

Biology 12

November 2000 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	CO	PLO	Q	K	C	CO	PLO
1.	C	K	1	A1, 3	26.	B	H	3	J12
2.	B	H	1	A1, 3; E1; H1	27.	A	U	3	K1; J4
3.	D	U	1	A1, 3	28.	A	K	3	K1
4.	B	U	1	B3	29.	D	U	3	L1, 2
5.	A	H	1	C1, 4	30.	A	H	3	L4, 5
6.	A	H	1	C5; I7	31.	C	H	3	M3
7.	D	U	1	D1	32.	D	U	3	M3
8.	D	K	1	D1; C2	33.	A	H	3	M3, 5, 6
9.	C	K	1	D2	34.	A	U	3	N4
10.	B	U	1	D5, 1	35.	C	U	3	N5
11.	D	K	2	E1	36.	D	U	3	O2
12.	D	H	2	E2	37.	A	U	3	O2
13.	D	H	2	E1, 2	38.	D	H	3	O2
14.	A	K	2	F1	39.	B	U	3	O3, 2
15.	A	K	2	F2	40.	A	U	3	O4
16.	C	K	2	F4	41.	C	U	3	P1
17.	B	U	2	F5	42.	C	U	3	P1, 6
18.	B	U	2	G3	43.	D	U	3	P3
19.	D	U	2, 3	G5; M5, 6	44.	C	U	3	P4
20.	C	H	2	G6	45.	C	K	3	P5
21.	C	H	2	G3, 6	46.	C	U	3	P6, 10
22.	C	K	3	I1	47.	B	U	3	P7
23.	B	U	3	I7, 5	48.	A	U	3	P10, 9, 7
24.	D	K	3	J2	49.	B	U	3	P9
25.	D	U	3	J7, 8	50.	A	H	3	P10, 9

Multiple Choice = 50 marks

Part B: Written Response

Q	B	C	S	CO	PLO
1.	1	U	6	1, 2, 3	A1, 2, 3; G1, 8, I1, 7; O2
2.	2	K	6	1	C10
3.	3	U	6	1	H6
4.	4	U	8	3	I2, 4, 5
5.	5	H	10	3, 2	J1, 6; K4; G7; N2, 3
6.	6	U	5	3	L7, 8
7.	7	U	7	3	M1, 2, 8
8.	8	U	2	3	O2

Written Response = 50 marks

Multiple Choice = 50 (50 questions)

Written Response = 50 (8 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

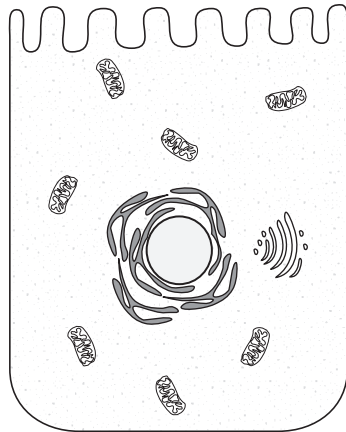
PART B: WRITTEN RESPONSE

Value: 50 marks

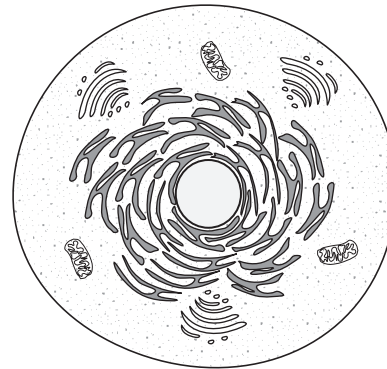
Suggested Time: 75 minutes

Use the following diagrams to answer question 1.

Cell A



Cell B



1. Cell A is found lining the proximal convoluted tubule of the nephron. Cell B is found in the liver. Identify **three** visible differences between the two cells and explain how each difference aids the cell in carrying out its specific functions. **(6 marks: 2 marks each)**

(Student must give 3 of the following differences and explain the purpose of each difference.)

Difference:

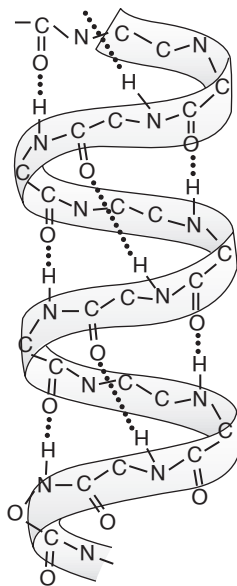
- Cell A has a brush border (microvilli) and Cell B does not.
- Cell B has more endoplasmic reticulum than Cell A.
- Cell A has more mitochondria than Cell B.
- Cell B has more Golgi bodies than Cell A.
- Cell A has a columnar shape and Cell B does not.

Explanation:

- This greatly increases its surface area for absorption. Cell A must absorb large amounts of sodium ions, glucose, water and amino acids from the filtrate.
 - This allows it to detoxify blood.
- OR**
- This allows it to make plasma proteins.
 - Cell A must produce more ATP for the active transport of sodium ions/glucose/amino acids across its membrane.
 - Golgi bodies are needed to package cell products which the liver synthesizes.
 - The columnar shape is more conducive to lining of a tubule.

2. Levels of protein structure differ according to the types of bonds that hold them together. As an enzyme is synthesized, these bonds form to give the protein its final 3-dimensional shape. For each of the following diagrams, name the level of protein structure and describe the type of bonding responsible.

(6 marks: 1 mark each for level; 1 mark each for description)

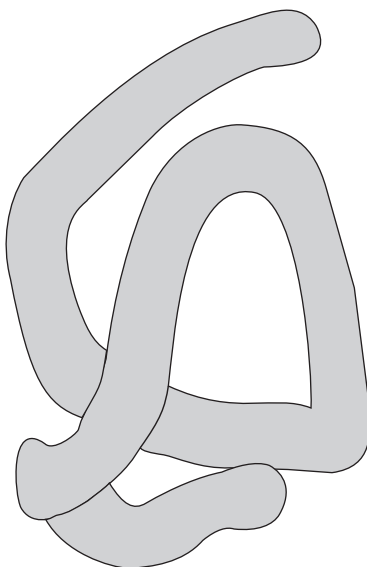


Level of protein structure:

- **secondary (2°) / alpha helix (1 mark)**

Description of bonding:

- **H-bonding (1 mark)**



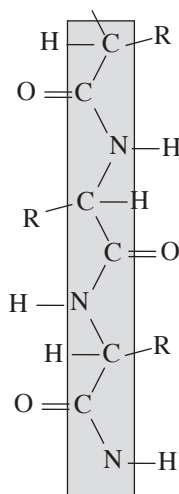
Level of protein structure:

- **tertiary (3°) (1 mark)**

Description of bonding:

- **There is ionic bonding.**
- **There is hydrogen bonding between the R-groups.**
- **There is covalent bonding.**
- **There are disulfide bridges (bonds).**

} **any one for
1 mark**



Level of protein structure:

- **primary (1°) / linear sequence of amino acids (1 mark)**

Description of bonding:

- **There is peptide bonding.**
- **There is covalent bonding.**

} **either one for
1 mark**

3. What effect would each of the following changes have on the rate of an enzyme-catalyzed reaction occurring in the stomach? Give an explanation for the effect.

a) The temperature is increased from 35°C to 37°C.

(2 marks)

• The rate of the reaction would increase. (1 mark)

- Increasing the temperature speeds up the molecules, thereby increasing the chance of a successful collision between reacting molecules.
- A greater number of enzyme-substrate complexes would form.
- 37°C is the optimum or best temperature.

} any one for
1 mark

b) A competitive inhibitor is added.

(2 marks)

- The reaction rate would decrease or stop. (1 mark)
- A competitive inhibitor fits into the active site in place of the substrate. (1 mark)

Note: Denaturation of enzyme was not accepted.

c) The pH is increased from 3 to 8.

(2 marks)

• The reaction would decrease or stop. (1 mark)

- Raising the pH denatures the enzyme (loss of active site).
- Pepsinogen would not be activated.
- It would not be the optimum pH for pepsinogen.
(*Note: Student must name enzyme.*)

} any one for
1 mark

4. Identify **four** substances produced by the pancreas and give **one** function of each.
(8 marks: 1 mark each for substance; 1 mark each for function)

(Students must identify 4 of the following substances and give one function of each.)

Substance:

Function:

- | | |
|--|--|
| • lipase | • digests / hydrolyzes / breaks down fats to fatty acids / glycerol |
| • trypsin(ogen) | • digests / hydrolyzes / breaks down proteins (polypeptides) to peptides |
| • pancreatic amylase | • digests / hydrolyzes / breaks down starch (carbohydrates) to maltose |
| • sodium bicarbonate / NaHCO_3 / bicarbonate ions | • raises the pH in the small intestine (duodenum)
• makes the pH of the duodenum alkaline / basic
• over neutralizes the chyme / acts as a buffer of chyme
• creates optimum pH conditions for action of pancreatic / intestinal enzymes
• activates trypsinogen |
| • insulin | • stimulates cells to metabolize glucose
• makes cells more permeable to glucose absorption
• stimulates cells to absorb glucose and store as glycogen
• reduces blood glucose level
• promotes buildup of fats / proteins (and inhibits use of energy source) |
| • glucagon | • stimulates cells to convert glycogen to glucose
• raises blood glucose level
• promotes breakdown of fats / proteins to unit molecules |
| • nucleases | • break down nucleic acids |

Note: Student must correctly identify the substance to get a mark for the function.

5. a) The average resting blood pressures and blood velocities were measured in various blood vessels of an individual as shown in the table below. Identify the type of blood vessel in the space provided. **(5 marks)**

BLOOD VESSEL	AVERAGE BLOOD VELOCITY (cm/s)	AVERAGE BLOOD PRESSURE (mm Hg)	TYPE OF BLOOD VESSEL
A	48.0	100	artery
B	0.5	22	capillary
C	15.0	60	arteriole
D	25.0	2	vein
E	4.0	10	venule

b) Explain the observed blood pressure and velocity in the following vessels.

Vessel A: **(2 marks)**

- **It is close to the heart.**
 - **It is elastic which helps maintain blood pressure.**
 - **It is made of smooth muscle to allow constriction.**
 - **The left ventricle contracts and forces the blood under high pressure.**
- } any two for 1 mark each

Vessel B: **(2 marks)**

- **The capillaries have the greatest cross-sectional area.**
 - **The capillaries are farther from the heart than the arteries.**
 - **The capillaries are narrow and thus increased friction leads to lower velocity.**
- } any two for 1 mark each

c) How does the sympathetic nervous system raise blood pressure?

(1 mark)

- **The sympathetic nervous system causes constriction of the blood vessels. / The medulla oblongata generates sympathetic nerve impulses which cause vasoconstriction and increased cardiac output.**
- **Adrenalin causes increased heart rate which increases blood flow and blood pressure.**
- **The blood is diverted (shuttled) from the digestive system to the skeletal system.**

} **any one for
1 mark**

6. a) During external respiration, reactions involving gases occur in the capillaries.
Describe **three** of these reactions.

(3 marks)

- **oxygen combines with hemoglobin to form oxyhemoglobin ($O_2 + Hb \rightarrow HbO_2$) (1 mark)**
- **carbaminohemoglobin releases carbon dioxide ($HbCO_2 \rightarrow Hb + CO_2$) (1 mark)**
- **bicarbonate ions combine with hydrogen ions to release carbon dioxide ($HCO_3^- + H^+ \rightarrow H_2CO_3 \rightarrow H_2O + CO_2$) (1 mark)**

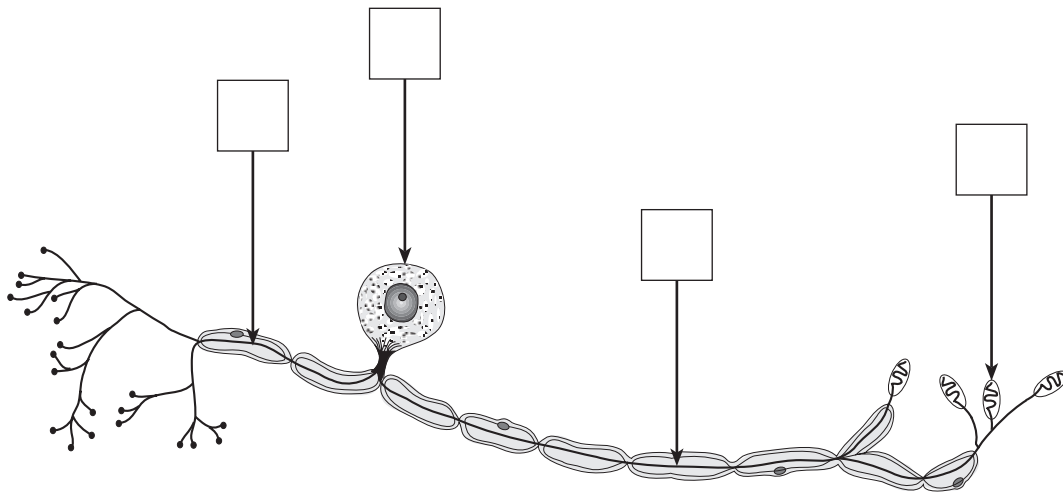
b) Describe **two** conditions in the capillaries during external respiration that affect the rate of the reactions above.

(2 marks)

- **Blood at the lung capillaries has a lower temperature.**
- **Blood at the lung capillaries has a higher pH / less acidic.**
- **Blood at the lung capillaries has a lower oxygen concentration.**
- **Blood at the lung capillaries has a higher carbon dioxide concentration.**
- **Low amounts of hemoglobin will reduce the amount of O_2 diffused per minute.**
- **Changes in blood pressure and blood velocity will affect the rate of gas exchange.**

} any two for
1 mark each

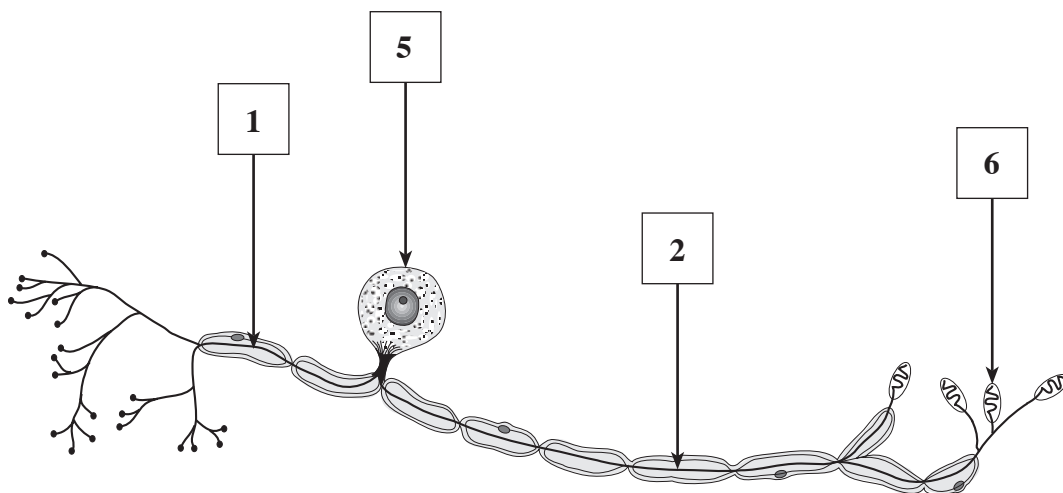
Use the following diagram to answer question 7.



7. a) Label the diagram above using the numbers of the terms listed below.
(Not all the terms will be used.)

(2 marks: $\frac{1}{2}$ mark each)

1. axon
2. dendrite
3. synapse
4. node of Ranvier
5. cell body
6. receptor



b) Describe how a reflex arc functions.

(5 marks)

- **A stimulus initiates a nerve impulse in a receptor.**
- **The sensory neuron carries the impulse (action potential) to the interneuron.**
- **The interneuron carries the impulse from the sensory neuron to the motor neuron.**
- **The motor neuron carries the impulse from the interneuron to an effector.**
- **The effector responds to the stimulus (in the case of a muscle, it causes contraction; in the case of a gland, it causes secretion).**
- **A reflex arc is automatic / doesn't use the brain / is involuntary.**

} **any five for
1 mark**

8. Name **two** substances that are actively excreted during the process of tubular excretion.

(2 marks)

- uric acid
- penicillin / antibiotics / drugs
- histamine
- creatinine
- ammonia (NH_3)
- hydrogen ions (H^+)
- toxins / poisons
- potassium ions (K^+)

any two for
1 mark each

END OF KEY