

# Biology 12

## November 2001 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 | U | 1 | 1    | A1, 3     | 26. | A | K | 1 | 3    | J5               |
| 2.  | A | U | 1 | 1    | A1, 3     | 27. | B | H | 1 | 3    | J6, 1            |
| 3.  | D | U | 1 | 1    | A1; C2    | 28. | A | U | 1 | 3    | J9               |
| 4.  | B | U | 1 | 1    | A1, 3     | 29. | D | K | 1 | 3    | J12              |
| 5.  | D | U | 1 | 1    | B1        | 30. | B | U | 1 | 3    | K1               |
| 6.  | C | K | 1 | 1    | B2        | 31. | D | U | 1 | 3    | K1, 6            |
| 7.  | B | U | 1 | 1    | C3, 4     | 32. | A | K | 1 | 3    | K2               |
| 8.  | D | U | 1 | 1    | C1, 2     | 33. | A | K | 1 | 3    | L2               |
| 9.  | A | K | 1 | 1    | C12; A1   | 34. | B | U | 1 | 3    | L3               |
| 10. | C | H | 1 | 1    | D2        | 35. | D | K | 1 | 3    | L6               |
| 11. | A | U | 1 | 2    | E1        | 36. | B | H | 1 | 3, 2 | L7, 1; G3, 7; J2 |
| 12. | A | H | 1 | 2    | E2        | 37. | B | U | 1 | 3    | L6, 7, 8         |
| 13. | A | K | 1 | 2    | F1        | 38. | B | U | 1 | 3    | M2, 8            |
| 14. | C | U | 1 | 2    | F1        | 39. | B | K | 1 | 3    | M5, 6            |
| 15. | B | U | 1 | 2    | F3, 4, 5  | 40. | D | U | 1 | 3    | N2, 3            |
| 16. | D | H | 1 | 2    | G1, 3     | 41. | D | H | 1 | 3    | N4               |
| 17. | D | U | 1 | 2    | G6        | 42. | C | H | 1 | 3    | N4               |
| 18. | B | H | 1 | 2    | H3        | 43. | D | H | 1 | 3    | O4, 5            |
| 19. | C | U | 1 | 3    | I1; J8    | 44. | A | H | 1 | 3    | O2               |
| 20. | D | U | 1 | 3    | I1        | 45. | B | U | 1 | 3    | O5               |
| 21. | C | H | 1 | 3, 2 | I2; G3    | 46. | D | U | 1 | 3    | P1               |
| 22. | C | U | 1 | 3    | I2        | 47. | A | U | 1 | 3    | P1               |
| 23. | B | H | 1 | 3, 1 | I5, 1; C5 | 48. | B | U | 1 | 3    | P2               |
| 24. | D | K | 1 | 3    | J2        | 49. | C | K | 1 | 3    | P7               |
| 25. | C | U | 1 | 3    | J4; K1    | 50. | C | K | 1 | 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        | 3        | 1         | A1                          |
| 2.       | 2        | U        | 4        | 2, 1      | E1; D2                      |
| 3.       | 3        | U        | 4        | 2         | G3, 5                       |
| 4.       | 4        | U        | 6        | 2, 3      | H6, 7; G7; I2               |
| 5.       | 5        | U        | 5        | 3         | I7; J7                      |
| 6.       | 6        | H        | 8        | 3, 2      | J2, 12; L7, 8; G7; I1, 5, 9 |
| 7.       | 7        | U        | 8        | 3         | M3, 4                       |
| 8.       | 8        | K        | 6        | 3         | O1                          |
| 9.       | 9        | K        | 6        | 3         | P7                          |

**Written Response = 50 marks**

Multiple Choice = 50 (50 questions)  
Written Response = 50 (9 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 unless otherwise instructed.
  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. For each of the following structures, identify a cellular process in which the structure is involved. **(3 marks: 1 mark each)**

chromosomes:

- **DNA replication**
  - **protein synthesis / transcription**
  - **cell division (e.g., mitosis, meiosis)**
  - **mutations**
- } **any one for 1 mark**

mitochondria:

- **active transport**
  - **cellular respiration**
  - **create energy**
- } **any one for 1 mark**

lysosomes:

- **hydrolysis**
  - **intracellular digestion**
  - **autolysis / autodigestion**
  - **breaks down molecules / cells / cell parts**
- } **any one for 1 mark**

2. Complete the following table showing the products and locations of the cellular processes indicated.

(4 marks)

|          | Translation  | Replication   |
|----------|--|---|
| Product  | <ul style="list-style-type: none"> <li>• proteins</li> <li>OR</li> <li>• polypeptides</li> <li>OR</li> <li>• amino acid chain</li> </ul>   | <ul style="list-style-type: none"> <li>• two DNA molecules</li> <li>OR</li> <li>• a molecule of DNA identical to the original molecule</li> </ul> |
| Location | <ul style="list-style-type: none"> <li>• cytoplasm</li> <li>OR</li> <li>• ribosome</li> <li>OR</li> <li>• polysome</li> <li>OR</li> <li>• rough endoplasmic reticulum</li> </ul> | <ul style="list-style-type: none"> <li>• nucleus</li> <li>OR</li> <li>• mitochondria</li> </ul>   |

3. Identify and describe the process by which each of the following substances moves into a cell.  
(4 marks: 1 mark each for process; 1 mark each for description)

oxygen:

Name of process: **diffusion (1 mark)**

Description:

- **The movement of oxygen from an area of higher oxygen concentration outside the cell to an area of lower oxygen concentration inside the cell. (1 mark)**

macromolecule:

Name of process:

- **endocytosis**
  - **phagocytosis**
  - **pinocytosis**
- } **any one for  
1 mark**

Description:

- **The cell membrane uses ATP to form a vesicle.**
- **The cell membrane engulfs the macromolecule in order to bring the macromolecule into the cell.**
- **The cell membrane binds with receptors which forms vesicles / vacuoles.**

} **any one for  
1 mark**

4. The following experiment was conducted to observe the effect of temperature on the rate of enzyme activity.

- 10 mL of a starch solution was added to each of five lettered test tubes.
- Each test tube was placed in a different water bath as shown in the table below.
- An equal amount of salivary amylase was added to test tubes **W**, **X**, **Y** and **Z**.
- A sample was taken from each test tube every minute and tested with IKI, an indicator that turns from yellow to black when mixed with starch.

| Test Tube | Temperature of Water Bath (°C) | 1 min. | 2 min. | 3 min. | 4 min. | 5 min. |
|-----------|--------------------------------|--------|--------|--------|--------|--------|
| V         | 20                             | black  | black  | black  | black  | black  |
| W         | 0                              | black  | black  | black  | yellow | yellow |
| X         | 20                             | black  | black  | yellow | yellow | yellow |
| Y         | 40                             | black  | yellow | yellow | yellow | yellow |
| Z         | 60                             | black  | black  | black  | black  | yellow |

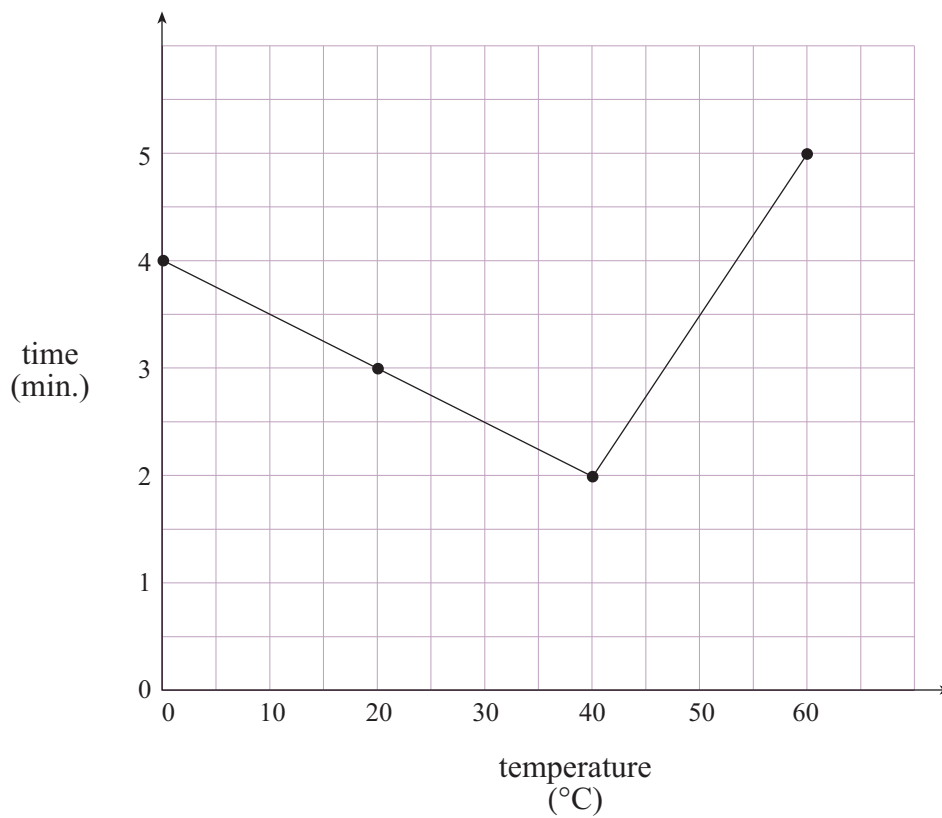
a) What is the purpose of test tube **V**?

**(1 mark)**

- **Test tube V is the scientific control.**
- **The purpose is to show IKI doesn't turn from yellow to black in the absence of salivary amylase.**

} either one for  
1 mark

b) Using the grid provided, draw a graph that relates the time it takes for the indicator to turn yellow to the temperatures of test tubes **W, X, Y** and **Z**. **(2 marks)**



**Mark distribution:**

- ( $\frac{1}{2}$  mark for plotting the points)**
- ( $\frac{1}{2}$  mark for drawing the curve)**
- ( $\frac{1}{2}$  mark for labelling y-axis)**
- ( $\frac{1}{2}$  mark for correct increment scale)**

c) Explain the results of the experiment. **(3 marks)**

- **The reaction rate is slower at 0°C due to fewer collisions between molecules.**
- **The optimum temperature for the enzyme is 40°C (approximately body temperature).**
- **The enzyme is becoming denatured at 60°C, slowing the reaction.**
- **The reaction rate increases between 0°C and 40°C due to increased collisions between the molecules.**

} any three for  
1 mark each

5. a) State **one** digestive system function of the liver.

**(1 mark)**

- It produces bile to emulsify fats.
  - It stores glucose as glycogen after eating.
- } either one for  
1 mark

b) State **three** circulatory system functions of the liver.

**(3 marks)**

- It makes blood proteins. (1 mark)
- It detoxifies the blood by removing poisonous substances. (1 mark)
- It converts hemoglobin in worn-out red blood cells to bilirubin and biliverdin. (1 mark)

c) State **one** excretory system function of the liver.

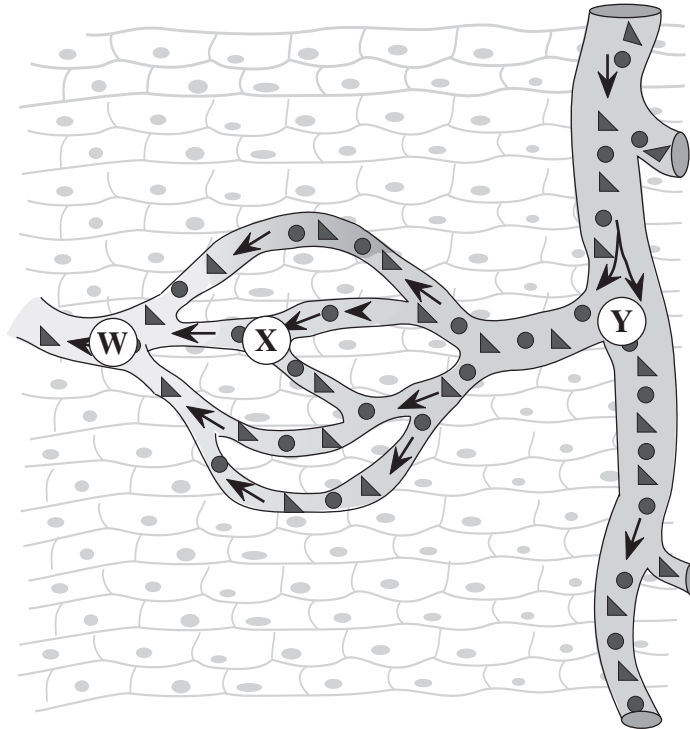
**(1 mark)**

- It excretes bile / bile pigments.
- It excretes nitrogenous wastes.
- It produces urea from the breakdown of amino acids.
- Deamination.
- Detoxifies blood because poisons go to the excretory system.

} any one for  
1 mark



Use the following diagram to answer question 6.



6. The diagram represents the capillary bed of a villus in the small intestine.

a) Identify vessel Y:

(1 mark)

- mesenteric artery
  - mesenteric arteriole
- } either one for  
1 mark

*Note:*

(only  $\frac{1}{2}$  mark given for artery or arteriole)

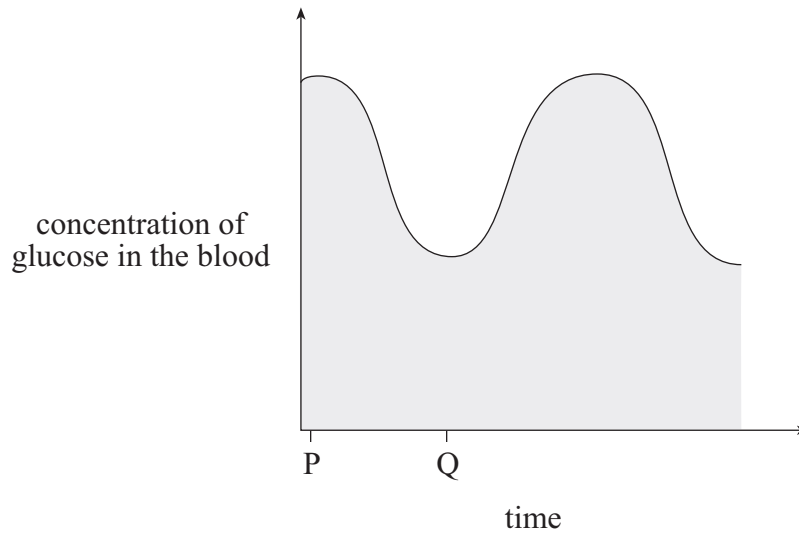
b) Describe **four** ways in which the composition of the blood at point **X** changes, two to three hours after eating a meal.

**(4 marks)**

- **There is an increased concentration of glucose because it is entering the capillary from the small intestine.**
- **There is an increased concentration of nucleotides because they are entering the capillary from the small intestine.**
- **There is an increased concentration of amino acids because they are entering the capillary from the small intestine.**
- **There is an increased concentration of carbon dioxide because it is entering the capillary from the tissues.**
- **There is a decreased concentration of oxygen because it is entering the tissues from the capillary.**
- **$\text{CO}_2 + \text{Hb} \rightarrow \text{HbCO}_2$**
- **$\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3 \rightarrow \text{HCO}_3^- + \text{H}^+$**
- **$\text{H}^+ + \text{Hb} \rightarrow \text{HHb}$**
- **$\text{HbO}_2 \rightarrow \text{Hb} + \text{O}_2$**
- **There is an increase in water reabsorption.**
- **There is an increase in insulin.**

**any four for  
1 mark each**

c) The following is a graph of glucose concentration in vessel **W** over time.



Explain the observed changes in the glucose concentration between time **P** and time **Q**.

**(3 marks)**

- **Blood glucose levels are decreasing, probably as a result of not eating.**
- **Insulin is released by the pancreas which decreases the glucose concentrations.**
- **The liver is converting glucose to glycogen so the glucose levels decrease.**
- **Physical activity has increased, decreasing glucose concentrations.**
- **An increase in thyroxin increases cellular respiration, thus decreasing glucose concentrations.**
- **Glucose is being used by the cells.**
- **Glucose has entered the cells.**
- **Mitochondria use glucose to produce ATP.**

**any three for  
1 mark each**

7. a) Use the word list below to complete the paragraph describing characteristics of a nerve impulse. (Use each word only once. Not all of the words will be used.)

(2 marks:  $\frac{1}{2}$  mark each)

- resting potential
- threshold
- recovery phase
- all-or-none
- stimulus
- polarized membrane

Any change in the environment that can open sodium gates is called

a(n) stimulus. If the change in the environment does not open a sodium gate then the threshold has not been reached.

When an action potential is produced, it is called the all-or-none response. During the recovery phase, no further action potentials can be generated.

b) Describe the changes that occur in the polarity of the membrane and the distribution of ions during an action potential. (4 marks)

- Sodium gates open.
- Sodium ions ( $\text{Na}^+$ ) enter the cell.
- The cell membrane depolarizes ( $-60 \text{ mV} \rightarrow +40 \text{ mV}$ ).
- An “upswing” in polarity results.

AND

- Potassium gates open.
- Potassium ions ( $\text{K}^+$ ) leave the cell.
- The cell membrane repolarizes ( $+40 \text{ mV} \rightarrow -60 \text{ mV}$ ).
- A “downswing” in polarity results.

} any two for  
1 mark each

} any two for  
1 mark each

c) Describe the structure of the myelin sheath and explain why it speeds up the transmission of nerve impulses. **(2 marks)**

- **The myelin sheath consists of many layers of Schwann cells which surround the axon.**
- **Schwann cells are separated by the nodes of Ranvier.**
- **A fatty white sheath with interruptions.**

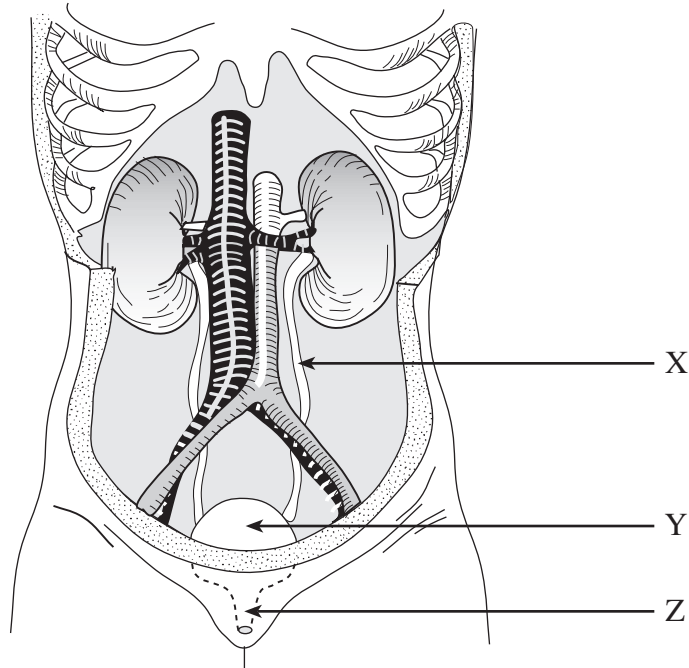
} any one for  
1 mark

**AND**

- **An action potential (depolarization) jumps from node to node instead of all the way along the neuron; therefore, the transmission of the nerve impulses speed up.**
- **Depolarization occurs only at the nodes of Ranvier; therefore, the transmission of the nerve impulses speed up.**
- **The ions are only water soluble and therefore ion exchange occurs only at the nodes of Ranvier.**
- **Saltatory conduction occurs.**

} any one for  
1 mark

Use the following diagram to answer question 8.



8. Identify and give **one** function of each of the following structures.  
(6 marks: 1 mark each for name; 1 mark each for function)

Structure **X**:

Name: **ureter (1 mark)**

Function: **It carries urine from the kidney to the bladder. (1 mark)**

Structure **Y**:

Name: **bladder (1 mark)**

Function: **It stores urine. (1 mark)**

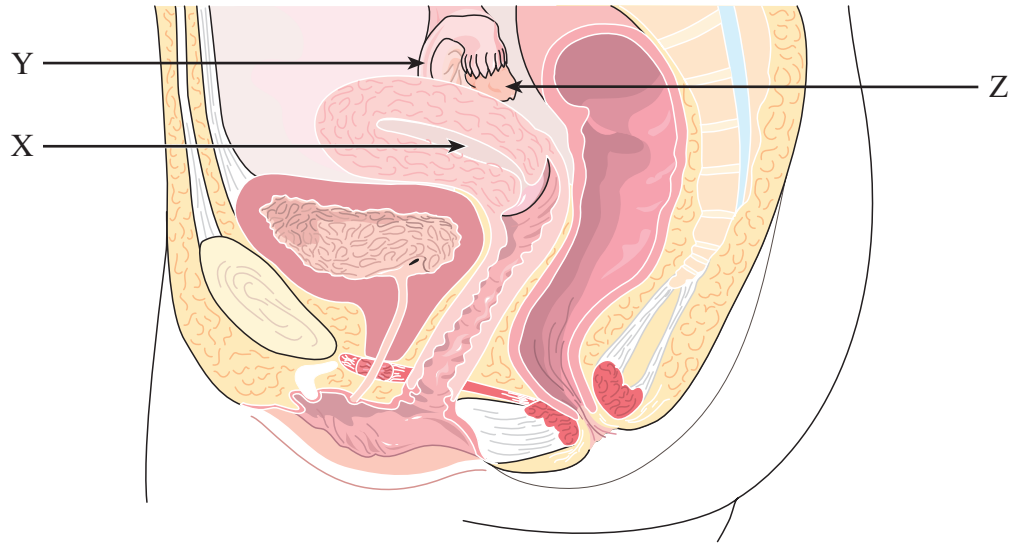
Structure **Z**:

Name: **urethra (1 mark)**

Function:

- **It transports semen.**
  - **It carries urine out of the body.**
- } either one for  
1 mark

Use the following diagram to answer question 9.



9. Identify and give **one** function of each of the following structures.

**(6 marks: 1 mark each for name; 1 mark each for function)**

Structure **X**:

Name:

- **uterus**
  - **endometrium**
  - **womb**
- } any one for  
1 mark

Function:

- **The muscles contract at birth.**
  - **It is the site of embryo development.**
  - **Site of implantation.**
- } any one for  
1 mark

Structure **Y**:

Name:

- **oviduct**
  - **fallopian tube**
- } either one for  
1 mark

Function:

- **It sweeps the egg toward the uterus.**
  - **It is usually the site of fertilization of the egg.**
- } either one for  
1 mark

Structure **Z**:

Name: **ovary (1 mark)**

Function:

- **It produces eggs.**
- **It produces estrogen.**
- **It produces progesterone.**
- **It produces a follicle.**

} **any one for  
1 mark**

**END OF KEY**