

Biology 12

August 2001 Provincial Examination

ANSWER KEY / SCORING GUIDE

CURRICULUM:

Organizers	Sub-Organizers
1. Cell Biology	A, B, C, D
2. Cell Processes and Applications	E, F, G, H
3. Human Biology	I, J, K, L, M, N, O, P

Part A: Multiple Choice

Q	K	C	S	CO	PLO	Q	K	C	S	CO	PLO	
1.	B	U	1	1	A1, 3	26.	D	U	1	3	J2; L8; K1	
2.	C	K	1	1	A1	27.	DELETED					
3.	B	U	1	1	A1	28.	D	U	1	3	K1	
4.	C	K	1	1	A1	29.	C	H	1	3	K6	
5.	B	H	1	1	B1, 2; C2, 8	30.	C	H	1	3	K5; N3	
6.	B	H	1	1, 2, 3	B3; E1; I4	31.	A	K	1	3	L1	
7.	A	U	1	1	C4	32.	A	U	1	3	L2	
8.	D	H	1	1	C7	33.	C	U	1	3	L1, 4, 5	
9.	B	H	1	1	D1, 2	34.	C	K	1	3	L7, 8	
10.	A	U	1	1	D2	35.	B	H	1	3	L7, 8	
11.	A	U	1	1	D2	36.	C	H	1	3	M5, 6, 7	
12.	C	U	1	1	D5	37.	A	K	1	3	N4	
13.	C	H	1	2	G5	38.	D	H	1	3	N4	
14.	C	U	1	2	H2	39.	C	U	1	3	N2	
15.	A	U	1	2	H1	40.	A	U	1	3	N4	
16.	C	K	1	3	I1, 4	41.	A	H	1	3	O2	
17.	A	K	1	3	I1	42.	D	H	1	3	O2	
18.	B	U	1	3	I7	43.	B	U	1	3	O5	
19.	B	K	1	3	I2	44.	D	U	1	3	O5, 2	
20.	D	H	1	3, 2	I4; H6	45.	D	U	1	3	P1	
21.	C	K	1	3	I9	46.	B	K	1	3	P1	
22.	D	K	1	3	J1	47.	B	K	1	3	P4	
23.	D	K	1	3	J2	48.	A	U	1	3	P7, 8	
24.	C	U	1	3	J2	49.	A	K	1	3	P7	
25.	D	H	1	3	J2	50.	A	U	1	3	P12	

Multiple Choice = 50 marks

Part B: Written Response

Q	B	C	S	CO	PLO
1.	1	U	8	1, 2	C2, 8, 11, C12; G1, 3; A1
2.	2	U	4	2	E1, 2, 3, 4
3.	3	U	3	2	F1
4.	4	U	4	2, 3	G1, 2, 4; I2
5.	5	U	5	3	J2
6.	6	H	7	3, 2	L7, 6, 8; H6
7.	7	U	7	3	M1, 2, 3, 4
8.	8	U	7	3	O1, 2
9.	9	K	5	3	P9, 10

Written Response = 50 marks

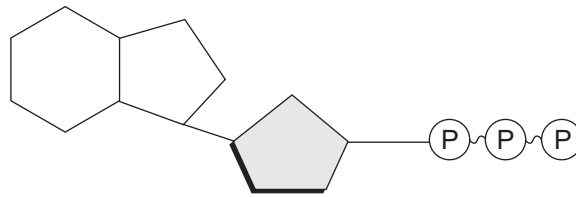
Multiple Choice = 50 (50 questions)
Written Response = 50 (9 questions)
EXAMINATION TOTAL = 100 marks

LEGEND:

Q = Question Number **B** = Score Box Number **S** = Score
K = Keyed Response **C** = Cognitive Level **CO** = Curriculum Organizer
PLO = Prescribed Learning Outcome

Use the following diagram to answer question 1 b).

Molecule Y



b) i) Identify molecule Y and name the organelle where the molecule is made.

Name of molecule:

(1 mark)

- ATP
 - triphosphonucleotide
- } either one for
1 mark

Name of organelle where made:

(1 mark)

- chloroplast
 - mitochondrion
- } either one for
1 mark

ii) Describe two ways in which molecule Y is used by the cell membrane.

(2 marks)

- ATP is required for exocytosis.
- ATP is required for endocytosis.
- ATP is required for pinocytosis.
- ATP is required for phagocytosis.
- ATP is required for active transport.
- ATP is involved in enzymatic reactions.
- ATP is required as an energy source for cilia and flagella.

} any two for
1 mark each

Use the following chart of mRNA codons to answer question 2 a).

Three-letter codons of messenger RNA and the amino acids specified by the codons			
AAU } Asparagine AAC }	CAU } Histidine CAC }	GAU } Asparatic acid GAC }	UAU } Tyrosine UAC }
AAA } Lysine AAG }	CAA } Glutamine CAG }	GAA } Glutamate GAG }	UAA } Stop UAG }
ACU } Threonine ACC ACA ACG }	CCU } Proline CCC CCA CCG }	GCU } Alanine GCC GCA GCG }	UCU } Serine UCC UCA UCG }
AGU } Serine AGC }	CGU } Arginine CGC CGA CGG }	GGU } Glycine GGC GGA GGG }	UGU } Cysteine UGC }
AGA } Arginine AGG }			UGA – Stop UGG – Tryptophan
AUU } Isoleucine AUC AUA }	CUU } Leucine CUC CUA CUG }	GUU } Valine GUC GUA GUG }	UUU } Phenylalanine UUC }
AUG – Methionine			UUA } Leucine UUG }

2. A segment of hemoglobin has the following sequence of amino acids:

leucine–threonine–proline–glutamate–glutamate

The same segment of hemoglobin found in people who have sickle-cell anemia has the following sequence:

leucine–threonine–proline–valine–glutamate

a) Using the chart above, explain how DNA is different in people with sickle-cell anemia.

(2 marks)

- **The DNA code C T T or C T C (1 mark) has changed to C A A or C A G or C A T or C A C (1 mark).**

OR

- **There is a mutation and the triplet code for one amino acid is altered. The code for glutamate (C T T or C T C) is changed to that for valine (C A A / C A G / C A T / C A C); i.e., thymine is changed to adenine (C T T → C A T or C T C → C A C). (2 marks)**

OR

- **A single base substitution / mutation has occurred. (1 mark)**

b) State **two** environmental agents that can change the DNA.

(2 marks)

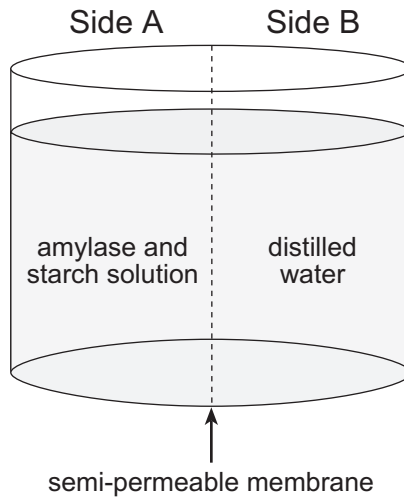
- X rays
 - viruses
 - bacteria
 - ultraviolet light
 - mutagenic chemicals
 - radiation
- } any two for
1 mark each

3. Tissue sample **A** is taken from a mole on the skin that shows abnormal growth while tissue sample **B** is composed of normal skin cells. Describe how the cells in tissue sample **A** are different from those in tissue sample **B**. **(3 marks)**

- **Tissue sample A is vascularized.**
- **The cells in tissue sample A are unspecialized.**
- **The cells in tissue sample A are able to metastasize.**
- **The cells in tissue sample A exhibit lack of contact inhibition.**
- **The cells in tissue sample A have a larger nucleus to cytoplasm ratio.**
- **The nuclei of sample A cells may have an abnormal number of chromosomes.**
- **The cells in tissue sample A display abnormal nuclei, have increased growth factors and receptors.**

**any three for
1 mark each**

Use the following diagram to answer question 4.



4. Side **A** contains a solution of amylase and starch. Side **B**, which only contains distilled water, is separated from side **A** by a semi-permeable membrane. The contents of the beaker are kept at 37°C.

a) What characteristic does the semi-permeable membrane share with a living membrane?

(1 mark)

- It limits what can move across the membrane.
- It allows the passage of small molecules (material passes through on the basis of size).
- It allows for passive transport.

} any one for
1 mark

b) After 20 minutes, the liquid on side **B** was tested and a disaccharide was found. Identify this disaccharide and account for its presence on side **B**.

(3 marks: 1 mark for name; 2 marks for explanation)

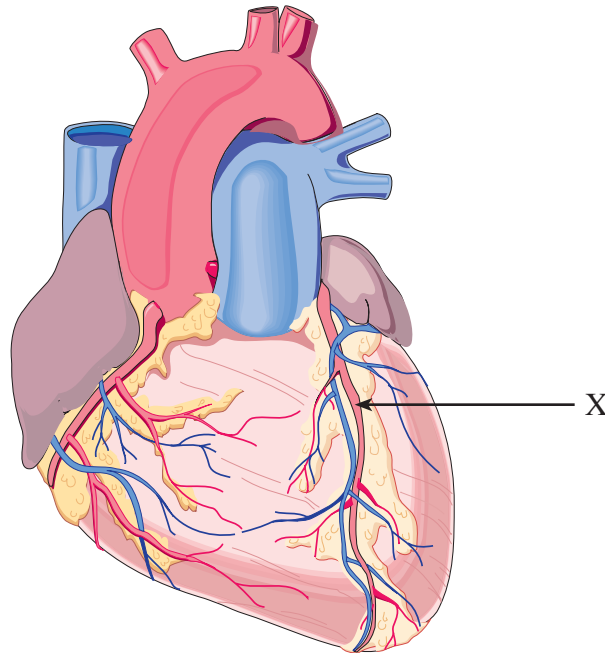
Name: **maltose** (1 mark)

Explanation:

- The starch was digested by amylase into maltose.
- The disaccharide moved by diffusion from side A to side B.
- The disaccharide moved from a higher concentration on side A to a lower concentration on side B.
- Maltose was small enough to move through the membrane to the other side.

} any two for
1 mark each

Use the following diagram to answer question 5 a).



5. a) Describe **three** things that would occur if the artery labelled **X** became blocked? **(3 marks)**

- **A heart attack would occur.**
- **The heart muscle would die.**
- **An irregular heartbeat would occur.**
- **Nutrients and oxygen would not get to the heart muscle.**
- **Other vessels would grow in and re-establish the blood supply.**
- **Blood pressure in vessel X increases.**

**any three for
1 mark each**

b) What would happen if the atrioventricular (AV) valve in the left side of the heart did **not** close properly? **(2 marks)**

- **The heart rate would increase.**
- **Cardiac output would decrease.**
- **The left ventricle wall would enlarge.**
- **The heart would not pump as efficiently.**
- **Blood pressure in the lungs would increase.**
- **Backflow of blood into the left atrium would occur.**
- **Increased fluid would be pushed into the lung tissues.**
- **There would be decreased blood pressure in the aorta.**
- **A heart murmur could be detected.**

**any two for
1 mark each**

Use the following information to answer questions 6 a) and b).

ACTIVITY	RATE OF AIR INTAKE
exercise	7–8 L/min.
sitting (at rest)	4–5 L/min.
sleeping	2 L/min.

6. a) What substance found in the plasma would cause the change in the rate of air intake during exercise?

(1 mark)

- **adrenalin**
 - **hydrogen ions (H^+)**
 - **carbon dioxide (CO_2)**
 - **bicarbonate ions (HCO_3^-)**
 - **reduced hemoglobin**
- } any one for
1 mark

b) Write the chemical reactions that occur during internal respiration that return the rate of air intake during exercise to the resting rate.

(2 marks)

- $CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow HCO_3^- + H^+$
 - $H^+ + Hb \rightarrow HHb^+$
 - $Hb + CO_2 \rightarrow HbCO_2$
 - $HbO_2 \rightarrow Hb + O_2$
- } any two for
1 mark each

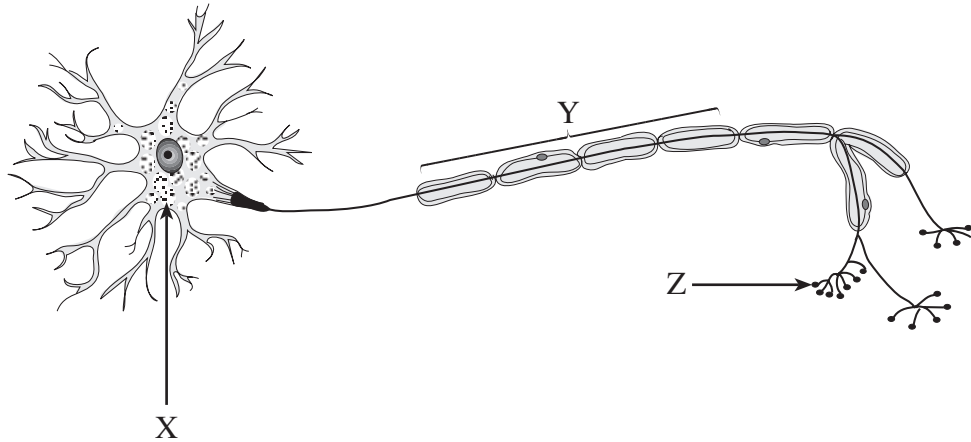
c) i) Why would a drop in pH cause the enzymes that clot blood to function at a slower rate? **(2 marks)**

- **Due to the lowered pH, the enzymes in the blood will become denatured and lose their tertiary structure.**
 - **As a result, the shape of the active site will change and the substrate will no longer be able to bind with the enzymes.**
- } **either one for 2 marks**

ii) State **two** other conditions that would have the same effect on the enzymes in the blood. **(2 marks)**

- **adding an inhibitor**
 - **increasing the temperature substantially**
 - **adding heavy metals (e.g., lead, mercury)**
 - **lack of coenzyme / cofactors**
- } **any two for 1 mark each**

Use the following diagram to answer question 7.



7. a) Identify the following structures.

(2 marks: 1 mark each)

Structure X:

- cell body
 - axoplasm
 - cytoplasm
- } any one for
1 mark

Structure Z:

- synaptic ending (bulb)
 - presynaptic membrane
- } either one for
1 mark

b) Describe the stages in the transmission of a nerve impulse.

(4 marks)

- Sodium gates open.
- Sodium ions (Na^+) enter the cell.
- Depolarization of the cell membrane occurs.
- Potassium gates open.
- Potassium ions (K^+) leave the cell.
- Repolarization of the membrane occurs.
- Sodium-potassium pump re-establishes the ion distribution.
- Depolarization causes the sodium gates to open in the adjacent area.
- Action potential is generated.

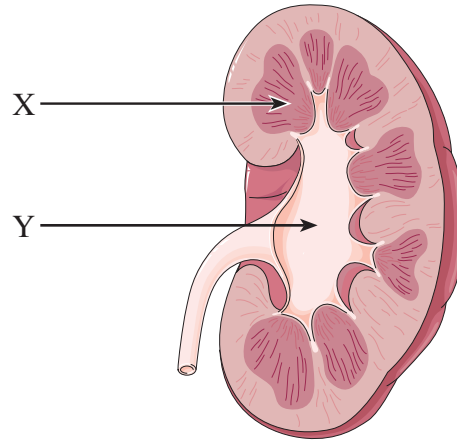
} any four for
1 mark each

c) How would nerve impulse transmission be affected without the cells that form structure Y?

(1 mark)

- The nerve transmission would be much slower (without the myelin sheath).
 - The nerve transmission could be induced / transferred to adjacent axons.
- } either one for 1 mark

Use the following diagram to answer questions 8 a) and b).



8. a) Identify structure **X** and describe the environment within the structure.
(2 marks: 1 mark for name; 1 mark for description)

Name: **renal medulla / renal pyramid** (1 mark)

Description:

- **The environment in the renal medulla is hypertonic to the inside of the loop of Henle; i.e., there is a higher concentration of solutes.**
- **There is a low water content AND a high salt concentration.**

} either one for
1 mark

- b) Identify structure **Y** and give its function.
(2 marks: 1 mark for name; 1 mark for function)

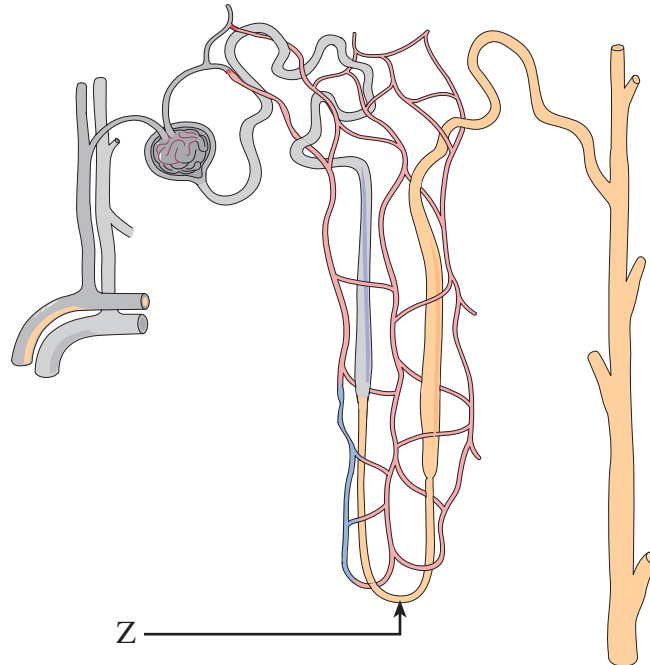
Name: **renal pelvis** (1 mark)

Function:

- **collects urine**
- **connects collecting ducts with ureter**

} either one for
1 mark

Use the following diagram to answer question 8 c).



c) Identify structure **Z** and describe **two** characteristics that assist in its function.
(3 marks: 1 mark for name; 2 marks for characteristics)

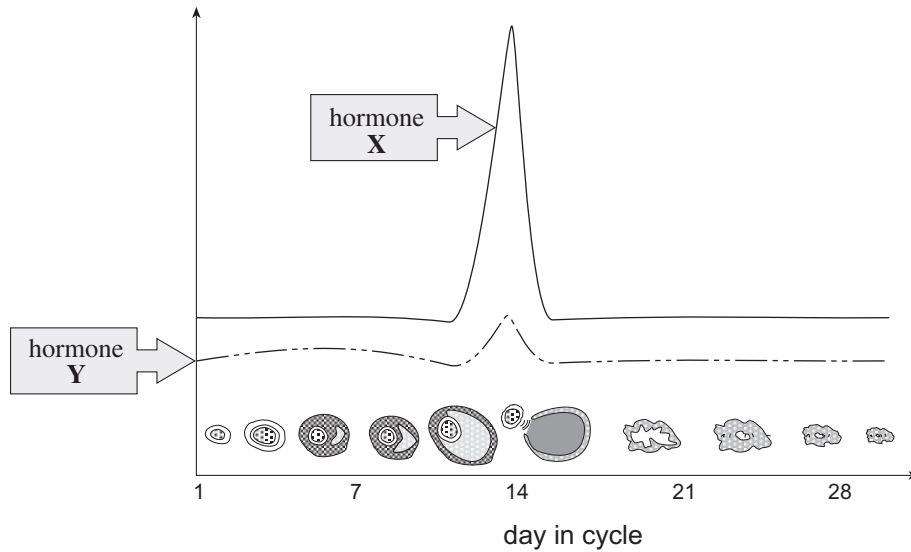
Name: **loop of Henle** (1 mark)

Characteristics:

- **The ascending limb is impermeable to water.**
- **The ascending limb actively transports sodium ions into the renal medulla.**
- **The long descending limb allows maximum reabsorption of water.**
- **It has a thin membrane for efficient diffusion.**
- **There are a great number of mitochondria for active transport.**
- **It has a long / large surface area for the reabsorption of water.**

} any two for
1 mark each

Use the following diagram to answer question 9.



9. a) On what day does ovulation take place?

(1 mark)

- day 14 / 15 / 16 (1 mark)

b) i) Identify hormone X.

(1 mark)

- luteinizing hormone (LH) (1 mark)

ii) What structure secretes hormone X?

(1 mark)

- (anterior) pituitary (1 mark)

c) Describe the effects on the body caused by the release of hormone Y between days 1 and 14.

(2 marks)

- Follicle-stimulating hormone (FSH) causes the follicle to mature.
- Increasing amounts of estrogen (and some progesterone) are released.
- This leads to the negative feedback of luteinizing hormone (LH) and FSH.
- Proliferation of the endometrium occurs.
- Ovum matures in the follicle.

} any two for
1 mark each

END OF KEY