

# Biology 12

## January 2000 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 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.	D	K	1	A1	26.	C	K	3	L1, 2
2.	A	U	1	A1	27.	B	K	3	L1
3.	D	K	1	A1	28.	A	K	3	L4, 5
4.	D	H	1, 2	A1, 2, 3; E1	29.	A	K	3	L8
5.	D	H	1, 3	A1, 3; L7	30.	D	U	3	M1, 2
6.	A	H	1	B1, 2	31.	B	H	3, 1, 2	M3; C12; G3
7.	C	H	1	C1, 9, 2, 10	32.	B	U	3	M3
8.	C	H	1	C2, 8	33.	A	K	3	M5, 6, 8
9.	D	U	1	D3, 4	34.	A	K	3	N1, 2
10.	B	H	2	F1	35.	A	U	3	M3
11.	A	K	2	F2	36.	D	K	3	N4
12.	D	U	2	F3, 4	37.	D	K	3	N4
13.	C	H	2, 3	G1; J11	38.	A	K	3	O1
14.	C	U	2, 1	G1; C8	39.	D	U	3	O1, 2
15.	C	U	2	G2	40.	A	U	3	O2
16.	B	U	2	G3	41.	A	K	3	O2
17.	B	H	2, 1	G6, 3; A3	42.	A	U	3	O3
18.	C	H	2	G8	43.	D	H	3	O4; N5
19.	D	K	3	I1	44.	B	K	3	O5; N4, 5; L6
20.	C	U	3	I1	45.	C	U	3	O5, 2
21.	B	K	3	I1, 2, 4	46.	C	K	3	P1
22.	B	U	3	I5	47.	B	K	3	P3
23.	C	U	3	J2, 6	48.	D	U	3	P7, 9
24.	D	K	3	J9	49.	C	U	3	P7, 9
25.	A	U	3	L1	50.	D	K	3	P12

**Multiple Choice = 50 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	K	2	1	C6, 5
2.	2	K	3	1	D5, 1
3.	3	U	4	2	E1
4.	4	H	7	2	H2, 3, 6; G7
5.	5	U	6	3	I6, 7
6.	6	U	6	3	J9, 11; K3, 4; N2
7.	7	U	6	3	J12, 7
8.	8	U	3	3	L5, 6, 8
9.	9	U	3	3, 2	M5, 6, 3; G5
10.	10	U	4	3	O2
11.	11	U	6	3	P1, 5, 6, 8, 10, 11

**Written Response = 50 marks**

Multiple Choice = 50 (50 questions)  
Written Response = 50 (11 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**

- 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. State **two** biological functions of glucose in living organisms.

**(2 marks)**

- **As markers on cell surface.**
- **As a building block of cellulose (forms plant cell walls).**
- **As a source of energy to produce ATP in the process of cellular respiration.**
- **As a building block of starch.**
- **As a building block of glycogen.**

} any two for  
1 mark each

2. Using the chart below, contrast DNA and mRNA.

**(3 marks: 1 mark for each contrasting pair)**

	DNA	mRNA
TYPE OF SUGAR	<b>deoxyribose sugar</b>	<b>ribose sugar</b>
NUMBER OF STRANDS	<b>two</b>	<b>one</b>
BASES	<b>C, G, A, T</b>	<b>C, G, A, U</b>

3. Describe **one** way in which each of the following pairs of molecules are functionally related in the process of protein synthesis. **(4 marks: 1 mark each)**

DNA and mRNA:

- mRNA is produced from the DNA code during transcription.
  - mRNA carries the DNA code into the cytoplasm.
- } either one for  
1 mark

mRNA and tRNA:

- tRNA attaches complementarily to the mRNA during translation. (1 mark)

tRNA and amino acids:

- tRNA brings amino acids to the ribosome for protein synthesis.
  - a specific tRNA binds to a specific amino acid.
- } either one for  
1 mark

protein and rRNA:

- rRNA and protein form the ribosome structure.
  - Protein is manufactured at the ribosomes which are made of rRNA.
- } either one for  
1 mark

4. An experiment was conducted to measure the effects of the presence of thyroxin and temperature on oxygen use in human tissue cells. Two tissue samples were prepared as shown below.

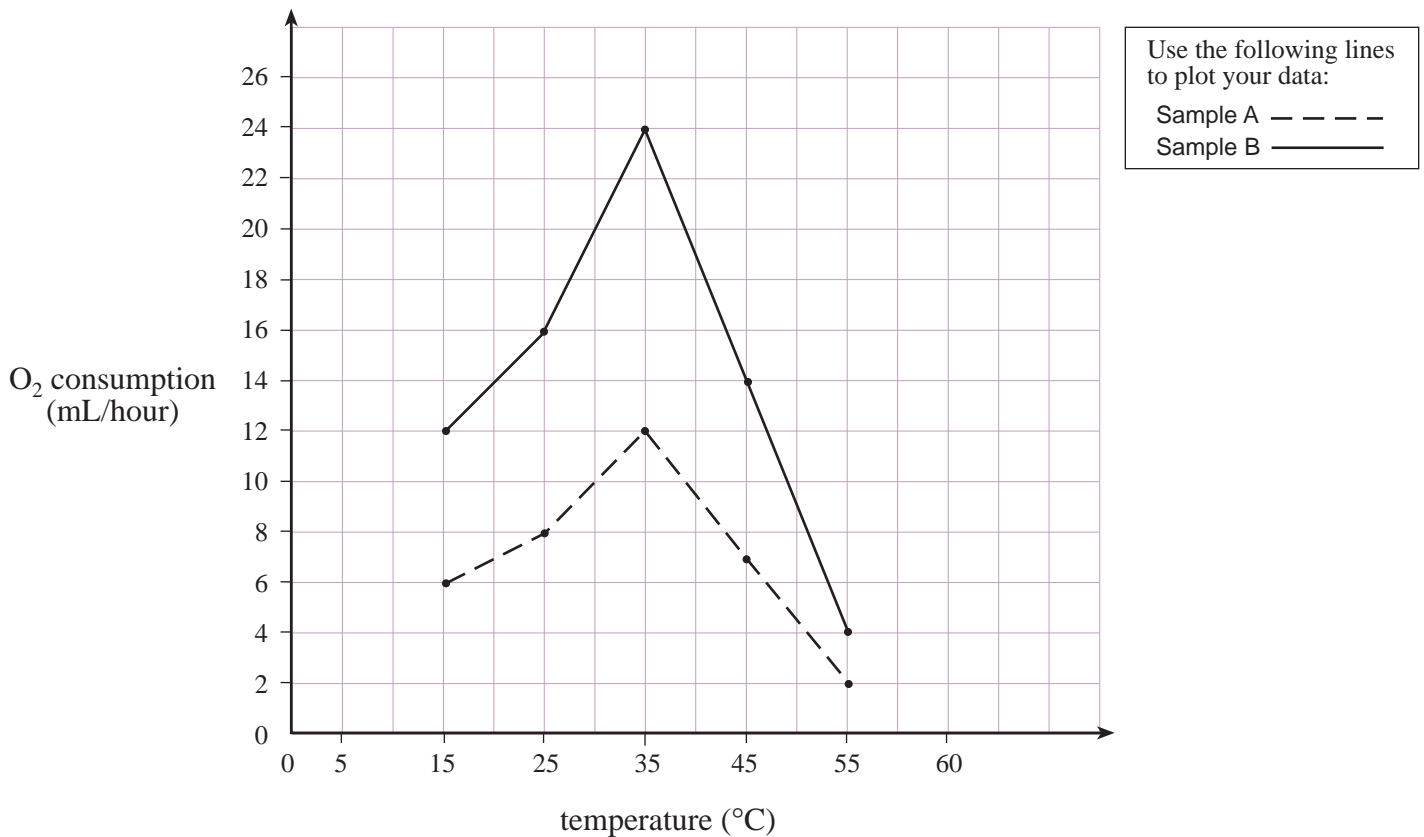
Sample A: 50 grams of muscle tissue was added to a nutrient solution.

Sample B: 50 grams of muscle tissue was added to a thyroxin and nutrient solution.

Oxygen consumption was measured at various temperatures. The results are shown below.

Temperature (°C)	Consumption of oxygen (mL/hour)	
	Sample A muscle tissue	Sample B muscle tissue + thyroxin
15°C	6	12
25°C	8	16
35°C	12	24
45°C	7	14
55°C	2	4

- a) Use the grid provided to graph the data in the table above. Label the  $x$ -axis as temperature. **(2 marks: 1 mark for correct scale and labels; 1 mark for plotting and lines)**



b) Based on your graph of the data for sample **B**, predict the amount of oxygen consumed per hour at 20°C. (1 mark)

- **13 – 14 mL/hour**

c) Explain the difference observed in the results of samples **A** and **B**. (1 mark)

- **Thyroxin increases the consumption of oxygen (metabolic rate). (1 mark)**

d) Explain the results for sample **B** at each of the following temperatures. (3 marks: 1 mark each)

15°C:

- **The particles move slowly so that the metabolic rate is low resulting in little oxygen being consumed. (1 mark)**

35°C:

- **The temperature is near optimum for the hormone function and therefore metabolic rate is high in sample B. This leads to high oxygen consumption. (1 mark)**

55°C:

- **The hormone has begun to denature so the metabolic rate slows and oxygen consumption is lower.**
  - **The enzymes in the muscle tissue have begun to denature.**
- } either one for 1 mark

5. Explain how the liver is involved in each of the following processes.

digestion of fat:

(2 marks)

- **The liver produces bile (1 mark) which emulsifies (increases surface area of) fat in the duodenum of the small intestine (1 mark).**

maintenance of blood glucose levels:

(2 marks)

- **The liver converts glucose to glycogen (1 mark) which lowers blood sugar levels (1 mark).**

**OR**

- **The liver converts glycogen to glucose (1 mark) which raises blood sugar levels (1 mark).**

maintenance of healthy blood:

(2 marks)

- **The liver breaks down worn-out red blood cells.**
- **The liver makes blood proteins from amino acids.**
- **The liver detoxifies the blood by removing toxins such as alcohol.**

} any two for  
1 mark each



6. How does the circulatory system respond to each of the following?

an antigen enters the blood:

(2 marks)

- **White blood cells produce antibodies that inactivate the antigen. (1 mark)**
- **White blood cells phagocytize the antigen. (1 mark)**

**Note to markers:** *2 marks may be awarded for a detailed response.*

increased stimulation by the sympathetic nervous system:

(2 marks)

- **Heart rate increases resulting in higher blood pressure. (1 mark)**
- **Arterioles constrict resulting in higher blood pressure. (1 mark)**

**Note to markers:** *2 marks may be awarded for a detailed response.*

hardening of the arteries (inability of arteries to expand and recoil):

(1 mark)

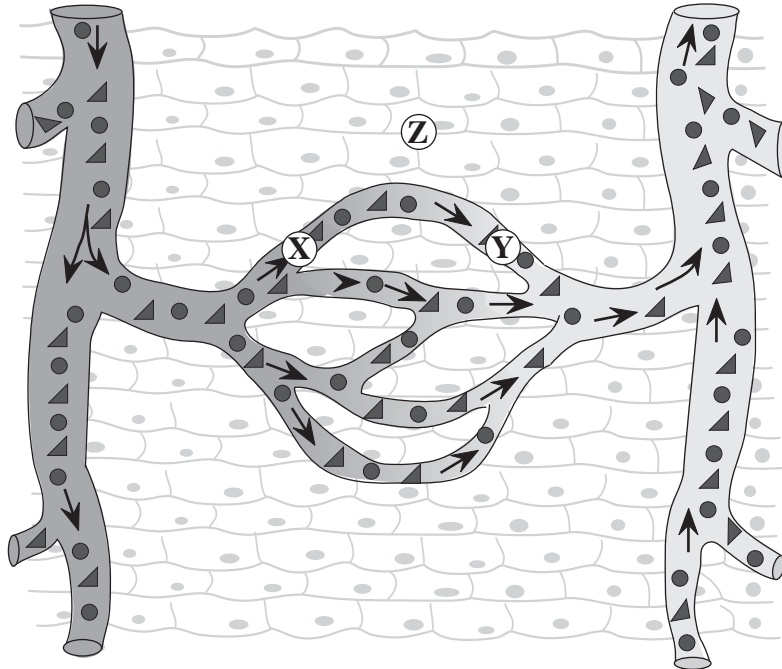
- **Heart rate increases to raise blood pressure. (1 mark)**

a cut on your finger:

(1 mark)

- **Platelets release a clotting protein to help seal the wound. (1 mark)**

Use the following diagram to answer question 7.



7. a) Describe the capillary-tissue fluid exchange

at X.

(2 marks)

- Plasma, carrying nutrients, oxygen and hormones, leaves the capillaries. (1 mark)
- This occurs because the blood pressure is higher than the osmotic pressure. (1 mark)

at Y.

(2 marks)

- Tissue fluid, containing wastes and secretions from the cells, enters the capillaries. (1 mark)
- This occurs because osmotic pressure is greater than blood pressure. (1 mark)

b) Describe what is occurring at Z between the tissue fluid and the cells.

(2 marks)

- Oxygen and nutrient molecules enter the cells.
- This occurs by diffusion, facilitated transport and active transport.
- Wastes and carbon dioxide leave the cells.
- This occurs by diffusion (along a concentration gradient).

} any two for  
1 mark each

8. a) How does an increase in the concentration of carbon dioxide in the blood affect the breathing rate?

**(1 mark)**

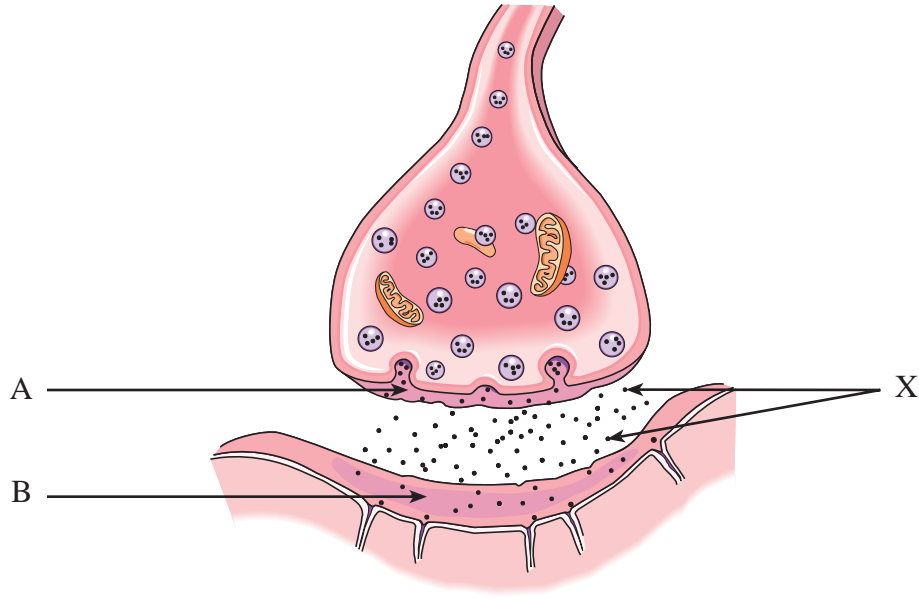
- **The breathing rate increases. (1 mark)**

b) Where is an increase in the concentration of carbon dioxide in the blood detected?  
Explain how the body responds to return carbon dioxide concentration to normal levels.

**(2 marks)**

- **The medulla oblongata detects an increase in carbon dioxide concentration. (1 mark)**
- **The medulla oblongata then sends out a nerve impulse that increases the rate of contractions of the diaphragm and intercostal muscles. (1 mark)**

Use the following diagram to answer question 9.



9. a) Identify the process by which the molecules labelled **X** leave the cell. **(1 mark)**

- **exocytosis (1 mark)**

b) How do the molecules travel from membrane **A** to membrane **B**? **(1 mark)**

- **diffusion (1 mark)**

c) Describe the effect of these molecules on membrane **B**. **(1 mark)**

- **cause increased permeability to  $\text{Na}^+$  (1 mark)**

10. Describe the process which occurs at each of the following structures.

**(4 marks: 1 mark each)**

Bowman's capsule:

- **pressure filtration of the blood (1 mark)**

proximal convoluted tubule:

- **reabsorption of nutrients and water (1 mark)**

collecting duct:

- **reabsorption of water**
  - **regulation of pH**
- } **either one for  
1 mark**

loop of Henle:

- **reabsorption of water**
  - **absorption of salt**
- } **either one for  
1 mark**

11. Give **one** function of each of the following hormones.

**(6 marks: 1 mark each)**

testosterone:

- **causes sperm maturation**
  - **promotes the normal development of the primary sex organs**
  - **brings about and maintains the secondary sex characteristics in males**
- } **any one for 1 mark**

follicle-stimulating hormone:

- **stimulate the follicle to produce estrogen**
  - **initiates egg maturation and sperm production**
  - **promotes spermatogenesis in the seminiferous tubules**
- } **any one for 1 mark**

luteinizing hormone:

- **promotes ovulation**
  - **controls testosterone levels**
  - **controls sex hormone production**
  - **stimulates the corpus luteum to produce progesterone**
- } **any one for 1 mark**

estrogen:

- **stimulates growth of the endometrium (begins the development of the uterine lining)**
  - **causes female secondary sex characteristics**
- } **any one for 1 mark**

progesterone:

- **stimulates growth of the endometrium**
  - **causes the endometrium to become secretory**
  - **causes the uterine glands to mature, producing a thick mucoid secretion**
  - **brings about and maintains the secondary sex characteristics in females**
- } **any one for 1 mark**

oxytocin:

- **causes the uterus to contract during childbirth**
  - **stimulates the release of milk from the mother's mammary glands**
- } **either one for 1 mark**

**END OF KEY**