

# HURLSTONE AGRICULTURAL HIGH SCHOOL



## Trial Higher School Certificate Examination 2011

# BIOLOGY

### General Instructions -

- \* Reading time - 5 minutes
- \* Working time - 3 hours
- \* Write using black or blue pen
- \* Draw diagrams in pencil
- \* Board-approved calculators may be used
- \* Write your Student Number at the top of each answer page

**Total marks - 100**

### SECTION I (85 marks)

#### Part A - Multiple Choice - 20 marks

- \* Attempt questions 1 - 20
- \* Your choices should be placed on the multiple choice answer sheet
- \* Allow about 35 minutes for this part

#### Part B - Extended response - 65 marks

- \* Attempt questions 20 - 29
- \* Allow about 1 hour 55 mins for this part

### SECTION II (15 marks)

- \* Questions on your option Genetics: The Code Broken
- \* Allow about 30 minutes for this section

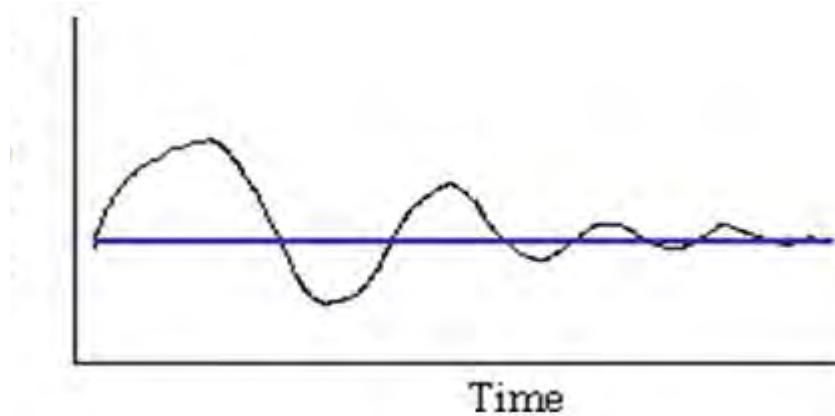
**SECTION I Part A - Multiple Choice**

1. The pH of the blood is maintained at a constant level by the action of a chemical buffer. This is required to counter the effect of which substance in the blood?
  - (A) Carbon dioxide
  - (B) Haemoglobin
  - (C) Oxygen
  - (D) Plasma
  
2. John F. Kennedy, US President in the early 1960's, had Addison's disease. He needed hormone replacement therapy to replace the lack of aldosterone that would be normally be secreted by his adrenal glands. This was necessary to maintain a normal:
  - (A) urea concentration in the urine
  - (B) salt concentration in the blood
  - (C) testosterone level
  - (D) body temperature
  
3. Different types of organisms living in different environments use different strategies in dealing with nitrogenous waste. Which statement is correct?
  - (A) All bony fish excrete copious dilute urine.
  - (B) Desert animals generally concentrate nitrogenous waste in its less toxic forms.
  - (C) Marine (sea water) fish have problems maintaining enough urea in their tissues.
  - (D) Ammonia is one of the less toxic forms of nitrogenous waste.
  
4. Spinifex is also called porcupine grass because its leaves can curl up into a needle shape. The stomates are located in sunken grooves on the underside of the leaf and are enclosed as the leaf curls up. Which process do these adaptations best reduce?
  - (A) Conduction
  - (B) Pollination
  - (C) Translocation
  - (D) Transpiration
  
5. A small Australian mammal that lives in the alpine regions of New South Wales has specific features that enable it to retain body heat. Identify the features that are most likely to be present in the mammal described.
  - (A) Long ears, rounded body, long legs
  - (B) Short ears, rounded body, short legs
  - (C) Short ears, slender body, long legs
  - (D) Short ears, slender body, short legs

6. What are three products extracted from donated blood?

- (A) Oxygen, water and urea
- (B) Red blood cells, salts and oxygen
- (C) Plasma, platelets, and red blood cells
- (D) Platelets, hormones and amino acids

7. The graph models the effect of an environmental stimulus on temperature control in mammals.



What does this graph represent?

- (A) A reflex action
- (B) An immune response
- (C) An impulse pathway
- (D) A feedback mechanism

8. Blood travels around the human body with a number of substances dissolved in it. Which of the following correctly describes the substance and its form in the blood?

	<i>Substance</i>	<i>Form in blood</i>
A	oxygen	Hydrogen carbonate ions
B	Waste nitrogenous material	Ammonia ions in plasma
C	Salts	As ions in plasma
D	oxygen	urea

9. Which of the following correctly identifies where active transport occurs in the nephron?

- (A) The glomerulus
- (B) The collecting duct
- (C) The Bowman's capsule
- (D) The tubule or loop of Henle

10. The table shows descriptions of four disease causing agents –

<i>Disease causing agent</i>	<i>A Description</i>
<b>i</b>	Shape varies and includes spheres, rods and spirals; its genetic material is one circular DNA molecule; reproduces by binary fission.
<b>ii</b>	Can be uni-cellular or multicellular; multicellular types have feeding threads called hyphae; pathogens can infect a human's skin.
<b>iii</b>	An abnormal form of a protein that normally lives in brain tissue; the abnormal form joins together to form fibres that destroy brain nerve cells.
<b>iv</b>	Composed of a protein coat surrounding DNA or RNA; can only reproduce within a host cell that eventually bursts releasing many of the infective agents.

Each disease causing agent is correctly identified as –

- (A) i – prion; ii – fungi; iii – bacteria; iv – virus.
- (B) i – fungi; ii – bacteria; iii – virus; iv – prion.
- (C) i – virus ; ii – prion; iii – fungi; iv – bacteria.
- (D) i – bacteria; ii – fungi; iii – prion; iv – virus.

11. For an organism to be described as a pathogen, two of the conditions that would be needed are –

- (A) the organism needs to virulent and the potential host has a poor ability to fight off the pathogen.
- (B) the organism may need the ability to survive outside a host and it needs to be able to reproduce asexually.
- (C) there needs to be a reservoir of the organism and it would need the ability to pierce and enter the host's cells.
- (D) there would need to be contact between an infected host and a potential host and the organism would need to release a toxin that protects it from the host's immune system.

12. Disease can best be defined as –

- (A) a condition caused by an infectious or non-infectious factor.
- (B) any condition that impairs the normal functioning of the body.
- (C) the result of infection by microscopic or macroscopic organisms.
- (D) an interaction between a host, a pathogen and the environment.

13. How many autosomal chromosomes does a normal human female inherit from her mother?

- (A) 22
- (B) 44
- (C) 23
- (D) 46

14. Red-green colour blindness affects about 10% of males but less than 1% of females. This means that about one in ten males can't distinguish red from green whereas approximately one in a hundred females has this problem. The most likely explanation for this data is that colour blindness is caused by –

- (A) co-dominance.

- (B) a dominant gene in males.
- (C) sex linkage of a dominant gene.
- (D) sex linkage of a recessive gene.

15. A student described Mendel's work as follows –

- (i) Mendel was an Austrian monk who experimented with garden peas and found out a lot about genetics.
- (ii) Mendel said that genes assort or segregate independently of one another except when they are on the same chromosome.
- (iii) Mendel found that sometimes genes may be on the X – chromosome and when this happens the male only has one, not two, genetic factors.

Which of the above statements is true?

- (A) (i) only.
- (B) (i) and (ii) only.
- (C) (i), (ii) and (iii).
- (D) (iii) only.

16. Which of the following statements best describes the process of hybridisation frequently used in agriculture?

- (A) The transfer of a gene from one species to another.
- (B) The crossing of two genetically different strains of a species.
- (C) The production of genetically identical offspring by cloning.
- (D) The artificial selection and breeding of one species with another species.

17. The table shows the contributions of five scientists to our knowledge of genetics and the inheritance of characteristics –

<i>Scientist</i>	<b>Their research and findings</b>
<i>I</i>	Crossed two species of sea urchins and noted that the offspring had features from both parents. Crossed enucleated eggs with normal sperm and observed that the offspring were dwarfed and had the features of only one parent. Concluded that inheritance was due to something present in the nucleus

<b>II</b>	Crossed red-eyed female fruit flies with white eyed males producing red-eyed offspring only. Crossed two of these red-eyed offspring and observed that only males from this cross had white eyes. Concluded that the gene for producing eye colour is on the X - chromosome
<b>III</b>	Reviewed the work on sea urchins and Mendel's cross breeding experiments with garden peas and concluded that the inheritance of characteristics is due to factors on chromosomes
<b>IV</b>	Bread mould normally produces four enzymes, each catalysing the synthesis of a specific vitamin. Mould spores were irradiated, on four different occasions, and it was found that each time the mould lost its ability to produce one of these vitamins. It was concluded that each time one gene was mutated and so its enzyme and so vitamin was not produced. The theory "one gene, one enzyme" was proposed.

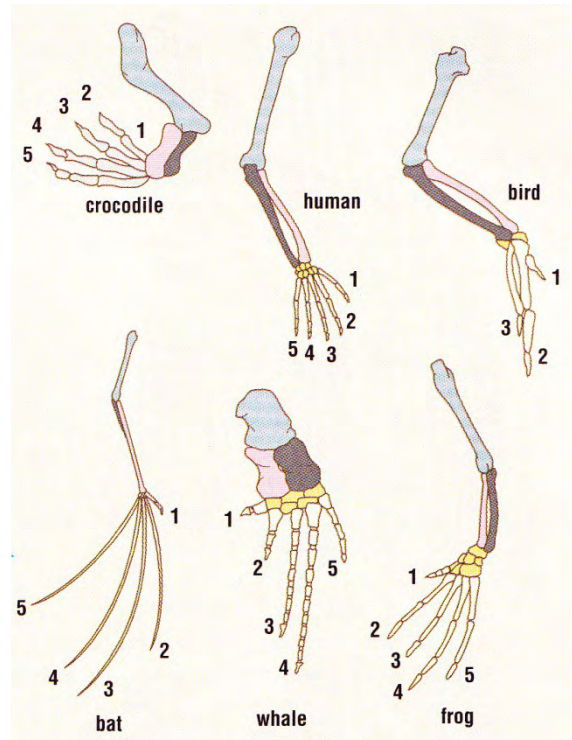
The correct identification of the scientists is –

- (A) I – Beadle and Tatum; II – Morgan; III – Sutton; IV – Boveri.
- (B) I – Morgan; II – Sutton; III – Beadle and Tatum; IV – Boveri.
- (C) I – Boveri; II – Morgan; III – Sutton; IV – Beadle and Tatum.
- (D) I – Sutton; II – Beadle and Tatum; III – Boveri; IV – Morgan.

18. The diagram shows an homology – the pentadactyl limbs of six very different members of the phylum chordata.

This homology best shows evidence of –

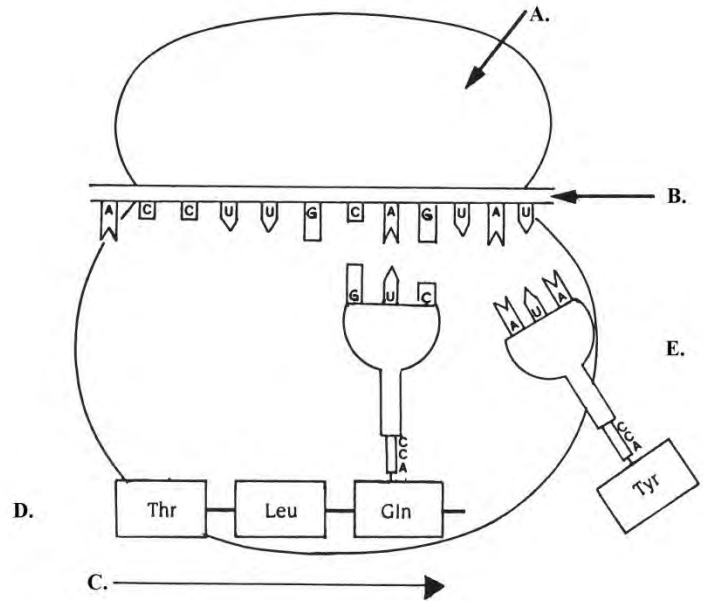
- (A) an evolutionary sequence between the organisms.
- (B) how very different organisms will evolve very similar characteristics in response to their similar environments.
- (C) how closely related the organisms are as they are all members of the phylum chordata.
- (D) a common ancestor many millions of years ago.



19. The diagram represents one part of polypeptide synthesis – translation.

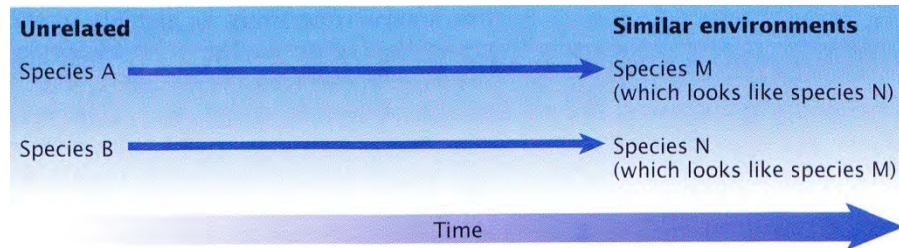
The letters on the diagram represent –

- (A) A – ribosome; B – mRNA;  
C – polypeptide forms;  
D – amino acid; E – tRNA.
- (B) A – mitochondrion; B – DNA;  
C – protein forms;  
D – fatty acid; E – mRNA
- (C) A – golgi body; B – DNA;  
C – polypeptide forms;  
D – amino acid; E – tRNA
- (D) A – endoplasmic reticulum;  
B – DNA; C – protein forms;  
D – fatty acid; E – mRNA.

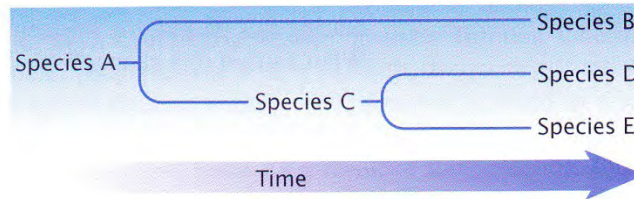


20. The diagrams represent two types of evolution –

Type of evolution I.



Type of evolution II.

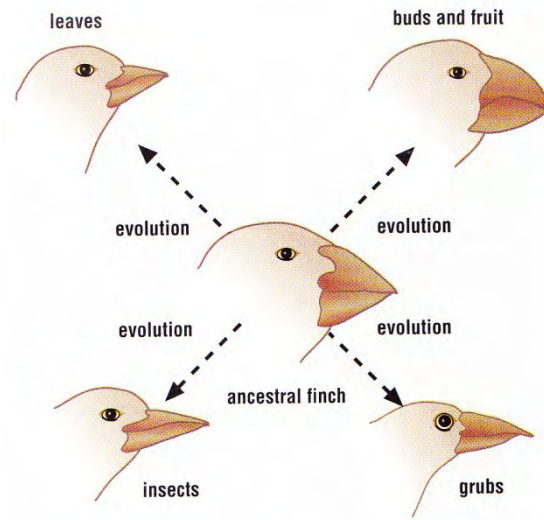


The two types of evolutionary processes shown are –

- (A) Type I = Divergent evolution; Type II = Convergent evolution.
- (B) Type I = Gradualism; Type II = Punctuated equilibrium.
- (C) Type I = Punctuated equilibrium; Type II = Gradualism.
- (D) Type I = Convergent evolution; Type II = Divergent evolution.

**Part B - Extended response**

21.(a) The diagram represent some of Charles Darwin's Galapagos Island finches



How did Darwin explain this example of evolution? (3 marks)

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(b) How does Darwin's and Wallace's (1859) theory of evolution differ from Stephen Gould's theory of Punctuated Equilibrium (1975)? (2 marks)

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22. Anna and Bill have a son called Evan and a daughter called Debbie.  
Anna has one brother, Chris.  
Anna's mother and father are Flora and Gerry.  
All members of the family are right-handed, except for Gerry and Debbie who are left-handed.

(a) Using the correct symbols and a legend, draw a pedigree (or family tree) to represent this information.

*(2 marks)*

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(b) Suggest which type of inheritance determines left-handedness. Justify your answer.

*(2 marks)*

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(c) State the genotypes of Gerry and Bill.

*(1 mark)*

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23. A plant breeder replicated one of Mendel’s pea plant breeding experiments. The results of a cross between green (G) pods and yellow (g) pods are shown in the table –

<i>Generation</i>	<i>Pod colour</i>	
	Green (G)	Yellow (g)
<i>F<sub>1</sub></i>	632	0
<i>F<sub>2</sub></i>	1560	482

- (a) List all possible genotypes of the **F<sub>2</sub>** generation (where two **F<sub>1</sub>** offspring are crossed). (1 mark)

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- (b) Using your understanding of current genetic thinking, interpret the results of the **F<sub>2</sub>** cross shown above explaining why the genotypes and phenotypes were produced. (3 marks)

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- (c) Describe the features of TWO experimental techniques used by Mendel that contributed to the success of his investigations. (3 marks)

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24. Discuss the difficulties in defining the term ‘health’. (2 marks)

25. Over 3000 years ago, cultures such as the Chinese were advocating cleanliness in food, water and personal hygiene.

Explain how the cleanliness and hygiene practices we use today assist in control of disease. *(2 marks)*

26. (a) Identify one way that water can be treated to ensure that it is safe to drink. *(1 mark)*

(b) Explain how this method reduces the risk of infection from pathogens. *(2 marks)*

27. Technological advances such as developments with the microscope, vaccinations and antiseptics during the 19<sup>th</sup> century contributed to an expanding understanding of the nature of disease. Both Louis Pasteur and Robert Koch made outstanding contributions during this time.

Describe how Robert Koch has increased our understanding of infectious diseases. *(2 marks)*

28. In your studies of the topic ‘The Search for Better Health’ you have researched an infectious disease.

(a) Identify the infectious disease you researched. (1 mark)

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(b) For this identified disease;  
(i) describe its cause and transmission. (2 marks)

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(ii) outline the control measures (2 marks)

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29. 'Super-bugs' in recent times are becoming increasingly problematic in the field of medicine and disease control, particularly with diseases that have previously been effectively treated, such as tuberculosis.

Discuss how the use of antibiotics in the management of infectious disease is contributing to antibiotic resistance and the rise of 'super-bugs'. (3marks)

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30. (a) Define the term *enantiostasis*. (1 mark)



Use the grid lines below to construct a table to compare the response of EACH animal to a decrease in ambient temperature.

In your table, outline how each response assists with *temperature regulation*. (7 marks)


34. During your study of **Maintaining a Balance**, you were required to determine the effect of increasing carbon dioxide levels on the pH of water.

(a) Discuss the *method* and *equipment* used. (3 marks)

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(b) Describe ONE possible *risk* in this investigation and ONE *precaution* needed to reduce risk. (2 marks)

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(c) Identify two variables that were controlled in this investigation. (1 mark)

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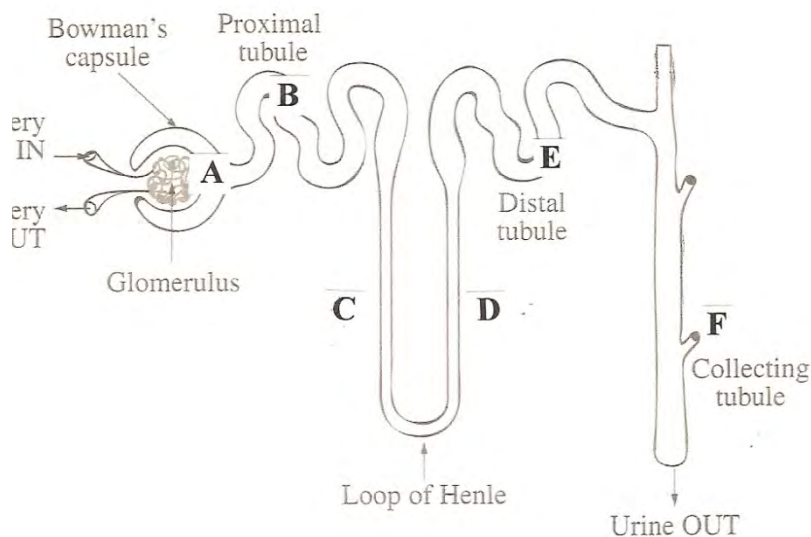
(d) Outline any trends obtained in the data you collected. (1 mark)

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(e) Discuss ONE way of improving the *reliability* of the results. (2 marks)

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35. The kidney nephron ensures that the body can retain valuable nutrients and expel excess nutrients and toxins.



(a) Complete the table, showing some of the important roles of the nephron. (4 marks)

<b>Part of nephron</b>	<b>Substances moving into or out of nephron tubule</b>
A. Bowman's capsule	Identify two moving into (filtration under pressure) -
B. Proximal tubule	Identify two moving out of (re-absorption) -
D. Loop of Henle - ascending limb.	Identify one moving out of (re-absorption) -
F. Collecting tubule or duct.	Identify one moving out of (re-absorption) -

(b) Complete the following sequences of events, illustrating important function of the hormone Aldosterone. - (2 marks)

Kidney receptor cells detect LOW levels of sodium ions in the blood →  
 Cortex of adrenal gland secretes aldosterone →

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**SECTION II (15 marks)**

(a) (i) Describe a linked gene (1 mark)

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(ii) Explain how investigations in dihybrid crosses can identify that certain genes are linked in a given species. (2 marks)

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(b)(i) Compare the terms ‘diploid’ and ‘haploid’ and the location of cells associated with these terms. (2 marks)

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(ii) If a child with AB blood group has a father who is heterozygous A group, determine the possible genotypes of the mother. Clearly explain your answer using diagrams or Punnet squares. (3 marks)

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(c) (i) The Human Genome Project has confirmed that the majority of human DNA is identical. In recent decades the applications of DNA technologies have been expanding into fields such as forensics. Outline how it is that DNA fingerprinting is still a useful process despite the largely identical nature of DNA. (2 marks)

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(iii) Outline another application of DNA fingerprinting other than forensics, indentifying why it is of value. (1 mark)

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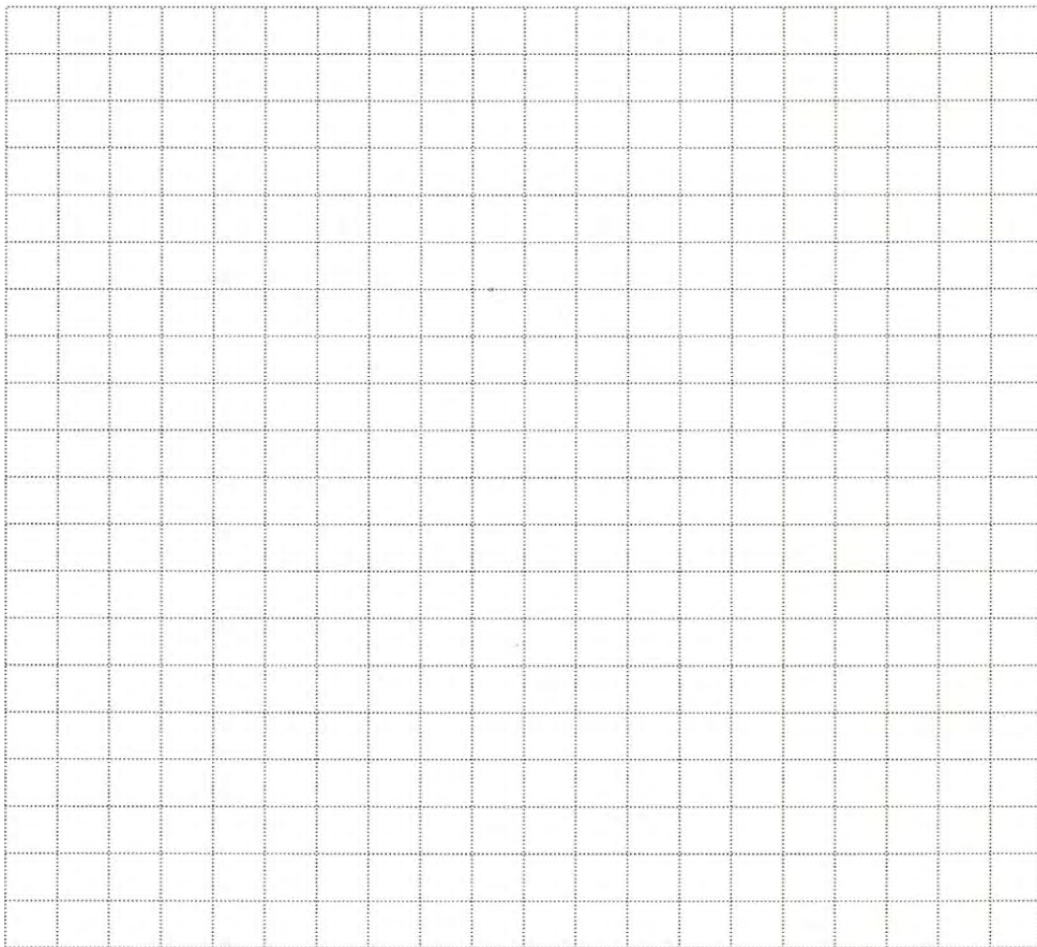
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(d) The data in the table below shows frequency of ear length in corn.

<i>Ear length (cm)</i>	<i>Frequency</i>
7	5
8	15
9	26
10	26
11	50
12	68
13	66
14	71
15	41
16	24
17	14

(i) Graph the data on the graph paper provided (2 marks)



*This question continues on the next page*

- (ii) Explain the trend in the graph with regard to the fact that ear length in corn is controlled by a number of different genes. *(2 marks)*

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