Biology 12

January 1998 Provincial Examination

ANSWER KEY / SCORING GUIDE

CURRICULUM:

Organizers	Sub-Organizers
1. Cell Biology	A, B, C, D
2. Cell Processes and Application	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.	C	U	3	J9
2.	D	H	1	A1, 2; G5	27.	D	K	3	K1, 6
3.	C	K	1	A3	28.	B	K	3	J11
4.	B	K	1	A1	29.	B	H	3	J12
5.	D	H	1	B1	30.	B	K	3	K2
6.	C	U	1	B3	31.	D	U	3	K6
7.	D	H	1	C4, I2	32.	A	H	3	L3, 8
8.	A	U	1	C6, 12	33.	C	U	3	L4
9.	B	U	1	D1	34.	D	K	3	L6
10.	C	U	1	D2	35.	D	U	3	L8
11.	D	H	2	E1, 2	36.	A	U	3	M2
12.	B	U	2	F1	37.	A	H	3	M3
13.	C	U	2	F1, 4	38.	C	K	3	M1
14.	D	K	2	F2	39.	D	U	3	M6, 7
15.	D	H	2	G4	40.	A	U	3	N3
16.	A	H	2	G6	41.	C	U	3	N4
17.	B	K	2	H5	42.	C	U	3	N5
18.	A	H	3	I2	43.	D	H	3	O2
19.	B	U	3	I1	44.	D	U	3	O2
20.	B	U	3	I5	45.	C	K	3	O2
21.	A	U	3	I7	46.	B	H	3	O4, 5
22.	A	H	3	J1	47.	A	U	3	P1
23.	D	U	3	J2	48.	C	U	3	P4
24.	D	U	3	J6	49.	B	U	3	P7, J5
25.	A	U	3	J8	50.	C	U	3	P10

Multiple Choice = 50 marks

Part B: Written Response

Q	B	C	S	CO	PLO
1.	1	U	4	1	C9
2.	2	U	4	2	E1
3.	3	K	4	2	G3
4.	4	U	5	2	G7, H6
5.	5	U	6	3	I4, L7, O2
6.	6	U	4	3	I9
7.	7	U	4	3	L3
8.	8	U	5	3	M8
9.	9	H	6	3	O5, N5, J7
10.	10	K	8	3	P5, 8, 6

Written Response = 50 marks

Multiple Choice	=	50 (50 questions)
Written Response	=	50 (10 questions)
EXAMINATION TOTAL	**=**	**100 marks**

LEGEND:

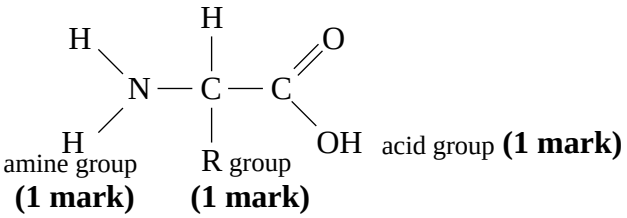
Q = Question Number **K** = Keyed Response **C** = Cognitive Level
B = Score Box Number **S** = Score **CO** = Curriculum Organizer
PLO = Prescribed Learning Outcome

PART B: WRITTEN RESPONSE

Value: 50 marks **Suggested Time: 75 minutes**

INSTRUCTIONS:
1. Use a **pen** for this part of the examination.
2. Write your answers in the space below the questions.
3. Organization and planning space has been incorporated into the space allowed for answering each question.
4. You may not need all of the space provided to answer each question.

1. Draw a generalized amino acid and label the amine, acid (carboxyl) and R groups. **(4 marks)**
(You may use a pencil for your drawing.)



(1 mark for correct linkage of amine and acid groups. If unlabelled, $-\frac{1}{2}$ mark each only.)

2. Give **one** role of each of the following in the production of a protein. **(4 marks: 1 mark each)**

DNA:

- **Contains the code (gene) that determines the amino acid sequence of the protein.**
- **It is the template (blueprint) for mRNA.**

} **either one for 1 mark**

mRNA:

- **Reads gene (transcription) and carries message out of the nucleus to the ribosomes. (1 mark)**

tRNA:

- **Specific tRNAs attach to specific amino acids and carry them to the ribosome. (1 mark)**

rRNA:

- **rRNA forms the ribosomes that read the mRNA and provide a site for tRNAs to join with the mRNA. (1 mark)**

3. State how each of the following transport mechanisms functions to move materials into a cell.
(4 marks: 1 mark each)

Diffusion:

- **Net flow of molecules from an area of high concentration to an area of low concentration. (1 mark)**

Osmosis:

- **Net flow of water from an area of low solute concentration to an area of high solute concentration across a selectively permeable membrane.**
- **Net flow of water from an area of high water concentration to an area of low water concentration.**

either one for 1 mark

Facilitated transport:

- **Use of a carrier protein to move molecules from a higher to a lower concentration. (1 mark)**

Active transport:

- **Use of a carrier protein and an energy source to move molecules from a lower to a higher concentration. (1 mark)**

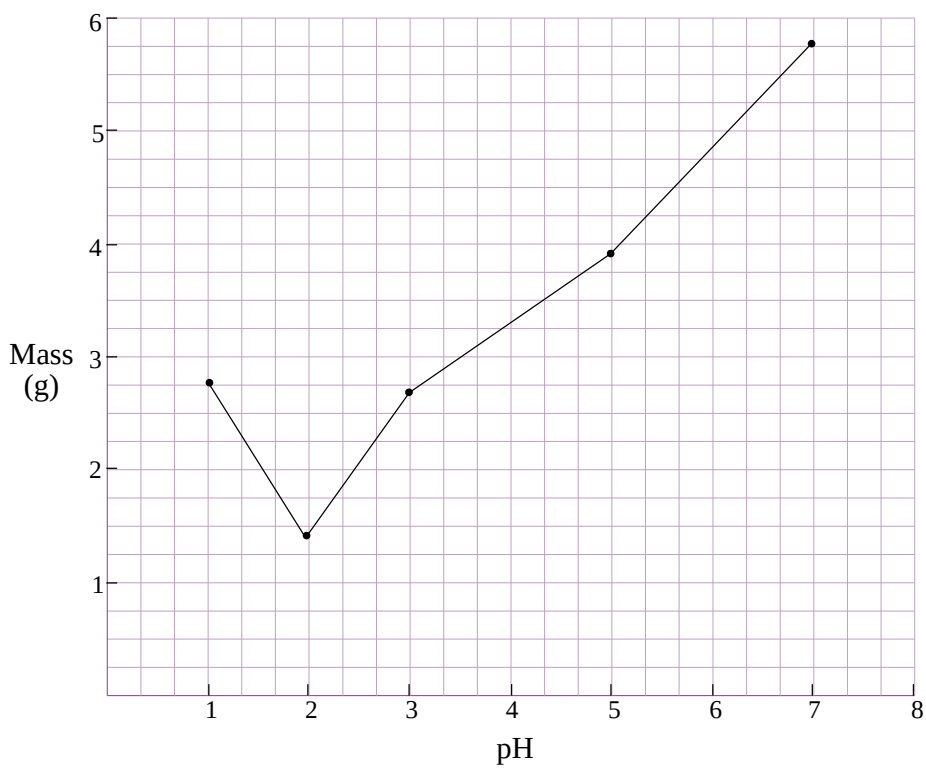
4. An experiment was conducted to determine the effects of pH on pepsin. The following steps were performed:

   1. Five test tubes were numbered and equal amounts of egg white and water were added to each.
   2. A buffer was added to each test tube to maintain its pH at the level given in the table below.
   3. An equal amount of pepsin was added to each test tube.

   After one hour, the mass of egg white **remaining** in each test tube was determined. The results are recorded below:

TEST TUBE	pH	MASS OF EGG WHITE (in grams)
1	1	2.8
2	2	1.3
3	3	2.7
4	5	3.9
5	7	5.8

a) Draw a graph that compares the pH to the amount of egg white remaining in each test tube. Label the *x*-axis (horizontal axis) as pH. **(2 marks)**



($\frac{1}{2}$ mark for each correctly labelled axis; 1 mark for correct plot points)

b) What appears to be the optimum pH for pepsin? **(1 mark)**

- **pH of 2. (1 mark)**

c) Explain what happens to pepsin at a pH of 7, and why this affects its activity. **(2 marks)**

- **The enzyme denatures. (1 mark) The active site is lost so that the enzyme can no longer hold its substrate. (1 mark)**

5. Give **three** functions of the bicarbonate ion $\left(HCO_3^-\right)$ in the body and identify **one** specific location of each function. **(6 marks: 2 marks each)**

Students could chose 3 of the following:

Function: • **Bicarbonate ions are formed when carbon dioxide and water combine. Most of the carbon dioxide generated by cellular respiration is carried back to the lung capillaries as bicarbonate. (1 mark)**
Location: • **In the capillaries. (1 mark)**

Function: • **Bicarbonate ions neutralize stomach acid. (1 mark)**
Location: • **In the duodenum. (1 mark)**

Function: • **When blood is acidic, bicarbonate ions are reabsorbed to maintain the proper pH of the blood. (1 mark)**
Location: • **In the nephron. (1 mark)**

Function: • **Initiates breathing by action on breathing centre. (1 mark)**
Location: • **Medulla. (1 mark)**

6. Describe how the small intestine is specialized for digestion and absorption.

Digestion: **(2 marks)**

- **Produces enzymes to break down nutrients.**
- **Produces maltase to convert maltose into glucose.**
- **Produces peptidases to convert peptides into amino acids.**
- **Produces nucleases to break down nucleic acids.**
- **Its long length allows time for digestion.**

any two for 1 mark each

Absorption: **(2 marks)**

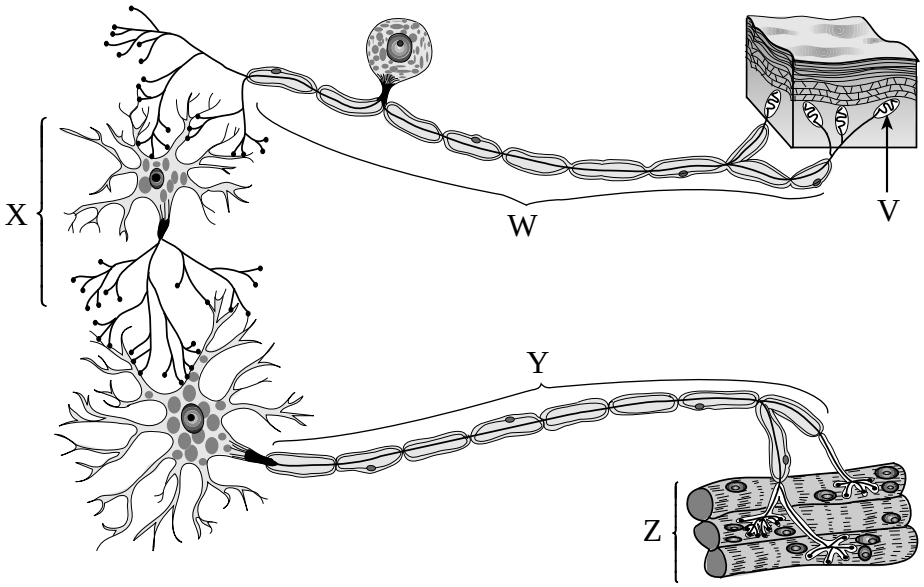
- **Its long length and villi provide a large surface area.**
- **Lacteals absorb lipids.**
- **Capillary network absorbs amino acids and glucose.**
- **Microvilli (brush border) increase absorptive area.**

any two for 1 mark each

7. How is the structure of the alveoli ideally suited to the exchange of gases with the blood?
(4 marks)

- **Maximize surface area.**
- **Lipoprotein lowers surface tension so they cannot collapse.**
- **Thin-walled to increase diffusion rates.**
- **Highly vascularized.**

Use the following diagram to answer question 8.



8. The diagram above represents a simple reflex arc. Identify structures **V, W**, **X**, **Y** and **Z** and give **one** function of each structure.

(5 marks: $\frac{1}{2}$ mark for each name, $\frac{1}{2}$ mark for each function)

STRUCTURE	NAME	FUNCTION
V	• **Receptor**	• **Initiates impulse from environmental stimuli.**
W	• **Sensory neuron**	• **Carries impulse to CNS.** **or** • **Carries impulse to spinal cord.**
X	• **Interneuron**	• **Relays impulse to motor neuron.**
Y	• **Motor neuron**	• **Carries impulse to effector.** **or** • **Carries impulse to muscle.** **or** • **Carries impulse to gland.**
Z	• **Effector**	• **A muscle or gland that responds to the stimulus.**

9. Plasma from a student was analyzed before and after a ten kilometre cross-country run. During the run, the student became dehydrated. Explain how the resulting lowered blood volume is detected by the body and describe a homeostatic mechanism by which it is returned to normal. **(6 marks)**

Path One:

- **Stretch receptors in the walls of the arteries detect that the plasma lacks sufficient water.**
- **ADH (antidiuretic hormone) produced by hypothalamic neurons is transported to the posterior pituitary where it is released into the blood.**
- **ADH increases the permeability of the distal convoluted tubule and the collecting duct in the nephron.**
- **This increased permeability causes more water to be reabsorbed.**
- **Increased water in the plasma will return ion concentrations to normal levels.**
- **As the blood becomes more dilute, ADH ceases to be produced and released.**
- **This mechanism is an example of negative feedback.**

any six for 1 mark each

OR

Path Two:

- **Osmoreceptors in the hypothalamus detect that the plasma lacks sufficient water.**
- **The hypothalamus causes sensations of thirst.**
- **The student drinks.**
- **Water is absorbed from the stomach, small intestine and large intestine into the blood.**
- **Blood volume is increased.**

any for 1 mark each

OR

Path Three:

- **Kidney releases an enzyme when blood volume and Na^+ is low which eventually targets adrenal gland.**
- **Adrenal gland releases aldosterone.**
- **Aldosterone targets kidney tubules.**
- **This increases Na^+ recovery in the nephrons.**
- **This results in increased water recovery and subsequent increase in blood volume.**

any for 1 mark each

(Students may describe a combination of pathways.)

10. State the effects that each of the following hormones has on the body during puberty. **(8 marks)**

Testosterone: (**three** effects)

- **Maturation of penis and testes.**
- **Production of sperm.**
- **Growth of body hair.**
- **Larynx and vocal chords enlarge.**
- **Increased muscle strength.**
- **Oil and sweat glands secrete.**

any three for 1 mark each

Estrogen: (**three** effects)

- **Growth of uterus and vagina.**
- **Onset of uterine cycle.**
- **Growth of body hair.**
- **Fat distribution.**
- **Pelvic girdle and breasts enlarge.**

any three for 1 mark each

Follicle stimulating hormone: (**two** effects)

- **Promotes the development of the follicle.**
- **Produces sperm.**
- **Causes spermatogenic cells to take up testosterone.**
- **Maturation of the egg.**

any two for 1 mark each

END OF KEY