

Student Name: _____



BIOLOGY 2016

Unit 4

Key Topic Test 4 – Heredity

Recommended writing time*: 45 minutes

Total number of marks available: 45 marks

QUESTION BOOK

* The recommended writing time is a guide to the time students should take to complete this test. Teachers may wish to alter this time and can do so at their own discretion.

Conditions and restrictions

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

Materials supplied

- Question and answer book of 11 pages.

Instructions

- Print your name in the space provided on the top of the front page.
- All written responses must be in English.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic communication devices into the room for this test.

SECTION A – Multiple-choice questions

Instructions for Section A

Select the response that is **most correct** for the question. A correct answer scores 1, an incorrect answer scores 0. Marks are not deducted for incorrect answers. If more than 1 answer is completed for any question, no mark will be given.

The following information relates to questions 1-3

Corn is an ancient plant that has been modified throughout the years to suit the needs of consumers. It comes in two colours, purple and yellow. It also has two kernel types, smooth and wrinkled. Both are encased in green husks that turn yellow as the flesh begins to diminish in the sunlight. A cross between a purple kernel plant and a yellow kernel plant was successfully undertaken. 1340 purple kernel smooth plants, 200 purple kernel wrinkled plants and 0 yellow kernel plants were produced as offspring.

Question 1

Which of the following correctly identifies the mode of inheritance and parental generation of kernel colour in corn?

- A. The purple plant was homozygous dominant and the yellow plant was homozygous recessive
- B. The purple plant was heterozygous dominant and the yellow plant was heterozygous dominant
- C. Both the purple and yellow plants were heterozygous dominant
- D. The purple plant was heterozygous dominant and the yellow plant was homozygous recessive

Question 2

If the genes for colour and kernel texture are not linked genes, how many genotypes are possible for the offspring from the parental generation?

- A. 2
- B. 3
- C. 6
- D. 8

Question 3

Two plants from the F1 generation were cross pollinated and produced offspring that only contained purple wrinkled kernels. What is the most likely genotype of the two plants from the F1 generation?

- A. PPSS
- B. ppSS
- C. Ppss
- D. PpSs

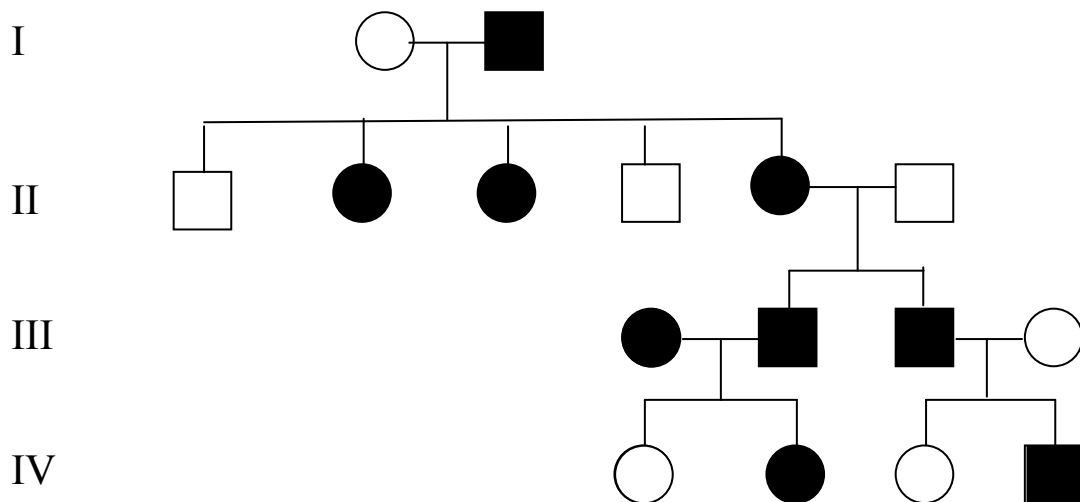
Question 4

What is the name given to a cross by which a phenotypically dominant individual and a phenotypically recessive individual are crossed to determine the genotype of the dominant individual?

- A. A homozygous cross
- B. A test cross
- C. A hybrid cross
- D. A dihybrid cross

The following information relates to questions 5-7

The following pedigree demonstrates the inheritance of a particular type of colorectal cancer among a family.



Question 5

Which individuals would best suggest that the mode of inheritance is dominant?

- A. Individuals I1 and II1
- B. Individuals III1, III2 and IV1
- C. Individuals II5, II6 and III3
- D. Individuals III3 and IV4

Question 6

Which individuals would best suggest that the gene is not found on the X chromosome?

- A. Individuals III3, III4 and IV4
- B. Individuals I2, II1 and II2
- C. Individuals II5, III2 and III3
- D. Individuals I1, II4 and II5

Question 7

Correctly identify which of the following processes allows recombination to occur.

- A. Mitosis
- B. Anaphase II
- C. Telophase I
- D. Prophase I

Question 8

If two heterozygotes for two particular monogenic genes that are not linked produce offspring. How many different genotypes would be produced?

- A. 8
- B. 4
- C. 6
- D. 2

Question 9

If two heterozygotes for two particular monogenic genes that are not linked produce offspring. What would the expected phenotypic ratios look like?

- A. 3:3:3:1
- B. 1:1:1:1
- C. 3:1
- D. 9:3:3:1

Question 10

In an X-linked trait, males that are affected are said to be _____ for the condition.

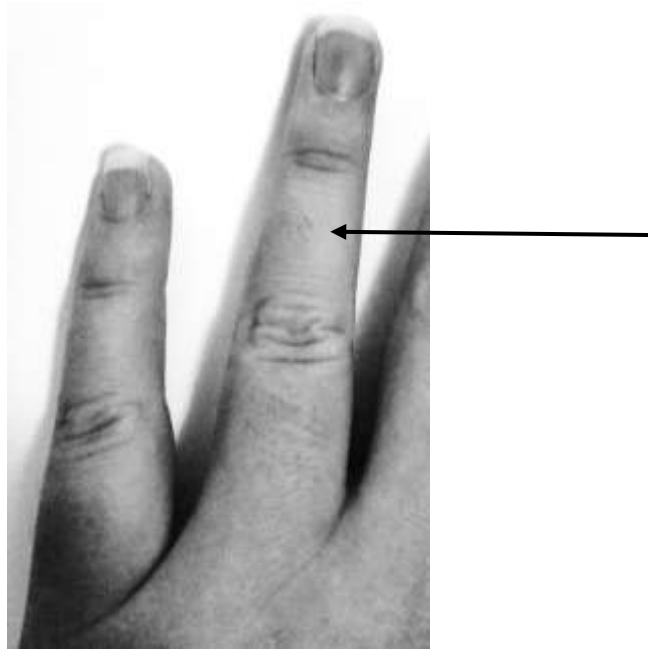
- A. Dominant
- B. Hemizygous
- C. Recessive
- D. Heterozygous

SECTION B- Short-answer questions

Instructions for Section B

Answer all questions in the spaces provided.

Question 1 (14 marks)



The diagram above shows the presence of mid-digit finger hair, a condition caused by a dominant allele. The photographed subject's father also has the trait, however, the mother does not. Other brothers of the individual do not show the trait.

- a.** Determine the phenotype and genotype of the mother.

2 marks

- b.** Determine the phenotype and genotype of the father.

2 marks

- c. Determine the phenotype and genotype of the subject.

2 marks

- d. Outline the difference between a phenotype and genotype.

2 marks

- e. The subject has a sister, what is the probability that she will also have the same trait?

1 mark

- f. The subject has a brother who suffers a medical condition where the medication taken causes individuals lose the hair on their bodies. He does not have mid-digit hair. Explain how the environment can effect ones phenotype and genotype.

2 marks

- g. What proportion of the subject's children will have mid-digit hair if they were to reproduce with another individual without mid-digit hair? Show all working.

3 marks

Question 2 (6 marks)

Based on your knowledge of genetic crosses, fill in the table below.

Cross of F1 generation	Number of different kinds of gametes	Number of different kinds of genotypes in F2 generation	Number of different kinds of phenotypes in F2 generation
TT x Tt			
TTbb x TtBb			

6 marks

Question 3 (8 marks)

Geraniums are a flowering plant with a range of colours and varieties. One particular variety gives rise to red, pink, white and white with red splash flower colours. The cross between a red flower plant and white flower plant produced only white with red splash flower plants.

a. Assign appropriate alleles to the following plant flower colours:

i. Red flower plants

1 mark

ii. White flower plants

1 mark

iii. White with red splash flower plants

1 mark

- b.** Draw a punnet square to show the cross between the red and white flower plants and demonstrate why only white with red splash flower plants were produced.

2 marks

- c.** What mode of inheritance is being demonstrated in this cross?

1 mark

- d.** It was noticed that all of the red flower plants had leaves that curled on the edges, whereas the white flower plants had straight ends. What could be suggested by this observation?

1 mark

- e.** Given the observation from part d, what would be expected to occur in regards to leaf edges in the white with red splash flower plants?

1 mark

Question 4 (7 marks)

Fur colour in rabbits is controlled by different allele combinations. Below is a table to outline the genotypes of the different phenotypes.

Genotype	Phenotype
$C^+C^+, C^+C^{ch}, C^+C^h, C^+c$	Brown fur
$C^{ch}C^{ch}$	Black tipped white fur
C^hC^h, C^hc	White with black extremities fur
cc	Albino fur

- a. Identify the main dominant allele for fur colour

1 mark

- b. Identify the main recessive allele for fur colour

1 mark

- c. A homozygous white with black extremities fur was mated with an albino fur rabbit. Draw a punnet square for this cross and outline the expected phenotypic ratio.

2 marks

- d. Identify showing all working a cross that would produce the greatest number of albino fur rabbits from a non-albino cross.

2 marks

- e. In humans the control of hair colour is determined by a variety of genes. What is this type of inheritance known as?

1 mark

END OF KEY TOPIC TEST