



2002

HIGHER SCHOOL CERTIFICATE

TRIAL EXAMINATION

BIOLOGY

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 Student Number at the top of pages*

Total marks - 100

Section I Pages 2 – 31

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 Questions 16 - 28
- Allow about 1 hour and 45 minutes for this part

Section II Pages 32 – 39

25 marks

- Attempt all parts of this question
- Allow about 45 minutes for this section

Section I

75 marks

Part A – 15 marks

Attempt Questions 1 – 15

Allow about 30 minutes for this part

Use the multiple choice answer sheet.

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

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

A B C D

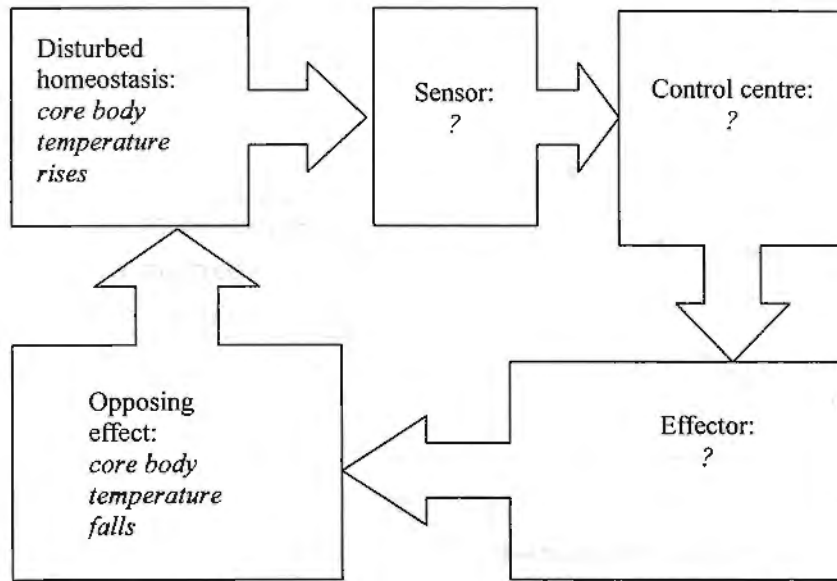
If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A B C D

If you change 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 C D
correct ↘

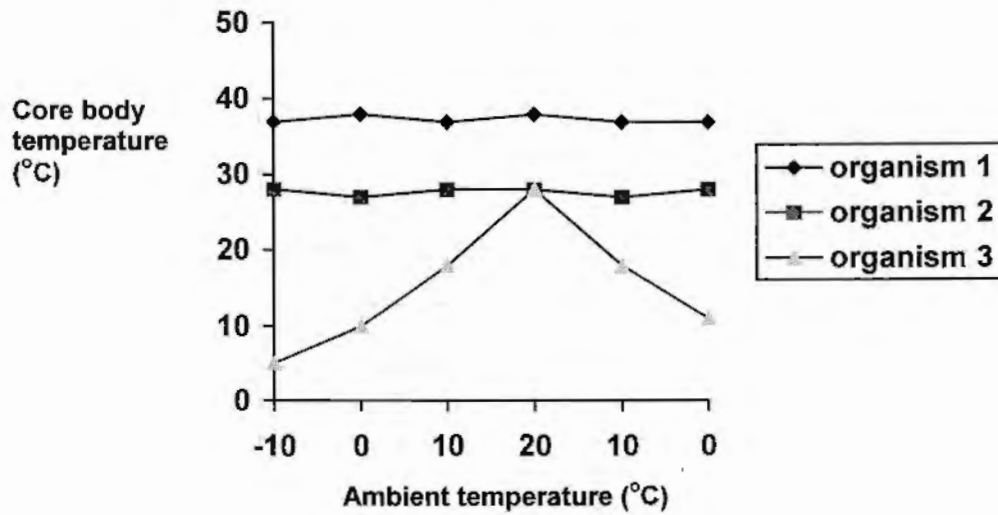
1. This question refers to the diagram, which is a simplified scheme of mammalian physiological responses to environmental temperature change.



Which option correctly represents the scheme?

	Sensor:	Control centre:	Effector:
(A)	pituitary gland	cerebrum of brain	thyroid gland
(B)	thermoreceptors in hypothalamus	hypothalamus	nerve cells of blood vessels
(C)	thermoreceptors in skin	hypothalamus	thermoreceptors in skin
(D)	nerve cells of blood vessels	cerebrum of brain	thermoreceptors in cerebrum of brain

2. The graph shows the relationship between the ambient temperature and the core body temperature for three different animals living in an Australian desert.



A student examines the graph and makes the following comments about the organisms:

		Temperature regulation classification	Response of animal to an ambient temperature of 0°C	Response of animal to an ambient temperature of 20°C
Comment 1	Organism 1:	ectotherm	shivering	basking in the sun
Comment 2	Organism 2:	endotherm	sheltering	moving
Comment 3	Organism 3:	ectotherm	shivering	basking in the sun

Which comment(s) are true?

- (A) Comment 1 only
- (B) Comment 2 only
- (C) Comment 3 only
- (D) Comments 2 and 3

3. Which statement correctly describes a healthy human's response to an increase in the concentration of carbon dioxide in the blood?
- (A) Breathing becomes deeper and slower.
 - (B) There is an increase in the pH of the blood.
 - (C) There is an increase the concentration of haemoglobin in the blood.
 - (D) There is an increase the concentration of bicarbonate in the blood.
4. Which statement explains how urea in the blood moves into a nephron?
- (A) Blood stream pressure and osmosis across the membrane of the Bowman's capsule.
 - (B) Blood stream pressure and tiny holes in the membranes of the Bowman's capsule and the glomerular capillaries.
 - (C) Active transport across the membranes of the Bowman's capsule and the glomerular capillaries.
 - (D) Gravity effects on the non-cellular components of blood in the Bowman's capsule.

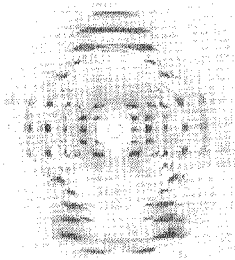
5. Information about the presence or absence of a kidney, the nature of the nitrogenous waste and the type of urine produced for four different organisms is given in the table.

Organism	Contains a kidney?	Nitrogenous waste:	Urine water content relative to blood of organism:
1	no	uric acid	very low
2	yes	urea	medium to high
3	no	uric acid	very high
4	yes	ammonia	very high

Which organisms best represent an insect, a terrestrial mammal and a fish?

	insect	terrestrial mammal	fish
(A)	organism 1	organism 2	organism 4
(B)	organism 3	organism 1	organism 2
(C)	organism 1	organism 4	organism 2
(D)	organism 4	organism 3	organism 1

6. This picture of DNA was taken in 1958.



Who was the person who took this picture?

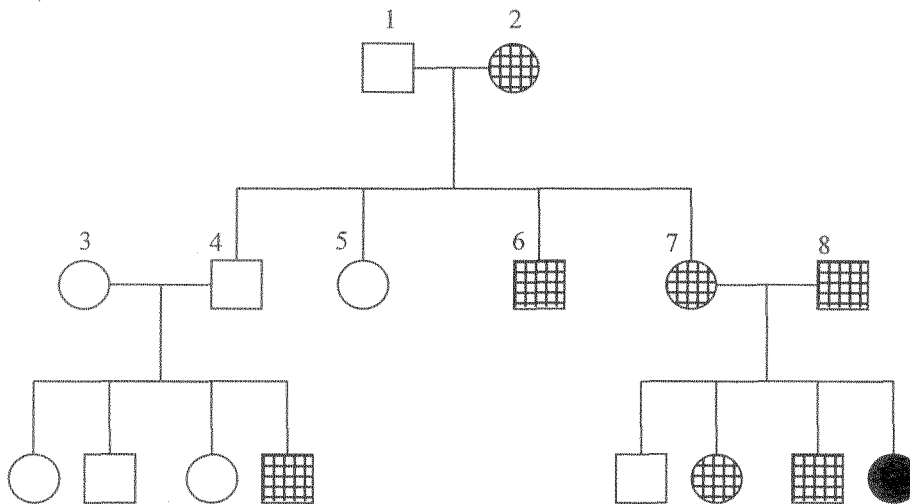
- (A) James D. Watson
- (B) Francis H. C. Crick
- (C) Rosalind Franklin
- (D) Maurice H. F. Wilkins

7. The first sex-linked trait discovered was white-eye colour in *Drosophila*; controlled by a recessive allele. This mutation suddenly appeared in pure breeding red-eyed *Drosophila* stock (the red eye allele being dominant).

What would be the phenotypic ratios if a heterozygous female fly for this trait were crossed with a red-eyed male fly?

	Females	Males
(A)	all white-eyed	50% white-eyed, 50% red-eyed
(B)	50% white-eyed, 50% red-eyed	all white-eyed
(C)	all red-eyed	25% white-eyed, 75% red-eyed
(D)	all red-eyed	50% white-eyed, 50% red-eyed

8. The pedigree for a particular condition in humans, involving the breaking down of an amino acid, is shown.



KEY

	male who can completely breakdown the amino acid in blood		female who can completely breakdown the amino acid in blood
	male who breakdowns the amino acid at a reduced rate in the blood		female who breakdowns the amino acid at a reduced rate in the blood
	male who cannot breakdown the amino acid at all		female who cannot breakdown the amino acid at all

The observations made by four students about the pedigree are given in the table.

Which observer is correct?

		Genotype of Individual '7'	Type of inheritance
(A)	Observer 1:	pp	recessive
(B)	Observer 2:	PP	incomplete dominance
(C)	Observer 3:	Pp	incomplete dominance
(D)	Observer 4:	X ^P X ^P	incomplete dominance

9. Scientist 'X' studied sea urchins and found that chromosomes are needed for sea urchin cells to develop. Scientist 'Y' studied male grasshoppers and suggested that genes are 'particles' located in chromosomes.

Who were scientists 'X' and 'Y'?

	Scientist 'X'	Scientist 'Y'
(A)	T. Boveri	W. S. Sutton
(B)	T. H. Morgan	G. Mendel
(C)	W.S. Sutton	G. Mendel
(D)	G. Mendel	T. Boveri

10. What is an advantage and a disadvantage of forming hybrids of corn or wheat?

	Advantage	Disadvantage
(A)	increased yield of crop	increased genetic variability
(B)	increased disease resistance	decreased genetic variability
(C)	decreased genetic variability	harder to harvest
(D)	increased genetic variability	a uniform crop

11. Which is the correct sequence of water purifying methods?

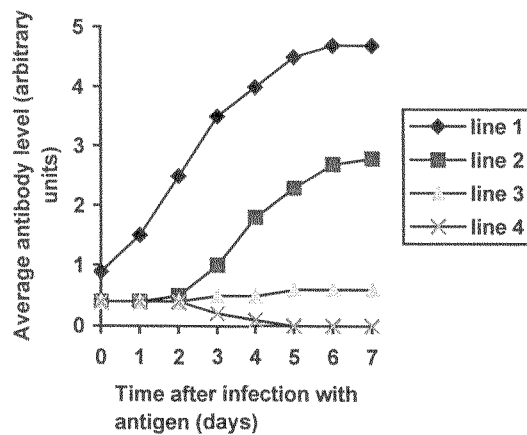
	least effective method → most effective method			
(A)	gravel/sand filtering	chlorine gas spray to water droplets	boiling for 3 minutes	membrane (0.2 μm pores) filtering
(B)	membrane (0.2 μm pores) filtering	boiling for 3 minutes	chlorine gas spray to water droplets	gravel/sand filtering
(C)	boiling for 3 minutes	chlorine gas spray to water droplets	gravel/sand filtering	membrane (0.2 μm pores) filtering
(D)	chlorine gas spray to water droplets	boiling for 3 minutes	membrane (0.2 μm pores) filtering	gravel/sand filtering

12. Which option is the best explanation for the occurrence of candidiasis?

	Factor which leads to the formation of the disease	Explanation for the disease	Effect on microflora
(A)	use of antibiotics	decrease in the amount of naturally occurring microbes in the mouth and respiratory tract	increase in the number of <i>Candida albicans</i>
(B)	use of antibiotics	increase in the amount of naturally occurring microbes in the gastrointestinal tract	increase in the number of <i>Candida albicans</i>
(C)	immune suppression	increase in the amount of naturally occurring microbes in the mouth and respiratory tract	decrease in the number of <i>Candida albicans</i>
(D)	immune suppression	formation of new microbes in the mouth and respiratory tract	increase in the number of <i>Candida albicans</i>

13. Which process occurs as a result of the inflammation response when a person accidentally gets cut?
- (A) Blood moves quicker through the injured area.
 - (B) Blood moves slower through the injured area.
 - (C) The amount of fluid in the injured area decreases.
 - (D) Blood clotting does not occur in the injured area.
14. A vaccinated person for a particular antigen and a person who has not been vaccinated for the same antigen are both infected with the antigen at the same time.

Which lines of the graph show the responses of the vaccinated person and the person who has not been vaccinated for the particular antigen?



	Vaccinated person's response is represented by	Non-vaccinated person's response is represented by
(A)	line 2	line 4
(B)	line 2	line 1
(C)	line 1	line 3
(D)	line 1	line 2

15. Black spot is a fungus that manifests itself as black spots on rose leaves causing the leaves to yellow and fall prematurely. A nursery owner decides to grow some roses during summer time, when the average temperature of the garden is 25°C.

Which option contains conditions that are the most likely to result in Black spot on the roses?

	Spacing of rose plants	Amount of sunlight exposure	Watering time
(A)	10m	high	middle of the day
(B)	5m	moderate	mid-afternoon
(C)	3m	low	early morning
(D)	0.3m	very low	just before darkness

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Student Number

Write your Student Number at the top of this Part A Answer Sheet.

Select the alternative A, B, C or D that best answers the question and, using **ink**, fill in the response circle completely.

1. A ○ B ○ C ○ D ○
2. A ○ B ○ C ○ D ○
3. A ○ B ○ C ○ D ○
4. A ○ B ○ C ○ D ○
5. A ○ B ○ C ○ D ○
6. A ○ B ○ C ○ D ○
7. A ○ B ○ C ○ D ○
8. A ○ B ○ C ○ D ○
9. A ○ B ○ C ○ D ○
10. A ○ B ○ C ○ D ○
11. A ○ B ○ C ○ D ○
12. A ○ B ○ C ○ D ○
13. A ○ B ○ C ○ D ○
14. A ○ B ○ C ○ D ○
15. A ○ B ○ C ○ D ○

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Section I (continued)

Student Number

Part B – 60 marks

Attempt Questions 16 - 28

Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided

Question 16 (3 marks)

Marks

In some emergency situations doctors use drugs to control a patient's ventilation (breaths taken per minute). These drugs, however, can create an imbalance in the amount of oxygen and carbon dioxide causing too much carbon dioxide in the blood and not enough oxygen.

- (a) Compare the technologies that allow the doctor to measure the oxygen saturation and carbon dioxide concentrations in the blood.

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- (b) Describe the form in which most carbon dioxide is transported in mammalian blood.

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Questions continue on next page →

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Student Number

Marks

Question 17 continued

(c) Explain your experimental results.

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Question 18 (6 marks)

(a) Describe the differences between active and passive transport.

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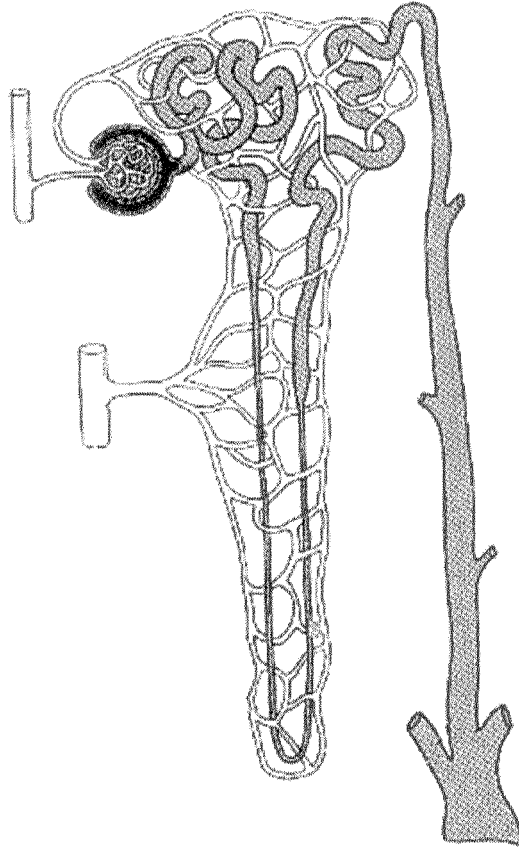
Question 18 continues on next page →

Question 18 continued

(b) On the diagram of the kidney nephron (the loop of Henle section):

- (i) Indicate with 'X' one region where active transport occurs.
- (ii) Name a substance that is actively transported at 'X'.

1



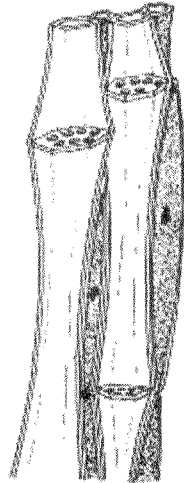
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Student Number

Marks

Question 18 continued

The diagram is a longitudinal section of part of a plant transport system.



- (c) State the name of the plant structure shown in the diagram and describe one theory about the movement of materials in it.

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Question 19 (3 marks)

(a) Outline the use of hormone replacement therapy in people who cannot secrete aldosterone.

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(b) Explain why this therapy is important for these people.

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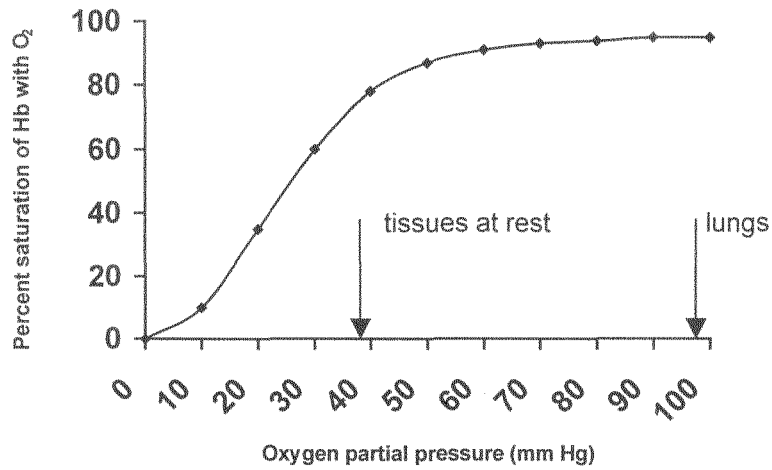
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Student Number

Question 20 (4 marks)

Marks

- (a) The graph shows the oxygen-haemoglobin association-dissociation curve for normal adult human haemoglobin.



Explain the implications this graph has for the offloading of oxygen in tissues and the picking up of oxygen in the lungs.

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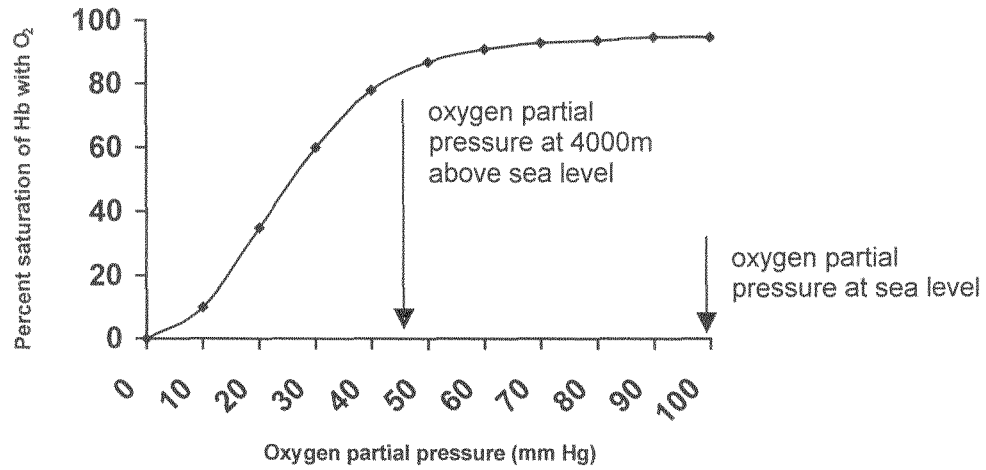
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Question 18 continued

Marks

(b) The graph shows the amount of oxygen-saturated haemoglobin in relation to the altitude.



Explain how this information relates to the physiological responses of humans to high altitudes.

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Student Number

Question 21 (3 marks)

Marks

(a) Using the theory of evolution, explain how the vertebrates that exist today came about. **1**

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(b) Describe one piece of evidence for the evolution of vertebrates. **1**

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(c) Describe the role of Darwin/Wallace in developing the theory of evolution. **1**

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Question 22 (4 marks)

(a) Explain why biodiversity is important.

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(b) Identify a current method being used to monitor the biodiversity of a named organism and describe why monitoring the biodiversity of this organism is useful.

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Student Number

Marks

Question 25 (7 marks)

(a) Why is the immune system of the body described as the third line of defence?

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(b) Distinguish between the T and B lymphocytes in terms of their:

(i) function in the immune system

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Question 25 continued

(ii) interaction with each other (including the mechanisms that allow the interaction between the B and T lymphocytes)

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(c) Give one reason why the immune response is suppressed in organ transplant patients.

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Question 27 (5 marks)

In your course you studied an infectious disease.

(a) State the name of this disease and give the cause of the disease.

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(b) Describe how the disease is transmitted.

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(c) Describe response of the host.

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Student Number

Question 27 continued

Marks

(d) Outline an appropriate treatment for the disease.

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(e) Describe how the disease can be controlled.

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Section II

Student Number

25 marks

Attempt ALL questions for this option (Genetics-The Code is Broken?)

Allow about 45 minutes for this part

Answer the questions in the spaces provided

Question 31 Genetics – The Code is Broken? (25 marks)

Marks

(a) One strand of a DNA molecule has the sequence of bases CGGCTTACG (read left to right).

1

Amino acid	Possible codons
Alanine (Ala)	GCU, GCG, GCC, GCA
Arginine (Arg)	CGU, CGG, CGC, CGA, AGG, AGA
Asparagine (Asn)	AAU, AAC
Aspartic acid (Asp)	GAC, GAU
Cysteine (Cys)	UGC, UGU
Glutamic acid (Glu)	GAA, GAG
Glutamine (Gln)	CAA, CAG
Glycine (Gly)	GGA, GGC, GGG, GGU
Histidine (His)	CAC, CAU
Isoleucine (Ile)	AUA, AUC, AUU
Leucine (Leu)	UUA, UUG, CUA, CUC, CUG, CUU
Lysine (Lys)	AAA, AAG
Methionine (Met)	AUG
Phenylalanine (Phe)	UUC, UUU
Proline (Pro)	CCA, CCC, CCG, CCU
Serine (Ser)	AGC, AGU, UCA, UCC, UCG, UCU
Threonine (Thr)	ACA, ACC, ACG, ACU
Tryptophan (Trp)	UGG
Tyrosine (Tyr)	UAC, UAU
Valine (Val)	GUA, GUC, GUG, GUU
Stop	UAA, UAG, UGA

Given the information, what is the sequence of amino acids in the polypeptide formed from this DNA strand?

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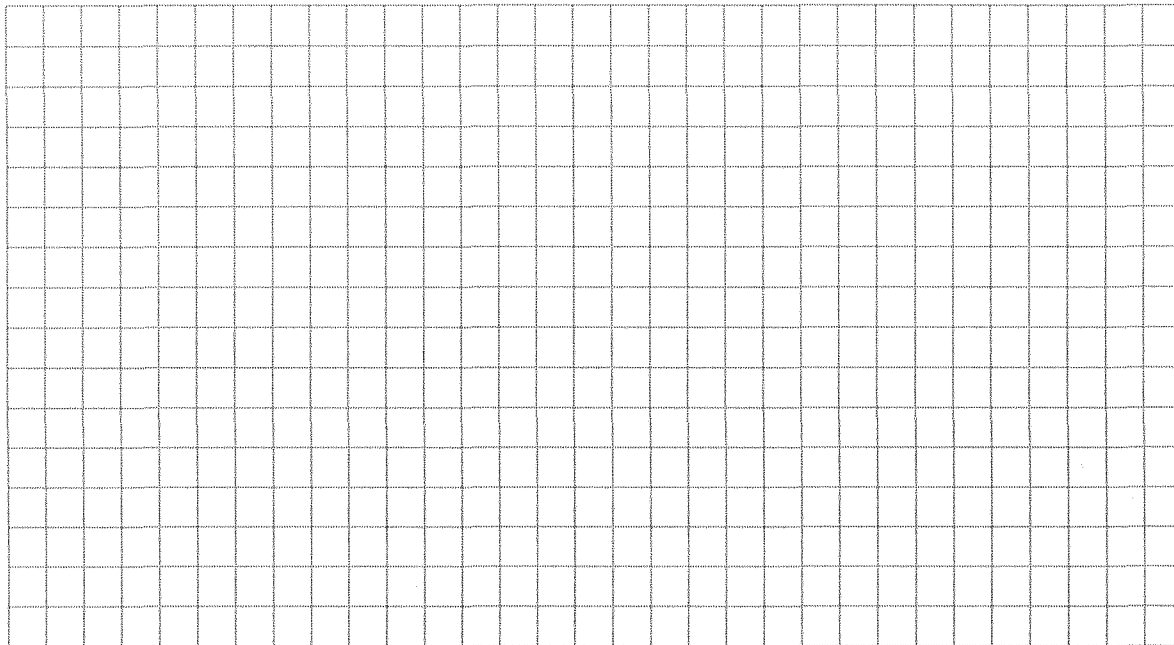
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Student Number

Marks

- (b) (i) On the grid provided, construct two graphs, one graph depicting polygenic inheritance, the other graph depicting inheritance determined by multiple alleles. Label the axes of each graph with the appropriate information for the trait you are using as an example for each type of inheritance. Label the polygenic graph 'P' and the multiple allele graph 'Q'.

2



- (ii) Explain the differences between your graphs.

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(c) Explain how DNA fingerprinting can be used for paternity testing and the pedigreeing of animals.

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Student Number

Marks

(d) (i) Name a genetic disease that is currently being treated using gene therapy.

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(ii) Describe how gene therapy is being used to treat the disease you stated in (i).

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(e) Chromosomal rearrangements are one type of mutation.

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(i) Give an example of a condition that results from chromosomal rearrangements and explain how this mutation occurred.

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(ii) Is the mutation you described in (i) inheritable? Give a reason for your answer.

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James Ruse Agricultural High School

2002 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

BIOLOGY MARKING GUIDELINES

SECTION I: PART A

Questions 1-15 (1 mark each)

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|-----|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| 1. | A <input type="radio"/> | B <input checked="" type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 2. | A <input type="radio"/> | B <input checked="" type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 3. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input checked="" type="radio"/> |
| 4. | A <input type="radio"/> | B <input checked="" type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
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| 13. | A <input type="radio"/> | B <input checked="" type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 14. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input checked="" type="radio"/> |
| 15. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input checked="" type="radio"/> |

SECTION I: PART B

Questions 16 - 28

16 (a)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Oxygen saturation: use an oximeter. This measures the amount of light absorbed by the haemoglobin that is not bound with oxygen. Oximeter attached to finger and does not require invasive techniques. Carbon dioxide: from blood gas analysis (invasive). 	2	4
	<ul style="list-style-type: none"> Only one of the above given 	1	

16 (b)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> If carbon dioxide levels get too high the patient's blood too acidic and this affects the functioning of the body. Or, low levels of oxygen may result in damage to the brain. <i>HCO₃⁻</i> 	1	5

17 (b)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Depends on the factor given by the student in 17 (a). E.g., if temperature given, then variables that would need to be controlled would be the amount of enzyme used in each test tube, and the amount of substrate provided in each test tube. If temperature given, then the control condition would be a test tube(s) with no enzyme but containing all other substances (substrate). <i>or replication</i> Description of how results were determined. 	3	5
	<ul style="list-style-type: none"> Only two of the above points given. 	2	
	<ul style="list-style-type: none"> Only one of the above points given. 	1	

17 (c)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Depends on the factor given by the student in 17 (a). E.g., if temperature given: <ul style="list-style-type: none"> The enzyme's activity would increase with the temperature. This continues right up to its optimal temperature. Beyond this temperature the enzyme's activity would decrease as it becomes denatured due to the high temperature affecting its structure. 	2	5
	<ul style="list-style-type: none"> The enzyme's activity would increase with the temperature. This continues right up to its optimal temperature. 	1	

18 (a)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Active transport: movement of substances against their concentration gradient via energy-requiring mechanisms. (Must have both points.) Passive transport: movement of substances down their concentration gradient. Does not require energy. (Must have both points.) 	2	5
	<ul style="list-style-type: none"> Only one of the above points given. 	1	

18 (b)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Correct labelling of the ascending loop of Henle for active transport plus stating either Na⁺ or Cl⁻ or NaCl as being actively transported. 	1	4

18 (c)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Phloem Translocation may occur via the pressure-flow hypothesis (accounting for the source-to-sink pattern). This means that the sugar of the leaves (the source) attracts water, the pressure of the water consequently causing it to flow to other tissues lacking in sugar (the sink). This flow of water from source to sink drags sugar molecules. 	3	6
	<ul style="list-style-type: none"> Only two of the above points given correctly. Only one of the above points given correctly. 	2	

19 (a)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Aldosterone is a hormone that acts on the distal tubule cells and causes them to increase their reabsorption of sodium. Hormone replacement therapy involves replacing, or substituting, the hormones that the adrenal glands are not making. Cortisol is replaced orally with hydrocortisone tablets, a synthetic glucocorticoid, taken once or twice a day. If aldosterone is also deficient, it is replaced with oral doses of a mineralocorticoid, called fludrocortisone acetate (Florinef), which is taken once a day. 	2	5
	<ul style="list-style-type: none"> Only one of the above points given. 	1	

19 (b)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Aldosterone is a hormone that acts on the distal tubule cells and causes them to increase their reabsorption of sodium. Sodium is needed for nerve impulses and correct osmotic potentials. 	1	5

20 (a)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> At high oxygen pressures, such as in the lungs, haemoglobin becomes fully saturated with oxygen. At low oxygen pressures, such as in the tissues, haemoglobin loses some of its oxygen, which the cells use in respiration. (This allows some of the CO₂ produced from respiration to be carried on the haemoglobin in the form of carbaminohaemoglobin.) 	2	6
	<ul style="list-style-type: none"> Only one of the above points given. 	1	

20 (b)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> At high altitudes the oxygen partial pressure is low thus causing less haemoglobin to be saturated with oxygen. This causes a lower oxygen pressure in the blood. The lower oxygen pressure in the blood is detected by chemoreceptors (carotid bodies and aortic bodies), which stimulate an increase in the rate and depth of breathing and cause an increase in heart rate. 	2	6
	<ul style="list-style-type: none"> Only one of the above points given. 	1	

21 (a)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> The theory of evolution contends that all living organisms arose in the course of history from earlier forms. Usually, many groups of organisms such as the vertebrates have a common ancestor. As the earth's environments altered over a long period of time, organisms gradually change, or evolved, into other types of organisms, such as the vertebrates. 	1	6

21 (b)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Palaeontological evidence refers to the fossil record and this provides support for the theory of evolution. For example, the modern horse, Equus, has had several ancestors, as found in the fossil record. These horse fossils show gradual changes over the course of some 65 million years. The earliest horse fossil for instance, Hyracotherium, had a three-toe foot structure whilst the younger horse fossil, Miohippus, had evolved to have mainly a single-toe foot with two side bones; the Equus has a single toe foot. These changes are thought to be the result of the horse evolving in an environment that was changing from marsh-like to one that was dry and of hard ground. 	1	4

Outcomes assessed:			
	Criteria	Marks	Band
	<ul style="list-style-type: none"> • Darwin/Wallace contend that evolution is due to the natural variation that occurs in a population being acted upon by the environment. Those organisms that had favourable characteristics for survival in a particular environment will survive and reproduce offspring that will inherit the favourable traits for survival and so on. As the environment changed so did the types of organisms that existed. They therefore contributed the <u>theory of Natural Selection</u> as a mechanism for how evolution may occur. 	1	3

22 (a) Outcomes assessed:			
	Criteria	Marks	Band
	<ul style="list-style-type: none"> • Biodiversity refers to the amount of genetic variation in the gene pool of a species. (Or, the number of different species in an ecosystem or number of different types of ecosystems.) • Having a <u>greater genetic variation</u> means there is more chance of a species surviving changing environmental conditions including disease-causing organisms. More genetic variation leads to <u>different phenotypes and thus more chance of surviving.</u> 	2	4
	<ul style="list-style-type: none"> • Only one of the above points given. 	1	

22 (b) Outcomes assessed:			
	Criteria	Marks	Band
	<ul style="list-style-type: none"> • <u>Koala</u> numbers are dropping and this may lead to inbreeding depression. • By measuring the genetic diversity of koalas, conservationists can develop breeding programs that will lead to <u>more vigorous koala populations.</u> This is achieved by mixing koalas that have enough genetic diversity. 	2	5
	<ul style="list-style-type: none"> • Only one of the above points given. 	1	

23 Outcomes assessed:			
	Criteria	Marks	Band
	<ul style="list-style-type: none"> • Humans and apes. • Fossil-based evidence of apes pointed to gorillas and chimpanzees being more closely related than humans; they evolved much later than humans, who split from the ape lines some 15 million years ago. • However, DNA and protein studies show that humans are more closely related to chimpanzees and gorillas than that proposed by the fossil evidence. This shows that humans split from the ape lines some 5 million years ago. • Amino acid sequences of universal proteins such as <u>cytochrome C</u> and haemoglobin are analysed and compared between different groups of organisms. The number of different amino acids between organisms is related to the time since separation of the groups during their evolutionary history. 	4	5
	<ul style="list-style-type: none"> • Only three of the above points given. 	3	
	<ul style="list-style-type: none"> • Only two of the above points given. 	2	
	<ul style="list-style-type: none"> • Only one of the above points given. 	1	

① technique: "DNA sequencing" "amino acid sequencing"

① organisms involved: humans and apes.

① relationship: "more similar the sequences..."
"more closely related."

① difference: "changed... than previously thought"

24	Outcomes assessed:		
	Criteria	Marks	Band
d p p p	<ul style="list-style-type: none"> A transgenic species is one that has integrated into its own DNA a foreign gene or genes (1). Advantages (3): Transgenic animals have been used for simulating diseases and testing new therapies. E.g., cardiovascular and neurodegenerative diseases. Animal models provide an opportunity to test methods for the prevention or delay of disease in humans. Genetic research; to produce drugs (pharming); organ donation (neutralise antigenic proteins on animal organs so they can be suitable human transplants). In agriculture, transgenesis may: increase the yield of crops; increase the quality of crops; for pest and disease resistance; to produce drugs (pharming). Transgenesis may reduce or even replace the large-scale use of pesticides and long-lasting herbicides used in agriculture. When fully developed, it may offer a number of advantages over traditional methods of breeding. Compared with traditional methods, transgenic breeding is: <ul style="list-style-type: none"> More specific: scientists can choose with greater accuracy the trait they want to establish. The number of additional unwanted traits can be kept to a minimum. Faster: establishing the trait takes only one generation compared with the many generations often needed for traditional selective breeding, where much is left to chance. More flexible: traits that would otherwise be unavailable in some animals or plants may be achievable using transgenic methods. Less costly: much of the cost and labour involved in administering feed supplements and chemical treatments to animals and crops could be avoided. 	8	6
n n n e or e	<ul style="list-style-type: none"> Disadvantages (3): Difficult to estimate the effect of transgenesis on a species; it may be advantageous and it may not. New diseases may be created as a result of modifying viral and bacterial genes. May lead to loss of biodiversity since the same type of organism is being used, with only one gene modified. Ethical issues (1): Companies that have the patent for the transgenesis of a species may have a monopoly on the market; who decides what genes can be incorporated?; who decides what should be transgenic? 		
	• Only one – seven of the above points given.	1-7	

8 = dpp nnn ee
8 = dppp nn ee
8 = dppr nnn e

25 (a)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Immune system required when a pathogen or modified pathogen (as in a vaccine) has entered the bloodstream of the body. <i>or specifying required.</i> 	1	4

25 (b) (i)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> T lymphocytes: There are three types of T cells (any one of these is adequate): <ul style="list-style-type: none"> (i) The <u>cytotoxic (killer)</u> T lymphocytes recognise infected cells or cells with antigens on their membrane and then may combine with the cell thus immobilising it and at the same time producing a chemical called lymphokine which attracts macrophages for phagocytosis. Alternatively, killer T cells may produce cytotoxins that are chemicals that directly destroy the cell. (ii) <u>Helper</u> T lymphocytes activate other types of T cells as well as B lymphocytes in responding to antigens. (iii) <u>Suppressor</u> T lymphocytes inhibit the immune response by suppressing B cell and T cells. They only live a short time. B lymphocytes: When a B cell comes into contact with the specific antigen to which it is targeted, it divides rapidly to form a clone of identical cells. Most of these B cells differentiate into plasma cells. Plasma cells continue to divide and to produce antibodies. 	2	4
	• Only one of the above points given.	1	

*Mit
state type
of T cell*

25 (b) (ii)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Once activated by foreign antigen on the surface of a specialised antigen-presenting cell, an appropriate helper T cell can help activate a B cell by binding to the same foreign antigen on the B cell surface. (The helper T cell recognises the same antigen-MHC complexes on the B cell it helps as on the antigen-presenting cell that initially activated the T cell.) The specific contact between a helper T cell and a B cell initiates an internal rearrangement of the helper cell cytoplasm toward the target B cell. This enables the helper T cell to direct the secretion of interleukins onto the B cell surface. These interleukins include IL-4, which helps initiate B cell activation, <u>IL-5</u>, which stimulates activated B cells to proliferate, and IL-6, which induces activated B cells to mature into antibody-secreting cells. 	2	6
	• Only one of the above points given.	1	

*interleukin ① only
interleukin + MHC = ②
MHC only ①
general correct ①*

25 (c)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> It has been shown that the T cells are directed against certain cell-surface glycoproteins (a carbohydrate and protein complex) known as the major histocompatibility complex, or MHC. These antigens are coded for by at least 20 different genes, and each of these genes has as many as 8 to 100 alleles; so the total number of different combinations is enormous. Hence, it is predicted that no two persons will ever be found to have the same MNC; it is a fingerprint. Therefore, these antigens exist on the tissues associated with an organ being transplanted. The cells that infiltrate the graft are mainly lymphocytes and macrophages, and it is the T cells that are responsible for the graft rejection. Transplant patients are given drugs to suppress the immune response, however, this has the problem of causing infections in patients. 	2	4
	<ul style="list-style-type: none"> Only one of the above points given. 	1	

26	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Australia is BSE-free due to strict quarantine measures. Quarantine measures such as prevention of importation of cattle from BSE infected countries have thus been effective. The potential importation of exotic diseases and species via illegal boats, for example, could have potentially devastating quarantine consequences for Australia's \$13.5 billion agricultural industry. Australia has a large and isolated coastline and this is difficult to monitor. Thus quarantine is not effective against illegal migration. Australian Quarantine's early warning system has again demonstrated its effectiveness by delivering a timely warning of the presence of Japanese encephalitis (JE). Blood samples, which are collected from the pigs each week during the wet season and airfreighted to CSIRO's Australian Animal Health Laboratory in Geelong and the Queensland Health laboratory for testing, last week tested positive for the JE virus. As there is no way to stop JE coming into Australia annually, early warning remains our best protection against this disease. Early detection of JE this wet season again underscores the importance of Quarantine's monitoring and surveillance program in northern Australia, which plays a vital role in our defence against exotic pests and disease. 	4	
	<ul style="list-style-type: none"> Only three of the above points given. 	3	
	<ul style="list-style-type: none"> Only two of the above points given. 	2	
	<ul style="list-style-type: none"> Only one of the above points given. 	1	

K ①
 aw
 eg - healthy ①
 eg - healthy ①
 why ①
 n ①
 quarantine

27 (a)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Malaria is caused by a protozoan, <i>Plasmodium vivax</i>. 	1	

27 (b)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Transmission: via the female <i>Anopheles</i> mosquito, which has bitten an infected human. 	1	

27 (c)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Host response: some antibodies are made in response to the <i>Plasmodium</i>. Shivering and periodic bouts of high temperature (fever) associated with malaria are designed to fight the <i>Plasmodium</i> forms. 	1	

27 (d)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Treatment: chloroquine given orally 	1	

27 (e)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Disease control: prevention of mosquitoes. 	1	

28	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> According to the WHO, and other... 	4	
	<ul style="list-style-type: none"> Only three of the above points given. 	3	
	<ul style="list-style-type: none"> Only two of the above points given. 	2	
	<ul style="list-style-type: none"> Only one of the above points given. 	1	

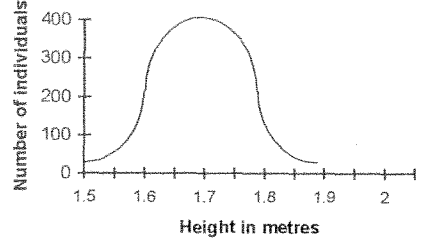
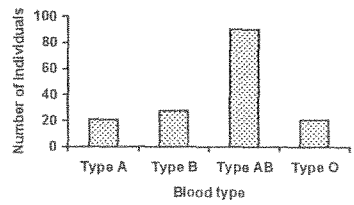
polio vaccine
 polio vaccine
 people
 now
 strains
 may
 occur

evidence (occurrence)
 ↓
 before vacc.
 ↓
 after vacc.
 ① effect
 ↓
 program requires efficient administration e.g. large organization
 to be effective e.g. multiple and depends on type of vaccine for the
 non-people given vaccine that are and hence spread.

spread → countries that do not have vaccine have sufferers
 ↓
 countries that have vaccine low % mortality
 ↓
 people object to adverse effect of vaccine
 ↓
 "boosters" every 10 years
 ↓
 may have to have disease completely eliminated.
 ↓
 and
 ↓
 (effective) organization

SECTION II: Question 31 Genetics – The Code is Broken? (25 marks)

31 (a)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> alanine-glutamic acid-cysteine 	1	

31 (b)	Outcomes assessed:		
(i)	Criteria	Marks	Band
	<p>• Polygenic inheritance shows continuous variation:</p> <p>Height measurements of a sample of NSW males</p>  <p>• Multiple alleles inheritance shows discontinuous variation:</p> <p>Number of blood types in a sample of NSW school students</p> 	2	
	<ul style="list-style-type: none"> Only one of the above graphs given. 	1	

31 (b)	Outcomes assessed:		
(ii)	Criteria	Marks	Band
	<ul style="list-style-type: none"> Polygenic inheritance is due to the effects of more than one gene. A trait affected by numerous genes does not have clear-cut differences between groups of individuals because of the differences in gene expression between individual genes within an individual and between individuals. Multiple alleles: more than two alleles have been identified for the same gene locus (that is location on a chromosome). Thus there are a limited number of clearly distinguishable phenotypes since only a small number of allele combinations can arise. 	2	
	<ul style="list-style-type: none"> Only one of the above points given. 	1	

31 (c)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> DNA fingerprinting involves the sequencing of short highly repeatable DNA sequences called minisatellites or Variable Number Tandem Repeats (VNTRs). DNA fingerprinting can be used to determine the pedigree of breeding dogs. By analysing the DNA fingerprints of one dog with another dog, the degree of closeness between DNA fingerprints will be a measure of closeness between the breeding pair. DNA fingerprinting can be used to establish the identity of the father of a child by comparing the minisatellites of the Y chromosome or other chromosomes of the child's with the suspected father's. The more similar the patterns the more chance the suspect is the father of the child. 	2	
	<ul style="list-style-type: none"> Only one of the above points given. 	1	

31 (d)	Outcomes assessed:		
(ii)	Criteria	Marks	Band
	<ul style="list-style-type: none"> Cystic fibrosis is a result of a defective cell membrane protein in the some lung tissues. This is a result of a mutated or a missing gene for the membrane protein. To treat this condition via gene therapy, the normal gene for the membrane protein is inserted into a viral vector. This viral vector is inserted into the lung tissue via a tube inserted in the patients nose, leading directly into the lungs. 	2	
	<ul style="list-style-type: none"> Only one of the above points given. 	1	

Trisomy 21 Down's Syndrome

31 (e) (i)	Outcomes assessed: <i>Chr - 21 - 21</i>		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> E.g., Down's syndrome. A non-disjunction occurs at pair ²¹ during meiosis in one parent. The gamete that contains the two chromosomes, instead of the usual single chromosome, may then be fertilised to form a zygote that has a trisomy at pair ²¹. 	3	
	<ul style="list-style-type: none"> Only two of the above points given. 	2	
	<ul style="list-style-type: none"> Only one of the above points given. 	1	

33 (e) (ii)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Chromosomal rearrangements and base substitutions may be inheritable if they occur in the germ line cells that are contained in the sex organs. These cells undergo meiosis to form into gametes. If the same non-disjunction described above occurs during meiosis of the person who has Down's syndrome, then the child may also have Down's syndrome. 	1	

33 (f)	Outcomes assessed:		
	Criteria	Marks	Band
	<ul style="list-style-type: none"> Embryonic development in many organisms depends on several types of genes, or genes that have similar roles: maternal effect genes, segmentation genes and pattern formation genes. Maternal effect genes cause the egg to have concentration gradients of proteins that may act as gene regulatory proteins (transcription factors). The amount of these proteins received by embryonic cells influences what genes are switched on or off. Gene expression in, and the developmental fate of, cells in the early embryo are influenced by these local differences in the distribution of cytoplasmic determinants. Pattern formation genes mainly depend on the expression of the homeotic genes that contain the homeobox sequence of DNA (found in many types of organisms). The proteins expressed by these genes are transcription factors that turn on or off other genes in the embryo cells. For example, mutations occurring in the homeobox genes are responsible for many limb defects in vertebrates. Gene cascades also play a role in the development of the embryo. If one of the transcription factor proteins switches on another gene that also is a transcription factor, the latter may switch on another gene(s), which may also be responsible for transcription. In this fashion a cascade of gene expression is built up (a type of amplification), producing proteins along the way that may influence what the embryonic cells differentiate into. The spatial location of the limb formation cells also influences the orientation of the cells and thus determines features such as left and right, front and back. Pattern formation is controlled by positional information, which is a set of molecular cues that indicate a cell's location relative to other cells in an embryonic structure and that help to determine how the cell and its descendants respond to future molecular signals. Gradients in the concentration of these signaling factors along the three orientation axis provide cells with positional information 	5	
	<ul style="list-style-type: none"> Only five of the above points given. 	5	
	<ul style="list-style-type: none"> Only four of the above points given. 	4	
	<ul style="list-style-type: none"> Only three of the above points given. 	3	
	<ul style="list-style-type: none"> Only two of the above points given. 	2	
	<ul style="list-style-type: none"> Only one of the above points given. 	1	

33 (g)	Outcomes assessed:	Marks	Band
	<p>Criteria</p> <ul style="list-style-type: none"> • Eucaryotic DNA segment including enhancer and promoter regions and genes coding for polypeptides/proteins. • Transcription factors (or regulatory proteins) binding to enhancer and promoter regions. RNA polymerase transcribes the operon when transcription factors bind to enhancer and promoter regions. Either mRNA or polypeptides/proteins produced from the genes being read by RNA polymerase. Absence of transcription factors (or regulatory proteins) results in no transcription. • Eucaryotic regulation of mRNA (mRNA splicing): introns are excised before the mRNA leaves the nucleus. • The exons are then spliced. Regulatory proteins control the splicing and cause different splicing events to occur thus leading to different polypeptides made. (Or, DNA unpacking: genes switched off due to the tightness of the packing of DNA wrapped around histones. Or, ends of transcribed RNA are capped. Removal of these protective caps allows mRNA to be degraded and hence shorten the life of the mRNA.) • Procaryotic: DNA segment includes promoter, operator and operon (genes coding for proteins/polypeptides). • Repressor bound to operator hence switching 'off' the operon. • Repressor bound to an inducer thus preventing it from binding to the operon. 	7	
	<ul style="list-style-type: none"> • Only six of the above points given. 	6	
	<ul style="list-style-type: none"> • Only five of the above points given. 	5	
	<ul style="list-style-type: none"> • Only four of the above points given. 	4	
	<ul style="list-style-type: none"> • Only three of the above points given. 	3	
	<ul style="list-style-type: none"> • Only two of the above points given. 	2	
	<ul style="list-style-type: none"> • Only one of the above points given. 	1	