Biology
Trial HSC 2003

Name: _____

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black or blue pen
- Draw diagrams using pencil
- Board – approved calculators may be used
- Write your name at the top of all papers

Total marks - 100

Section I

75 marks
This section has two parts, Part A and Part B

Part A – 15 marks
- Attempt questions 1-15
- Allow about 30 minutes for this part

Part B – 60 marks
- Attempt all questions
- Allow about 1 hour and 45 minutes for this part

Section II - Options

25 marks

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

Section 1 (total marks 75)

Part A (total marks 15)

Attempt Questions 1-15
Allow about 30 minutes for this part

Use the multiple choice sheet for your answers

1.

1. Remain unchanged at the end of the reaction.
2. Usually specific to a particular substrate
3. Sensitive to pH
4. Sensitive to temperature
5. A catalyst
6. A protein molecule
7. A carbohydrate molecule

Which of the above statements does not apply to enzymes?

A. 1, 3, 4, 5, 6, 7
B. 7
C. 2
D. 1, 2, 7

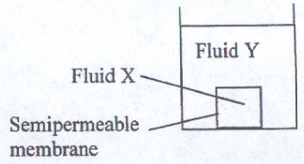
2. The blood in mammals transports materials around the body in various forms. Which of the following correctly describes how carbon dioxide exists in the blood?

A. Oxyhaemoglobin
B. Urea
C. Calcium carbonate
D. Hydrogen carbonate ions

3. A long distance runner has to maintain reasonable fluid levels by regularly drinking. During the run the body is also using an automatic process for fluid retention. Which of the following best describes this process?

A. It is controlled by the hypothalamus and the injection of ADH helps retain water in the blood stream.
B. The kidneys reduce the amount of aldosterone entering the blood stream to help retain water.
C. Aldosterone controls the water and ADH controls the salt concentration
D. When water concentration is low, the hypothalamus reduces the concentration of both ADH and aldosterone

4. The use of models in science is essential to test concepts and help explain them.



A cube full of fluid with a semipermeable membrane skin is placed into a beaker of water. The cube is modelling a typical fish. Which of the following scenarios will best depict what will happen to the model fish.

	Fluid X	Fluid Y	Prediction
A.	sea water	sea water	volume of the cube increases
B.	dilute sea water	sea water	volume of the cube increases
C.	sea water	dilute sea water	volume of the cube decreases
D.	dilute sea water	sea water	volume of the cube decreases

5. Excess amino acid from cellular metabolism in mammals needs to be removed because of its toxic nature. Which of the following best describes a broad outline of the pathway to its removal.

A Cell —amino acid→ kidneys —urea→ bladder
B. Cell —amino acid→ liver —urea→ kidneys —urea→ bladder
C. Cell —amino acid→ liver —urea→ kidneys —uric acid→ bladder
D. Cell —amino acid→ liver —uric acid→ kidneys —urea→ bladder

6. Which statement would <u>not</u> be considered part of Darwin/Wallace's theory of evolution?

A. Organisms best suited for the environment predominate in a population
B. Favourable characteristics are passed onto offspring
C. Similar organisms living in similar environments will always diverge in terms of their characteristics.
D. Changes in the environment such as the coming of an ice age, can cause the development of new species.

7. Which of the following statements <u>does not</u> describe Gregor Mendel's research on garden peas?

A. He discovered that tall plants are dominant over short plants
B. He realised that a single gene was responsible for the difference in colour between the yellow and green seed pods.
C. First generations bred from homozygous violet and white flowered plants produced the same coloured flower
D. He experimented with hundreds of plants.

8. The following are some characteristics of chromosomes:

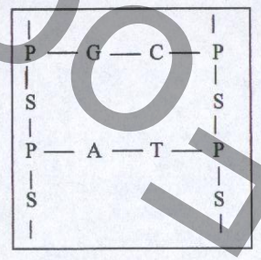
1. The DNA have a double helix structure
2. They line up during meiosis
3. Each gamete receives half the number of chromosomes compared to the parent cell
4. After fertilisation occurs the new zygote contains the correct number of chromosomes for that species
5. Organisms have many more inherited characteristics than they do chromosomes

Sutton and Boveri in the early 20th century developed a chromosomal theory of inheritance. Which of the above characteristics were initially recognised by them?

A. 1, 2, 3, 4
B. 1, 2, 3, 5
C. 2, 3, 4 ,5
D. 2, 5

9. Which of the following is a correct representation (model) of part of a DNA structure?

A



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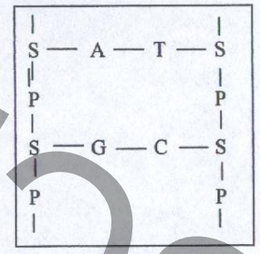

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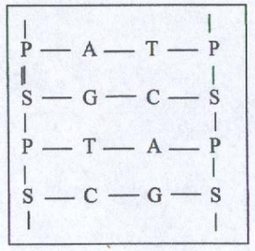

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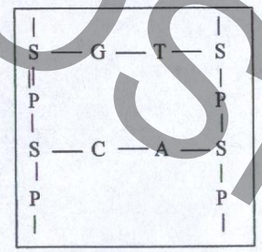
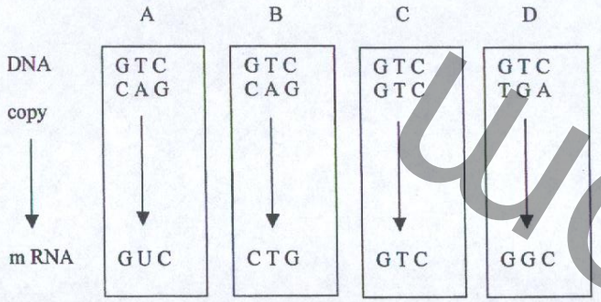


10. One of the key processes in the formation of polypeptides is the initial copying of DNA base sequences into m RNA base sequences. Which of the following is a correct transcription?



11. Normal healthy cells have their cycle well regulated by two complementary genes:

1. tumour suppressor gene
2. proto oncogene

Which of the following best describes the role of the proto oncogene ?

A. They reduce the growth that results from tumour suppressor genes
B. They stimulate cell growth and division
C. They are part of the last line of defence against tumours in the body
D. They search out and destroy tumour cells as they arise

12. Skin cancer, lung cancer, scurvy and haemophilia all have something in common.

A. They are all directly or indirectly related to sunlight
B. They are all non-infectious diseases
C. They are all inherited diseases
D. They are all environmental diseases

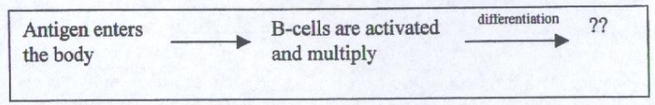
13. The need for clean food products is well understood today. Louise Pasteur first developed "pasteurisation" in the middle of the 19th century. Which of the following best describes his process?

A. Cool to 0°C then heat quickly to 60°C followed by cooling
B. Heat to 98°C for 85 minutes followed by immediate cooling to 0°C
C. Heat to 62°C for 30 minutes then allow it to cool
D. Heat to 80°C for 60 minutes followed by cooling and then three repeats

14. Hepatitis B has a circular DNA molecule enclosed in a protein coating. Which of the following classes of disease-causing organism does it belong to?

A. Protozoan
B. Bacteria
C. Prion
D. Virus

15.



The activation, cloning and differentiation of B-cells are a natural part of the immune response in humans. Which of the following happens after differentiation?

A. → B memory cells; Plasma cells → Antibodies
B. → B memory cells → Plasma cells → Antibodies
C. → B memory cells → Antibodies; Plasma cells
D. → Plasma cells → B memory cells; Antibodies

Section I (continued)

Part B (total marks 60)
Attempt Questions 16-25
Allow about 1 hour and 45 minutes for this part

Question 16 (6 marks)

Marks

(a) Briefly explain metabolism. 2

(b) By using flow charts or diagrams describe a stimulus-response pathway for an athlete suffering from increased body temperature during exercise. 4

Marks

Question 17 (6 marks)

(a) Compare the metabolism and food requirements of a named Australian ectotherm and endotherm of similar size in a similar environment. 2

(b) Using a named Australian example, describe how the organism responds to changes in ambient temperature and how this response assists temperature regulation. 2

(c) Describe the entry and transport processes for oxygen and glucose being taken in by our bodies. 2

Marks

Question 18 (6 marks)

(a) Describe artificial blood, and outline the reasons for using it. 2

(b) Draw and label a longitudinal section of: 2

(i) a xylem.

(ii) a phloem.

Marks

(c) Compare the movement of materials through phloem and xylem tissues. 2

Question 19 (6 marks)

(a) Compare the process of renal dialysis with the function of the kidney. 3

Marks

(b) Define what hormones are and outline the role of aldosterone and ADH in humans. 3

Question 20 (6 marks)

Firetails are a type of finch found in many niches throughout Australia. They are small seed-eating birds with stout conical bills adapted for crushing seeds. They often occur in large flocks.
The maps below display the distributions of the six species in Australia

Star Red-browed Painted Diamond Red-eared Beautiful

(a) Comment on the possibility of matching an unknown species of finch that you observed in a cage at the zoo to its correct environment above. Give reasons for your answer. 1

Marks

(b) Briefly define the Darwin/Wallace theory of evolution. 2

(c) Discuss whether the above example of the firetails can be explained by the Darwin/Wallace theory. 3

Marks

Question 21 (6 marks)

(a) Gregor Mendel carried out scientific experiments on the characteristics of garden peas. Among other things he discovered that tall plants were dominant over short plants.
Explain with the help of diagrams and/or tables the processes he used and some of his discoveries. 6

Marks

Question 22 (6 marks)

(a) These symbols represent the sequence of bases in part of a DNA strand.

C	C	A	T	G

(i) Name each base. 1

C _____

T _____

G _____

A _____

(ii) Draw a section of the double helix using the above sequence of bases with their sugars (S) and phosphates (P). 2

Marks

(iii) After several generations the sequence changed to:

C	C	G	T	A

Describe what has happened and the possible causes. 3

Question 23 (6 marks)

(a) Outline the function of genes in maintaining a healthy individual. 3

Marks

(b)

Disease	Organism
Influenza	Virus
Tonsillitis	Bacteria
Malaria	Protozoan
Tinea	Fungi

(i) Why are all of the above considered to be pathogens? 1

(ii) Choose one of the above diseases and outline how it can be spread amongst humans. 2

Marks

Question 24 (6 marks)

(a) Describe the major differences between bacteria and viruses. 3

(b) (i) State Koch's postulate. 1

(ii) Skin cancer and aids are becoming more common in society today. Comment on the effectiveness of Koch's postulates in helping to identify new cases of each disease. 2

Marks

Question 25 (6 marks)

> **Infection:** the invasion of any living organism by disease causing microorganisms which proceed to establish themselves, multiply and produce various symptoms in their host.

This definition was taken from a science dictionary.

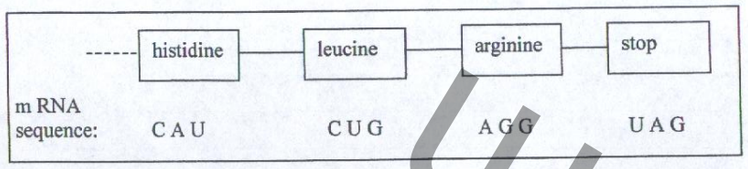
(a) Identify three possible "invasion" points for entering the body and describe the body's first line of defence at each of those spots. 3

(b) As the infecting microorganism breaks through the first line of defence, more specific immune responses occur. Describe how the phagocytes and the inflammation response combine to stop mild infections at this stage. 3

Marks

Question 28 **Genetics-The Code Broken** (25 marks)

(a)



This is part of a polypeptide sequence.

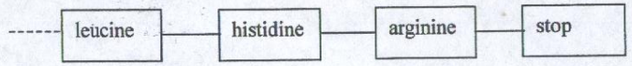
(i) What general group of substances do histidine, leucine and arginine belong to and what is their source outside the body? 1

(ii) Draw a complementary sequence of bases derived from DNA coding that could produce this section of the polypeptide. 2

(iii) Describe the role of the t-RNA. 2

(iv) What is the purpose of the stop codon? 1

(v) In a subsequent generation it was discovered that the sequencing of the polypeptide changed to:



Explain what could cause this change. 3

(b) Describe the possible blood types of offspring from parents of blood type A. Comment on the possibility of an O type offspring in future generations. 3

(c) Define polygenic inheritance and relate this to the work of Mendel 3

(d) (i) Predict the ratio of phenotypes in the second generation (F_2) offspring when homozygous yellow YY and tall TT parents are crossed with homozygous white yy and short tt parents in pea plants. Assume the genes are independent. 2

(ii) What effect will there be on the predicted F_2 ratio from question (i) if the genes are linked? How is it possible to use information like this to determine gene placement on chromosomes? 3

(e) Briefly discuss the benefits of the Human Genome Project. 3

(f) What evidence from gene research has assisted in our understanding of the theory of evolution? 2

End of question 28