

Biology

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Board approved calculators may be used
- Write using black or blue pen
- Draw diagrams using pencil
- Write your student number and/or name at the top of every page

Total Marks – 100

Section I

75 marks

This section has two parts, Part A and Part B

Part A

Total marks (15)

Attempt questions 1-15

Allow about 30 minutes for this part

Part B

Total marks (60)

Attempt questions 16-29

Allow about 1 hour 45 minutes for this part

Section II (Pages 16-23)

25 marks

Attempt ONE question from Questions 30-34

Allow about 45 minutes for this section

This paper MUST NOT be removed from the examination room

STUDENT NUMBER/NAME:

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1. The Thylacine or Tasmanian tiger was hunted to extinction in the early 1900's. It was superficially quite similar to a wolf or dog, although it had evolved entirely independently of these animals and was in no way related. It was about the size of a collie dog, had a long tail and a wolf like head with short ears and strong jaws and teeth. Its coat is brownish with a series of black stripes across the back. A nocturnal hunter, the thylacine preyed on animals up to the size of small kangaroos.



Wolf



Tasmanian tiger (Thylacine)

What do scientists call this process where two unrelated species evolve to look outwardly similar?

- (A) Divergent evolution
(B) Convergent evolution
(C) Competition
(D) Comparative anatomy
2. One form of juvenile diabetes results from destruction of the insulin producing cells in the pancreas. A recent epidemiological study has identified a higher than national incidence of this disease in certain areas of NSW. What does this suggest as the cause?
- (A) nutritional
(B) environmental
(C) infectious
(D) auto-immune
3. The release of ADH (anti-diuretic hormone) by the pituitary gland will result in which of the following?
- (A) an increase in urine concentration.
(B) a decrease in the permeability of the collecting ducts in the kidney.
(C) an increase in the uptake of urea from the blood.
(D) a decrease in the amount of water reabsorbed into the circulatory system.

Section I

Total marks (75)

Part A

Total marks (15)

Attempt questions 1 – 15

Allow about 30 minutes for this part

Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the grid below.

	A	B	C	D
1				
2				
3				
4				
5				
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9				
10				
11				
12				
13				
14				
15				

STUDENT NUMBER/NAME:

4. Which of the following statements best describes the process of cloning frequently used in farming?
- (A) The crossing of two genetically different members of the same species.
(B) Inserting DNA from one species into another to produce desirable characteristics.
(C) Artificially selecting desirable characteristics and breeding animals with these.
(D) The production of genetically identical offspring.
5. Which kind of cell plays a key role in the inflammatory response?
- (A) B cells
(B) macrophage cells
(C) memory cells
(D) T cells
6. Why was Beadle and Tatum's "one gene-one protein" hypothesis altered to the "one gene-one polypeptide" hypothesis?
- (A) some proteins are made up of more than one polypeptide chain each controlled by a different gene.
(B) one gene can control the production of many different polypeptides.
(C) genes only control the production of enzymes.
(D) genes are only control the production of polypeptide chains not proteins.
7. In a species of pea plant, round peas are produced much more often than wrinkled peas. The allele for round is given as (R) and the allele for wrinkled as (r).
- When two pea plants that both produce round peas are crossed, some of the offspring produce wrinkled peas. What is the only possible genotype for each parent pea plant?
- (A) RR, RR
(B) RR, Rr
(C) Rr, Rr
(D) Rr, rr

8. Understanding the third line defence against viruses has had most impact on the development of which technology?
- techniques to determine DNA sequences
 - transgenic technology
 - spectroscopic identification of organic compounds
 - reproductive technology
9. In 1910, a geneticist called Morgan worked with a mutation that arose in his fruit fly stocks. This mutation caused a white eye instead of the normal red eye colour. He crossed a white-eyed male fly with a normal, red-eyed female. All the first generation had red eyes. However, in the second generation all the females had red-eyes, but half the males had white eyes.
- Through further breeding, Morgan eventually got females with white eyes as well. This surprised Morgan, and he carried out a reciprocal cross i.e. he crossed a white-eyed female with a red-eyed male. He found that all the female offspring in the first generation were red-eyed, whereas all the male offspring were white-eyed. In the second generation half of the offspring of each sex were red-eyed, and half were white-eyed.
- How did Morgan try to explain these results?
- He reasoned that the gene for eye colour in fruit flies was co-dominant.
 - He explained that the gene for eye colour was located on the X chromosome.
 - He stated that there was no pattern in the inheritance of eye colour in fruit flies.
 - He explained that this pattern of inheritance was due to a mutation in the first generation of flies.
10. Which of these statements could most likely be attributed to Robert Koch?
- life forms originate from other life forms
 - certain diseases are transmitted by insect vectors.
 - the body's mechanism for fighting disease depends on cells being able to recognise self.
 - some specific diseases are caused by bacteria.

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STUDENT NUMBER/NAME:

Section I (continued)

Part B – 60 marks

Attempt Questions 16 – 29

Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided.

Question 16 (3 marks)

Read the newspaper article below and answer the following questions.

BLUE GENE MAY DRAG YOU DOWN

Ben Wyld

A common gene mutation found in more than half the population could explain why people sink or swim when faced with life stresses.

People who have a stress-sensitive version of the serotonin transporter 5-HTT gene are more than twice as likely to develop depression after multiple stressful events, according to an international research team.

Led by professors Terrie Moffitt and Avshalom Caspi, for the King's College London a team of researchers charted stressful events such as loss of a job, death of a loved one, health and relationship problems among 847 Caucasian New Zealanders aged 21 to 26.

Among those who reported four or more life stresses, 43 per cent had two copies of the short version of the gene developed depression. Of those with one short and one long version gene, 33 per cent developed depression.

Professor Ian Hickie, from the Australian depression initiative beyondblue, said that it was further evidence of the interplay between genes and the environment.

"But simply, having the gene doesn't mean you will have the illness... it is only expressed in key environments," he said.

Sydney Morning Herald Jul 19-20 2003

Answer the questions on the following page.

Question 16 continues on next page

Page 7

11. Which of the following is NOT an example of homeostasis?
- a horse perspiring after running in the Melbourne Cup
 - the liver removing glucose from the blood and storing it as glycogen
 - expansion of blood vessels in the skin during exercise
 - the production of saliva in the mouth while eating
12. What is enantiostasis?
- the maintenance of a constant body temperature independent of the environment
 - the movement of water through a semi permeable membrane
 - the removal of the waste products of metabolism
 - the maintenance of metabolic and physiological functions in response to variations in the environment
13. Which mechanism is an example of a specific immune response?
- the destruction of pathogens
 - defence adaptations at the point of entry
 - increased blood flow to a site of infection
 - production of B and T lymphocytes
14. Which of the following statements is correct about the excretion of waste through the kidneys?
- The concentration of urine excreted by terrestrial mammals is fairly constant.
 - The concentration of urine excreted by fresh water fish is very dilute.
 - The urine produced by marine fish is very dilute because they are constantly drinking water.
 - Urine secreted by desert dwelling mammals is generally very dilute, as they need to conserve water.
15. How is oxygen transported around the body by the blood?
- attached to haemoglobin in white blood cells.
 - dissolved in the blood plasma.
 - carried by the red blood cells.
 - transported through the lymphatic system attached to cholesterol molecules.

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STUDENT NUMBER/NAME:

Question 16 (continued)

Marks

- (a) Explain why not all people that carry the 5-HTT gene on their chromosome will develop depression.

1

- (b) Outline TWO other ways in which the environment may affect the expression of a gene in an individual.

2

Question 17 (4 marks)

Both endothermic and ectothermic animals can be found living in a wide variety of habitats.

- (a) Explain how an ectothermic animal might respond to the alpine conditions around the Kosciuszko ski fields during winter. Explain how this response might assist in temperature regulation.

2

- (b) Name ONE Australian endothermic animal. Describe TWO ways this organism might respond to a large increase in the ambient temperature.

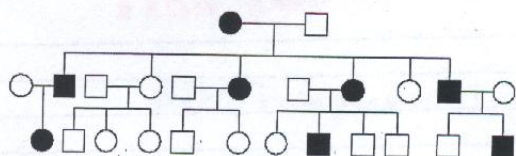
2

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Question 18 (4 marks)

Marks

The diagram below is a pedigree for albinism in Humans. Albinism can be any one of a number of genetic conditions that cause a lack of pigment in the eyes, skin and hair of sufferers.



Note: solid or "filled in" shapes denote the presence of that trait.

- (a) Is the allele responsible for albinism dominant or recessive? Justify your answer

2

- (b) Explain why a professional dog breeder might use a pedigree.

2

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STUDENT NUMBER/NAME:

- (b) Identify the dependent and independent variables in your investigation.

2

- (c) Identify a safety risk in the investigation you performed.

1

- (d) Outline a safe work practice you employed to minimise any risks in your investigation.

1

Question 21 (4 marks)

- (a) Describe the concept of punctuated equilibrium.

2

- (b) Compare punctuated equilibrium with the process proposed by Darwin.

2

Page 11

Question 19 (4 marks)

Marks

The human body has a number of defences against pathogens.

- (a) Outline a defence barrier to pathogens.

2

- (b) Compare this defence mechanism to the immune response mediated by B-lymphocytes.

2

Question 20 (7 marks)

During your Biology course you performed an investigation to identify microbes in food or water.

- (a) Outline the procedure you used.

3

Question 20 continues on next page

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STUDENT NUMBER/NAME:

Question 22 (4 marks)

Identify the role of antibiotics in disease management and evaluate their effectiveness in this role.

Question 23 (4 marks)

Construct a table to compare the structure of arteries and veins.

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Question 24 (4 marks)

Marks

Trees can grow to over 120 metres in height. Water and dissolved minerals must move from the roots through the xylem to the tips of the shoots. Materials produced in the leaves must be transported through the phloem to the roots and other parts of the plant. Briefly describe the current theory to account for this movement of materials in the:

(a) Xylem

2

(b) Phloem

2

Question 25 (6 marks)

(a) Discuss the potential impact of reproduction technologies on the genetic diversity of a named species of plant or animal that has been genetically altered.

4

(b) What implications does this have for the evolution of this named species of animal or plant?

2

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STUDENT NUMBER/NAME:

Question 28 (6 marks)

Marks

Explain how processes such as gamete formation and sexual reproduction bring about variability in the offspring of species.

Question 29 (5 marks)

NAME a non-infectious disease that you have studied.
For this named disease describe its:

-occurrence
-symptoms
-cause

-treatment or management measures that are commonly employed.

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Question 26 (3 marks)

Marks

Over a long period of time, most of Australia's plants have evolved mechanisms to survive irregular rainfall and very dry conditions. Describe THREE adaptations Australian plants have acquired through evolution to reduce water loss.

Question 27 (2 marks)

Describe the effect of temperature on the activity of enzymes.

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STUDENT NUMBER/NAME:

Question 32 – Genetics – The Code Broken? (25 marks)

Marks

- (a) (i) Give an example other than human of multiple alleles. 1
- (ii) Explain how a human male with blood type A and a human female with blood type B can have four children with different blood types. 2
- (iii) Compare the inheritance of the ABO and Rhesus blood groups. 2
- (b) The use of the highly variable genes for DNA profiling (fingerprinting) of forensic samples for paternity testing has been practiced widely nowadays.
- (i) Outline the steps that would have been taken to perform DNA fingerprinting. 4
- (ii) Comment on the reliability of this process and list any problems arising from this technology. 2
- (c) (i) Summarise the role of gene cascades in determining limb formation in birds or mammals. 4
- (ii) State the evidence that indicates the presence of ancestral vertebrate gene homologous in lower animal classes. 1
- (ii) Discuss some of the evidence available for the evolution of genes and their actions. 2
- (d) During your study of this Option you have gathered, processed, analysed information from secondary sources to describe the processes used in the cloning of an animal. You have also identified ways in which scientists could verify that the animal produced was a clone.
- Using an appropriate example, write an account of your findings. Include at least TWO references. 7

End of Question 32

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