

Biology 12

June 2002 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	K	1	1	A1, 3	26.	A	K	1	3	J8
2.	C	U	1	1	A1, 3	27.	B	K	1	3	J9
3.	B	H	1	1, 2	A1, 2; G8	28.	C	H	1	3	K1, 4
4.	B	K	1	1, 2	A1, 2; E1	29.	A	H	1	3	J2, 4; K1; L8
5.	C	K	1	1, 2	A1; E1	30.	DELETED				
6.	A	H	1	1	C1	31.	D	K	1	3	L1, 5
7.	B	K	1	1	C10	32.	B	K	1	3	L1
8.	B	K	1	1	D1; C2	33.	D	U	1	3	L1, 5, 4
9.	D	H	1	1	D1, 2	34.	D	U	1	3	L4, 5
10.	D	U	1	1	D3	35.	D	H	1	3	L8; K1
11.	B	U	1	1	D5	36.	D	K	1	3	M2
12.	B	K	1	2	F1	37.	C	U	1	3	M3
13.	C	U	1	2	F1	38.	A	U	1	3	M3
14.	C	U	1	2	F5	39.	B	U	1	3	M5, 6
15.	B	K	1	2	G1	40.	C	K	1	3	N4
16.	C	H	1	2	G7, 3, 6	41.	A	H	1	3	N4; P10
17.	A	K	1	3	I1	42.	B	K	1	3	O1, 2
18.	B	U	1	3	I1	43.	A	U	1	3	O1, 2, 3; J7
19.	C	U	1	3	I2, 1, 9	44.	A	H	1	3	O4, 5; N5
20.	A	U	1	3	I9	45.	C	K	1	3	P4
21.	B	K	1	3	I10	46.	D	U	1	3	P7, 9
22.	A	U	1	3	J1, 2	47.	B	U	1	3	P7, 12
23.	C	K	1	3	J2	48.	D	H	1	3	P6, 8, 10
24.	D	K	1	3	J2	49.	C	U	1	3	P9, 10
25.	B	K	1	3	J5	50.	B	H	1	3	P11, 1

Multiple Choice = 49 marks

Part B: Written Response

Q	B	C	S	CO	PLO
1.	1	U	6	1	C9, 11, 2, 1
2.	2	U	4	2	E1
3.	3	H	6	2	G1, 3, 4, 7
4.	4	U	6	2, 3	H1; I4
5.	5	U	5	3, 2	I9, 2, 4; B3
6.	6	U	3	3	J1
7.	7	U	4	3	L1, 3, 5
8.	8	U	6	3	N2, 3
9.	9	H	7	3	O1, 2, 3, 4; J12
10.	10	U	3	3	P3

Written Response = 50 marks

Multiple Choice = 49 (49 questions)
Written Response = 50 (10 questions)
EXAMINATION TOTAL = 99 marks

LEGEND:

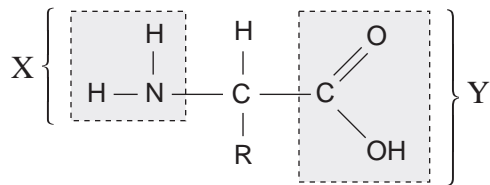
Q = Question Number **B** = Score Box Number **S** = Score
K = Keyed Response **C** = Cognitive Level **CO** = Curriculum Organizer
PLO = Prescribed Learning Outcome

PART B: WRITTEN RESPONSE

Value: 50 marks

Suggested Time: 75 minutes

Use the following diagram to answer question 1.



1. a) Identify each of the following parts of the molecule. **(2 marks: 1 mark each)**

Part X:

- amine group
 - amino group
- } either one for
1 mark

Part Y:

- acid group
 - carboxyl group (acid)
- } either one for
1 mark

b) State **two** different polymers that are synthesized from the molecule and give a function of each. **(4 marks: 1 mark each for polymer; 1 mark each for function)**

Polymer	Function
hemoglobin	<ul style="list-style-type: none"> • transports oxygen <li style="text-align: center;">OR • transports hydrogen ions <li style="text-align: center;">OR • transports carbon dioxide
protein hormone (i.e., insulin)	<ul style="list-style-type: none"> • lowers blood glucose levels
structural proteins	<ul style="list-style-type: none"> • forms muscles / hair / nails (e.g., keratin, myoglobin)
enzymes (e.g., lipase / amylase / trypsin)	<ul style="list-style-type: none"> • catalyzes reactions <li style="text-align: center;">OR • lowers the activation energy <li style="text-align: center;">OR • increases the rate of a reaction

2. Describe how the following are related in terms of their function in protein synthesis.

DNA and mRNA:

(2 marks)

- **DNA serves as a template for the production of mRNA. (1 mark)**
- **mRNA carries a complement of the DNA code to the cytoplasm. (1 mark)**

tRNA and ribosomes:

(2 marks)

- **tRNA brings amino acids to the ribosomes. (1 mark)**
- **Anticodons on tRNA pair with mRNA codons at the ribosomes. (1 mark)**

3. The cells of the thyroid gland are able to take in iodine atoms and may contain iodine concentrations up to 25 times that of the surrounding tissue fluid. In an experiment designed to study factors affecting the rate of iodine intake, thyroid cells were cultured and placed in a medium containing normal blood concentrations of iodine. Temperature and glucose concentrations were varied and the effects recorded. The results of the study are shown in the table below.

Sample	Glucose Concentration (%)	Temperature (°C)	Increase in Iodine Concentration (X)
normal conditions	0.20	38	22
A	0.01	38	12
B	0.20	60	8

- a) Explain the observed results for sample A. (2 marks)

- **The concentration of iodine is lower because iodine is transported by active transport which requires energy. (1 mark)**
- **Since there is less glucose available which fuels ATP (energy) production, less active transport occurs. (1 mark)**

- b) Explain the observed results for sample B. (2 marks)

- **Active transport requires carrier proteins and carrier proteins are denatured at high temperatures (60° C). (1 mark)**
- **Metabolic enzymes needed to produce ATP are denatured which leads to a lack of ATP. (1 mark)**

- c) Explain how the movement of amino acids into the cells would be affected by the conditions in sample B. (2 marks)

- **The rate decreases. (1 mark)**
- **Amino acids are transported by carrier proteins that are denatured. (1 mark)**

4. Describe the pH in each of the following regions along the digestive tract. Identify the secretion which determines the pH of the region and give the source of the secretion.

stomach:

(3 marks)

pH:

- **The pH is low (2–3). (1 mark)**

secretion:

- **hydrochloric acid (HCl) (1 mark)**

source of secretion:

- **gastric glands (1 mark)**

small intestine:

(3 marks)

pH:

- **The pH is high (8–8.5). (1 mark)**

secretion:

- **sodium bicarbonate (NaHCO_3) (1 mark)**

source of secretion:

- **pancreas (1 mark)**

5. For each of the following processes, describe how the small intestine functions to digest food and absorb nutrients.

digestion:

(3 marks)

- contains glands which produce enzymes
- secretes maltase which breaks down maltose
- secretes peptidases which break down peptides
- secretes nucleases which break down nucleic acids to nucleotides
- creates peristaltic waves which aid in mixing of food and enzymes
- length allows time for enzymatic reactions to occur

any three for
1 mark each

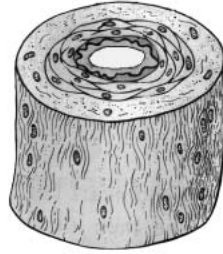
absorption:

(2 marks)

- is warm and moist to increase diffusion
- is very long which increases absorptive area
- intestinal wall is folded to increase absorptive area
- contains millions of villi, which are further covered with microvilli to increase absorptive area
- each villus contains lacteal to absorb the products of lipid digestion
- contains large numbers of capillaries to absorb nutrients into blood

any two for
1 mark each

Use the following diagram to answer question 6.



6. a) Identify the type of blood vessel shown in the diagram.

(1 mark)

- **artery (1 mark)**

b) State **two** functions of the blood vessel in the diagram.

(2 marks)

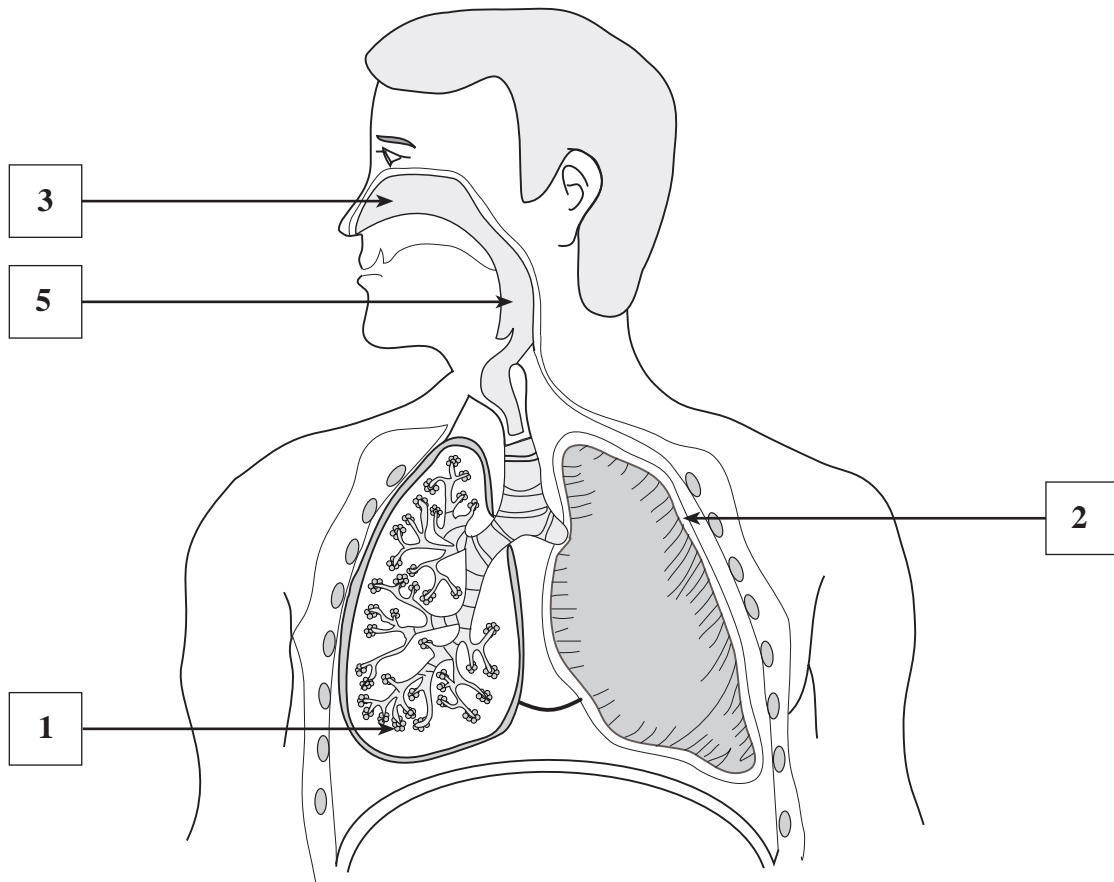
- **maintains blood pressure**
- **carries blood away from the heart**
- **carries nutrients and oxygen to the tissues**
- **controls amount of blood going to various parts of the body**

} any two for
1 mark each

7. Place the correct number for each of the following characteristics in the appropriate box at the locations in the diagram. (Only put one number per box. Not all of the characteristics will be used.)

(4 marks)

1. has stretch receptors
2. prevents collapse of the lungs
3. filters, warms and moistens air
4. stops food from entering the lungs
5. allows food and air to pass through
6. has cilia, cartilaginous rings and mucous membranes



8. a) In what type of situation does the sympathetic nervous system respond?

(1 mark)

- **emergency**
 - **“fight or flight”**
- } **either one for
1 mark**

b) What division is the sympathetic system part of?

(1 mark)

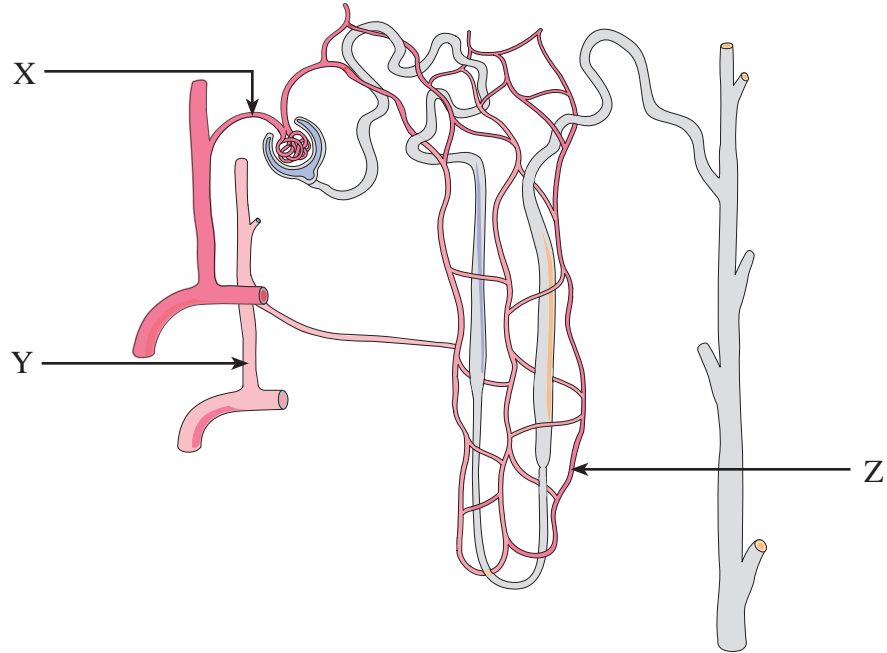
- **autonomic nervous system**
 - **peripheral nervous system**
- } **either one for
1 mark**

c) State **four** effects on the body when the sympathetic nervous system is active.

(4 marks)

- **releases noradrenalin**
 - **increases breathing rate**
 - **causes dilation of the pupils**
 - **inhibits the digestive system**
 - **causes an increase in heart rate**
 - **increases blood flow to the skeletal muscles**
- } **any four for
1 mark each**

Use the following diagram to answer question 9 a) and b).



9. a) Identify the following structures.

(2 marks: 1 mark each)

Structure **X**:

- afferent arteriole (1 mark)

Structure **Z**:

- peritubular capillary (1 mark)

b) In an experiment, fluids were removed at point **X** and at point **Y** and the composition of each sample was analyzed. Describe **three** ways in which the fluid obtained at point **X** is different from the fluid obtained at point **Y**. **(3 marks)**

- **higher concentration of glucose in X and lower in Y (glucose used to produce ATP for active transport in the proximal tubule or amino acids or nucleotides)**
 - **higher concentration of urea at point X (or lower at point Y)**
 - **higher concentration of histamines at point X (excreted by tubular excretion at distal convoluted tubule) than point Y**
 - **higher concentration of antibiotics (e.g. penicillin) at point X than Y (excreted by tubular excretion at distal convoluted tubule)**
 - **higher concentration of uric acid at point X than Y**
- } **any three for 1 mark each**

c) Explain how an increase in blood pressure from 120/80 to 160/100 would increase the volume of urine produced. **(2 marks)**

- **more fluid would be moved from the glomerulus to Bowman's capsule (1 mark)**
- **less antidiuretic hormone (ADH) would be produced and more fluid would be excreted as a result (1 mark)**

10. Give **one** function for each of the following substances found in seminal fluid.

(3 marks: 1 mark each)

Substance	Function
fructose	<ul style="list-style-type: none">• to provide energy source for sperm
prostaglandins	<ul style="list-style-type: none">• to cause uterine contractions
alkaline (basic) fluid	<ul style="list-style-type: none">• to neutralize the acidity of the vagina <p style="text-align: center;">OR</p> <ul style="list-style-type: none">• to provide suitable pH for sperm survival <p style="text-align: center;">OR</p> <ul style="list-style-type: none">• to provide suitable pH for sperm motility

END OF KEY