



SHORE

Exam Number:

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Year 12

Biology

Trial Examination

2017

General instructions

- Reading time – 5 minutes
- Working time – 180 hours
- Write using black or blue pen
- Draw diagrams using pencil
- Calculators may be used

Total marks – 100

Section I

75 marks

This section has two parts, Part A and Part B

Part A – 20 marks

- Attempt Questions 1 - 20
- Allow about 35 minutes for this part

Part B – 55 marks

- Attempt Questions 21-33
- Allow about 1 hour and 40 minutes for this part

Section II

25 marks

- Attempt ONE question from Questions 34 - 38
- Allow about 45 minutes for this section

Note: Any time you have remaining should be spent revising your answers.

DO NOT REMOVE THIS PAPER FROM THE EXAMINATION ROOM

Student Number:.....

Section I**75 marks****Part A – 20 marks****Attempt Questions 1-20****Allow about 35 minutes for this part**

Use the multiple-choice answer sheet provided for Questions 1-20

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9

A ☐ B ☒ C ☐ D ☐

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ☒ B ☒ C ☐ D ☐

If you have changed your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows:

A ☒ B ☒ ^{correct} C ☐ D ☐

- 1 What is usually introduced into the body by administering a vaccine?
 - (A) Antigens
 - (B) Killer T-cells
 - (C) Macrophages
 - (D) Plasma cells

- 2 A botanist counted 26 chromosomes in the cells of the shoots and root tips of a plant. What is the haploid and diploid number of this species?

	<i>Diploid number</i>	<i>Haploid number</i>
(A)	13	26
(B)	26	13
(C)	26	52
(D)	52	26

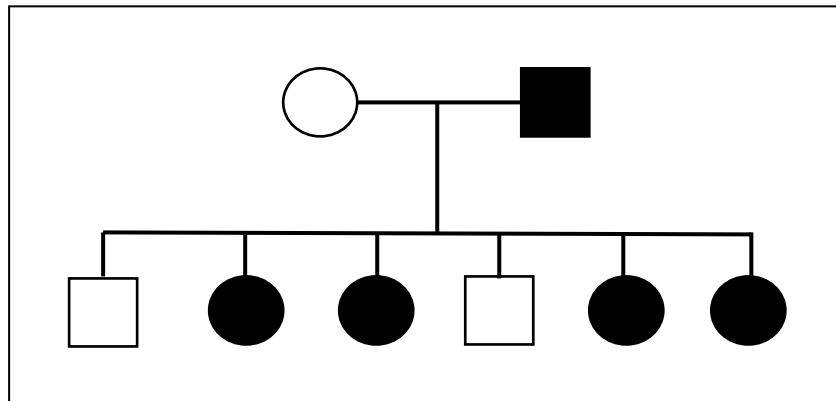
3 Darwin's Theory of Evolution by Natural Selection can be summarised in 4 steps.

1. *Some individuals are better suited to a particular environment.*
2. *Over time there is an increase in particular traits in the population.*
3. *Genotypic variation exists amongst individuals in a population.*
4. *Individuals with favourable traits reproduce.*

The statements are not in the correct order. What is the order which best represents Darwin's Theory?

- (A) 1, 2, 4, 3
 (B) 1, 3, 2, 4
 (C) 3, 2, 1, 4
 (D) 3, 1, 4, 2

4. The following pedigree shows the inheritance of Goltz Syndrome. This is a dominant sex linked disorder which presents in a person as yellow – pink bumps on the skin and pigmentation changes.



What are the genotypes of the parents in this pedigree?

	<i>Mother</i>	<i>Father</i>
(A)	$X^H X^h$	$X^h Y$
(B)	$X^H X^H$	$X^h Y$
(C)	$X^h X^h$	$X^H Y$
(D)	$X^H X^h$	$X^H Y$

- 5 What is the role of anti-diuretic hormone (ADH) in maintaining homeostasis?
- (A) Production of concentrated urine by reabsorption of water from the collecting duct
 - (B) Production of dilute urine by excreting excess water
 - (C) Reabsorption of glucose from the proximal tubules of the kidney to produce concentrated urine
 - (D) Reabsorption of salt in the distal tubule of nephrons
- 6 Which animals produce uric acid as the main nitrogenous waste?
- (A) Blue tongue lizard and Murray cod
 - (B) Ibis and kangaroo
 - (C) Ibis and red bellied black snake
 - (D) Murray cod and red bellied black snake
- 7 Which statements are correct about DNA transcription and translation?

	<i>Transcription</i>	<i>Translation</i>
(A)	Occurs in the nucleus	Produces mRNA
(B)	Produces mRNA	Occurs in the nucleus
(C)	Occurs at the surface of ribosomes	Produces mRNA
(D)	Produces mRNA	Occurs at the surface of ribosomes

- 8 During mitosis DNA must be replicated to ensure all cells have the correct number of chromosomes. This process is semi-conservative and is best described as:

- (A) DNA being broken down into bases and reassembled with new bases
- (B) DNA being split into two strands, each of which is replicated
- (C) DNA being split into triplets and new triplets being added
- (D) DNA remaining intact and a new DNA copy is built from new nucleotides

- 9 The tRNA anticodons coding for 3 amino acids is shown below.

<i>tRNA Anticodon</i>	<i>Amino acid</i>
CUU	Glutamic acid
UUA	Asparagine
UGG	Threonine

A cell makes a polypeptide with the amino acid sequence:

Threonine – Asparagine – Glutamic acid

What was the sequence of bases on the strand of the DNA which was complementary to the mRNA from which this polypeptide was formed?

- (A) ACCAAUGAA
- (B) TCCAATGAA
- (C) TGGTACTT
- (D) UGGUUACUU

- 10 Which of the following correctly matches each substance with the form in which it can be transported in mammalian blood?

Substance	(A)	(B)	(C)	(D)
Urea	Bound to haemoglobin	Dissolved in plasma	As uric acid	Dissolved in plasma
Carbon dioxide	Dissolved in plasma	As bicarbonate ions	Bound to haemoglobin	Bound to haemoglobin
Oxygen	Dissolved in plasma	Bound to haemoglobin	Dissolved in plasma	As oxide ions
Lipids	Dissolved in plasma	In chylomicrons	Bound to haemoglobin	As fatty acids

- 11 Which of the following is an adaptation of a freshwater bony fish for osmoregulation?

- (A) Drinking lots of water
- (B) Uptake of salts across the gills
- (C) Maintaining a body concentration close to that of freshwater
- (D) Producing large amounts of concentrated urine

- 12 A certain population of mosquitoes is subjected to a 0.004 mg.mL^{-1} concentration of DDT. As a result, 15% survive and mate to produce a relatively resistant strain of mosquito. The fact that the next generation of mosquitoes is resistant suggests that:

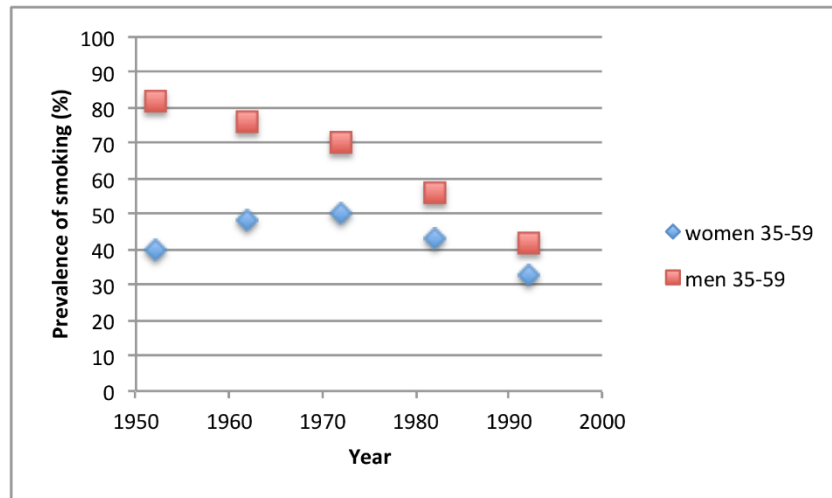
- (A) DDT cannot be used to control mosquito populations.
- (B) The offspring of the 15% that survived developed a genetic mutation that enabled them to become resistant.
- (C) A genetic adaptation that was present in the original population became more frequent in subsequent generations.
- (D) More than 0.004 mg.mL^{-1} concentration of DDT is needed to control populations.

Questions 13 and 14 refer to the following information:

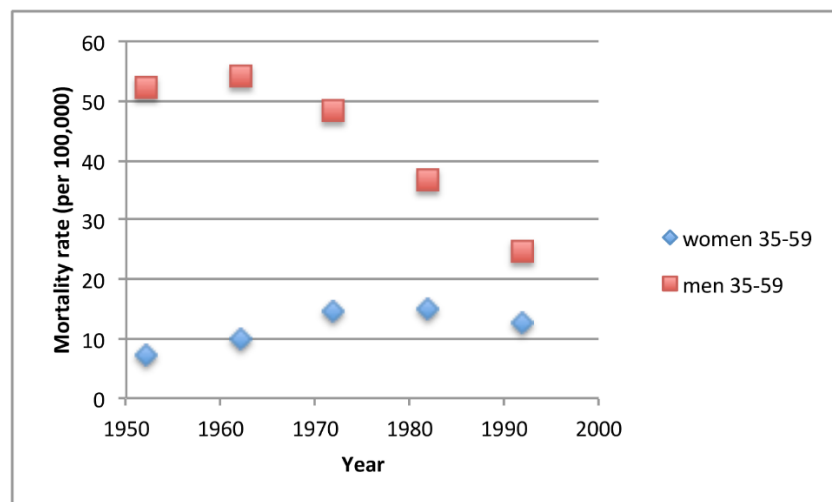
In 1910, research carried out at Columbia University involved breeding millions of *Drosophila* to look for new types of mutations. One day it was noticed that one of the male fruit flies had white eyes instead of red eyes. When this white-eyed male was mated with a red-eyed female fly, the first generation offspring all had red eyes. When these individuals were mated, the second generation produced both red-eyed and white-eyed flies, but all of the white-eyed flies were male.

- 13 The major conclusion from this series of experiments was that:
- (A) White eyes and red eyes are controlled by a single pair of alleles that are co-dominant.
 - (B) The white-eyed allele is carried on the X chromosome.
 - (C) The white-eyed allele is carried on the Y chromosome.
 - (D) The genes for red eyes and white eyes are linked on the same chromosome.
- 14 The credit for this discovery goes to:
- (A) Sutton and Boveri.
 - (B) Beadle and Tatum.
 - (C) Macfarlane Burnett.
 - (D) Thomas Morgan.
- 15 Which of the following is involved in a specific defence mechanism in the human immune system?
- (A) T-cells
 - (B) Mucous membranes
 - (C) Cilia
 - (D) Macrophages

- 16 The following graphs indicate the prevalence of smoking and the mortality rate from lung cancer for women and men between 35 and 59 years old in the United Kingdom.



Prevalence of smoking in women and men between 35 and 59 years old in the UK. Values plotted are percentages of the total population of females and males.



Mortality rate due to lung cancer of women and men between 35 and 59 years old in the UK. Values plotted are number of deaths due to lung cancer per 100,000 population of females and males.

Which of the following is a reasonable conclusion to draw from these data?

- (A) Men who smoke are more likely to die of lung cancer than women who smoke.
- (B) Mortality from lung cancer is correlated with the prevalence of smoking.
- (C) Men find it easier to give up smoking than do women.
- (D) No reasonable conclusion can be drawn as the population sizes for women and men are not known.

- 17 Robert Koch was a biologist who is best known for:
- (A) Developing a microscope powerful enough to study the disease-causing organisms known as prions.
 - (B) Discovering the cause of malaria.
 - (C) Developing a technique to determine the causal relationship between a pathogen and the occurrence of a disease.
 - (D) His swan-necked flask experiment that helped to prove that air-borne organisms can cause disease.
- 18 Several theories have been used to describe the processes responsible for the movement of materials through plants.
- Which of the following statements about the translocation of sucrose (sugar) in phloem is correct?
- (A) Sucrose molecules are actively transported from one sieve tube cell to the next.
 - (B) Sucrose molecules move by osmosis in solution dissolved in water.
 - (C) Sucrose molecules are actively loaded into the phloem at the sink.
 - (D) Sucrose molecules are moved by pressure flow within the sieve tubes.
- 19 Which of the following statements about the structure and function of blood vessels is correct?
- (A) All arteries carry oxygenated blood away from the heart.
 - (B) Blood in veins is under higher pressure than blood in arteries.
 - (C) Veins have valves to prevent the back flow of blood.
 - (D) Capillary walls allow for the exchange of all molecules.

- 20 A student examined samples of two different types of pathogens and described them as follows.

'I examined sample A with a magnifying glass and clearly saw six legs and two small antennae. Sample B was examined using a light microscope and contained individual cells that had clear nuclei. These cells lacked both chloroplasts and a cell wall.'

The types of pathogens in samples A and B respectively are

- (A) Macroparasite and bacteria
- (B) Fungi and bacteria
- (C) Macroparasite and protozoan
- (D) Fungi and protozoan

Section I (continued)

Part B – 55 marks

Attempt Questions 21 - 33

Allow about 1 hour and 40 minutes for this part.

Answer the questions in the spaces provided.

Question 21. (2 marks)

Several features of haemoglobin make it highly adaptive for uptake and delivery of oxygen to tissues. Describe two such adaptive advantages of haemoglobin.

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Question 22. (3 marks)

Outline the contributions of Walter Sutton and Theodore Boveri in aiding our understanding of chromosomes and inheritance.

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Question 23. (2 marks)

Selective breeding has been used to improve livestock and poultry in Australia. Different selective breeding paths have produced better chickens for commercial meat and egg laying purposes. One grows to a large body size with more meat and the other produces more eggs.

Outline how selective breeding affects genetic variability in a flock of chickens. **2**

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Question 24. (4 marks)

Compare DNA replication with protein synthesis. **4**

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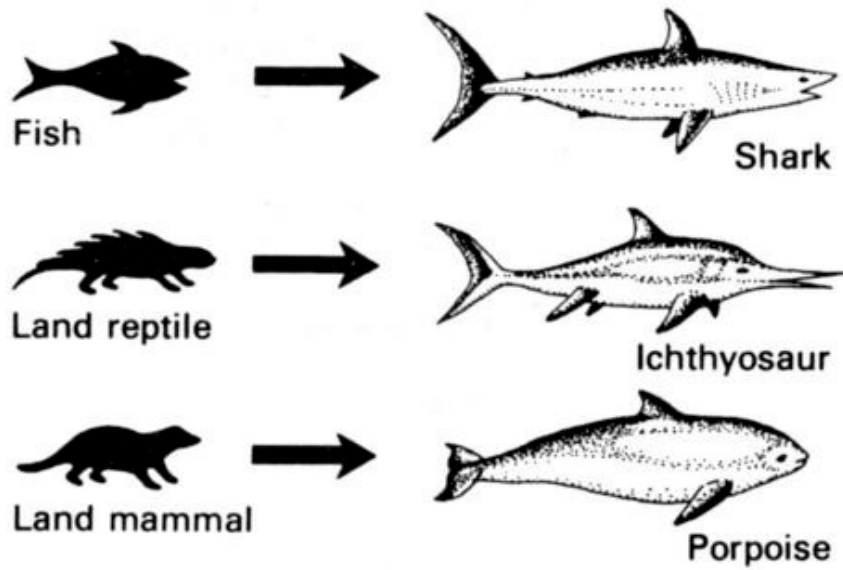
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Question 25. (4 marks)



The organisms shown are evidence for convergent evolution. Justify this statement. 4

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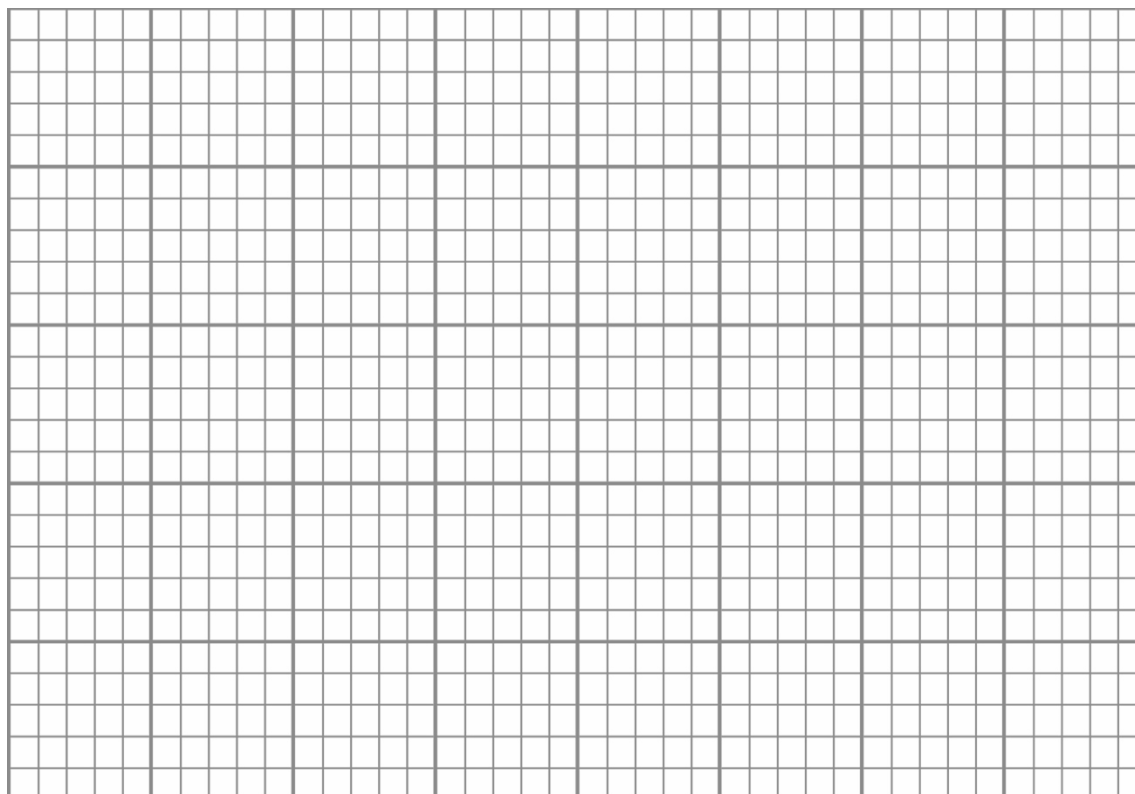
Question 26. (5 marks)

Two different animals (species A and species B) were placed in separate metabolic chambers in a laboratory and their body temperatures and metabolic rates were measured at different temperatures. The results are tabulated below.

Air temperature (°C)	Species A		Species B	
	Body temperature (°C)	Metabolic rate (mL O ₂ .g ⁻¹ .h ⁻¹)	Body temperature (°C)	Metabolic rate (mL O ₂ .g ⁻¹ .h ⁻¹)
5	6	0.3	38	9.6
10	12	0.4	37	8.4
15	16	0.5	37	7.3
20	21	0.6	38	6.2
25	25	0.8	37	5.2
30	29	0.9	36	4.3
35	35	1.1	37	4.4

- (a) Use the grid below to draw a graph of metabolic rate against air temperature for the two species.

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Question 26 continues on the next page.

Question 26 continued

- (b) Identify an Australian animal that would demonstrate the relationship between body temperature and air temperature of species B and describe two adaptations that it would use to regulate its body temperature in its natural environment.

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Question 27. (2 marks)

Describe an example of hybridisation within a species and outline the benefit to society of this hybridisation.

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Question 28. (4 marks)

Outline why removal of carbon dioxide from cells is essential.

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Question 29. (3 marks)

Unclean drinking water is a major source of gastrointestinal infection.

Explain how two methods of treating drinking water reduce the incidence of disease. **3**

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Question 30. (8 marks)

A scientist claims to have produced a transgenic variety of corn that can reach maturity faster than non-transgenic corn.

- (a) Outline a valid procedure to test the scientists claim. 4

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- (b) Debate two ethical issues arising from the use of transgenic species. 4

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Question 31. (5 marks)

During the HSC course you studied vaccination programs.

Evaluate the use of vaccination programs to reduce the spread and occurrence of disease.

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Question 32. (3 marks)

Propose reasons for why research into artificial blood is needed.

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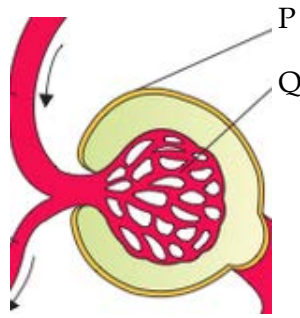
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Question 33. (4 marks)



The structure illustrated is part of the nephron.

- (a) Identify structure Q 1

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- (b) Identify the location in the nephron where the majority of glucose is reabsorbed. 1

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- (c) Hormone replacement therapy is required for people who cannot secrete aldosterone. Explain why this treatment is necessary 2

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Question 34. (7 marks)

Increased understanding of the causes of disease have changed approaches to the treatment and management of disease.

Assess this statement.

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Section I – Part B

Extra writing space.

If you use this space, clearly indicate which question you are answering.

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Section II

25 marks

Attempt ONE question from Questions 35-39

Allow about 45 minutes for this section

Answer parts (a)–(e) of ONE question in a Writing Booklet.

Extra writing booklets are available.

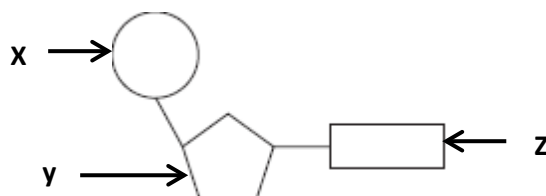
Show all relevant working in questions involving calculations.

			Pages
Question 35	Communication		
Question 36	Biotechnology		
Question 37	Genetics: The Code Broken		26-28
Question 38	The Human Story		
Question 39	Biochemistry		

Question 36 – Genetics: the code broken (25 marks)

- (a) As part of your course you performed a first-hand investigation to construct a model of DNA.

- (i) Name the segment of DNA shown in the diagram.

1

- (ii) Complete the following table to name the structures X, Y and Z in the diagram.

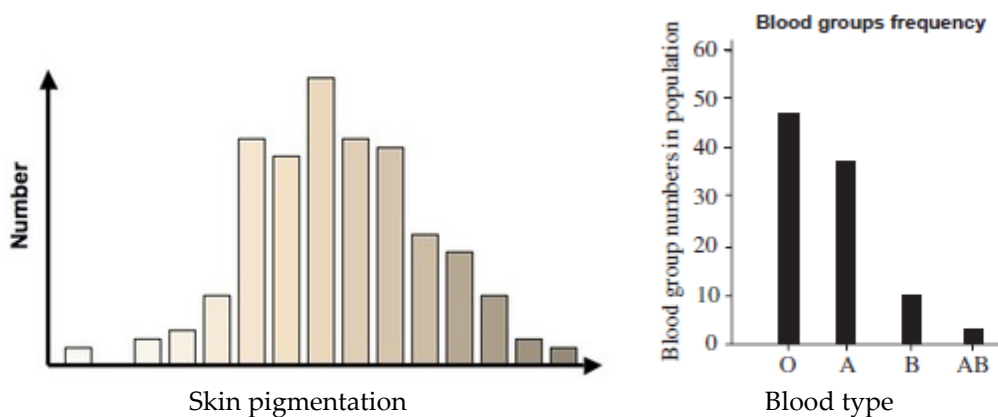
1

<i>Structure</i>	<i>Name</i>
X	
Y	
Z	

- (iii) Explain how using a model of DNA helped to increase your understanding of the structure of DNA.

2

- (b) This question refers to the graph below.



- (i) identify the graph that represents polygenic inheritance. 1
- (ii) Explain the differences between the graphs, supporting your answer with a description of multiple allele and polygenic inheritance. 3
- (c) A man who has blood type A and is Rh positive is married to a woman who is also blood type A but is Rh negative. They have a daughter who is blood type O and is Rh positive. He has started to worry that he may not be the biological father of this child.
- (i) Using your understanding of inheritance of blood types, explain how the child's phenotype could be the result of mating between two parents with the stated phenotypes. Show your working. 3
- (ii) Outline a technique that could be used to convince the man that he is the biological father of the child. 2
- (d) Describe the current use of gene therapy to manage a named genetic disease. 2

- (e) In a series of cross-breeding experiments scientists were looking at the inheritance of coat colour, tail length and ear length in mice.

In one experiment they crossed black long tailed males (BbLl) with white short tailed females (bbll). These offspring were crossed with the expectation that normal Mendelian ratios would occur.

- (i) Construct a Punnett square to show the phenotypic ratios that would have been obtained if these genes showed typical Mendelian dihybrid inheritance.

3

- (ii) The actual results of the experiment are shown below.

<i>Phenotype</i>	<i>Number of offspring</i>
Black, long tailed	23
Black, short tailed	3
White, long tailed	3
White, short tailed	23

The scientists concluded that the genes must be linked.

Show, with working, that the coat colour gene is 12 map units from the tail length gene.

2

- (f) During your HSC course you processed and analysed information on the Human Genome project (HGP).

Evaluate this project as a valuable source of research.

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Shore Biology Trial 2017 ANSWERS

Section I

Part A Multi-Choice

1. A 2. B 3. D 4. C 5. A 6. C 7. D 8. B 9. C 10. B 11. B 12. C
13. B 14. D 15. A 16. B 17. C 18. D 19. C 20. C

Part B

Question 21

Criteria	Marks
2 adaptive advantages clearly described.	2
1 adaptive advantage clearly described.	1

Sample answer:

Haemoglobin can carry far more oxygen than could be carried directly in the plasma.

Haemoglobin dissociates with oxygen at lower pH – making oxygen more available during exercise.

Haemoglobin dissociates with oxygen at higher temperature making oxygen more available during exercise.

Question 22

Criteria	Marks
The work of Sutton and Boveri clearly outlined with a clear connection to how that work aided our understanding.	3
The work of Sutton and Boveri clearly outlined.	2
Some description of Sutton and Boveri's work.	1

Sample answer:

Sutton studied chromosomes in the testes of grasshoppers. He observed that chromosomes occur in matching pairs that separate during meiosis.

Boveri experimented with sea urchins. He showed that a complete set of chromosomes is necessary for normal development.

They independently proposed that genes are carried on chromosomes.

Question 23

Criteria	Marks
Selective breeding described with a clear outline of the effect on genetic variability.	2
Selective breeding described OR the effect of selective breeding on variability correctly outlined.	1

Sample answer:

Selective breeding is the manipulation of the phenotype in the offspring to achieve desirable traits.

This can have the effect of decreasing genetic variability over time since on the individuals with desirable traits are bred and the less favourable traits disappear.

Question 24

Criteria	Marks
Clear comparison with 2 similarities and 2 differences.	4
As above but missing a similarity or a difference.	3
1 similarity and 1 difference or 2 differences.	2
1 difference.	1

Sample answer:

Similarities:

DNA unzips.

Utilize complementary base pairing to make the new strand.

Utilize DNA helicase to unzip.

Differences:

DNA replication :only in the nucleus, end product is a new DNA strand

Protein synthesis: starts in nucleus end in cytoplasm, uses uracil instead of thymine.

Question 25

Criteria	Marks
Convergent defined + features in the diagram that reflect convergence + relating features to evolution to similar environment and indicating different origins.	4
3 of 4 above	3
2 of 4 above	2
Some form of information related to convergence.	1

Sample answer:

Convergent evolution is where unrelated organisms evolve over time to develop similar characteristics because they live in similar environments. Although the organisms in the diagram have come from vastly different origins (fish, reptiles and mammals) they have all developed a similar characteristic (streamlined body) so they can move quickly through an aquatic environment.

Question 26 (a)

Criteria	Marks
All components of the graph complete with an appropriate indication of which line is which.	3
Some minor component of the graph incorrect.	2
A couple of parts of the graph incorrect.	1

Sample answer:

(b)

Criteria	Marks
An appropriate Australian endotherm with two described adaptations.	2
Endotherm with one adaptation or ectotherm with 2 adaptations.	1

Sample answer:

Red Kangaroo – as ambient temperature increases the Kangaroo will lick forearms and move into the shade.

Question 27

Criteria	Marks
Appropriate example described with the benefit to society.	2
Only one of the point above.	1

Sample answer:

The Australian Milking Zebu is a specially bred milk producer for Australian tropical regions. It was produced from crosses between Asian Dairy cattle and European Dairy cattle. It is heat resistant because it is able to sweat and its loose skin makes it resistant to ticks that it can easily shed.

Question 28

Criteria	Marks
Carbon dioxide linked to lower pH which is linked to less enzyme activity which is linked to cell metabolism.	3
Carbon dioxide linked to lower pH which is linked to less enzyme activity.	2
Carbon dioxide linked to lower pH.	1

Sample answer:

The build-up of carbon dioxide in cells will lead to a lower pH. Since enzymes operate optimally at a specific pH, lowering the pH will reduce enzyme activity. Since enzymes control metabolic rate will also reduce.

Question 29

Criteria	Marks
2 methods of treating drinking water listed/described and linked to reduction of microbes and then linked to how this will reduce the incidence of disease.	3
As above but without the final link.	2
2 methods of treating drinking water listed/described.	1

Sample answer:

Filtration removes particulate matter from water which may contain pathogens.

Chlorination - chlorine is toxic to microbes and kills them.

The removing pathogens from water means when the water is drunk pathogens are not consumed and there is therefore less chance of contracting a disease.

Question 30 (a)

Criteria	Marks
An experimental design including transgenic and non-transgenic groups + repetition (multiple plants in each group) + at least 2 controlled variables + some appropriate means of measurement (eg time to reach maturity)	4
3 of the above	3
2 of the above	2
1 of the above	1

Sample answer:

2 groups of plants were set up (20 plants in each group) – 1 group was the transgenic variety the other non-transgenic.

All the plants were grown in the same soil, same temperature, had the same amount of water added, exposed to the same amount of light.

The time taken for the plants to mature was measured and compared.

Transgenic corn have some gene from another organism inserted into its DNA. To test this hypothesis:

- 1. Grow 10 transgenic corn ^{from seeds} in nutrient soil and water daily.*
- 2. Grow 10 natural corn from seeds in the same conditions as the transgenic corn. (eg sun, water, Temp). This is the control.*
- 3. Record the number of days required from when the corn is planted, to when it reaches maturity for ~~both~~ all 20 corn.*
- 4. Repeat experiment three times to ensure reliability and average results.*

(b)

Criteria	Marks
2 ethical issues identified with at least 1 point for and 1 point against described for each.	4
2 ethical issues identified but only one side of the argument given.	3
Only one ethical issue debated	2
2 ethical issues identified OR 1 ethical issue with only one side of the argument.	1

Sample answer:

Ethical issue 1: Environment

For: by producing transgenic organisms like BT cotton which have a natural insecticide added there is less need to spray insecticide which can run off and affect organisms not targeted.

Against: Transgenic organisms like BT cotton with a natural insecticide may be killing beneficial organisms which feed upon the cotton and ultimately affected the natural food chain.

Ethical issue 2: Health

For: Transgenic organisms like golden rice provide an easy way to get an essential vitamin into the population where it wouldn't been part of their diet otherwise – saving lives.

Against: The effect of consuming transgenic foods on human health is unknown and could be negative.

Health For: Transgenic species allow access to nutrients which are expensive in commonly occurring substances. Such as Golden rice containing Beta Carotene which benefits eyes.
 Against: There could be unforeseeable long-term health consequences such as cancers which onset ^{years} ~~well~~ after the transgenic species is ingested. ✓

Economic For: Allows cheaper access to food as transgenic species can ~~be~~ be produced more efficiently. Eg: Golden rice
 Against: Natural growing farmers are put out of business due to these ¹⁹ large companies, increasing unemployment and reducing the agricultural sector.

Question 31

Criteria	Marks
At least 2 vaccination programmes described and their effects on the spread and occurrence of the disease given + a valid evaluation; or a description of how immunity is achieved through a vaccine	5
As above with no evaluation OR lacking some detail in the description or effect of the programme.	4
A brief description of 2 vaccination programmes with an evaluation OR description lacking some detail with no evaluation OR one programme thoroughly done with an evaluation	3
A brief description of 2 vaccination programmes OR one programme thoroughly done with no evaluation	2
2 vaccination programmes mentioned OR a brief description of one programme	1

Sample answer:

The smallpox vaccination programme was very successful.

WHO introduced a worldwide vaccination programme in 1967 and the disease was eradicated worldwide by 1978.

The Diphtheria vaccination programme has also been very successful.

Immunisation programmes were introduced into Australia in the 1930s and similar programmes were introduced across the globe. There have been no reported cases in Australia since 2004.

Vaccinations introduce a weakened ^{or dead} pathogen ⁽⁵⁾ into the immune system meaning memory cells can recognise a full strength ~~disea~~ pathogen in the future, and quickly stimulate B and T cells to kill it. ✓

Smallpox: ~~sp~~ Small pox killed 1 in 10 people in the 18th century, but the WHO has announced ^(1980s) the world is free of small pox following extensive vaccination programs. Diphtheria & Polio: both were prevalent during the 18th century. (Diphtheria killed 50% of people who contracted it) However, the majority of the world is now free of the two diseases, ~~which have~~ and outbreaks have been reduced to small, isolated incidents rather than its previous global outbreaks. ✓ Evaluation: This stresses how vaccination programs have been vital in ~~reducing~~ reducing the spread and occurrence of diseases, particularly Smallpox.

Question 32. (3 marks)

Question 32

Criteria	Marks
3 reasons outlined.	3
2 outlined.	2
1 outlined OR 3 mentioned.	1

Sample answer:

Donated blood has a limited shelf life and must be disposed of after this – artificial blood could remove this issue saving money and shortages.

Donated blood needs to be typed - artificial blood would remove the need for typing and the risk of rejection and shortages of certain types. Donated blood can carry disease – artificial blood would carry no disease and would remove restrictions and risk that exist with donation.

Propose reasons ⁽³⁾ for why research into artificial blood is needed.

- Remote locations lack the storage equipment + methods to harvest blood for blood banks, so blood cannot be administered for those in need. Hence, artificial blood capable of easy storage + production could save many lives.
- In select communities, the prevalence of blood-borne diseases make it unsafe to give blood. Hence, the number of donors has been reduced and so the chance of the availability of donors with a rare blood type is lessened. ✓
- Artificial blood production ^{could} be cheaper + faster/efficient than manually harvesting blood from donors, increasing the price of ~~the~~ artificial blood (supply and demand) so more remote clinics can have a large/ varied blood supply.

Question 33 (a)

Criteria	Marks
Glomerulus named	1

(b)

Criteria	Marks
Proximal tubules named.	1

(c)

Criteria	Marks
Description of function of aldosterone linked to water balance and ultimately enzyme function and metabolism.	2
Just description and function of aldosterone.	1

Sample answer:

Aldosterone increases the absorption of sodium from the ascending Loop of Henle which in turn increases water reabsorption when the blood is low in water. With a lack of water waste products are in greater concentration which in turn affects pH and enzyme function and ultimately metabolism.

Question 34

Criteria	Marks
A comprehensive answer referring to 3 increases in our understanding of disease and their subsequent impact on the treatment or management of disease with a clear and valid judgement.	7
Same as above but lacking some detail or a valid judgment.	5-6
A superficial answer mentioning a couple of increases in understanding and some impact with or without a judgement	3-4
Some indication of increases in our understanding of disease with or without a judgment	1-2

Sample answer:

The increased understanding of how diseases are transmitted and spread have allowed for a shift in the way we treat and manage diseases.

Malaria:

Originally thought of as being caused by "bad air" by the ancient Greeks, the increased understanding of how malaria is transmitted has changed the way we treat + prevent it. Through the contributions of Ross, Golgi, and Laveran in the late 1800's and 1900's, our knowledge that malaria is caused by a plasmodium, carried by the female anopheles mosquito, has led to dramatic changes to minimize its effect. For example, the use of mosquito nets and repellent to prevent exposure to the plasmodium is an effective way to manage the disease that would not have come about without the understanding of the cause.

Pasteur + Koch:

The contributions to the understanding of the cause of disease from Pasteur and Koch have changed approaches to treatment and management as well.

* e.g. covering your mouth when you cough/sneeze.
Student Number:

Pasteur disproved the theory of spontaneous generation and showed that microbes exist in the air. This subsequently led to the use of facemasks and importance of hygiene* to treat and prevent the spread of disease. ✓
Similarly, Koch identified a method of identifying the cause of disease through his postulate's. This allowed farmers to understand that pathogens can cause disease, and therefore infected animals should be isolated from the rest of the herd. Thus a management of disease developed from our increased understanding. ✓

Quarantine + Vaccination:

Thanks to Pasteur's understanding that disease can be caused by microbes in the air, quarantine measures have taken place in airports and across domestic borders that reduce the spread of pathogens, thus managing disease. Likewise, the use of vaccinations can be attributed to the understanding of McFarlane Burnet and the immune response, which allows humans to build immunity to particular diseases, recognising the antigen in memory cells. Thus the use of vaccinations as a prevention/treatment

Q34 continued) Of disease is the result of an increased knowledge of the cause of disease. Ultimately, the statement is valid and highly true in modern medicine. Thanks to our understanding of the causes of disease, we have been able to adopt our preventative measures and treatments to suit the demands of specific diseases.

Question 37

- a) i) nucleotide
ii) X-phosphate Y-sugar Z-base
iii)

Criteria	Marks
Two ways the model aided understanding explained with an example OR One way model aided understanding explained with two examples.	2
Two ways model aided understanding with no explanation OR one way explained with one eg.	1

Sample answer:

The model simplified the complicated structure of DNA by using structures to represent molecules such as phosphates, sugars and molecules rather than showing every atom which would have made it difficult to make sense of the connections.

The model was also magnified – the structure could normally not be seen even with a microscope – by making the molecules out of visible objects the structure and connections between molecules became clearer.

(if asked a question like this in the HSC – I suggest describing your whole model then explaining how this helped understanding.)

Modeling the DNA with different lollies (red bag for sugar, ~~red jelly~~ Black jelly bean for phosphate, ~~Skittles~~ Skittles for proteins G-Green, T-Red, A-Yellow, C-Blue) helped my understanding as it was enlarged compared to normal DNA helping me see the structure more easily. The simplification - 2 of only 6 nucleotides also helped my understanding as it wasn't ~~hundreds~~ there weren't hundreds so allowed me to focus on a section

(The HSC is not a charity – if you cannot plan questions and write according to the directive verb you are not going to cut it)

(b) (i) Skin pigmentation

(ii)

Criteria	Marks
Differences between graphs fully explained by referring to different alleles and many gene loci with polygenic and multiple alleles at one gene locus with multiple alleles and the ultimate effect on phenotype.	3
Differences in graphs identified and differences between polygenic and multiple alleles described.	2
Differences between polygenic and multiple alleles described.	1

Sample answer:

Polygenic inheritance is where many gene loci each with different alleles contribute to one phenotypic feature eg skin colour, or height – a person who has the pale allele for each gene has very pale skin, alternatively a person with the dark allele for each gene has very dark skin and there are numerous combinations of colour in between – the nature of the inheritance leads to a continuous variation in phenotypes as seen in the graph – producing the typical bell curve.

Multiple alleles are the result of more than two alleles at one gene locus – eg with blood there are 3 alleles leading to 4 possible phenotypes as seen in the blood graph.

The skin pigmentation has a ~~smoother~~ ^{more even} distribution, similar to bell-curve distribution, as well as many more phenotypes. Blood-type however, has only four phenotypes and a very uneven distribution. The high variability of skin pigmentation suggests it is the result of polygenic inheritance. i.e. it is a trait that is determined by multiple genes, most likely on multiple chromosomes, rather than simply a single gene. The presence of four distinct phenotypes for the blood type, suggests that it is a trait determined by a single gene but with multiple alleles. i.e. that instead of simply ~~two~~ ^{one or two} possible alleles for the particular gene (1-3 genotypes) there are in fact 3 or more ^{possible} ~~other~~ different variations of the gene, or different alleles. In the case of blood types, these ~~the~~ three alleles are i, I^A, I^B , and the four phenotypes are the results of different pairs of these 3 alleles.

1) The graph of skin pigmentation represents polygenic inheritance. This is because skin colour is determined by a number of genes, which range in the amount of melanin, that makes up the colour of your skin. Other factors such as environment and inherited genes also account for the ^{wide} range or gradient of skin colours presented in the graph.

However, the graph of Blood Group Frequency represents ³ multiple alleles. Blood grouping, when crosses occur, produce 4 types of ^{phenotypes} alleles, O, A, B, AB as shown in the graph. There is no steady gradient between these differences, like there is in polygenic inheritance. And a number of genes do not influence the blood type, they are the result of the parent.

(c) (i)

Criteria	Marks
Correctly constructed punnet square/s showing both ABO and rhesus inheritance with an appropriate explanation.	3
Correct punnet square/s with no explanation	2
Correct punnet square for ABO inheritance	1

Sample answer:

	I ^A D	I ^A d	iD	id
I ^A d	I ^A I ^A Dd	I ^A I ^A dd	I ^A iDd	I ^A i dd
id	I ^A iDd	I ^A i dd	iiDd	ii dd

Assuming that both parents are heterozygous for A type blood and the father is heterozygous for Rhesus - it can be seen in the punnet square there is a 1:8 chance that they have a child with O type blood who is Rhesus positive.

(c) (ii)

Criteria	Marks
Thorough outline of DNA fingerprinting.	2
An outline of DNA fingerprinting lacking some detail.	1

Sample answer:

DNA fingerprinting: This involves the use of highly variable (non-coding) sections of genes. Restriction enzymes are used to cut the DNA at certain spots. The fragments are then separated using gel electrophoresis. A profile is then produced using fluorescent probes. Identical patterns of fragment size suggest identical sources of DNA – for a paternity test one would expect half of the child's profile to match the father and the other the mother.

ii) Paternal relations can be determined using DNA fingerprinting. This involves the extraction of ~~short~~ short tandem repeats in the DNA using a restriction enzyme, which is then passed through a gel. ~~People with~~ these short repeats of non-coding DNA is highly variable and thus can be used to show ^{similar} relation. ~~A similar~~ gaps in the DNA profile of the child and the father provides more conclusive evidence of paternity than blood type.

(d)

Criteria	Marks
Disease mentioned with specific detail on treatment including method of inserting healthy gene.	2
Disease mentioned with some detail on treatment.	1

Sample answer:

iii) Gene therapy involves the replacement of faulty genes with functional ones. Sickle Cell anaemia (SCA) is a genetic disease that reduces one's capacity to fight off pathogens as a specific gene fails to produce B or T lymphocytes. Therefore, Gene therapy is used, ² removing the ~~cells~~ stem cells from the bone marrow to be inserted with a ^{retrovirus!} functional gene. This is reinserted into the bone marrow, and the gene is now functional, thus ~~also~~ curing the disease.

(e)

Sample answer

$\text{Recombinants} / \text{total offspring} \times 100$

(f)

Criteria	Marks
Uses a logical progression of ideas to describe and explain the benefits and limitations of the project with an evaluation on research value based on information provided.	5
As above lacking a judgement OR a lack of depth in the explanation of benefits and limitations.	3-4
Describes some benefits and limitations with an evaluation	1-2

Sample answer:

Goal: to determine the sequence of nucleotide base pairs that make up human DNA

f) Plan: Pros: helpful for identification of genes from protein

- understanding that not all DNA is coding

Cons: - doesn't mean we understand everything

- doesn't account for environmental factors

Evaluation: valuable more in that it paves the way for future research.

While the Human Genome Project did not turn out ~~to~~ to be as valuable as initially thought, there were still plenty of benefits that come out of it as a valuable piece of research.

Advantages:

- Once a particular protein is identified, by working backwards to determine the associated DNA sequence, scientists can now accurately determine exactly where on ~~the~~ which chromosome the relevant gene is located
- From the HGP, scientists now understand that not all DNA is genes that code for certain proteins, some of it is non-coding DNA, something that scientists are now continuing to learn more about.

Disadvantages:

- While scientists now ~~understand~~ have identified their entire base sequence of human DNA, they still have very little understanding of what most of it does or codes for, with no practical means of identifying the purpose of each piece of DNA
- The HGP does not completely solve all mysteries about the body or disease, as it does not ~~take~~ into explain the role of environmental factors, such as in mental health

Despite the disadvantages, there are still multiple ~~at~~ benefits of the HGP, especially in that it paves the way for future DNA research, hence the HGP is a valuable source of research.



The Human Genome project (HGP) was both useful and less so, however ultimately was a valuable research source.

The HGP was the mid/late-20th Century pursuit of mapping the entire human genome, with the intention for it to be used as a reference point when regarding genetic mutations and inherited diseases as a result from genetic disorders. Furthermore, it was intended to show similarities between humans and other species as a tool for evolutionary research.

The HGP:

- improved sequencing methods, allowing the technological developments of new DNA sequencing technology which has become very useful in today's society
- allowed the identification of genes that produce functional proteins common in most humans
- allows scientists to compare the human genome with the genome of other organisms; showing evolutionary similarities to be used as a source for evolutionary research
- on a social level, the highly publicised HGP over media created public interest into genetics; leading to more funding and

- population of scientists in the field of genetics
- development of software to more efficiently decipher the human genome's DNA sequences.

However, the HGP did not fulfill ^{all the} expectations it was set out to do:

- The HGP was as ^{several people} one single person, hence the produce genome was flawed as it was only the single person's genome (meaning genetic flaws and potential defects could be present and the researchers would be unaware)
- despite the common belief of the researchers, the HGP did not magically identify all the proteins being produced or what the genes did; which required further testing (the HGP was ultimately a long list of letters which did not identify genes)
- Did not solve the mystery surrounding "junk" DNA, as the HGP only showed what the genes were but not what they did

Hence, the HGP was overall beneficial as a reference point for further research but does not complete all the goals it was initially described to do.