

BIOLOGY

Units 3 & 4

Trial Examination

SOLUTIONS BOOK

Use this page as an overlay for marking the multiple choice answer sheets. Simply photocopy the page onto an overhead projector sheet. The correct answers are open boxes below. Students should have shaded their answers. Therefore, any open box with shading inside it is correct and scores 1 mark.

	ONE ANSWER PER LINE		ONE ANSWER PER LINE		ONE ANSWER PER LINE
1	██████ <input type="checkbox"/> ████	15	██████████ <input type="checkbox"/>	28	██████████ <input type="checkbox"/>
2	██████████ <input type="checkbox"/>	16	<input type="checkbox"/> ██████████	29	██████ <input type="checkbox"/> ████
3	███ <input type="checkbox"/> ██████████	17	<input type="checkbox"/> ██████████	30	██████████ <input type="checkbox"/>
4	██████ <input type="checkbox"/> ████	18	███ <input type="checkbox"/> ██████████	31	███ <input type="checkbox"/> ██████████
5	<input type="checkbox"/> ██████████	19	██████ <input type="checkbox"/> ████	32	██████ <input type="checkbox"/> ████
6	███ <input type="checkbox"/> ██████████	20	███ <input type="checkbox"/> ██████████	33	<input type="checkbox"/> ██████████
7	██████ <input type="checkbox"/> ████	21	<input type="checkbox"/> ██████████	34	██████ <input type="checkbox"/> ████
8	██████████ <input type="checkbox"/>	22	██████ <input type="checkbox"/> ████	35	<input type="checkbox"/> ████ <input type="checkbox"/> ████
9	██████ <input type="checkbox"/> ████	23	███ <input type="checkbox"/> ██████████	36	███ <input type="checkbox"/> ██████████
10	██████████ <input type="checkbox"/>	24	██████████ <input type="checkbox"/>	37	<input type="checkbox"/> ██████████
11	██████ <input type="checkbox"/> ████	25	██████ <input type="checkbox"/> ████	38	██████ <input type="checkbox"/> ████
12	███ <input type="checkbox"/> ██████████	26	██████████ <input type="checkbox"/>	39	██████ <input type="checkbox"/> ████
13	███ <input type="checkbox"/> ██████████	27	██████ <input type="checkbox"/> ████	40	██████████ <input type="checkbox"/>
14	██████████ <input type="checkbox"/>				

TEACHERS, PLEASE NOTE:

In marking the Exam, teachers should keep in mind that the language used in the suggested answers is sometimes more sophisticated than a student would offer, since these answers are written for teachers' information in their correction of the Exam.

*The answers suggested here might not be the only correct responses possible. Teachers must use their professional judgement in awarding marks for other answers offered. However, in accordance with the VCAA practice, students who give a correct response, and then offer a contradictory incorrect response within the same part of the question, should **not** be awarded any marks for the correct part of the response. Also in accordance with the VCAA practice, no half marks should be given.*

SECTION A – MULTIPLE CHOICE QUESTIONS (1 mark each: 40 marks)

1	C	15	D	29	B
2	D	16	A	30	D
3	B	17	A	31	B
4	C	18	B	32	C
5	A	19	C	33	A
6	B	20	B	34	C
7	C	21	A	35	A
8	D	22	C	36	B
9	C	23	B	37	A
10	D	24	D	38	C
11	C	25	C	39	C
12	B	26	D	40	D
13	B	27	C		
14	D	28	D		

SECTION B - WRITTEN RESPONSES (80 marks)**Question 1**

- a Multiple test tubes containing the same concentrations of starch and amylase would be set up (1). A range of pH buffer solutions (1). The test tubes would be incubated at the same temperature – ideally the optimum temperature for the amylase enzyme (1). A short amount of solution would be taken from each test tube at regular intervals (such as 20 seconds) and tested for the presence of starch or rate of maltose production (1). 4 marks
- b (Any 2 of the following for 1 mark each)
- At low or high pH the enzyme could be denatured (1).
 - The tertiary structure of the enzyme and the shape of the active site has changed so that the substrate no longer fits (1).
 - High concentration of H^+ ions or OH^- ions interfere with the reaction by disrupting bonds (1). 2 marks
- c Repeat the experiment with pH values close to pH 7 such as 6.5 and 7.5. 1 mark
- d A non-competitive inhibitor prevents the enzyme from working by attaching to a site other than the active site whereas a competitive inhibitor binds to the active site and prevents the substrate from attaching. 1 mark
- e inhibitor 1 is the competitive inhibitor & inhibitor 2 is the non-competitive inhibitor (1). Reasoning: As the concentration of substrate increases the substrate molecules outnumber the competitive inhibitor and so the reaction rate can reach a maximum. The action of the non-competitive inhibitor is not affected by an increase in substrate concentration therefore does not reach a maximum rate (1). 2 marks

Total Question 1: 10 marks

Question 2

- a glycolysis 1 mark
- b carbon dioxide 1 mark
- c The experiment was performed in a sealed container as it was investigating anaerobic respiration so it was important that oxygen was prevented from entering the set-up. 1 mark
- d By repeating the experiment 3 times the student is able to demonstrate a consistency in the results and eliminate anomalies. 1 mark
- e One would expect that in the same fixed amount of time the average volume would be greater at 30°C than at 22°C (1). This is because the rate of chemical reaction increases with an increase in temperature because of the increased movement of the reactant particles and the increased possibility of fruitful collisions (1). 2 marks
- f (Any two of the following for 1 mark each)
- Availability of the substrate.
 - The ability of the yeast to take up the substrate.
 - The ability of the enzymes to act on glucose.
 - The rate at which carbon dioxide is expelled from the cell.

2 marks

Total Question 2: 8 marks**Question 3**

- a The Calvin cycle / light independent reaction. It takes place in the stroma of the chloroplast. 1 mark

b

letter	name or chemical symbol	
R	CO ₂	(1)
S	ATP	(1)
T	ADP + P	
W	NADPH	(1)
X	NADP ⁺	
Y	glucose	(1)

4 marks

- c The light dependent reaction. 1 mark

Total Question 3: 6 marks**Question 4**

- a it is hydrophobic 1 mark
- b receptor protein 1 mark
- c W is transcription (1) and molecule X is pre messenger RNA (1) 2 marks
- d (Any three of the following for 1 mark each)
- introns removed and exons joined (1)
 - addition of methyl cap (1)
 - addition of poly A tail (1)
 - addition of 5' cap (1)
- e T₃ could bind to different receptor proteins in the cytoplasm, activating different secondary messengers resulting in the formation of a different hormone receptor complex (1) that binds to the DNA at sites for different genes for different myosin proteins. This will then activate transcription of some genes and inhibit transcription of others (1). 2 marks

3 marks

Total Question 4: 9 marks**Question 5**

- a Test the patient's blood for the presence of Zika virus antibodies. 1 mark
- b Interferons are released from virus infected cells that reduce the susceptibility of neighbouring cells (1). Interferons attract natural killer cells that ingest virus infected cells (1). 2 marks
- c B memory cells – are able to rapidly divide and differentiate into plasma cells to produce antibodies when the pathogen invades the body in the future (1).

- T* memory cells – are able to differentiate into *T* helper cells and cytotoxic *T* cells when the pathogen invades the body in the future (1). 2 marks
- d Isolate the antigen responsible for the immune response or kill or weaken the virus using chemicals so that it can no longer cause the disease (1).
Test on animals for effectiveness (1).
Undergo human trials before general release (1). 3 marks

Total Question 5: 8 marks

Question 6

- a glutamine 1 mark
- b Caspases are protease enzymes that when activated bring about apoptosis or programmed cell death (1). Caspases are thought to be activated in Huntington's disease and as a result of this activation, cell death of neurones in the brain occurs, manifesting itself as Huntington's disease (1). 2 marks
- c (Any two of the following for 1 mark each)
- Misuse of test results, such as disclosure to insurance companies, of an individual's genetic status (1).
 - Disclosure of information to family members who have not consented to testing (1).
 - Test results may be inconclusive leaving the individual uncertain of the outcome (1).
 - Testing may cause undue stress to an individual especially if there is no treatment for the condition (1).
- 2 marks

Total Question 6: 5 marks

Question 7

- a A master control gene is a regulatory gene that controls other genes in embryonic development. 1 mark
- | | | | |
|-----------------------|--------|------|-----|
| | BMP4 | CaM | |
| b | low | high | (1) |
| Geospiza scandens | medium | high | (1) |
| Geospiza conirostris | high | low | (1) |
| Geospiza magnirostris | | | |
- 3 marks
- c Mutations would have occurred in both the BMP4 gene and the CaM gene resulting in variation in the amount of gene products (1). This would have resulted in beaks of different thicknesses and lengths (1). Those finches that had phenotypes best suited to niches in the environment would have survived to pass those traits on to their offspring so those traits would have become more frequent in the population due to natural selection (1). 3 marks

Total Question 7: 7 marks

Question 8

- a *Homo erectus* 1 mark
- b The ancestors of the Neanderthals and the Denisovans left Africa before the evolution of *Homo sapiens*. Hence modern Africans do not have Neanderthal or Denisovan DNA. 1 mark
- c Europeans, Chinese and Melanesians. 1 mark
- d According to the diagram the Neanderthals interbred with the ancestors of Europeans, Chinese and Melanesians (1) and this occurred 80,000 years ago (1). 2 marks
- e As the ancestors of Australian aborigines had little Neanderthal DNA, it suggests they separated from Denisovans after the mating between Neanderthals and Denisovans 80,000 years ago (1) and before the mating between Neanderthals and Denisovans 65,000 years ago (1). This therefore supports the settlement of Australia by the Aborigines 70,000 years ago. 2 marks
- f (Any two comparisons for one mark each)
Biological evolution is inherited directly from parents, whereas cultural evolution can be inherited from non-related individuals (1).
Biological evolution is slow whereas cultural evolution is fast (1).
Biological evolution results from random processes whereas cultural evolution is a result of deliberate decisions (1). 2 marks

- g *Tool making is a form of technological evolution that requires spoken language for instruction and teaching (1). Even though Neanderthals had a bigger brain than Homo sapiens, the development of the brain may not have been in the areas associated with advanced language skills therefore limiting their ability to show innovation (1).* 2 marks

Total Question 8: 11 marks

Question 9

- a *The function of PCR is to amplify small amounts of DNA.* 1 mark

- b *step 1: Denaturation*

The DNA sample is denatured into two separate strands by heating up to 95°C (1).

step 2: Annealing

Short segments of single stranded DNA known as primers are added. The primers pair with the regions at either end of the DNA segment of interest (1).

step 3: Extension

The polymerase enzyme uses the attached primers as a starting point and extends them by adding nucleotides so that two complete double strands of DNA are formed (1). 3 marks

- c *This enables the DNA polymerase enzyme to synthesise the new strand of complementary DNA from the nucleotides.* 1 mark

Total Question 9: 5 marks

Question 10

- a *Anti-viral drugs do not usually destroy the virus but inhibit its insertion, replication or release by cells, whereas antibiotics destroy bacteria directly by interfering with a biochemical pathway essential for bacterial cell survival.* 1 mark

- b *This term refers to the study of the shapes of molecules in order to design a drug that fits the active site of a molecule so that the natural reaction of the molecule cannot occur.* 1 mark

- c *shape: square or rectangle shape (1) reasoning: The drug needs to be able to bind into the CCR5 receptor in order to prevent the virus gp120 from binding (1).* 2 marks



- d *The virus would not be able to effectively bind to the cell membrane and as a result the viral genetic material would not be able to enter the cell to make more virus particles so the progress of the disease would be halted.* 1 mark

- e *Take two groups of 20 people who had contracted the HIV virus and test that the virus was present (1).*

Give one group the drug and the other group a placebo such that neither the recipients nor the administrators of the drug know who has received the drug. (i.e. a double blind experiment) (1).

After a period of time the patients would be tested for levels of the virus. There should be a reduction of HIV levels in patients receiving the drug if it has been effective (1). 3 marks

- f *Monoclonal antibodies are identical antibodies produced by a single clone of a cell (hybridoma) that are specific against a particular antigen.* 1 mark

- g *Monoclonal antibodies that attach to free virus particles or cells infected with the virus could be developed and activate the immune system (1) whereas anti-viral drugs only inhibit the replicating virus (1).* 2 marks

Total Question 10: 11 marks

Total Section B: 80 marks

Total Examination: 120 marks

END OF SUGGESTED SOLUTIONS

