

# Biology 12

## November 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.  | A | U | 1 | 1, 2 | A1, 3; E1     | 26. | A | U | 1 | 3  | K1             |
| 2.  | A | U | 1 | 1    | A1, 3         | 27. | C | K | 1 | 3  | K2             |
| 3.  | C | H | 1 | 1, 2 | A2, 3, 1; E1  | 28. | C | K | 1 | 3  | L1             |
| 4.  | A | U | 1 | 1, 2 | A1, 3; G3     | 29. | A | K | 1 | 3  | L1             |
| 5.  | A | U | 1 | 1    | B1            | 30. | A | H | 1 | 3  | L1, 7, 8       |
| 6.  | B | K | 1 | 1    | B3            | 31. | B | K | 1 | 3  | L2             |
| 7.  | B | H | 1 | 1    | C1, 5, 2      | 32. | A | U | 1 | 3  | L4, 5          |
| 8.  | C | K | 1 | 1, 3 | C5; I2        | 33. | B | U | 1 | 3  | M4             |
| 9.  | C | U | 1 | 1    | D2            | 34. | C | K | 1 | 3  | M2             |
| 10. | B | K | 1 | 2    | F1            | 35. | D | H | 1 | 3  | M3             |
| 11. | A | K | 1 | 2    | F2            | 36. | C | U | 1 | 3  | N2             |
| 12. | C | U | 1 | 2, 3 | F4, 5; J11    | 37. | B | U | 1 | 3  | N5; O4; P6, 10 |
| 13. | A | U | 1 | 2, 3 | G1; M3        | 38. | B | K | 1 | 3  | O1             |
| 14. | A | U | 1 | 2    | G1, 3         | 39. | B | U | 1 | 3  | O2             |
| 15. | B | H | 1 | 2    | G6, 7         | 40. | D | U | 1 | 3  | O2             |
| 16. | A | U | 1 | 2    | G3, 6, 7      | 41. | C | H | 1 | 3  | O3, 1, 2       |
| 17. | A | U | 1 | 2    | G6, 7         | 42. | D | H | 1 | 3  | O4, 5          |
| 18. | C | U | 1 | 2, 3 | H6; I2        | 43. | D | K | 1 | 3  | O4, 2          |
| 19. | C | H | 1 | 2    | H6; G7        | 44. | D | U | 1 | 3  | P1, 3          |
| 20. | D | U | 1 | 2    | H6, 1         | 45. | D | U | 1 | 3  | P2             |
| 21. | A | H | 1 | 3    | I5; O2        | 46. | C | U | 1 | 3  | P4             |
| 22. | A | K | 1 | 3    | J5            | 47. | B | H | 1 | 3  | P5, 6, 1       |
| 23. | B | H | 1 | 3    | J5; K1; L7, 8 | 48. | B | U | 1 | 3  | P6; N5         |
| 24. | D | U | 1 | 3    | J9; L8        | 49. | D | U | 1 | 3  | P7             |
| 25. | D | H | 1 | 3    | J12           | 50. | A | H | 1 | 3  | P11            |

**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        | 6        | 1         | A1; B2; C8          |
| 2.       | 2        | U        | 3        | 1         | D5                  |
| 3.       | 3        | U        | 4        | 2         | E1                  |
| 4.       | 4        | U        | 4        | 2         | H3, 1, 6            |
| 5.       | 5        | U        | 9        | 3         | I1, 2, 4, 5, 7      |
| 6.       | 6        | U        | 5        | 3, 2      | K1, 3, 4, 6; L6; G7 |
| 7.       | 7        | H        | 3        | 3         | J9, 11, 8           |
| 8.       | 8        | U        | 3        | 3         | J12                 |
| 9.       | 9        | U        | 6        | 3         | N4                  |
| 10.      | 10       | K        | 3        | 3         | O1, 2               |
| 11.      | 11       | U        | 4        | 3         | P9, 10, 12          |

**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**

1. Give **two** functions of each of the following.

water:

**(2 marks)**

- solvent
  - lubricant
  - hydrolysis
  - temperature regulator
- } any two for  
1 mark each

lipids:

**(2 marks)**

- digestion of macro molecules
  - steroids / hormones
  - membrane component
  - long-term energy source
  - thermal insulation as fats
  - padding for organs as fats
  - myelin sheath on neurons
  - specific example (destruction of tadpole tails or webbed fingers in human embryos)
  - recycle molecular content inside cell
- } any two for  
1 mark each

lysosome:

**(2 marks)**

- intracellular digestion
  - autolysis / autodigestion
  - digestion of food vacuoles
  - digestion of macromolecules
  - recycle molecular content inside cell
  - digestion of worn-out cell organelles
  - hydrolysis of macrophages (granular leukocytes)
  - specific example (destruction of tadpole tails or webbed fingers in human embryo)
- } any two for  
1 mark each

2. Complete the table below by giving **three** differences between DNA and RNA.  
**(3 marks: 1 mark for each contrasting pair)**

| DNA  | RNA                                   |
|--|---------------------------------------|
| <b>double-stranded molecule</b>                    | <b>single-stranded molecule</b>       |
| <b>contains thymine (T)</b>                        | <b>contains uracil (U)</b>            |
| <b>forms a double helix</b>                        | <b>linear</b>                         |
| <b>found in the nucleus<br/>(and mitochondria)</b> | <b>found in nucleus and cytoplasm</b> |
| <b>one type</b>                                    | <b>three types</b>                    |
| <b>contains deoxyribose</b>                        | <b>contains ribose</b>                |

3. Describe the structure and function of each of the following molecules.

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

mRNA:

structure:

- **single stranded**
  - **contains codons**
  - **linear chain of molecules / nucleotides**
  - **complementary to DNA template but has uracil not thymine**
- } any one for 1 mark

function:

- **dictates the sequence of amino acids**
  - **transports “genetic code” transcribed from DNA to ribosomes**
- } either one for 1 mark

tRNA:

structure:

- **single stranded**
  - **clover leaf / T / L / hairpin shape**
  - **contains anticodons**
  - **has attachment site for amino acids**
  - **anticodons are made up of three nucleotide bases**
- } any one for 1 mark

function:

- **transport a specific amino acid to ribosome / mRNA-ribosome complex**
  - **anticodon bonds to mRNA codon to place the amino acid**
  - **translates the mRNA strand into a polypeptide at the ribosome by bringing the amino acid to the mRNA**
- } any one for 1 mark

4. Explain how enzymes catalyze reactions in cells.

**(4 marks)**

- **The substrate(s) fit into the active site of the enzyme.**
- **An enzyme-substrate complex is formed.**
- **The product(s) are released from the enzyme leaving the enzyme unchanged. / Products are produced (explain in the process) and released. / Enzyme is NOT changed by the reaction. / Enzyme specificity (each enzyme can only catalyze a specific reaction or can only bind to a specific substrate). / Coenzymes or cofactors are needed by some enzymes for the reaction to proceed. / An enzyme can only function at an optimum temperature and/or pH.**
- **The active site has unique shape.**
- **The energy of activation is lower.**

**any four for  
1 mark each**

5. a) Describe how carbohydrates are digested and absorbed in the human digestive system.

(6 marks)

- In the mouth physical digestion occurs.
- In the stomach physical digestion occurs.
- In the mouth, salivary amylase hydrolyzes the starch into maltose.
- In the small intestine, pancreatic amylase hydrolyzes the starch into maltose.
- In the small intestine, maltase hydrolyzes the maltose into glucose.

} any five for  
1 mark each

AND

- Glucose is actively transported into the capillary net in the villi. (1 mark)

*Note to markers:*

Student must discuss absorption to receive full marks.

b) Describe the role of the pancreas and the liver in maintaining blood sugar levels.

(3 marks)

- When blood glucose levels are high, insulin is released by the pancreas.
- Increases cell permeability to glucose.
- This makes cells take up glucose from the blood.
- The liver stores excess glucose as glycogen.
- The blood glucose level drops, and the liver converts glycogen back to glucose which is released into the blood.
- Insulin stimulates conversion of glucose to glycogen.

} any three for  
1 mark each

*Note to markers:*

Answer must include one liver and one pancreas.

6. In an effort to improve fitness level, an adult participates in a tennis program for five months. The following data were collected over this time period.

|   | April  | August |
|---|--------|--------|
| resting pulse rate (beats/min)                                  | 75     | 65     |
| pulse rate during exercise (beats/min)                          | 140    | 110    |
| time for pulse to return to resting rate after exercising (min) | 13     | 2      |
| resting blood pressure (mm Hg)                                  | 125/89 | 120/80 |
| resting breathing rate (breaths/min)                            | 17     | 15     |
| breathing rate during exercise (breaths/min)                    | 35     | 25     |

a) In August the person's resting blood pressure is 120/80. Explain how the numbers 120 and 80 relate to heart function. (2 marks)

- **120 is the systolic pressure, the highest pressure after the heart contracts. (1 mark)**
- **80 is the diastolic pressure, the lowest pressure (heart at rest) (contraction / relaxation of left ventricle). (1 mark)**

b) Explain why the pulse rate during exercise went down between April and August. (1 mark)

- **The heart muscle is stronger, producing greater volume with every pump (increased cardiac output).**
  - **Larger, more efficient heart with increased vascularization results in stroke volume.**
- } any two for  
1 mark each

c) Explain the change in breathing rate from resting to exercise. (2 marks)

- **Exercising produces increased concentrations of CO<sub>2</sub> (carbon dioxide) and H<sup>+</sup> (hydrogen ions).**
  - **These stimulate the medulla oblongata, which stimulates breathing rate.**
  - **There is increased demand for oxygen by the muscle cells.**
  - **There is increased need for ATP at muscle.**
- } any two for  
1 mark each



7. Explain how the lymphatic and circulatory systems respond to a viral infection.

**(3 marks)**

- **Antibodies are produced by white blood cells.**
- **Antibodies attach to specific antigens.**
- **White blood cells engulf the inactivated virus.**
- **The number of lymphocytes increase in the lymph nodes.**
- **Viruses are removed from the lymph by the lymph nodes.**
- **Histamines released cause inflammation.**
- **Lymphatic system produces T-cells / T-helper cells.**
- **Circulatory system produces B-cells.**

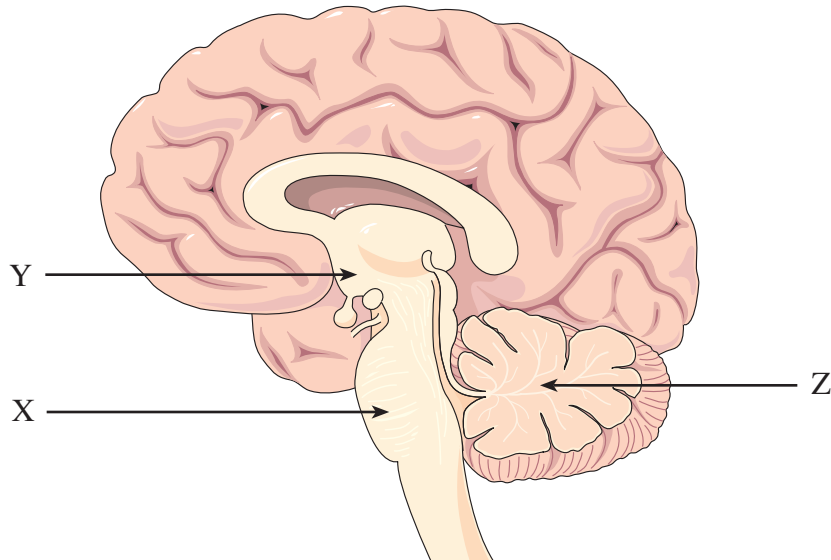
} **any three for  
1 mark each**

8. Using the following table, distinguish between the chemical composition of the blood in the arterial end and the venous end of a capillary bed in a muscle.

**(3 marks)**

| Arterial End                                     | Venous End  |
|--|---|
| <b>higher concentration of oxygen</b>            | <b>lower concentration of oxygen</b>  |
| <b>higher concentration of nutrients</b>         | <b>lower concentration of nutrients</b>   |
| <b>lower concentration of nitrogenous wastes</b> | <b>higher concentration of nitrogenous wastes</b>   |
| <b>lower concentration of carbon dioxide</b>     | <b>higher concentration of carbon dioxide</b>   |
| <b>higher oxyhemoglobin</b>                      | <ul style="list-style-type: none"><li>• <b>higher bicarbonate ions</b></li><li>• <b>higher hydrogen ions</b></li><li>• <b>higher reduced hemoglobin</b></li></ul> |

Use the following diagram to answer question 9.



9. Identify structures **X**, **Y** and **Z** and give **one** function of each.  
(6 marks: 1 mark each for name; 1 mark each for function)

structure **X**:

name: **medulla oblongata / brain stem** (1 mark)

function:

- **reflex centres**
- **controls autonomic nervous system**
- **detects carbon dioxide and hydrogen ions**
- **regulates heart rate / breathing rate / vasoconstriction**

} any one for  
1 mark

**OR**

name: **pons** (1 mark)

function:

- **Medulla to regulate breathing rate and has reflex centres to respond to visual and auditory stimuli.** (1 mark)

structure **Y**:

name: **hypothalamus** (1 mark)

function:

- **maintains homeostasis**
- **synthesizes ADH / oxytocin**
- **controls the pituitary gland / centres for hunger / thirst / body temperature / blood volume (water balance) / blood pressure / sleep**
- **releases GNRH to stimulate anterior pituitary**

} any one for  
1 mark

structure **Z**:

name: **cerebellum (1 mark)**

function:

- **coordinates muscle for posture / tone / balance**
  - **proprioception**
- } **either one for  
1 mark**

10. Give **one** function of each of the following.

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

renal pelvis:

- passes urine to the ureter
  - collects urine from collecting ducts
- } either one for  
1 mark

proximal convoluted tubule:

- reabsorbs water
  - selective (tubular) reabsorption
  - actively transports  $\text{Na}^+$  (sodium ions) out of the tubule
  - reabsorbs nutrients (glucose, amino acids, etc.) back into the blood
- } any one for  
1 mark

ureter:

- carries urine from the kidney to the urinary bladder (1 mark)

11. a) Complete the table for a typical 28-day ovarian cycle.

**(2 marks)**

| Days  | Pituitary Hormone Responsible for Changes in the Ovary |
|-------|--|
| 1–12  | <b>FSH (follicle-stimulating hormone)</b>              |
| 15–28 | <b>LH (leuteinizing hormone)</b>                       |

b) Describe the hormonal changes that occur as a result of implantation.

**(2 marks)**

- **HCG (human chorionic gonadotropin) is produced.**
- **FSH secretion is inhibited.**
- **Progesterone continues to be produced.**
- **Progesterone inhibits LH production.**
- **Less GNRH from hypothalamus.**
- **Estrogen levels increase.**

} any two for  
1 mark each

**END OF KEY**