

Biology 12

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

Part B: Written Response

Q	B	C	T	S	CGR
1.	1	H	3	4	II-A-1, IX-D-2
2.	2	U	2	6	III-E-1, 2, 5
3.	3	U	2	6	IV-B-3
4.	4	U	4	3	X-B-1, 3
5.	5	U	4	3	VII-A-3, 5
6.	6	U	4	3	XI-A-3
7.	7	K	4	3	XII-C-1

Core written-response total = 28 marks

Part C: Option Section – Score only 2 out of 6 boxes (options) from box 8 to box 13.

	Q	B	C	T	S	CGR
Option I	1–3	8	U	5	10	Option I
Option II	1–3	9	U	6	10	Option II
Option III	1–3	10	U	7	10	Option III
Option IV	1–3	11	U	8	10	Option IV
Option V	1–3	12	U	9	10	Option V
Option VI	1–3	13	U	10	10	Option VI

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

Multiple Choice = 52 (52 questions)

Written Response = 48 (7 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 table to answer question 1.

Body Part	BLOOD FLOW (in mL/min)			
	At Rest	Light Exercise	Fairly Strenuous Exercise	Maximum Exertion
Skeletal muscles	1 200	4 500	12 500	22 000
Intestine	1 400	1 100	600	300
Skin	500	1 500	1 900	1 600
Brain	750	750	750	750
All other regions	600	400	400	100

1. The table above shows the changes in blood flow to various parts of the body while at rest and during different levels of exercise. Explain the blood flow to the following organs at the different levels of exercise. **(4 marks: 1 mark each)**

Skeletal muscles:

- **As exercise increases, the muscles require increased amounts of oxygen and glucose. Oxygen and glucose are supplied to the muscles by the blood. Increased waste removal is required.**

} **1 mark**

Intestine:

- **Blood supply to the intestine decreases because blood is diverted from the intestine to other parts of the body.** } 1 mark

Skin:

- **Blood flow to the skin initially increases as the body attempts to get rid of the excess heat that has been produced during increased activity (to facilitate cooling).**
 - **Blood flow to the skin decreases during maximum exertion because blood is diverted to skeletal muscles.**
- } either one for 1 mark

Brain:

- **There is no change in blood flow to the brain because the brain requires a constant supply of oxygen and nutrients in order to function properly no matter what the circumstances.** } 1 mark

2. In paragraph form, explain how each of the following is involved in protein synthesis. **(6 marks)**

- DNA
- mRNA
- tRNA
- ribosome
- peptide bond
- amino acid

• *DNA* contains the genetic code which directs protein synthesis. (1 mark)

• *mRNA* is transcribed complementary to the DNA. (1 mark)

OR

• *mRNA* carries the genetic information to the ribosome. (1 mark)

• The *ribosome* is the site of translation (protein assembly). (1 mark)

• *tRNAs* bind to the mRNA in a complementary manner. (1 mark)

OR

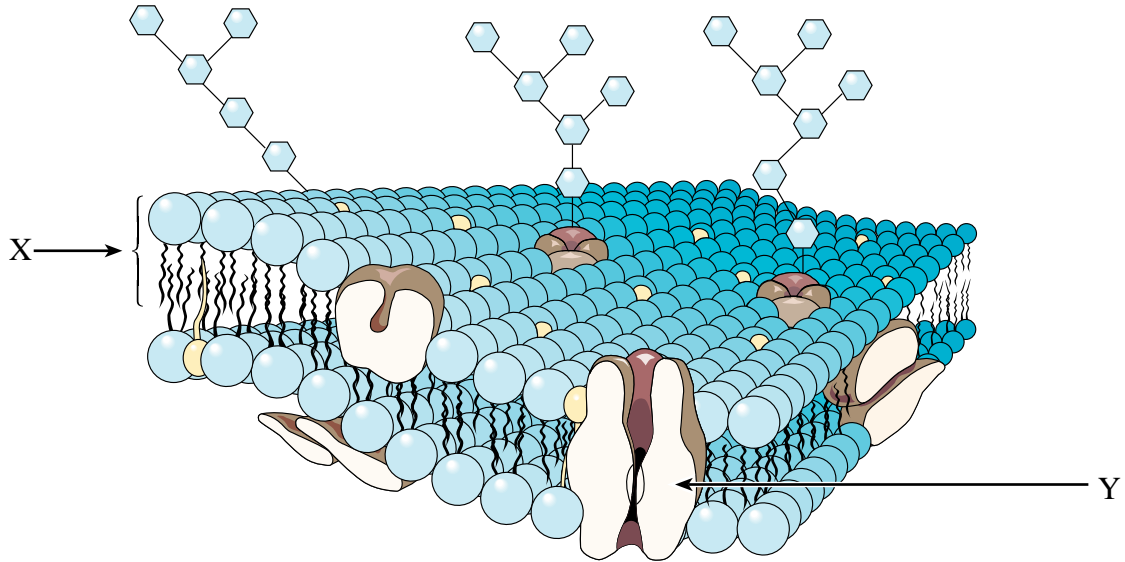
• Each *tRNA* carries a specific amino acid to the ribosome. (1 mark)

• *Amino acids* are joined to make a polypeptide (protein). (1 mark)

• *Peptide bonds* are formed between the amino acids in the chain. (1 mark)

***Note to markers: If students have covered the roles of all 6 terms with respect to protein synthesis, allow 6 marks.**

Use the following diagram to answer question 3.



3. Identify molecules **X** and **Y** in the diagram above. For each molecule, give **one** function and name its unit molecules (building blocks). **(6 marks: 1 mark each)**

Molecule X: • **Phospholipid molecule.** **(1 mark)**

Function of X: • **Forms the cell membrane.**
 • **Keeps cytoplasm contained.**
 • **Allows for diffusion.**
 • **Allows for flexibility of membrane.**
 • **Excludes ions and water.** } **any one for 1 mark**

Unit molecules of X: • **Fatty acids.**
 • **Glycerol.**
 • **Phosphate.** } **any two for 1 mark**

Molecule Y: • **Protein.** **(1 mark)**

Function of Y: • **Carries molecules in or out of the cell.**
 • **Some proteins are receptors that influence the metabolic activity of the cell.** } **either one for 1 mark**

Unit molecules of Y: • **Amino acids.** **(1 mark)**

4. Give **one** role of each of the following in the transmission of a nerve impulse. **(3 marks: 1 mark each)**

Na⁺/K⁺ pump:

- **Difference in charge and ion concentrations across a membrane maintained by the Na⁺/K⁺ pump. Net positive charge on the outside and negative charge on the inside.**
 - **Maintains resting potential.**
- } **either one for 1 mark**

Sodium gate:

- **The opening of a Na⁺ gate initiates an action potential as sodium ions move into the axon.**
 - **Depolarizes the membrane.**
- } **either one for 1 mark**

Myelin sheath:

- **Increases the speed of impulse transmission along a neuron.**
 - **Insulation.**
- } **either one for 1 mark**

5. a) State **one** function of each of the following substances.

(2 marks: 1 mark each)

Glucagon:

- **Raises the glucose concentration of the blood. (1 mark)**

Lipase:

- **Breaks down fats into fatty acids and glycerol. (1 mark)**

b) Name the organ which secretes glucagon and lipase.

(1 mark)

- **The pancreas. (1 mark)**

6. How is the structure of the alveoli ideally suited to their function?

(3 marks)

- **They have a large surface area for gas exchange.**
- **They have a large number of capillaries for gas exchange.**
- **They are thin-walled for gas exchange.**
- **They have stretch receptors for exhalation.**
- **They are moist to increase the efficiency of gas diffusion.**
- **The inner surface of the alveoli is coated with a surfactant (lipoproteins) to decrease surface tension in order to hold the alveolus open.**

**any three for
1 mark each**

7. Complete the following table for the endocrine system.

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

ENDOCRINE GLAND	NAME OF ONE HORMONE SECRETED	ONE FUNCTION
<ul style="list-style-type: none">• Anterior pituitary	Growth hormone (GH)	<ul style="list-style-type: none">• Promotes cell division, protein synthesis, and bone growth.
Adrenal cortex	<ul style="list-style-type: none">• Cortisol	<ul style="list-style-type: none">• Raises level of amino acids in blood for gluconeogenesis.
<ul style="list-style-type: none">• Posterior pituitary	<ul style="list-style-type: none">• ADH (antidiuretic hormone)	Water retention by the kidneys

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. **(6 marks)**

COLUMN A	COLUMN B
allergy	
macrophage	a) multiple sclerosis <u>auto immune disease</u>
antigen	b) causes a secondary immune response <u>booster shot</u>
interferon	c) results in shock in severe cases <u>allergy</u>
antibody	d) prevents viral replication <u>interferon</u>
leukotrene	e) a product of plasma cells <u>antibody</u>
auto immune disease	f) capable of phagocytosis <u>macrophage</u>
booster shot	

2. Identify **three** kinds of T lymphocytes, and give a function of each. **(3 marks: $\frac{1}{2}$ mark each for names, $\frac{1}{2}$ mark each for functions)**

Name: • **Helper T cells.** ($\frac{1}{2}$ mark)

Function: • **Produce lymphokines necessary to stimulate B cells to divide and produce plasma cells.** ($\frac{1}{2}$ mark)

Name: • **Cytotoxic (killer) T cells.** ($\frac{1}{2}$ mark)

Function: • **Lyse cells displaying a foreign antigen.** ($\frac{1}{2}$ mark)

Name: • **Suppressor T cells.** ($\frac{1}{2}$ mark)

Function: • **Slow immune response.** ($\frac{1}{2}$ mark)

3. Give **one** use for monoclonal antibodies in passive immunity. **(1 mark)**

- **Diagnose pregnancy.**
 - **Fight cancer.**
 - **Fight a specific infection, etc.**
- } any one for
1 mark

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. **(6 marks)**

COLUMN A	COLUMN B
cartilage	
tendon	a) attaches muscles to bones <u>tendon</u>
ligament	b) weak bones caused by mineral deficiency <u>osteoporosis</u>
spongy bone	c) contains Haversian canals <u>compact bone</u>
compact bone	d) found in tip of the nose <u>cartilage</u>
scoliosis	e) binds two bones together <u>ligament</u>
osteomyelitis	f) curvature of the spine <u>scoliosis</u>
osteoporosis	

2. Give the role of the following in muscle contraction. **(3 marks: 1 mark each)**

Ca⁺⁺;

- **Needed for actin to bind with myosin.**
 - **Binds troponin causing tropomyosin thread to shift.**
- } either one for
1 mark

Actin:

- **Slides past myosin contracting the sarcomere. (1 mark)**

Sarcoplasmic reticulum:

- **Stores and releases calcium ions. (1 mark)**

3. What is the function of creatine phosphate? **(1 mark)**

- **Storage form of high energy phosphate needed for muscle contraction. (1 mark)**

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. **(6 marks)**

COLUMN A	COLUMN B
prostate gland	
ovary	a) location for spermatogenesis <u> seminiferous tubule </u>
epididymis	b) has enzymes used to penetrate egg <u> acrosome </u>
seminiferous tubule	c) sperm mature here <u> epididymis </u>
uterus	d) secretes progesterone <u> ovary </u>
fallopian tube	e) location of the developing fetus <u> uterus </u>
ductus (vas) deferens	f) provides nutrients for sperm <u> prostate gland </u>
acrosome	

2. Describe the following stages or processes of embryonic development. **(3 marks: 1 mark each)**

Cleavage:

- **Cell division without growth. (1 mark)**

Morphogenesis:

- **Movement of embryonic cells into a specific shape. (1 mark)**

Neurula:

- **Specialized cells first begin to appear.**
 - **Deferentiation of the nervous system.**
- } **either one for 1 mark**

3. What kind of organism causes gonorrhoea? **(1 mark)**

- **A bacterium (*Neisseria gonorrhoeae*). (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. **(6 marks)**

COLUMN A	COLUMN B
ligase	
protoplast	a) division of cytoplasm contents <u>cytokinesis</u>
restriction enzyme	b) virus carries DNA to a cell <u>transduction</u>
somaclonal variant	c) used to seal in foreign DNA <u>ligase</u>
transduction	d) plant cell lacking a cell wall <u>protoplast</u>
conjugation	e) plant cell cultures containing mutations <u>somaclonal variant</u>
DNA probe	f) sexual exchange of DNA in bacteria <u>conjugation</u>
cytokinesis	

2. Give **one** phenotype characteristic of each of the following genetic disorders. **(3 marks: 1 mark each)**

Klinefelter syndrome (Trisomy XXY):

- **Male with underdeveloped testes and enlarged breasts.**
 - **Sterile male.**
- } either one for
1 mark

Down syndrome: **(1 mark)**

- **Folded eyelids.**
 - **Short stature.**
 - **Mental retardation.**
 - **Large tongue.**
- } any one for
1 mark

Turner syndrome: **(1 mark)**

- **Female with stocky build and lack of breast development.**
 - **No puberty.**
- } either one for
1 mark

3. Give **one** use of recombinant DNA in humans. **(1 mark)**

- **Diagnosis of infections.**
 - **Sex of fetus.**
 - **Genetic diseases.**
 - **Gene therapy.**
 - **DNA probes.**
- } any one for
1 mark

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. **(6 marks)**

COLUMN A	COLUMN B	
carcinoma		
leukemia	a) new growth of cancer cells	<u>neoplasia</u>
sarcoma	b) spreading of cancer cells	<u>metastasis</u>
metastasis	c) epithelial skin cancer is one example	<u>carcinoma</u>
interleukin	d) activates immune system	<u>interleukin</u>
neoplasia	e) cancer of the blood	<u>leukemia</u>
macrophage	f) cancer of connective tissue	<u>sarcoma</u>
initiator		

2. a) State **two** ways by which the spread of cancer is hindered by the lymphatic system. **(2 marks: 1 mark each)**

- **Produce lymphocytes that attack cancer cells.**
 - **Produce macrophages that ingest cancerous cells.**
 - **Lymph nodes may filter out cancer cells.**
- } **any one for 1 mark**

b) State **one** way by which the spread of cancer is assisted by the lymphatic system. **(1 mark)**

- **Carry cancer cells to other parts of the body.**
 - **It is easy to invade the lymphatic system.**
- } **either one for 1 mark**

3. What is a proto-oncogene? **(1 mark)**

- **A normal gene that can be transformed into an oncogene. (1 mark)**

