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BIOLOGY MOCK EXAM

NESA Number

2020 HIGHER SCHOOL CERTIFICATE EXAMINATION

Biology

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black or blue pen
- Draw diagrams using pencil
- Calculators approved by NESA may be used
- Write your NESA number where required

Total marks: 100

Section I – 20 marks (pages 2-11)

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

Section II – 80 marks (pages 12-23)

- Attempt Questions 21-30
- Allow about 2 hours and 25 minutes for this section

Section I

20 marks
Attempt Questions 1-20
Allow about 35 minutes for this section

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

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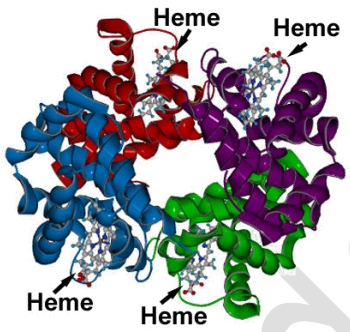
1 The following diagram below represents a molecule of the protein haemoglobin.



Which level of protein structure is presented by this model?

A. Primary

B. Secondary

C. Tertiary

D. Quaternary

2 A genetic disorder is controlled by a gene on the Y chromosome. What is the probability a man with the condition will have an affected daughter?

A. 0%

B. 25%

C. 25%

D. 100%

3 Which of the following is an example of the body's specific immune response?

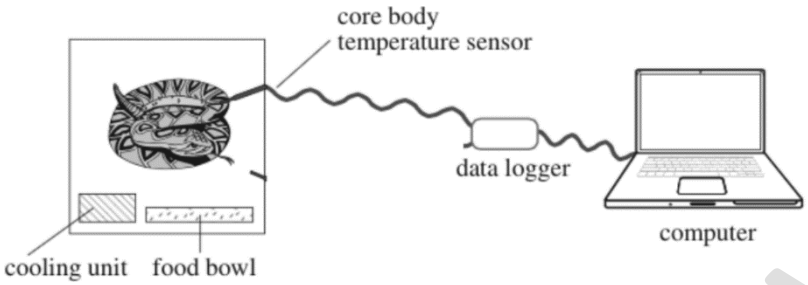
A. The first line of defence (e.g. the skin)

B. Inflammation

C. Phagocytosis

D. Antibody production

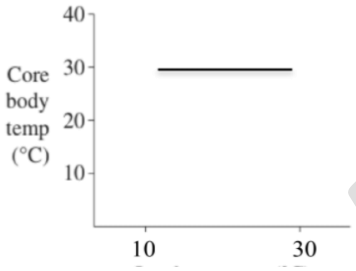
4 An experiment was set up to measure the changes in the core body temperature of a snake in response to changes in the temperature of the surrounding.



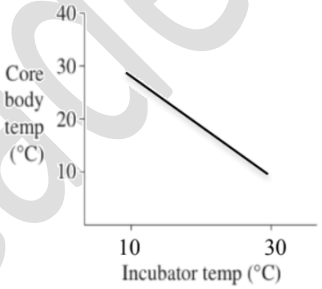
The cooling unit in the incubator housing the snake was used to reduce the temperature of the surrounding from 30°C to 10°C.

Which graph best predicts the change in core body temperature of the snake?

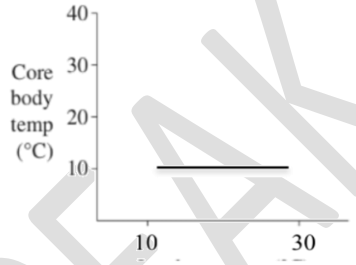
A.



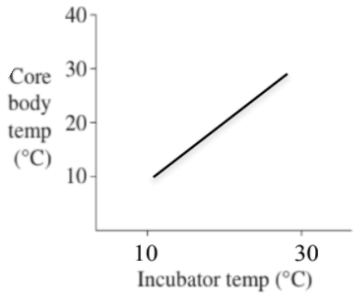
B.



C.



D.



5 What was Pasteur's contribution to our understanding of infectious disease?

A. He produced a set of postulates to identify the organism which causes a particular disease

B. He disproved the theory of spontaneous generation by showing that microbes could only come from pre-existing microbes

C. He invented the light microscope and improved milk packaging techniques

D. His experiment showed that disease causing microbes could spontaneously arise from rotten and decaying matter

6 Which of the following body systems is involved in detecting and responding to environmental changes?

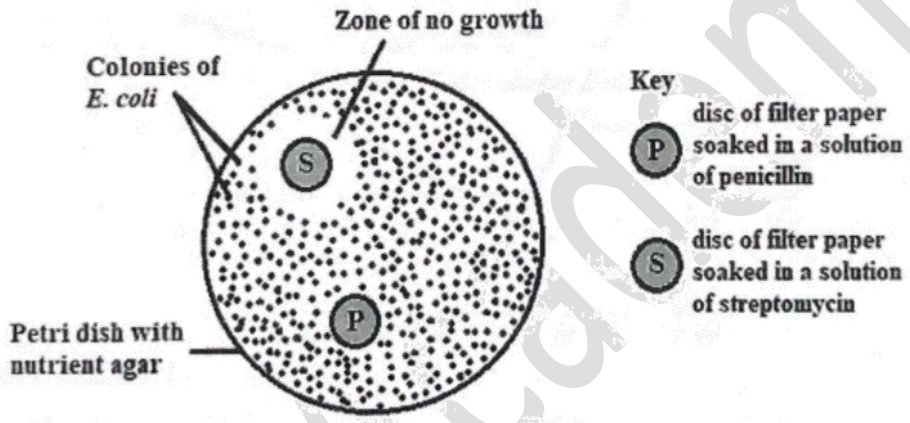
A. Nervous

B. Circulatory

C. Lymphatic

D. Excretory

7 The following diagram shows the effects of the antibiotics, streptomycin and penicillin on the bacterium *Escherichia coli (E. coli)*.



What can be inferred about the response of *E. coli* to the antibiotics?

A. *E. coli* is resistant to streptomycin only

B. *E. coli* is resistant to penicillin only

C. *E. coli* shows no resistance to either antibiotics

D. *E. coli* is resistant to both penicillin and streptomycin

8 At the end of a marathon race a runner's body is dehydrated. How does the body control the two hormones, ADH and aldosterone, to help to re-establish normal water balance?

A. ADH is released and aldosterone is released

B. ADH is inhibited and aldosterone is inhibited

C. Both ADH and aldosterone are inhibited

D. Both ADH and aldosterone and released

9 A New Zealand research team inserted a single gene into an onion to reduce the activity of the enzyme that makes your eyes water, resulting in an onion that you can cut without crying. Which term best describes this team's process?

A. Cloning

B. Artificial pollination

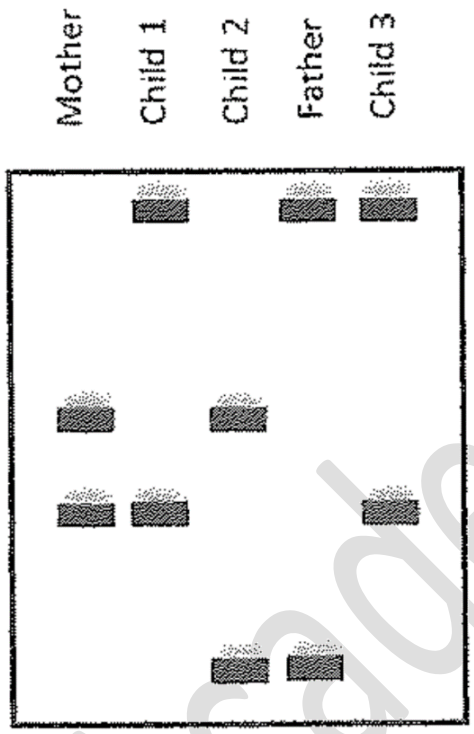
C. Genetic engineering

D. Artificial insemination

10 Reproduction ensures the continuity of species. Select the row that correctly represents the method and type of reproduction for the organism identified.

	Organism	***Method of Reproduction***	***Type of Reproduction***
A.	Yeast	Budding	Asexual
B.	Birds	External fertilisation	Asexual
C.	Bacteria	Binary fission	Sexual
D.	Ferns	Internal fertilisation	Sexual

11 Results from a DNA fingerprint analysis for a man and woman and their three children are shown in the diagram below.



Which child, if any, is NOT the biological offspring of the father?

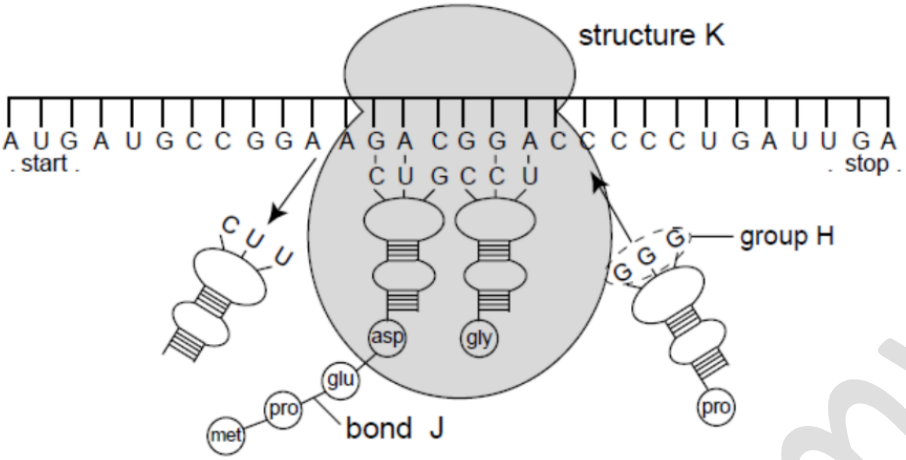
A. Child 1

B. Child 2

C. Child 3

D. All the children could be the biological offspring of the father.

12 The diagram below is of a biological process involved in protein synthesis.



What is the correct identification of the process, structure K and group H?

	Process	***Structure K***	***Group H***
A.	Transcription	Chromosome	Anticodon
B.	Translation	Ribosome	Anticodon
C.	Transcription	Chromosome	Codon
D.	Translation	Ribosome	Codon

13 Which of the following is a plant defence against pathogens?

A. Pathogen-specific antibodies are produced

B. Large spines prevent bacteria and fungi from gaining entry

C. The production of antimicrobial proteins and enzymes

D. Yellowing of leaves and stem and increased sap flow

14 Below is a picture seen through healthy eyes and the same picture seen through eyes affected by cataracts.

Normal Vision Vision with Cataracts

In which part of the eye do cataracts form?

A. The cornea

B. The iris

C. The lens

D. The retina

15 After an organ transplant operation, why must patients take drugs that suppress the immune system?

A. To strengthen the immune system and prevent infection of the transplanted organ

B. To prevent the body from attacking the transplanted organ as if it were a pathogen

C. To prevent the transplanted organ from rejecting its new body

D. To strengthen the transplanted organ and hasten the healing process

16 Coat colours of Andalusian fowls are an example of a trait determined by codominant alleles. Black, blue (a mixture of black and white) and white are the three phenotypes in Andalusian fowls.

When blue fowls are crossed with white fowls, what percentage of the F1 will be blue?

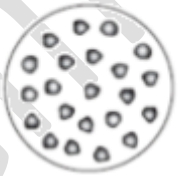
A. 0%

B. 25%

C. 50%

D. 75%

17 Students performed an investigation to compare the effectiveness of two water treatments for purifying pond water.
Three samples of pond water, A, B and C, were collected and each used to inoculate an agar plate. The plates were incubated at 25°C and examined three days later. The number of visible bacterial colonies on each plate was counted and the results tabulated.

Sample	***A***	***B***	***C***
Treatment	5 grams of pool chlorine per litre of water	Boiling for one minute	No treatment
Number of visible bacterial colonies	0 	6 	22 

What is the dependent variable in this investigation?

A. Treating the water by boiling or adding pool chlorine

B. The use of a control sample

C. The number of visible bacterial colonies

D. The use of sterile agar plates for each sample

18 Which observation can be used to demonstrate Koch's contribution to understanding the cause of disease?

A. The bacteria, *Helicobacter pylori*, are present in the stomach of all people diagnosed with stomach ulcers

B. Some mosquitoes carry a pathogen that is often fatal to people

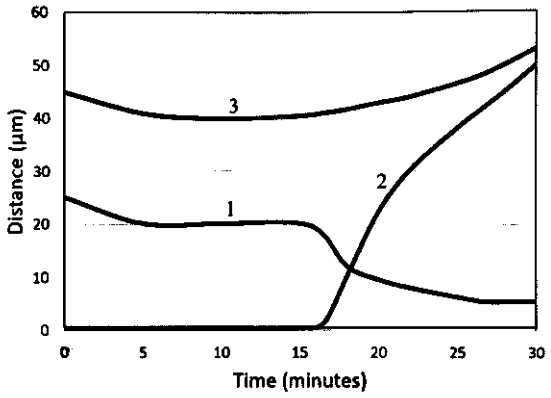
C. A lack of vitamin C is found in all people suffering the nutritional disease scurvy

D. Polio vaccinations trigger an immune response

19 Which of the following correctly indicates a function of each hormone in the menstrual cycle?

	LH	***FSH***	***Progesterone***	***Oestrogen***
A.	Stops FSH being produced	Maintains the lining of the uterus during the middle of the menstrual cycle	Causes the mature egg to be released from the ovary	Prepares the uterus to receive a fertillised ovum
B.	Maintains the lining of the uterus during the middle of the menstrual cycle	Stimulates the pituitary gland to release LH	Causes an egg to mature in the ovary	Causes the mature egg to be released from the ovary
C.	Causes the mature egg to be released from the ovary	Causes an egg to mature in the ovary	Prepares the uterus to receive a fertillised ovum	Stimulates the pituitary gland to release LH
D.	Stimulates the ovaries to release oestrogen	Prepares the uterus to receive a fertillised ovum	Stops FSH being produced	Maintains the lining of the uterus during the middle of the menstrual cycle

20 The graph below shows three measurements obtained during mitosis in a cell. On the time scale, "0" marks the beginning of the time when chromosomes line up at the equator.



What measurements do the curves represent?

	Distance between centromeres and centrioles	***Distance between centromeres of sister chromatids***	***Distance between centrioles***
A.	1	2	3
B.	1	3	2
C.	3	1	2
D.	3	2	1

Section II

80 marks
Attempt Questions 21-30
Allow about 2 hours and 25 minutes for this section

Question 21 (5 marks)

The photograph below shows a genetically modified AquAdvantage Salmon (top) compared to an Atlantic salmon of the same age.

The AquAdvantage Salmon is basically an Atlantic Salmon which has had a growth hormone from the Chinook Salmon and a gene promoter from the Ocean pout inserted into its genome. As a result of this, it grows to market size in 16 - 19 months, instead of 30 months needed by farmed Atlantic Salmon.

(a) The AquAdvantage Salmon is an example of a transgenic species. Outline what this means. **1**

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(b) Discuss the potential impacts of this reproductive technology as applied to the AquAdvantage Salmon on society and the environment. **4**

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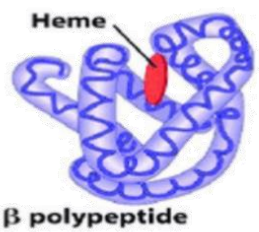
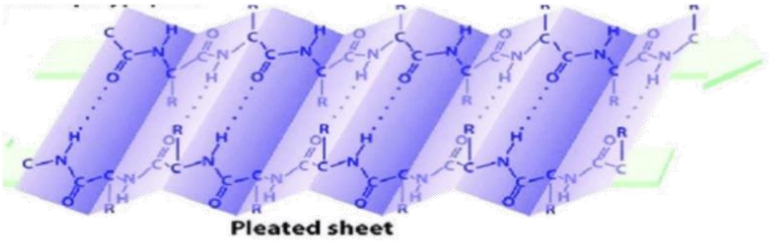
Question 22 (10 marks)

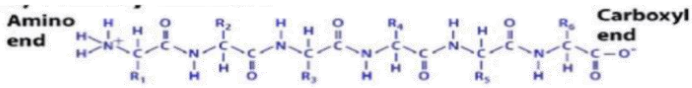
The diagrams above show the four levels of protein structure.



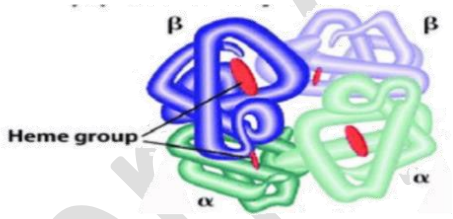
A



B



C



D

(a) Complete the table below of correct protein structure at the level represented. **2**

Protein Diagram	***Protein Structure at the Level Represented***
A	
B	
C	
D	

(b) Explain how the structure of a named protein is related to its function. **4**

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(c) The coding strand of some DNA is shown. It is part of a sequence that codes for a polypeptide.

A T C A G T C G T A C G A T C G C A T A

Contrast the effect of a frameshift mutation with the effect of a base substitution mutation on the polypeptide produced from this sequence. **4**

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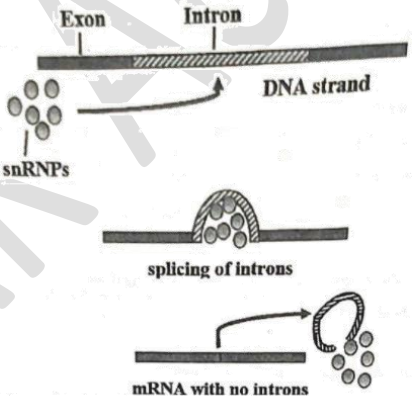
Question 23 (6 marks)

The diagram below shows the process of how an intron is removed from a section of DNA to form a strand of mature mRNA.



(a) Outline the transcription phase of polypeptide synthesis. **3**

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(b) Assess the significance of mutations to introns on evolutionary fitness. **3**

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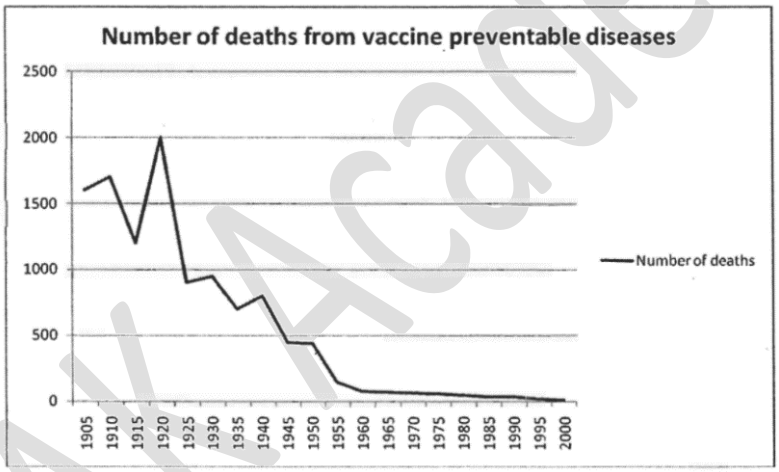
Question 24 (9 marks)

Refer to the graph and information below.



Diphtheria vaccine introduced to schools in 1920; Measles vaccine introduced 1932; Tetanus vaccine introduced 1939; Pertussis (whooping cough) vaccine introduced 1942; Polio vaccine introduced 1955 and used widely

(a) Outline the trend in the graph. **3**

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(b) Describe how vaccinations are used to control the spread of disease and evaluate their effectiveness. **6**

Question 25 (7 marks)

(a) Draw a labelled diagram to explain how crossing over occurs in meiosis. **3**

(b) Identify where crossing over occurs in mitosis. **1**

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(c) Assess the importance of crossing over in contributing to genetic variation. **3**

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Question 26 (10 marks)

A non-infectious disease was observed in a mother and her four sons who live with her. She has no daughters. The father of these children does not have the disease and does not live with them. The woman's parents and her two sisters who live overseas do not have the disease.

A geneticist suspects that the disease is inherited.

(a) Draw the family pedigree for this disease. **3**

(b) Identify two points of evidence which indicates that the disease could be the result of a recessive allele and not be sex-linked. **2**

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(c) Complete the following table for one non-infectious disease. **5**

Name of disease	
Type of non-infectious disease	
Cause/Transmission	
Symptoms	
Treatment/prevention/control	

Question 27 (4 marks)

Spinifex is a grass common across central Australia where soils are nutrient-deficient. It frequently grows as a circular clump of stems and the diameter of the clump increases slowly each year. Initially the leaves are flat, and the roots are shallow. As the plant matures, the leaves curl inwards to form long thin tubes with the stomata on the inside, while the roots grow deep into the soil to obtain nutrients and water. Silicon granules make the stems tough.

Explain how TWO of the adaptations outlined above allow Spinifex to survive in hot, dry conditions. **4**

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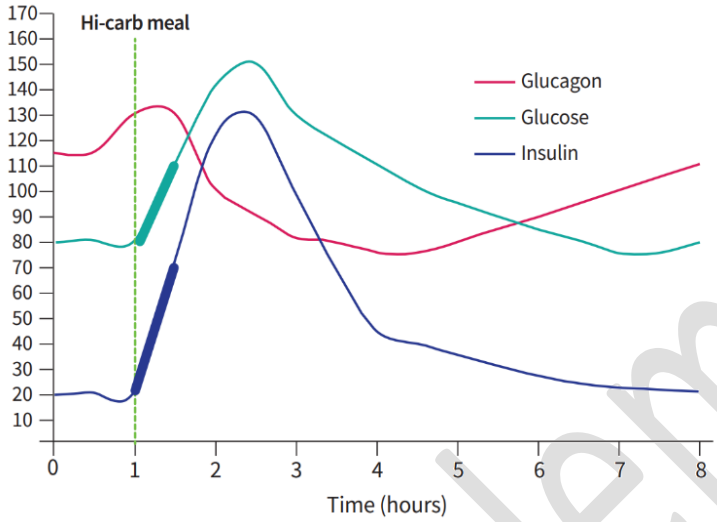
Question 28 (16 marks)

The graph below provides information about the homeostasis of blood glucose levels after a high carbohydrate meal.



(a) Explain what happens to glucose, insulin, and glucagon levels after a high carbohydrate meal. **6**

(b) Type 2 diabetes is a progressive condition in which the body becomes resistant to the normal effects of insulin and/or gradually loses the capacity to produce enough insulin in the pancreas. Tubules in the kidney contain sodium-glucose co-transporters 2 (SGLT2) which reabsorb glucose into the blood. **4**

Explain the role of SGLT2 inhibitors in the treatment of Type 2 diabetes.

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(c) Diabetic nephropathy is a common complication of Type 1 and Type 2 diabetes. Over time, poorly controlled diabetes can cause damage to blood vessel clusters in your kidneys that filter waste from your blood. This can lead to prolonged kidney damage which may lead to chronic kidney disease.

Assess the impact of one method of management or treatment of kidney disease. **6**

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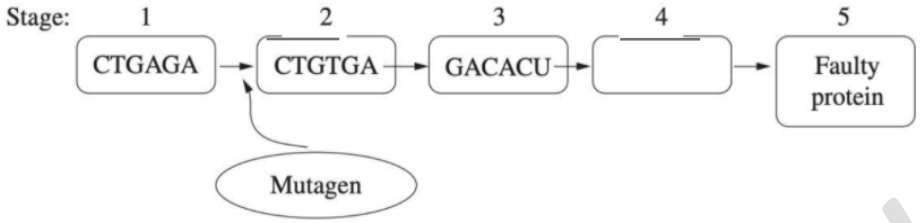
Question 29 (5 marks)

The flowchart illustrates the effect of a point mutation on an organism.



(a) Identify the process that occurs at stage 4. **1**

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(b) Using the above data, draw a flowchart showing how the mutation has resulted in a faulty protein. **4**

Question 30 (8 marks)

(a) Outline the normal third-line defence to a pathogen the body has previously not encountered. **4**

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(b) Our immune system functions to protect our bodies from pathogens. In certain cases, however, serious disorders can arise from over-activity of the immune system. **4**

Discuss this statement using specific examples.

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End of paper

Biology

Answer Sheet – Multiple Choice

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 correct answer and fill in the new answer.

A ● B ✕ C ○ D ○

If you change your mind and have cross out what you consider to be the correct answer, then indicate the correct answer by writing the word "correct" and drawing an arrow as follows.

Start Here →

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