is often preferred by farmers.

- a** Identify the genotype of a plant with a short stem.

1 mark

- b** Describe one environmental condition that could also contribute to a short stem phenotype.

1 mark

The red colour of the wheat seed is controlled by a single gene. A wheat plant with white seeds was allowed to self-pollinate. All of the seeds produced were also white. Some of these white seeds were pollinated by a plant with red seeds. All of the offspring seeds were red.

- c** Identify the inheritance of white seed colour as a dominant or recessive trait.

1 mark

- d** Justify your answer to part c.

2 marks

- e** Identify the genotype of the red seeds used in the cross above where white seeds were pollinated by a plant with red seeds and all of the offspring seeds were red.

1 mark

- f** Explain why the inheritance of seed colour could **not** be described as incomplete dominance.

2 marks

Leaf rust is a fungal disease that infects many species of wheat. One of the genes responsible for the recessive inheritance of leaf rust resistance is Sr2. The Sr2 gene is linked with the Lm gene that slows the spread of leaf rust by causing groups of leaf cells to die.

g Describe what is meant by the term ‘linked genes’ and explain how it affects inheritance.

2 marks

Question 3 (13 marks)

The platypus (*Ornithorhynchus anatinus*) is found in eastern Australia from Queensland to Tasmania. One island population of the platypus is located on King Island in Bass Strait. A mammal that avoids contact with humans, the platypus uses its flat tail and webbed feet to propel itself through the water. As it does this, it uses sensors in its bill to identify changes in pressure and electrical activity to detect prey such as insects, larvae and crustaceans. In cold environments, the platypus can redirect blood flow to its important internal organs. The male platypus can defend itself by using a poisonous spur on its hind leg.

- a** Identify **one** structural, physiological, and behavioural adaptation of the platypus. For each adaptation, describe how it contributes to the survival of the platypus.

structural adaptation: _____

survival advantage of the structural adaptation: _____

2 marks

physiological adaptation: _____

survival advantage of the physiological adaptation: _____

2 marks

behavioural adaptation: _____

survival advantage of the behavioural adaptation: _____

2 marks

The platypus has 26 pairs of chromosomes including 5 pairs of sex chromosomes.

- b** Define the term 'sex chromosome'.

1 mark

- c** Identify the name of the other 21 pairs of non-sex chromosomes in the platypus.

1 mark

The current range of the platypus extends along the east and southeast coasts of mainland Australia. A small population of platypuses from Victoria and Tasmania were introduced to Kangaroo Island, which has an area of 4405 km² and is located off the coast of South Australia. Before the 2020 bushfires, the size of the population on this island was thought to be only 150 platypuses.

The distribution of platypuses across Australia



Source: <<https://platypus.asn.au/distribution-numbers/#:~:text=Elsewhere%2C%20platypus%20population%20density%20has,National%20Park%20on%20Kangaroo%20Island>>

- d** Describe how a low-density population can affect the reproductive rate of an animal.

2 marks

Scientists are concerned that the small population of platypuses on Kangaroo Island will decrease even further as a result of the 2020 bushfires.

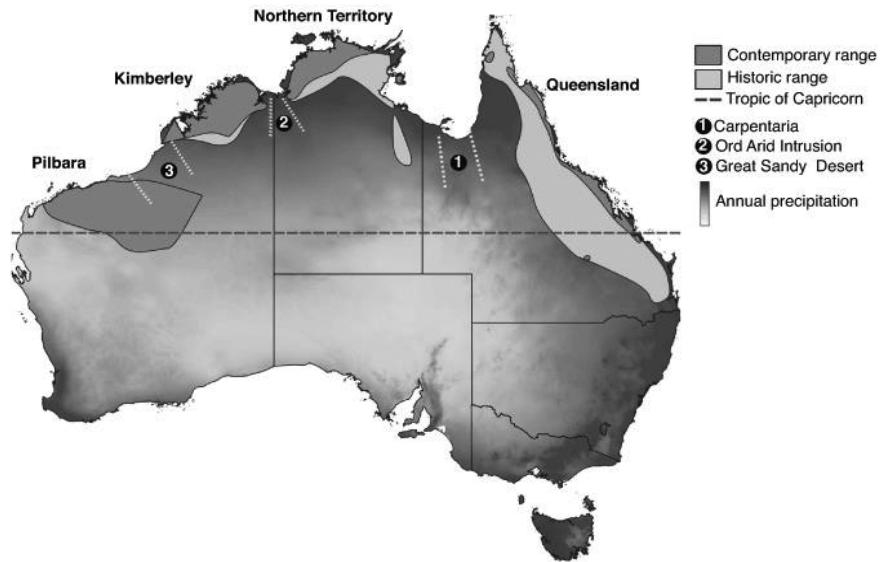
- e** Explain why the lack of genetic diversity of small populations can affect its survival.

3 marks

Question 4 (3 marks)

The Northern Quoll (*Dasyurus hallucatus*) can be found from the Pilbara to Brisbane. They eat many small creatures in their environment, including insects, frogs, small mammals, birds and reptiles. They are considered a keystone species. They have also been known to eat the poisonous cane toads.

The distribution of the Northern Quoll

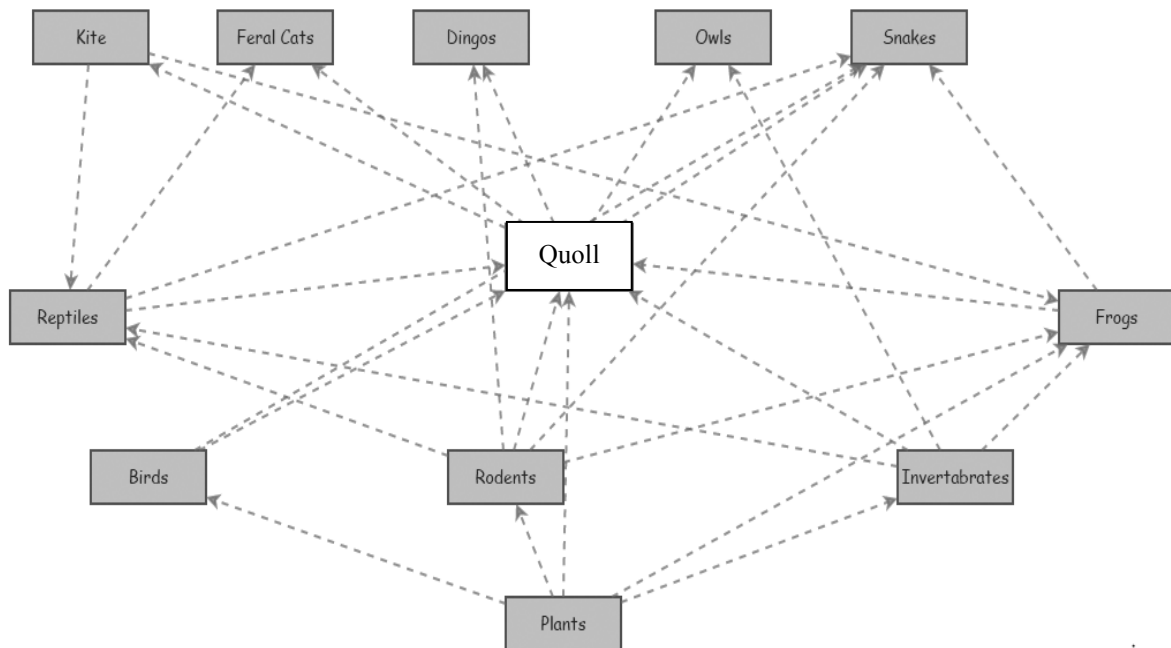


Source: <<https://www.publish.csiro.au/am/fulltext/am21002>>

- a** Describe how the Northern Quoll population in northern Australia would be affected by the growing population of cane toads.

1 mark

The diagram below shows a Northern Quoll food web.



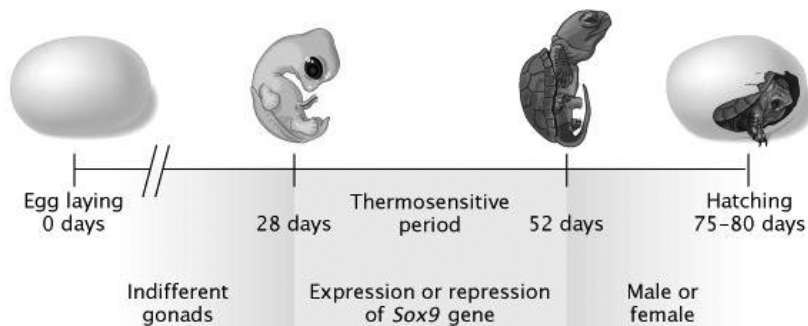
Source: <<https://olliegristkakadunationalpark.weebly.com/endangered-species.html>>

- b** Use the food web above to identify how a reduction in the Northern Quoll population could affect the population of any **two** other species.

2 marks

Question 5 (6 marks)

The sex of the green sea turtle (*Chelonia mydas*) is determined by the environmental temperature in the egg between day 28 and day 52 of its development as shown in the diagram below. At a temperature of 28°C, 50% of the eggs will be male and 50% will be female. At higher temperatures, most of the eggs will be female.



- a** Write a hypothesis for an experiment that will test the proportion of eggs that will be male at 27°C.

1 mark

- b** Design an experiment to test your hypothesis. Include the independent and dependent variables and any controlled variables.

4 marks

The temperature of the environment is considered an epigenetic factor.

- c** Describe what is meant by an 'epigenetic factor'.

1 mark

Question 6 (10 marks)

In cats, long hair is dominant to short hair. A breeder of cats has a new cat that has long hair. They want to determine if the cat is homozygous or heterozygous for long hair.

a Define the following terms:

homozygous: _____

heterozygous: _____

2 marks

b Describe how the breeder could determine if their new cat is heterozygous for long hair.

Justify your response by showing any relevant monohybrid cross Punnett squares in the space below.

5 marks

Like cats, zebra sharks usually reproduce through sexual reproduction. Despite this, in 2020, a zebra shark produced 6 unfertilised eggs. Three of them hatched to produce juvenile pups.

- c** Identify the type of asexual reproduction of the zebra shark.

1 mark

- d** Explain one advantage and one disadvantage of asexual reproduction.

advantage: _____

disadvantage: _____

2 marks

END OF TRIAL EXAMINATION

