

# Biology 12

## August 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.	B	K	1	1	A1; C1	26.	A	U	1	3	K1
2.	B	U	1	1	A1, 2, 3	27.	A	U	1	3	K1; J6, 4
3.	A	U	1	1	B3; C9	28.	A	U	1	3	K3; N2
4.	C	K	1	1	C3	29.	C	U	1	3	L2, 1
5.	B	H	1	1	C5, 6	30.	A	K	1	3	L3, 1
6.	D	K	1	1	C10	31.	C	U	1	3	L4, 5
7.	D	K	1	1	D1	32.	C	H	1	3	M1, 2, 5
8.	A	U	1	1	D1, 2	33.	A	H	1	3	M3
9.	C	U	1	1	D1, 2	34.	C	H	1	3	M3, 5
10.	D	H	1	1	D1	35.	B	K	1	3	M7
11.	C	H	1	2	F1	36.	A	K	1	3	M4, 3
12.	B	K	1	2	F4	37.	C	U	1	3	O1, 2
13.	C	U	1	2	H1, 6	38.	D	U	1	3	O2
14.	D	K	1	2	H1, 4	39.	A	K	1	3	O1
15.	C	K	1	3	I1; L1	40.	A	U	1	3	O1, 2
16.	B	K	1	3	I1, 10	41.	A	U	1	3	O2
17.	D	H	1	3, 2	I2; G7; J2	42.	A	K	1	3	O4
18.	A	K	1	3, 1	I2, 4; C1	43.	D	U	1	3	P1, 2
19.	B	K	1	3, 1	I2, 4; B3	44.	B	U	1	3	P1, 5
20.	C	U	1	3	I5	45.	D	K	1	3	P1
21.	A	U	1	3	I6, 1	46.	D	K	1	3	P1
22.	B	U	1	3	I3	47.	D	K	1	3	P1
23.	C	H	1	3	J1	48.	A	U	1	3	P7
24.	B	U	1	3	J2	49.	B	H	1	3	P7, 10
25.	B	U	1	3	J12, 7; O2	50.	C	H	1	3	P10

**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	4	1, 2	A1, 2, 3; E1
2.	2	U	3	1	B1
3.	3	K	4	2	E1
4.	4	U	7	2	G2, 3, 4, 6
5.	5	U	4	2	H1, 3
6.	6	U	4	3	I9
7.	7	U	3	3	J8
8.	8	K	4	3	K2
9.	9	U	5	3	L7, 8
10.	10	U	6	3	N2, 3
11.	11	H	4	3	O5
12.	12	U	2	3	P9

**Written Response = 50 marks**

Multiple Choice = 50 (50 questions)  
Written Response = 50 (12 questions)  
**EXAMINATION TOTAL = 100 marks**

### **LEGEND:**

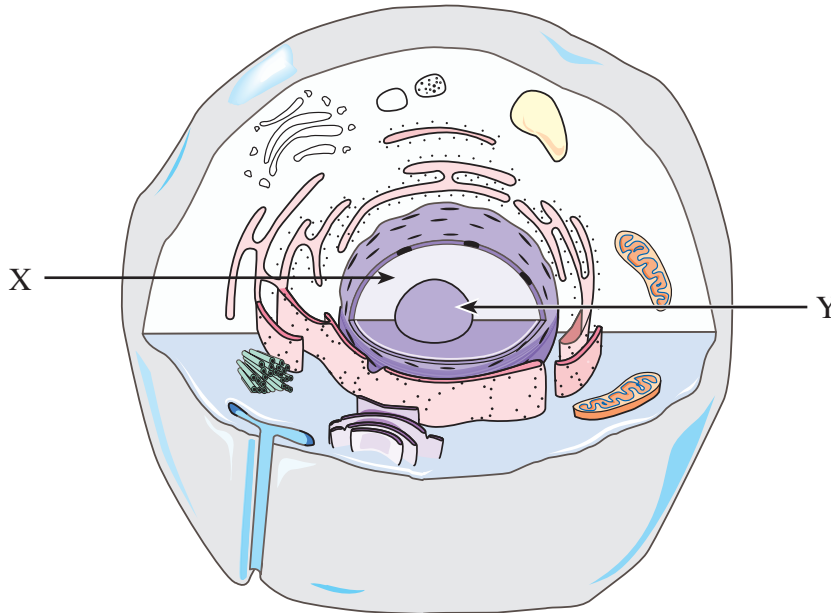
**Q** = Question Number    **B** = Score Box Number    **S** = Score  
**K** = Keyed Response    **C** = Cognitive Level    **CO** = Curriculum Organizer  
**PLO** = Prescribed Learning Outcome

**PART B: WRITTEN RESPONSE**

**Value: 50 marks**

**Suggested Time: 75 minutes**

Use the following diagram to answer question 1.



1. Name structures **X** and **Y** and explain how each functions in protein synthesis.  
(4 marks: 1 mark each for structure; 1 mark each for function)

structure **X**:

name:

- nucleus
  - nucleoplasm
- } either one for  
1 mark

function:

- The nucleus is the site of production of mRNA (or transcription).
  - It contains DNA which contains the code for amino acid sequence in protein.
  - DNA code is transcribed into codons or mRNA or amino acid sequence.
- } any one for  
1 mark

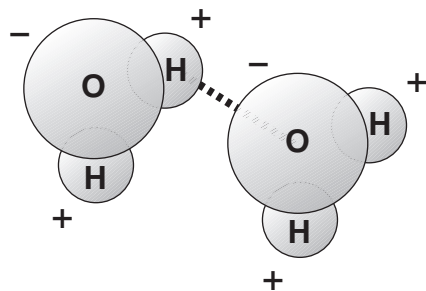
structure **Y**:

name: nucleolus (1 mark)

function:

- The nucleolus is the site of the production of rRNA.
  - The nucleolus forms ribosomal subunits.
  - Ribosomes are the site of protein synthesis.
  - The nucleolus produces ribosomes.
- } any one for  
1 mark

2. Draw a diagram showing the bonding between water molecules and explain how the structure of the water molecules allows these bonds to form. (You may use a pencil for your diagram.)  
(3 marks: 1 mark for diagram; 2 marks for explanation)



(1 mark for diagram)

- Water molecules are polar.
- Electrons are shared unequally between the oxygen and the hydrogen.
- The oxygen has a slight positive charge and the hydrogen has a slight negative charge.
- Opposite polarities (charges) attract each other.

OR

- Bond forms between the positive end of one molecule and the negative end of another molecule. (2 marks)

} any two for  
1 mark each

3. Describe how each of the following contributes to the production of a protein.

**(4 marks)**

DNA:

- **involved in transcription**
- **serves as a template for mRNA production**
- **contains or carries the genetic information for the protein to be produced**
- **contains the code which determines the sequence of a protein**
- **DNA code determines the mRNA codons**

} **any one for  
1 mark**

codon:

- **determines the specific amino acid**
- **carries the information from the nucleus to the cytoplasm**
- **binds with the anticodon on tRNA**

} **any one for  
1 mark**

tRNA:

- **joins to mRNA through complimentary base pairing**
- **carries a specific amino acid to the ribosome**
- **carries a specific amino acid to the mRNA strand**
- **has anticodon for specific amino acid**

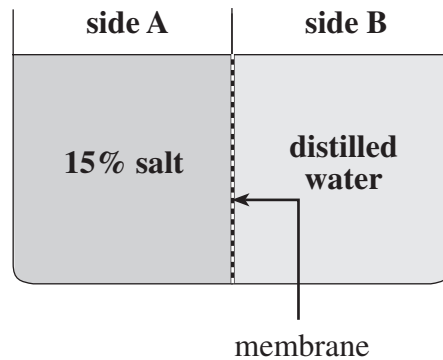
} **any one for  
1 mark**

ribosome:

- **is the site of protein synthesis**
- **binds to the mRNA strand**
- **is where translation occurs**

} **any one for  
1 mark**

Use the following diagram to answer question 4.



4. An experiment was carried out to study the movement of molecules through a membrane. Two solutions were placed into a container on either side of a membrane which is permeable to salt and water. The temperature was maintained at 40°C.

a) Describe what happens to the volume of the solution on both side **A** and side **B** after five hours. Explain your answer. (2 marks)

• **Volume stays the same because both salt and water permeable. (2 marks)**

• **The volume of water on side A increases.**  
• **The volume of water on side B decreases.** } either one for 1 mark

• **Water moves from an area of lower solute concentration on side B to an area of higher solute concentration on side A, causing the level of the solution to rise on side A.**  
• **Water moves to a hypertonic environment.**  
• **Side B is hypotonic which causes water to leave it.**  
• **The solution can eventually be isotonic.** } any one for 1 mark

b) Describe what happens to the solute concentration on side **B**. Explain your answer. (3 marks)

• **The solute concentration will increase on side B. (1 mark)**  
• **Salt diffuses from side A to side B, increasing the solute concentration. (1 mark)**  
• **Water diffuses from side B to side A, reducing the amount of water and increasing the solute concentration. (1 mark)**

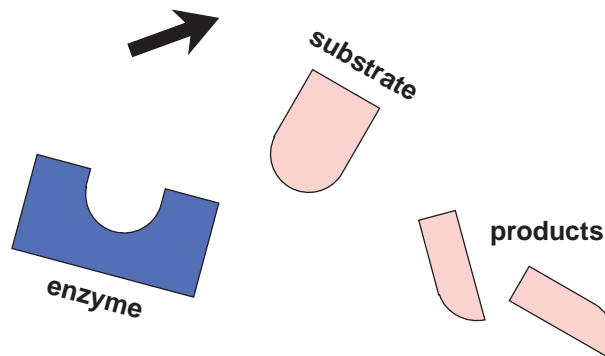
c) If the temperature at the beginning of the experiment was at 5°C, describe how the results obtained at 5°C would be different from the results obtained at 40°C. Explain your answer.

**(2 marks)**

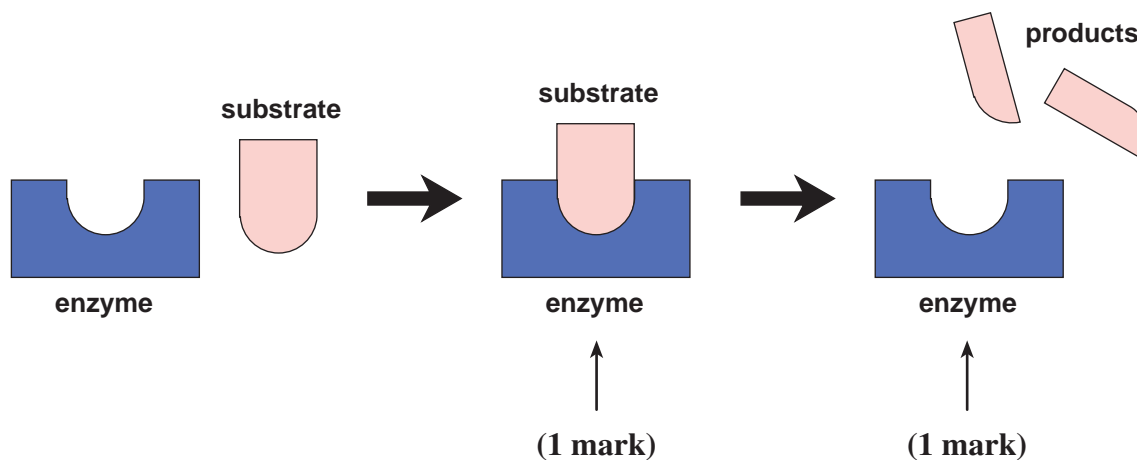
- **The experiment would take longer for the same results.**
- **The water levels change more slowly.**
- **Less kinetic energy would slow the rate of diffusion / particles would move more slowly.**
- **There would be fewer collisions.**

} **any two for  
1 mark each**

Use the following symbols to answer question 5.



5. Using **all** of the symbols above as often as necessary, produce a diagram to illustrate how enzymes function. Explain your diagram. (You may use a pencil for your diagram.)  
**(4 marks: 2 marks for diagram; 2 marks for explanation)**



(Note: First step is not required in the diagram. The diagram does not need to be labelled.)

- substrate attaches to enzyme (at active site) and an enzyme-substrate complex is formed
- product is formed from substrate
- products are released
- enzyme is re-used
- enzyme decreases the activation energy
- active site is specific to the enzyme OR substrate fits into active site
- reaction occurs

any two for  
1 mark each



6. Explain how the small intestine is specialized for the absorption of nutrients.

**(4 marks)**

- **The surface area of the small intestine is large due to its length.**
- **The numerous villi increase the surface area of the small intestine.**
- **The inside of each villus contains capillaries to absorb nutrients.**
- **The inside of each villus contains a lacteal (lymph capillary) to absorb fats.**
- **The numerous microvilli increase the surface area of the small intestine.**
- **Thin epithelium, moist, warm which speeds up diffusion / absorption.**
- **There are more mitochondria in cells to provide energy for active transport.**
- **The small intestine has folds.**
- **Peristalsis increases the surface area of the food.**

**any four for  
1 mark each**

7. Describe **three** roles of the lymphatic system.

**(3 marks)**

- **The lymphatic capillaries pick up excess tissue fluid and return it to the blood system.**
- **The lymph nodes purify the lymph of any infectious organisms or debris through the action of white blood cells.**
- **The lymph capillaries (lacteals) absorb fats in the intestinal villi and transport them to the blood stream.**
- **The lymphocytes produce antibodies.**
- **The spleen purifies the blood.**
- **Red bone marrow produces red and white blood cells.**
- **Produces histamine as part of the inflammatory reaction.**
- **Spleen acts as a blood reservoir.**
- **Fights infection.**

**any three for  
1 mark each**

8. Complete the following table.

(4 marks: 1 mark each for location; 1 mark each for function)

Structure	Location in the heart	Function
Sinoatrial (SA) node	<ul style="list-style-type: none"><li>• <b>in upper wall of right atrium</b></li><li>• <b>right atrium</b></li></ul>	<ul style="list-style-type: none"><li>• <b>sends nerve impulses to the AV node</b></li><li>• <b>acts as pacemaker</b></li><li>• <b>causes both atria to contract</b></li><li>• <b>initiates the heartbeat</b></li></ul>
Purkinje fibres	<ul style="list-style-type: none"><li>• <b>throughout muscle tissue surrounding both ventricles</b></li><li>• <b>ventricles</b></li><li>• <b>ventricular walls</b></li><li>• <b>septum</b></li></ul>	<ul style="list-style-type: none"><li>• <b>deliver impulse from AV node to walls of ventricles, cells of ventricles and muscle cells of ventricles</b></li><li>• <b>cause ventricles to contract</b></li></ul>

9. a) Compare the pH and temperature of the blood in the lung capillaries with the blood in the capillaries of other body tissues. (2 marks)

- The lungs have a higher (7.4) pH / the tissues have a lower (7.38) pH.
  - The lungs are more basic / less acidic.
  - The tissues are more acidic / less basic.
- } any one for 1 mark

AND

- The lungs have a lower (cooler) temperature / the tissues have a higher (warmer) temperature. (1 mark)

b) How does the pH and temperature of the blood in the body tissues affect the ability of oxygen to bind to hemoglobin? (1 mark)

- Oxygen is released more readily from hemoglobin due to the lower pH and the higher temperature.
  - Hemoglobin is denatured and releases oxygen at a lower pH and a higher temperature.
- } either one for 1 mark

c) How would the conditions of the blood in the body tissues change during strenuous exercise? (2 marks)

- pH would decrease
  - temperature would increase
  - more oxygen released from hemoglobin
  - decreased oxyhemoglobin ( $\text{HbO}_2$ ) in blood
  - greater concentration of bicarbonate ions in blood
  - increased carbaminohemoglobin ( $\text{HbCO}_2$ ) produced
  - more reduced hemoglobin (HHb) would be produced
  - increased lactic acid concentration
  - increased hydrogen ions ( $\text{H}^+$ )
  - more waste ( $\text{CO}_2$ )
  - sweating causes decreased blood volume
  - blood velocity increases
  - increased solute concentration due to sweating
- } any two for 1 mark each

10. Identify the division of the autonomic nervous system that is involved in the “fight or flight” response. (1 mark)

- **sympathetic division (1 mark)**

b) Identify the hormone involved in the “fight or flight” response, name its source gland, and give **three** effects that the hormone has on the body.  
**(5 marks: 1 mark for hormone; 1 mark for source gland; 3 marks for effects)**

hormone:

- **adrenalin**
  - **noradrenalin**
  - **epinephrine**
  - **norepinephrine**
- } any one for  
1 mark

source gland:

- **adrenal gland**
  - **adrenal medulla**
- } either one for  
1 mark

effects:

- **dilated pupils**
  - **increased heart rate**
  - **increased blood flow to the skeletal muscles**
  - **decreased blood flow to the digestive system**
  - **increased blood pressure**
  - **increased metabolic rate (cellular respiration)**
  - **increased blood glucose level (released by liver)**
  - **increased conversion of glycogen to glucose by liver**
  - **increased release of glucagon by pancreas**
  - **increased respiration**
  - **inhibits flow of saliva**
  - **inhibits peristalsis and secretion in gut**
  - **dilates bronchi**
  - **bladder voids / releases**
  - **constriction of skin blood vessels**
  - **muscles tense up**
  - **can perform feats of strength**
  - **heightened senses make person more alert to stimuli**
  - **inhibits tears**
  - **decreases urine production**
- } any three for  
1 mark each

11. Describe how the secretion of each of the following will affect the composition of blood.  
(4 marks: 2 marks each)

aldosterone:

- sodium ion concentration will increase
- potassium ion concentration will decrease
- the amount of water in the blood will increase
- $\text{Cl}^-$  concentration will increase
- salt in blood increases
- retention of  $\text{Na}^+$  AND excretion of  $\text{K}^+$
- $\text{H}_2\text{O}$  is reabsorbed to increase blood pressure or volume

any two for  
1 mark each

antidiuretic hormone:

- the amount of water in the blood will increase
- blood will become more dilute / solute concentration drops
- blood becomes hypotonic
- $\text{H}_2\text{O}$  reabsorption causes blood volume to increase

any two for  
1 mark each

12. Explain what happens to the uterine lining during the first five days of the uterine cycle and explain why this occurs.

(2 marks)

- **Menses occur / menstruation.**
- **The uterine lining / endometrium is sloughed off with blood flow.**
- **This occurs because the corpus luteum degenerates.**
- **The corpus luteum stops secreting progesterone and estrogen.**
- **Low levels of female sex hormones.**

} **either one for  
1 mark**

} **any one for  
1 mark**

**END OF KEY**