

# Biology 12

## November 2003 Provincial Examination

### ANSWER KEY / SCORING GUIDE

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#### 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.	D	U	1	1	A1, 3	35.	C	K	1	3	J2, 8
2.	D	H	1	1, 3	A1, 3; E1; L8	36.	C	U	1	3	J2, 4
3.	B	K	1	1	A1	37.	B	H	1	3	J12
4.	A	U	1	1	C2	38.	D	U	1	3	J6; K1
5.	C	K	1	1	C5	39.	C	H	1	3, 2	K6, 1; G7
6.	D	U	1	1	C12	40.	B	H	1	3	K2, 4, 5; N2
7.	B	U	1	1	C10	41.	A	U	1	3	K2, 1
8.	D	H	1	1	C8; A3	42.	D	K	1	3	L1
9.	B	K	1	1	B1, 2	43.	A	K	1	3	L2, 1
10.	C	U	1	1	B3	44.	C	U	1	3	L4, 5
11.	B	H	1	1, 2	D1, 2; E1	45.	D	H	1	3	L8, 7
12.	A	K	1	1	D5	46.	A	U	1	3	M2, 1, 8; N1
13.	C	U	1	1	D2	47.	B	U	1	3	M3
14.	A	U	1	1	D2; A1	48.	B	U	1	3	M3
15.	C	U	1	2	E1	49.	B	H	1	3, 2	M3; G3
16.	B	U	1	2	E1	50.	C	U	1	3	M4
17.	D	K	1	2	G1	51.	D	U	1	3	M5, 6
18.	A	U	1	2, 3	G3; I1	52.	B	U	1	3	M5, 6
19.	D	H	1	2, 1, 3	G3; C12; O2	53.	D	K	1	3	N1, 2
20.	D	K	1	2	G3	54.	A	U	1	3	N4
21.	A	U	1	2	G5	55.	D	U	1	3	N4
22.	C	H	1	2	G6	56.	B	K	1	3	O2
23.	D	U	1	2	H1	57.	B	H	1	3	O2
24.	C	U	1	2	H3	58.	D	U	1	3	O5
25.	A	U	1	2	H1	59.	A	H	1	3	O2
26.	B	K	1	2	H2	60.	A	U	1	3	O2, 1
27.	B	H	1	2	H1, 6	61.	A	K	1	3	P1
28.	B	H	1	2	H6	62.	A	U	1	3	P6, 10
29.	C	U	1	3	I1, 2, 4	63.	D	H	1	3	P7, 9, 10
30.	B	K	1	3	I1, 2, 6	64.	C	H	1	3	P7, 8
31.	C	K	1	3	I1, 7	65.	D	K	1	3	P9
32.	C	H	1	3	I1, 2, 7	66.	D	U	1	3	P11
33.	C	K	1	3	J2	67.	B	U	1	3	P8
34.	C	K	1	3	J2						

**Multiple Choice = 67 marks**

## Part B: Written Response

<b>Q</b>	<b>B</b>	<b>C</b>	<b>S</b>	<b>CO</b>	<b>PLO</b>
1.	1	U	2	1, 2	A1, 3; C12; G3, 5
2.	2	H	2	2	E1, 2
3.	3	U	5	3, 2	I2, 4; G7; H1, 3, 6
4.	4	U	4	3	J5; K1
5.	5	U	4	3	L4, 5
6.	6	U	4	3	O2
7.	7	U	2	3	P5, 6

**Written Response = 23 marks**

Multiple Choice = 67 (67 questions)  
Written Response = 23 (7 questions)  
**EXAMINATION TOTAL = 90 marks**

### **LEGEND:**

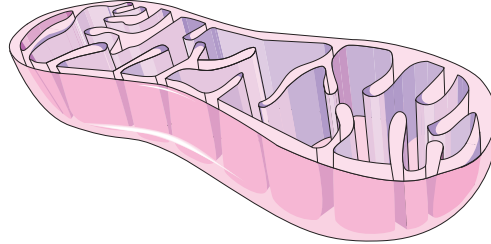
**Q** = Question Number    **B** = Score Box Number    **S** = Score  
**K** = Keyed Response    **C** = Cognitive Level    **CO** = Curriculum Organizer  
**PLO** = Prescribed Learning Outcome

**PART B: WRITTEN RESPONSE**

**Value: 23 marks**

**Suggested Time: 40 minutes**

**Use the following diagram to answer question 1.**



1. Name the product of this organelle that is required in the transport of materials across a cell membrane. Explain the product's role in this process. **(2 marks)**

product: **adenosine triphosphate (ATP) (1 mark)**

explanation:

- **provides energy for active transport**
- **ATP splits into ADP and P, releasing energy. Energy comes from phosphate bond.**

} **either one for  
1 mark**

*Note: Energy is key.*

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

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. Consider the following DNA base sequence read from left to right:

**C C A G G A A T A C C T**

Determine the amino acid sequence that results from this DNA strand.

**(2 marks)**

**glycine—proline—tyrosine—glycine ( $\frac{1}{2}$  mark each)**

3. The following procedure demonstrates the effect of pH on the activity of the enzyme trypsin.

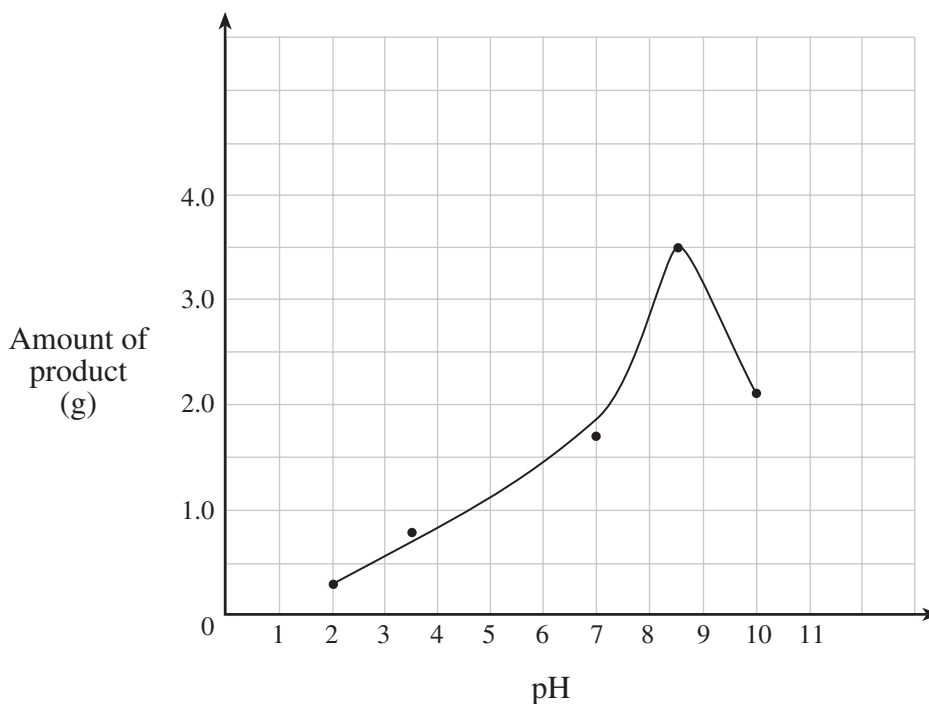
- 10 ml of a protein solution is added to each of five numbered test tubes, each of which is buffered at a different pH.
- The pH of each of the test tubes is maintained.
- An equal amount of a trypsin solution is added to each test tube.
- The temperature is maintained at 37°C.
- Each test tube is analyzed after three hours.

The results are recorded in the table below:

Test Tube	pH	Amount of product (g)
1	2.0	0.3
2	3.5	0.8
3	7.0	1.7
4	8.5	3.5
5	10.0	2.1

a) Use the data from the table to produce a line graph which illustrates the “Amount of product vs. pH” (plot the pH on the x-axis).

(2 marks)



( $\frac{1}{2}$  mark for correct labels on correct axes;  $\frac{1}{2}$  mark for correct scales;  
 $\frac{1}{2}$  mark for correct points;  $\frac{1}{2}$  mark for line)

b) Name the chemical product found in each test tube.

**(1 mark)**

- peptides
  - dipeptides
  - polypeptides
  - amino acid chains
- } any one for  
1 mark

c) Explain why less product is found in test tubes **1** and **2** than in the others.

**(1 mark)**

- **Low pH (acidic) conditions denature the enzyme trypsin so it is unable to speed the reactions.**
  - **It is not the optimum pH for the enzyme to function.**
  - **The active site is denatured, so the substrate is unable to fit.**
- } any one for  
1 mark

d) Name an enzyme that could further digest the product found in each of the test tubes.

**(1 mark)**

- **peptidase (1 mark)**

4. Compare the chemical composition of the blood in the right atrium of a fetus to the blood in the right atrium of an adult. Give reasons for these differences.

(4 marks: 2 marks for the comparisons; 2 marks for the reasons)

<b>Fetus</b>	<b>Adult</b>	
<ul style="list-style-type: none"><li>• lower dissolved carbon dioxide</li><li>• lower carbaminohemoglobin</li><li>• lower carbonic acid</li><li>• higher pH</li><li>• lower reduced hemoglobin</li><li>• higher oxyhemoglobin</li><li>• higher glucose</li><li>• higher amino acids</li><li>• lower urea</li><li>• lower histamine</li><li>• lower nitrogen containing waste</li><li>• higher sodium concentration</li></ul>	<ul style="list-style-type: none"><li>• higher dissolved carbon dioxide</li><li>• higher carbaminohemoglobin</li><li>• higher carbonic acid</li><li>• lower pH</li><li>• higher reduced hemoglobin</li><li>• lower oxyhemoglobin</li><li>• lower glucose</li><li>• lower amino acids</li><li>• higher urea</li><li>• higher histamine</li><li>• higher nitrogen containing waste</li><li>• lower sodium concentration</li></ul>	} any two for 1 mark each

**AND**

**Reasons:**

- The fetal right atrium receives blood which recently returned from the systemic system and the placenta (1 mark) whereas in the adult the right atrium receives blood returning from the systemic system (1 mark).

**OR**

- Adult has lower oxygen concentration and higher carbon dioxide concentration because it hasn't been to the lungs yet for oxygenation. (1 mark)

5. Describe the process of exhalation.

(4 marks)

- **The stretch receptors in the alveoli send signals to the medulla oblongata.**
- **The medulla oblongata stops the signals to the diaphragm and the intercostal muscles.**
- **The diaphragm relaxes.**
- **The rib muscles relax.**
- **The ribcage moves down and inwards.**
- **Air is pushed out of the lungs as the thoracic cavity decreases in size.**
- **Decreased size of the thoracic cavity results in increased pressure to force air out.**
- **The diaphragm moves up (back to dome shaped).**
- **The elastic lungs recoil to push the air out.**

any four for  
1 mark each



6. Many substances are moved by active transport in the nephron. Using **four** examples, explain how active transport is involved in urine production. **(4 marks)**

- excretion of penicillin in distal convoluted tubule
- excretion of histamines in distal convoluted tubule
- excretion of hydrogen ions in distal convoluted tubule
- excretion of uric acid at the distal convoluted tubule
- excretion of creatinine at the distal convoluted tubule
- excretion of ammonia at the distal convoluted tubule
- re-absorption of glucose in proximal convoluted tubule
- re-absorption of sodium ions in proximal convoluted tubule
- re-absorption of amino acids in proximal convoluted tubule
- active transport of sodium ions into medulla in loop of Henle

} any four for  
1 mark each

7. Describe how the hypothalamus increases testosterone levels in the blood.

(2 marks)

- The hypothalamus senses the low concentration of testosterone and secretes a releasing hormone.
- The anterior pituitary is stimulated to secrete LH (luteinizing hormone).
- LH stimulates the testes to secrete testosterone.

} any two for  
1 mark each

**OR**

- The hypothalamus secretes GnRH to the (anterior) pituitary.
- The (anterior) pituitary secretes LH to the testes.
- LH stimulates the interstitial cells to produce testosterone.

} any two for  
1 mark each

**END OF KEY**