# Biology 12

January 1997 Provincial Examination

## ANSWER KEY / SCORING GUIDE

**Topics:**

| | | | |
|---|---|---|---|
| **Core:** | 1. | | Methods and Principles |
| | 2. | | Cells |
| | 3. | | Humans VII, VIII, IX |
| | 4. | | Humans X, XI, XII |
| **Options:** (Choose **two** of six) | 5. | Option I: | Immunology |
| | 6. | Option II: | Skeletal System and Muscles |
| | 7. | Option III: | Reproduction and Embryology |
| | 8. | Option IV: | Genetic Disorders and Engineering |
| | 9. | Option V: | Cancer |
| | 10. | Option VI: | Sensory Receptors |

**Part A: Multiple Choice**

| Q | C | T | K | S | CGR | Q | C | T | K | S | CGR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | K | 2 | A | 1 | III-C-6 | 27. | U | 3 | A | 1 | VIII-A-3 |
| 2. | U | 2 | B | 1 | III-C-1 | 28. | U | 3 | D | 1 | VIII-A-2 |
| 3. | U | 2 | B | 1 | III-C-9 | 29. | U | 3 | B | 1 | IX-A-1 |
| 4. | K | 2 | D | 1 | III-E-2 | 30. | U | 3 | C | 1 | IX-A-2 |
| 5. | K | 2 | B | 1 | III-D-2 | 31. | U | 3 | B | 1 | IX-D-2 |
| 6. | U | 2 | D | 1 | III-E-1 | 32. | H | 3 | B | 1 | IX-D-2, D-1 |
| 7. | U | 2 | B | 1 | IV-B-1, 2 | 33. | U | 3 | B | 1 | IX-C-1 |
| 8. | U | 2 | D | 1 | IV-B-1, 2 | 34. | U | 4 | A | 1 | X-C-1 |
| 9. | U | 2 | A | 1 | IV-B-3 | 35. | U | 4 | A | 1 | X-B-1 |
| 10. | K | 2 | A | 1 | IV-A-1 | 36. | U | 4 | C | 1 | X-B-3 |
| 11. | H | 2 | B | 1 | V-A-2 | 37. | K | 4 | C | 1 | X-E-1 |
| 12. | H | 2 | B | 1 | V-A-3 | 38. | U | 4 | D | 1 | X-D-3 |
| 13. | H | 2 | B | 1 | V-B-5 | 39. | K | 4 | D | 1 | XI-A-1 |
| 14. | K | 2 | C | 1 | IV-B-1, 2 | 40. | U | 4 | C | 1 | XI-A-3 |
| 15. | U | 2 | B | 1 | V-C-2 | 41. | U | 4 | A | 1 | XI-A-2, C-2 |
| 16. | U | 2 | C | 1 | V-D-2 | 42. | K | 4 | A | 1 | XI-H-1 |
| 17. | K | 2 | C | 1 | V-D-1 | 43. | K | 4 | B | 1 | XI-H-1 |
| 18. | K | 2 | B | 1 | VI-A-1 | 44. | K | 4 | D | 1 | XI-E-2 |
| 19. | H | 2 | D | 1 | VI-B-1 | 45. | K | 4 | A | 1 | XI-G-2 |
| 20. | U | 2 | A | 1 | VI-B-1 | 46. | U | 4 | C | 1 | XI-H-1 |
| 21. | U | 2 | B | 1 | VI-C-2, D-1 | 47. | H | 4 | C | 1 | XI-I-2, 3 |
| 22. | U | 3 | C | 1 | VII-1 | 48. | H | 4 | A | 1 | XII-C-1 |
| 23. | U | 3 | B | 1 | VIII-A-2 | 49. | H | 4 | C | 1 | XII-A-1 |
| 24. | H | 3 | C | 1 | VIII-A-2 | 50. | U | 4 | C | 1 | XII-C-1 |
| 25. | **D E L E T E D** | | | | | 51. | K | 4 | A | 1 | XII-C-1, B-2 |
| 26. | U | 3 | B | 1 | VIII-A-10 | 52. | U | 4 | A | 1 | XII-A-3, C-1 |

**Part B: Written Response**

| Q | B | C | T | S | CGR |
|---|---|---|---|---|---|
| 1. | 1 | U | 2 | 4 | III-D-4 |
| 2. | 2 | U | 2 | 4 | V-D-1; VI-C-2, D-1 |
| 3. | 3 | H | 3 | 6 | IX-F-6 |
| 4. | 4 | K | 3 | 5 | VIII-A-5 |
| 5. | 5 | U | 4 | 5 | X-D-2, E-1 |
| 6. | 6 | U | 4 | 4 | XII-C-1 |

**Core written-response total = 28 marks**

**Part C: Option Section – Score only 2 out of 6 boxes (options) from box 7 to box 12.**

| | Q | B | C | T | S | CGR |
|---|---|---|---|---|---|---|
| Option I | 1–3 | 7 | U | 4 | 10 | Option I |
| Option II | 1–3 | 8 | U | 5 | 10 | Option II |
| Option III | 1–3 | 9 | U | 6 | 10 | Option III |
| Option IV | 1–3 | 10 | U | 7 | 10 | Option IV |
| Option V | 1–3 | 11 | U | 8 | 10 | Option V |
| Option VI | 1–3 | 12 | U | 9 | 10 | Option VI |

**Option Section written-response total = 20 (2 x 10)**

Multiple Choice = 52 (52 questions)
Written Response = 48 (6 questions and 2 options)
**Total = 100 marks**

**LEGEND:**

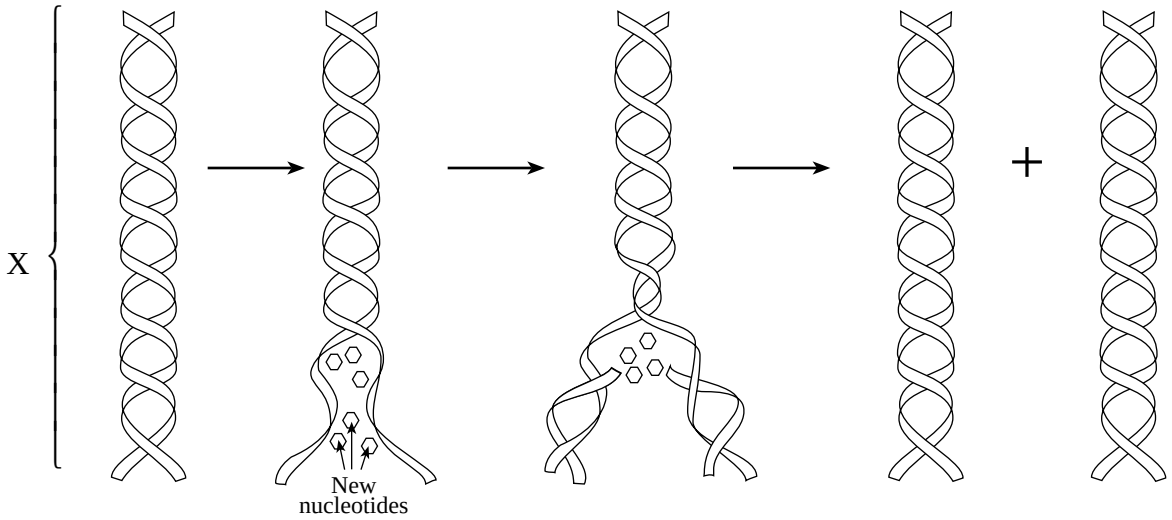
**Q** = Question Number **C** = Cognitive Level **T** = Topic
**K** = Keyed Response **S** = Score **CGR** = Curriculum Guide Reference
**B** = Score Box Number

## PART B: WRITTEN RESPONSE

**Value: 28 marks** **Suggested Time: 50 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.

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




1. a) Name the molecule indicated by **X**. **(1 mark)**

- **DNA. (1 mark)**

b) Where in a human cell does the process shown above occur? **(1 mark)**

- **Nucleus.**
- **Mitochondria.**

} **either one for 1 mark**

c) List **two** functions of molecule **X**. **(2 marks: 1 mark each)**

- **Acts as a genetic code.**
- **DNA replication.**
- **Mutation leading to evolution.**
- **Controls protein synthesis.**

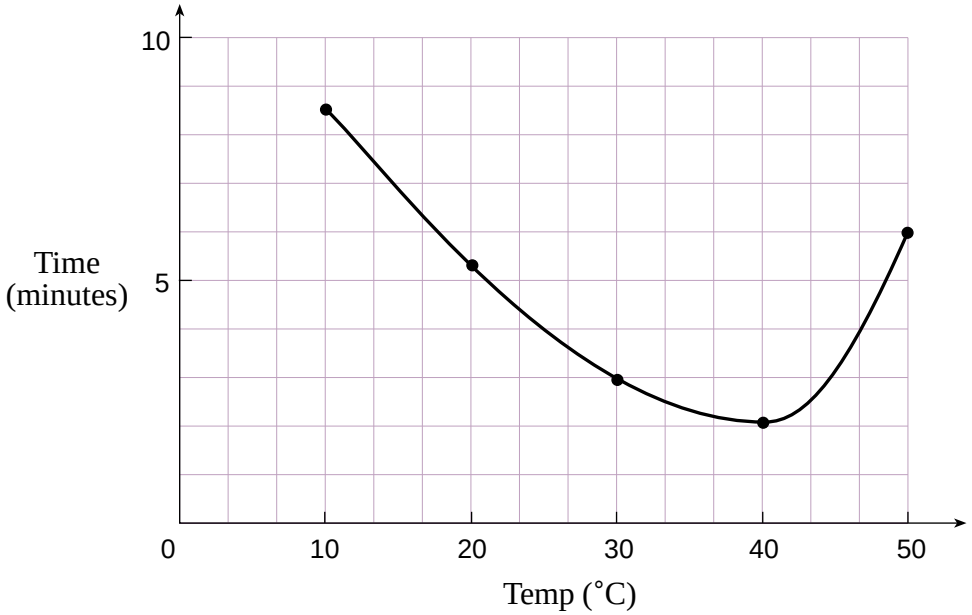
} **any two for 1 mark each**

2. Complete the following table contrasting photosynthesis and cellular respiration.

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

| | PHOTOSYNTHESIS | CELLULAR RESPIRATION |
|---|---|---|
| Reactants | • **requires $CO_2$ and $H_2O$** | • **requires $O_2$ and glucose** |
| End products | • **produces $O_2$, glucose and PGAL** | • **produces $CO_2$, $H_2O$, ATP and lactic acid** |
| Source of energy | • **uses light energy** | • **uses the chemical energy of glucose** |
| Organelle involved | • **occurs in the chloroplasts** | • **occurs in the mitochondria** |

3. An experiment was performed to determine the effect of changing temperature on the speed of blood clotting. Whole blood was placed in labelled test tubes. The tubes were then placed in water baths of various temperatures. Time required for a clot to form was then measured. The results are graphed below. **(6 marks: 2 marks each)**




Give the clotting times observed at 10°C, 40°C and 50°C and explain why these clotting times occur.

10°C:

- **Blood clotting takes approximately 8.5 minutes to occur. (1 mark)**
- **At lower temperatures fewer molecular collisions occur and therefore enzyme facilitated reactions take longer. (1 mark)**

40°C:

- **Optimum temperature. Blood clotting occurs in approximately 2 minutes. (1 mark)**
- **This temperature optimizes molecular collisions which facilitates the formation of complexes between enzymes and substrates in the clotting reactions. (1 mark)**

50°C:

- **Blood clotting takes approximately 6 minutes to occur. (1 mark)**
- **Because enzymes are partially denatured by high temperature, blood clotting reactions take longer to occur. (1 mark)**

4. a) Name the components of pancreatic juice and state how each aids in the digestion of food. **(4 marks)**

- **Proteases ($\frac{1}{2}$ mark) break down protein ($\frac{1}{2}$ mark).**
- **Amylases ($\frac{1}{2}$ mark) break down starch ($\frac{1}{2}$ mark).**
- **Lipases ($\frac{1}{2}$ mark) break down fats ($\frac{1}{2}$ mark).**
- **Bicarbonate ions ($\frac{1}{2}$ mark) neutralize stomach acid ($\frac{1}{2}$ mark).**

b) What is the function of water in pancreatic juice? **(1 mark)**

- **Water acts as a solvent.**
- **Water hydrolyzes substrates.**
- **Water aids in the movement of substances.**

**any one for 1 mark**

5. Give **one** function of each of the following parts of the nervous system. **(5 marks: 1mark each)**

Autonomic nervous system:

- **Controls heart rate.**
- **Controls function of internal organs.**
- **Controls function of smooth muscle.**
- **Initiates the fight or flight response.**
- **Initiates automatic or involuntary control.**

**any one for 1 mark**

Somatic nervous system:

- **Initiates contraction in skeletal muscles.**
- **Voluntary control of muscles.**

**either one for 1 mark**

Thalamus:

- **Relays information from the spinal cord to various parts of the brain. (1 mark)**

Cerebrum:

- **Functions as the centre of consciousness.**
- **Functions as an area of integration for motor activity, thought and sensation.**
- **Voluntary muscle control**

**any one for 1 mark**

Corpus callosum:

- **Permits information to move between the left and right hemispheres of the brain. (1 mark)**

6. Describe how the endocrine system maintains blood sugar at homeostatic levels. **(4 marks)**

- **Cortisol (1 mark) causes the conversion of amino acids to glucose (1 mark).**

  **or**

  **promotes the hydrolysis of muscle protein to amino acids (1 mark).**

- **Adrenalin (1 mark) causes the conversion of glycogen to glucose (1 mark).**
- **Insulin (1 mark) causes glucose to be stored as glycogen (1 mark).**
- **Glucagon (1 mark) causes glycogen to be broken down into glucose (1 mark).**

## PART C: OPTION SECTION

**Value: 20 marks** **Suggested Time: 30 minutes**

**INSTRUCTIONS:**

1. Select **two** options from the six options listed below.
2. Answer **all** of the questions in each option that you select.
3. If you answer questions in more than two options, only the **first two** will be marked.
4. You may not need all of the space provided to answer each question.

**OPTION I:** IMMUNOLOGY

**OPTION II:** SKELETAL SYSTEM AND MUSCLES

**OPTION III:** REPRODUCTION AND EMBRYOLOGY

**OPTION IV:** GENETIC DISORDERS AND ENGINEERING

**OPTION V:** CANCER

**OPTION VI:** SENSORY RECEPTORS

## OPTION I: IMMUNOLOGY

1. Select a term from column **A** that matches its description given in column **B**. Write the term in the blank beside each description. Each term may be used **only** once, and not all the terms will be used. **(6marks)**

| COLUMN A | COLUMN B | |
|---|---|---|
| antigen | | |
| booster shot | a) produced by hybridoma | **monoclonal antibody** |
| interferon | b) involved in cell-mediated immunity | **T cell** |
| monoclonal antibody | c) brings about secondary immune response | **booster shot** |
| T cell | d) phagocytic cell derived from monocytes | **macrophage** |
| B cell | e) marker on a foreign cell surface | **antigen** |
| primary immune response | f) secreted by virus-infected cell | **interferon** |
| macrophage | | |

2. State **one** function of each of the following in the immune system. **(2 marks: 1 mark each)**

Antibodies:

- **Mark the antigen-bearing cell or virus for destruction.**
- **Activate macrophages or neutrophils.**

} **either one for 1 mark**

Memory B cells:

- **Allow for the rapid production of antibodies after an initial infection. (1 mark)**

3. Give **two** ways in which passive immunity can be acquired. **(2 marks: 1 mark each)**

- **Breast-feeding.**
- **Injection of antibody serum.**
- **Antibodies move across the placenta.**

} **any two for 1 mark each**

## OPTION II: SKELETAL SYSTEM AND MUSCLES

1. Select a term from column **A** that matches its description given in column **B**. Write the term in the blank beside each description. Each term may be used **only** once, and not all the terms will be used. **(6marks)**

| COLUMN A | COLUMN B | |
|---|---|---|
| tendon | | |
| cartilage | a) provides energy for muscle contraction | **ATP** |
| Haversian canal | b) thin filaments within muscle tissue | **actin** |
| skeletal | c) tissue joining muscles to bones | **tendon** |
| ATP | d) contractile unit of a muscle | **sarcomere** |
| sarcomere | e) location of blood vessels in bone | **Haversian canal** |
| actin | f) muscle under autonomic control | **cardiac** |
| cardiac | | |

2. Give **one** function of each of the following. **(2 marks: 1 mark each)**

Spongy bone:

- **Site of blood cell production.**
- **Stores calcium.**

} **either one for 1 mark**

Compact bone:

- **Supports body (strength).**
- **Stores fat.**
- **Stores calcium.**
- **Stores $Ca_3(PO_4)_2$ salts.**

} **any one for 1 mark**

3. Why can muscles **not** operate continuously during oxygen debt? **(2 marks)**

- **Lactic acid is produced which causes a local pH change in the muscle which in turn interferes with the chemical reactions of contraction.**
- **Insufficient ATP is produced for muscle contraction.**

} **either one for 2 marks**

## OPTION III: REPRODUCTION AND EMBRYOLOGY

1. Select a term from column **A** that matches its description given in column **B**. Write the term in the blank beside each description. Each term may be used **only** once, and not all the terms will be used. **(6marks)**

| COLUMN A | COLUMN B | |
|---|---|---|
| epididymis | | |
| blastula | a) contains enzymes allowing fertilization to occur | **acrosome** |
| oögenesis | b) causes secondary sex characteristics | **estrogen** |
| Cowper's gland | c) production of egg cells | **oögenesis** |
| in vitro fertilization | d) a hollow ball of cells | **blastula** |
| morphogenesis | e) area of sperm maturation | **epididymis** |
| acrosome | f) artificial zygote implantation | **in vitro fertilization** |
| estrogen | | |

2. Give **one** function of each of the following in the male reproductive system. **(2marks: 1 mark each)**

   Seminal vesicles:

   • **Produce seminal fluid. (1 mark)**

   Seminiferous tubules:

   • **Spermatogenesis. (1 mark)**

3. What is the function of each of the following hormones in the female reproductive system? **(2 marks: 1 mark each)**

   Luteinizing hormone:

   • **Promotes the development of the corpus luteum.**
   • **Stimulates ovulation.**

   } **either one for 1 mark**

   Follicle stimulating hormone:

   • **Stimulates the development of follicles in the ovary. (1 mark)**

## OPTION IV: GENETIC DISORDERS AND ENGINEERING

1. Select a term from column **A** that matches its description given in column **B**. Write the term in the blank beside each description. Each term may be used **only** once, and not all the terms will be used. **(6marks)**

| COLUMN A | COLUMN B | |
|---|---|---|
| transformation | | |
| protoplast | a) absorbing new genetic material | **transformation** |
| virus | b) a method of detecting genetic abnormalities before birth | **amniocentesis** |
| mitosis | c) a type of bacterial DNA | **plasmid** |
| amniocentesis | d) seals new gene into plasmid | **ligase** |
| plasmid | e) plant cell stripped of its cell wall | **protoplast** |
| ligase | f) cell division | **mitosis** |
| restriction enzyme | | |

2. List **two** characteristics of people with the following genetic disorders.

a) Turner's syndrome: **(1 mark: $\frac{1}{2}$ mark each)**

- **Female.**
- **Short.**
- **Broad chest.**
- **Congenital heart defects.**
- **Do not reach puberty.**
- **Do not menstruate.**
- **Lack of breast development.**

**any two for $\frac{1}{2}$ mark each**

b) Trisomy XYY: **(1 mark: $\frac{1}{2}$ mark each)**

- **Male.**
- **Taller than average.**
- **Persistent acne.**
- **Barely normal intelligence.**

**any two for $\frac{1}{2}$ mark each**

3. Describe the process involved in the production of recombinant DNA. **(2 marks)**

- **A restriction enzyme is used to remove a foreign gene.**
- **Plasmids are removed from a bacterium.**
- **The foreign gene is placed in the plasmid and sealed with ligase.**

**any two for 1 mark each**

## OPTION V: CANCER

1. Select a term from column **A** that matches its description given in column **B**. Write the term in the blank beside each description. Each term may be used **only** once, and not all the terms will be used. **(6marks)**

| COLUMN A | COLUMN B | |
|---|---|---|
| oncogene | | |
| neoplasia | a) tumors that do not spread to new locations | **benign** |
| retrovirus | b) increases blood supply to tumor | **vascularization** |
| vascularization | c) new growth of cancerous cells | **neoplasia** |
| metastasis | d) cancer-causing segment of DNA | **oncogene** |
| benign | e) uses RNA as genetic material | **retrovirus** |
| interferon | f) spreading of cancer cells throughout the body | **metastasis** |
| anaplasia | | |

2. Name **two** types of cancer and the tissue in which each originates. **(2 marks: $\frac{1}{2}$ mark each)**

Type of Cancer 1: • **Carcinoma.** **($\frac{1}{2}$ mark)**
Tissue: • **Epithelial tissue.** **($\frac{1}{2}$ mark)**

Type of Cancer 2: • **Sarcoma.** **($\frac{1}{2}$ mark)**
Tissue: • **Connective tissue.** **($\frac{1}{2}$ mark)**

Other Cancer: • **Leukemia.** **($\frac{1}{2}$ mark)**
Tissue: • **Blood tissue.** **($\frac{1}{2}$ mark)**

} **any 2 pairs**

***Note: many more combinations were also acceptable.**

3. List **two** characteristics of cancer cells. **(2 marks: 1 mark each)**

- **Cancer cells do not show differentiation.**
- **Cancer cells do not show contact inhibition.**
- **Cancer cells divide more rapidly than normal cells.**
- **Cancer cells have an unlimited number of potential cell divisions.**

} **any two for 1 mark each**

## OPTION VI: SENSORY RECEPTORS

1. Select a term from column **A** that matches its description given in column **B**. Write the term in the blank beside each description. Each term may be used **only** once, and not all the terms will be used. **(6marks)**

| COLUMN A | COLUMN B | |
|---|---|---|
| proprioceptor | | |
| cone | a) taste bud | **chemoreceptor** |
| rod | b) light enters the eye through this structure | **cornea** |
| otolith | c) senses position of limbs | **proprioceptor** |
| chemoreceptor | d) responsible for vision in low light | **rod** |
| cornea | e) calcium carbonate granules | **otolith** |
| olfaction | f) the ability to smell | **olfaction** |
| optic nerve | | |

2. a) What is *accommodation*? **(1 mark)**

- **Accommodation is the ability to focus on objects at different distances from the eye. (1 mark)**

b) How does accommodation occur? **(2 marks)**

- **Close objects: The ciliary muscle contracts, the suspensory ligaments relax, and the lens becomes round because of its natural elasticity.**
- **Far objects: The ciliary muscle relaxes, the ligaments are pulled taut which pulls the lens flatter.**

} **2 marks**

3. Where in the cochlea are different sound pitches detected? **(1 mark)**

- **The organ of Corti.**
- **Basilar membrane.**

} **either one for 1 mark**

**END OF KEY**