Biology 12

August 1996 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	C	1	III-B-1	27.	H	3	C	1	IX-F-8
2.	U	2	B	1	III-C-11	28.	H	4	A	1	X-B-1
3.	K	2	D	1	III-C-1	29.	U	4	B	1	X-B-1
4.	H	2	D	1	III-C-1, 9; IV-B-1	30.	H	4	C	1	X-B-2
5.	K	2	B	1	IV-A-1	31.	K	4	C	1	X-D-3
6.	K	2	C	1	IV-B-1	32.	U	4	B	1	X-C-1
7.	U	2	D	1	IV-B-1	33.	K	4	A	1	X-E-1
8.	H	2	D	1	IV-B-1, 2; III-E-4	34.	U	4	B	1	X-E-1
9.	H	2	A	1	V-B-5	35.	U	4	C	1	X-E-1
10.	K	2	C	1	V-D-2	36.	K	4	C	1	X-E-2
11.	H	2	C	1	V-D-3	37.	K	4	C	1	XI-A-1
12.	U	2	D	1	VI-A-1	38.	H	4	C	1	XI-A-2
13.	K	2	A	1	VI-B-1	39.	U	4	B	1	XI-A-2; IX-A-2
14.	K	3	C	1	VII-1	40.	U	4	C	1	XI-A-3
15.	K	3	A	1	VIII-A-6	41.	U	4	D	1	XI-B-1
16.	K	3	D	1	VIII-B-1	42.	U	4	A	1	XI-C-1
17.	U	3	B	1	VIII-A-2	43.	K	4	C	1	XI-E-1
18.	U	3	C	1	VIII-A-2	44.	K	4	B	1	XI-E-2
19.	U	3	C	1	VIII-A-3	45.	H	4	C	1	XI-H-1
20.	U	3	C	1	VIII-A-3, 5	46.	H	4	D	1	XI-H-1
21.	K	3	A	1	VIII-A-5	47.	U	4	B	1	XI-H-1
22.	H	3	B	1	VIII-A-10	48.	H	4	D	1	XI-I-2
23.	H	3	C	1	IX-A-1	49.	K	4	C	1	XII-A-2
24.	K	3	A	1	IX-B-1	50.	H	4	B	1	XII-B-1, C-1
25.	K	3	D	1	IX-B-1	51.	H	4	D	1	XII-C-1
26.	U	3	A	1	IX-C-2	52.	K	4	D	1	XII-C-2

Part B: Written Response

Q	B	C	T	S	CGR
1.	1	U	1	6	V-B-5
2.	2	U	2	4	III-C-10; IV-B-1; III-E-1
3.	3	U	2	6	VI-C-2; V-D-3
4.	4	U	3	6	IX-A-1
5.	5	U	4	6	XII-C-1

Core written-response total = 28 marks

Part C: Option Section – Score only 2 out of 6 boxes (options) from box 6 to box 11.

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

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

Multiple Choice = 52 (52 questions)
Written Response = 48 (5 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.

1. The following procedure was conducted to observe the effect of pH on the rate of enzyme activity.

   - 10 mL of a starch solution was added to each of 5 lettered test tubes.
   - A different pH buffer was added to each tube resulting in the pH shown in the table below.
   - An equal amount of a starch-digesting enzyme was added to each tube.
   - Fresh samples were taken from **each tube every minute** and tested with IKI, an indicator that turns from yellow to black when mixed with starch.

   Results are recorded in the table below:

Test tube	pH of the solution	Colour of a sample when IKI was added after:			
		1 minute	2 minutes	3 minutes	4 minutes
V	5	black	black	yellow	yellow
W	6	black	yellow	yellow	yellow
X	7	black	black	yellow	yellow
Y	8	black	black	black	yellow
Z	9	black	black	black	black

a) What do the results indicate is present in **all** the test tubes at one minute? **(1 mark)**

- **Starch. (1 mark)**

b) What new substance is present in test tube **X** at three minutes? **(1 mark)**

- **Sugar.**
- **Maltose.**
- **Disaccharide.**

any one for 1 mark

c) Which test tube has the optimal pH for the enzyme? Explain your choice. **(2 marks)**

- **Test tube W has the optimal pH. (1 mark)**
- **Starch was digested more rapidly in this tube. (1 mark)**

d) After one hour, a sample from test tube **Z** still turned black. Using the lock and key model of enzyme action, explain these results. **(2 marks)**

- **The enzyme has stopped working. (1 mark)**
- **The change in pH has destroyed the enzyme's active site, (1 mark) or the enzyme has been denatured. (1 mark)**
- **The tertiary enzyme structure is altered. (1 mark)**
- **Therefore the substrate cannot bind to the active site. (1 mark)**

any two for 1 mark each

2. State **one** role of each of the following.

a) Phospholipids: **(1 mark)**

- **Form membranes.**
- **Polar nature enables them to play a role in determining what enters/exits a cell.**
- **Used to produce prostaglandins.**
- **Joins fat soluble and water soluble molecules together in the cell.**

any one for 1 mark

b) tRNA: **(1 mark)**

- **Brings amino acids to the ribosome.**
- **Brings amino acids to the polypeptide chain.**
- **Complements mRNA codon.**

any one for 1 mark

c) Smooth endoplasmic reticulum: **(1 mark)**

- **Synthesizes steroid hormones (lipids).**
- **Detoxifies drugs (oxidizes alcohol).**
- **Intracellular transport.**
- **Secretion of steroid hormones.**

any one for 1 mark

d) Cell wall: **(1 mark)**

- **Mechanical strength.**
- **Gives shape to the cell.**
- **Supports the cell (keeps plant upright).**
- **Provides protection.**

any one for 1 mark

3. a) Describe the three steps of DNA replication. **(3 marks)**

- **The DNA "unzips" (1 mark), then the complementary base pairing of new nucleotides to the parent strands occurs (1 mark), and finally the adjacent nucleotides join to form new sugar phosphate backbones. (1 mark)**

b) Where in the cell does DNA replication occur? **(1 mark)**

- **In the nucleus.**
- **In the mitochondria.**
- **In the chloroplasts.**

} **any one for 1 mark**

c) What is the purpose of DNA replication? **(1 mark)**

- **To pass on identical genetic information to "daughter cells". (1 mark)**

d) Which base is found in DNA but **not** in RNA? **(1 mark)**

- **Thymine. (1 mark)**

4. In the table below, state **one** function of each vessel and describe the vessel's structure that facilitates this function. **(6 marks: 1 mark for function, 1 mark for structure)**

VESSEL	FUNCTION	STRUCTURE
Arteries	• **carry blood away from the heart.** • **help in maintaining blood pressure (return to original diameter after expansion).**	• **thick-walled, elastic, equipped with smooth muscle.**
Veins	• **return blood to the heart.**	• **thinner walls.** • **equipped with one-way valves.** • **equipped with smooth muscle.**
Capillaries	• **allow for the transfer of materials from the vascular system into the tissues.** • **regulate temperature.** • **exchanges nutrients and wastes.**	• **thin-walled, one cell thick, leaky (permeable).** • **equipped with sphincters to direct blood flow.**

5. For each of the following hormones, identify its source and state its function.
(6 marks: 1 mark for source, 1 mark for function)

HORMONE	SOURCE	FUNCTION
Insulin	• **pancreas**	• **increases the permeability of cell membranes to glucose.** • **decreases blood sugar levels.** • **converts glucose to glycogen in liver.**
Thyroxin	• **thyroid gland**	• **increases metabolic rate.**
Growth Hormone (GH)	• **anterior pituitary**	• **lengthens bones** • **increases cell division** • **promotes protein synthesis.**

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		
multiple sclerosis	a) matures into a plasma cell	**B lymphocyte**
booster shot	b) second exposure to a vaccine	**booster shot**
monoclonal antibody	c) responsible for cell mediated immunity	**killer or cytotoxic T cell**
killer or cytotoxic T cell	d) antibody attack of the myelin sheath	**multiple sclerosis**
B lymphocyte	e) overactive IgE antibody response	**allergy**
rheumatoid arthritis	f) type of antibody produced *in vitro*	**monoclonal antibody**
antigen		

2. Name the causative agent of AIDS and give **one** type of host cell affected by this agent. **(2 marks)**

- **HIV. (1 mark)**
- **Helper T cells. (1 mark)**

3. State **two** ways in which organ rejection can be minimized. **(2 marks: 1 mark each)**

Organ rejection can be minimized by:

- **matching MHC proteins. (1 mark)**
- **the use of immunosuppressive drugs (e.g. cyclosporin, FK506). (1 mark)**
- **closely matching tissues (family members, blood type, etc...). (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	
ligament		
Haversian canal	a) site of blood cell production	**spongy bone**
tendon	b) thin filament that moves during muscle contraction	**actin**
osteomyelitis	c) the wall of the esophagus	**smooth muscle**
smooth muscle	d) connects muscles to bones	**tendon**
actin	e) surrounded by concentric circles of osteocytes	**Haversian canal**
osteoporosis	f) infection of the bone	**osteomyelitis**
spongy bone		

2. List **two** functions of the vertebral column. **(2 marks: 1 mark each)**

- **Flexibility, resiliency.**
- **Shock absorption.**
- **Anchor for bones/muscles.**
- **Production of red blood cells.**
- **Protection of spinal cord.**
- **Storage of minerals.**

} **any two for 1 mark each**

3. Explain the role of myosin in muscle contraction. **(2 marks)**

- **Forms cross bridges. (1 mark)**
- **Acts as an ATPase. (1 mark)**

OR

- **Cross bridges pull actin filaments inward, shortening the sarcomere during contraction. (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. **(6 marks)**

COLUMN A	COLUMN B	
in-vitro fertilization		
testosterone	a) production of sperm	**spermatogenesis**
implantation	b) egg and sperm are combined in a laboratory	**in-vitro fertilization**
differentiation	c) a cap on the head of the sperm	**acrosome**
spermatogenesis	d) embryo embeds itself in the endometrium	**implantation**
rhythm method	e) avoiding sex around the time of ovulation	**rhythm method**
morphogenesis	f) cells take on a specific structure and function	**differentiation**
acrosome		

2. List **two** components of semen. **(2 marks: 1 mark each)**

- **Water.**
- **Sperm.**
- **Fructose.**
- **Prostaglandins.**
- **Amino Acids.**
- **Proteins.**
- **Seminal fluid.**

any two for 1 mark each

3. Complete this table which summarizes the ovarian and uterine cycles. **(2 marks: 1 mark each)**

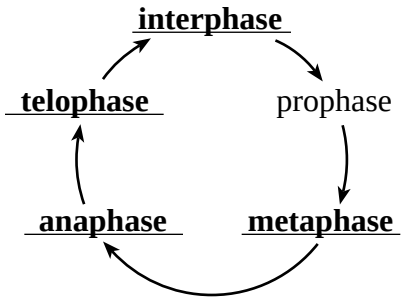
	OVARY	UTERUS
Days 1-14	• **follicle matures or** • **estrogen is secreted** • **ovulation could occur**	• endometrium is shed and then rebuilds.
Days 14-28	• corpus luteum forms and • progesterone is secreted	• **endometrium thickens, becomes vascular, and secretory**

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	
meiosis		
mitosis	a) having an extra chromosome (e.g. XXY)	**trisomy**
conjugation	b) plant cell with cell wall removed	**protoplast**
DNA probe	c) caused from lack of a second sex chromosome (XO)	**Turner syndrome**
protoplast	d) cell division which occurs during growth	**mitosis**
Turner syndrome	e) used to determine if the patient has a genetic disease	**DNA probe**
trisomy	f) nuclear material of one cell is transferred to another cell	**conjugation**
replication		

2. Fill in the blanks in the cell cycle of a eukaryote as outlined below. Make sure the stages are in the correct order. **(2 marks: $\frac{1}{2}$ mark each)**



3. Give **two** safeguards that scientists have suggested to ensure safe use of viruses and bacteria in genetic engineering. **(2 marks: 1 mark each)**

- **Specially built rooms.**
- **Use of attenuated strains.**
- **Sterilization of equipment.**
- **Restrictions on the host used.**
- **Restrictions on the type of experimentation allowed.**

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. **(6 marks)**

COLUMN A	COLUMN B	
anaplasia		
sarcoma	a) cancer of the connective tissue	**sarcoma**
carcinoma	b) activates immune system	**interleukin**
interleukin	c) increased circulatory development	**vascularization**
benign	d) DNA that causes uncontrolled cell growth	**oncogene**
vascularization	e) cancer of the epithelial tissue	**carcinoma**
oncogene	f) a type of tumor that does not spread	**benign**
malignant		

2. Explain the roles of initiators and promoters in the development of a cancerous tumor. **(2 marks: 1 mark each)**

Initiators:

- **Mutagen, creates an oncogene. (1 mark)**

Promoters:

- **Speed up the effects of the oncogene – tumor develops.**
- **Promoters such as a diet rich in cholesterol trigger the oncogene.**

} **either one for 1 mark**

3. What is a retrovirus? How can it affect normal cell function? **(2 marks)**

- **A retrovirus is a virus that has RNA instead of DNA as its genetic material. (1 mark)**
- **It can introduce a viral oncogene. (1 mark)**

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. **(6 marks)**

COLUMN A	COLUMN B	
sclera		
static equilibrium	a) build up of aqueous humor	**glaucoma**
cataract	b) controls the shape of the lens	**ciliary body**
ciliary body	c) knowledge of angular motion	**dynamic equilibrium**
photoreceptor	d) involves movement of the otoliths	**static equilibrium**
iris	e) found in the retina	**photoreceptor**
glaucoma	f) controls entrance of light	**iris**
dynamic equilibrium		

2. Arrange the following structures in the order in which sound waves travel to reach the auditory nerve. **(2 marks: $\frac{1}{2}$ mark each)**

Tympanic membrane
Auditory canal
Ossicles
Cochlea

1st: **Auditory canal**
2nd: **Tympanic membrane**
3rd: **Ossicles**
4th: **Cochlea**

Note to markers: part marks should be awarded for a partially correct sequence.

3. Describe the function of the rods in the eye. **(2 marks)**

- **Rods absorb light to break rhodopsin into opsin and retinal.**
- **They enable black and white vision.**
- **They enable vision in dim light.**
- **Responsible for motion detection.**

any two for 1 mark each

END OF KEY