

Biology 12

November 1999 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	CO	PLO	Q	K	C	CO	PLO
1.	C	K	1	A1	26.	C	U	3	J5
2.	C	U	1	A1, 3	27.	B	K	3	J9
3.	A	K	1	A3	28.	C	U	3	J9
4.	C	H	1	A2, 3	29.	C	K	3	K1
5.	C	H	1	A3	30.	C	K	3	L1
6.	A	K	1	C2, 4	31.	A	U	3	L1, 7
7.	C	H	1	C1, 2, 4	32.	C	H	3	L4, 5, 6
8.	D	K	1	C7	33.	A	U	3	L8; J4
9.	B	K	1	C10	34.	C	K	3	M1
10.	D	U	2	E1	35.	A	U	3	M2
11.	A	K	2	E3	36.	D	K	3	M3
12.	C	K	2	F3	37.	D	K	3	M4
13.	B	K	2	G3	38.	A	H	3	M8, 2, 4
14.	C	K	2	G3	39.	B	H	3	M8
15.	A	K	2	G5; M6	40.	B	U	3	N1
16.	C	H	2	G6	41.	A	K	3	N4
17.	C	U	2	H1, 5	42.	B	K	3	O1
18.	C	K	2	H5	43.	B	H	3	O1, 2
19.	C	H	3	I1, 4	44.	B	K	3	O2
20.	D	U	3	I3	45.	D	K	3	O4
21.	A	K	3	I4	46.	A	K	3	P1
22.	B	H	3	I9	47.	C	U	3	P2
23.	B	K	3	J1	48.	B	H	3	P9, 10
24.	C	K	3	J2	49.	A	H	3	P9, 10
25.	A	U	3	J1, 2, 4; K1	50.	A	U	3	P12

Multiple Choice = 50 marks

Part B: Written Response

Q	B	C	S	CO	PLO
1.	1	U	3	1	C4, 5, 11
2.	2	U	3	1	D2
3.	3	U	2	2	E1, 2
4.	4	U	2	2	F1
5.	5	U	3	2	G1
6.	6	U	4	2	H3, 6
7.	7	U	6	3	I1, 2, 4
8.	8	U	5	3	J12
9.	9	U	4	3	L3, 5, 7
10.	10	H	5	3	M5, 6, 7
11.	11	U	6	3	O2
12.	12	U	7	3	P3, 5, 6

Written Response = 50 marks

Multiple Choice = 50 (50 questions)

Written Response = 50 (12 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.
 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. State a **different** function for each of the following in the human body.

(3 marks: 1 mark each)

Monosaccharides:

- provide an energy source for the body.
 - are the building blocks of polysaccharides.
- } either one for
1 mark

Amino acids:

- are used to form proteins.
- are used to synthesize enzymes.
- are used to synthesize hormones.
- are the building blocks of antibodies, plasma proteins.
- are a source of energy. (*Note to markers: do not accept if student answered "energy source" for Monosaccharides.*)

} any one for
1 mark

Glycogen:

- is used as a stored form of glucose in animals.
- is converted to glucose in the liver/muscles.
- is used for cell-to-cell recognition.

} any one for
1 mark

2. Describe the process of DNA replication.

(3 marks)

- **The hydrogen bonds between the base pairs break (unzip).**
- **Helicase (enzyme) is involved in breaking hydrogen bonds.**
- **Complementary base pairing occurs.**
- **DNA polymerase acts as a “proof-reader” to ensure that there are no errors in base pairing.**
- **Sugar of one nucleotide joins with the phosphate of the adjacent nucleotide to form the sugar-phosphate backbone.**
- **The end result is the formation of two identical DNA molecules.**

**any three for
1 mark each**

Use the following chart to answer question 3.

Three-letter codons of messenger RNA and the amino acids specified by the codons			
AAU } Asparagine AAC }	CAU } Histidine CAC }	GAU } Asparatic acid GAC }	UAU } Tyrosine UAC }
AAA } Lysine AAG }	CAA } Glutamine CAG }	GAA } Glutamic acid GAG }	UAA } Stop UAG }
ACU } Threonine ACC ACA ACG }	CCU } Proline CCC CCA CCG }	GCU } Alanine GCC GCA GCG }	UCU } Serine UCC UCA UCG }
AGU } Serine AGC }	CGU } Arginine CGC CGA CGG }	GGU } Glycine GGC GGA GGG }	UGU } Cysteine UGC }
AGA } Arginine AGG }			UGA – Stop UGG – Tryptophan
AUU } Isoleucine AUC AUA }	CUU } Leucine CUC CUA CUG }	GUU } Valine GUC GUA GUG }	UUU } Phenylalanine UUC }
AUG – Methionine			UUA } Leucine UUG }

3. a) Determine the DNA base sequence that codes for the amino acid tryptophan. **(1 mark)**

- **ACC (1 mark)**

b) Determine the anticodon for tryptophan. **(1 mark)**

- **ACC (1 mark)**

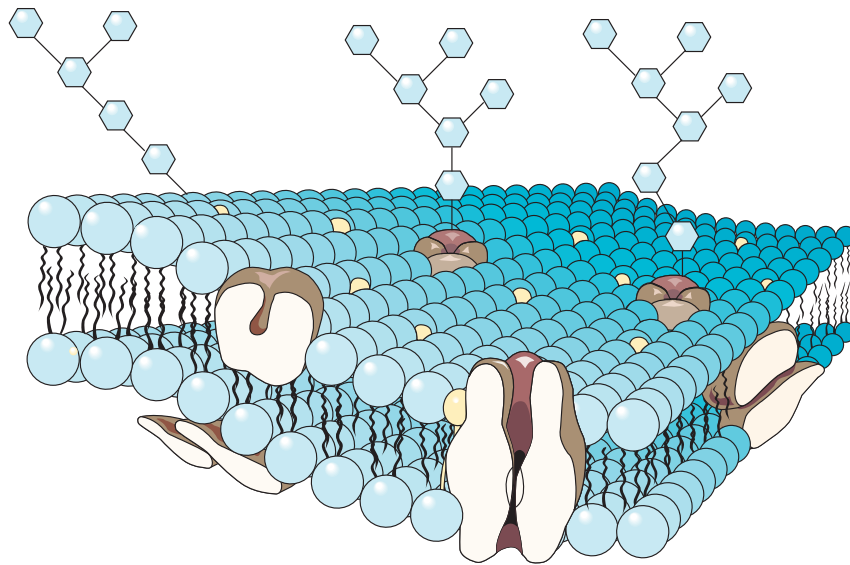
4. Describe how increased vascularization aids in the development of cancer.

(2 marks)

- **Removes wastes.**
- **Brings nutrients.**
- **Allows metastasis.**
- **Allows for increased metabolic activity.**
- **Nourishes tumour.**

} **any two for
1 mark each**

Use the following diagram to answer question 5.



5. Give **three** functions of the structure above.

(3 marks)

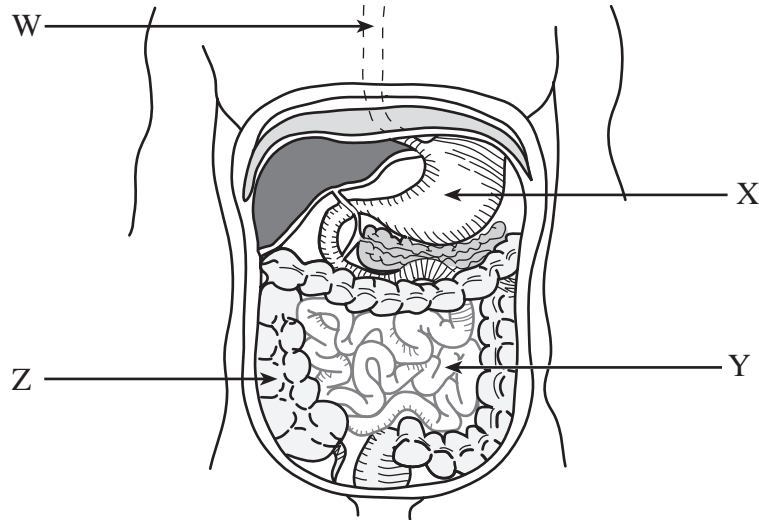
- **Maintains cell integrity.**
- **Catalyzes reactions on the cell surface.**
- **Forms tissues by joining to other cells (junctions).**
- **Regulates the exit and entrance of molecules out of and into the cell via pinocytosis / phagocytosis / endocytosis.**
- **Regulates the exit and entrance of molecules out of and into the cell via exocytosis.**
- **Regulates the exit and entrance of molecules out of and into the cell via diffusion.**
- **Regulates the exit and entrance of molecules out of and into the cell via osmosis.**
- **Regulates the exit and entrance of molecules out of and into the cell via active transport.**
- **Regulates the exit and entrance of molecules out of and into the cell via facilitated transport.**
- **Used in cell identification.**
- **Glycoproteins bring certain molecules in by pinocytosis.**
- **Provides receptor sites.**
- **Acts as a cell boundary—keeps the organelles within the cell.**

any three for
1 mark each

6. The addition of heavy metals, boiling water or acid all have the same effect on the rate of an enzyme-catalyzed reaction. Describe the effect that these additions have on the enzyme and the reaction rate. **(4 marks)**

- **They slow the rate of the reaction (1 mark) by denaturing the enzyme (1 mark).**
- **Fewer enzyme-substrate complexes can be formed (1 mark) because the enzyme and substrate do not fit as the active site has changed (1 mark).**

Use the following diagram to answer question 7.



7. Identify each of the labelled structures and give **one** function of each.
(6 marks: $\frac{1}{2}$ mark each for name; 1 mark each for function)

Part W:

Name: **esophagus** ($\frac{1}{2}$ mark)

- Function:
- **Transports food from the mouth to the stomach.**
 - **Secretes mucus.**

} **either one for
1 mark**

Part X:

Name: **stomach** ($\frac{1}{2}$ mark)

- Function:
- **Stores food.**
 - **Secretes HCl.**
 - **Digests protein.**
 - **Secretes pepsinogen.**
 - **Conducts mechanical churning of food.**
 - **Absorbs H₂O, alcohol.**
 - **Secretes mucus.**

} **any one for
1 mark**

Part Y:

Name: **small intestine** ($\frac{1}{2}$ mark)

- Function:
- **Emulsifies fats.**
 - **Absorbs nutrients.**
 - **Neutralizes acid chyme.**
 - **Digests maltose and peptides.**
 - **Secretes enzymes (e.g. maltase, peptidase).**
 - **Transports undigested materials to the large intestine.**
 - **Receives enzymes and bile.**

} **any one for
1 mark**

Part Z:

Name: **large intestine** ($\frac{1}{2}$ mark)

- Function:
- **Absorbs water and salts.**
 - **Stores indigestible materials.**
 - **Produces vitamins and growth factors.**
 - **Houses bacteria.**

} **any one for
1 mark**

8. Describe tissue-capillary fluid exchange.

(5 marks)

- **The blood pressure is higher than the osmotic pressure on the arteriole side of the capillary bed.**
- **Plasma is forced into the tissues as a result.**
- **As the blood flows through the capillary bed, the blood pressure drops.**
- **Therefore, the blood pressure is lower than the osmotic pressure on the venule side of the capillary bed.**
- **Fluid is drawn from tissues into the blood as a result of diffusion and osmosis.**
- **Nutrients diffuse into the tissues at the arteriole end of the capillary bed.**
- **Wastes diffuse out of the tissues at the venule end of the capillary bed.**
- **Substances move according to their concentration gradient.**

9. Describe how the characteristics of the lungs assist in the function of gas exchange. **(4 marks)**

- **Wetness increases the diffusion rate of gases.**
- **Large surface area allows for greater gas exchange.**
- **Alveoli are one cell layer thick for ease of diffusion.**
- **Numerous blood vessels increase the efficiency of gas exchange.**
- **Lipoprotein layer decreases surface tension to prevent alveolar collapse.**
- **Capillaries are one cell layer thick for ease of diffusion.**
- **Made up of alveoli to maximize surface area to volume ratio.**
- **Alveoli are made up of simple squamous epithelium.**
- **Alveoli are surrounded by a rich capillary network which increases the rate of diffusion.**
- **The large number of alveoli allows for greater gas exchange.**
- **A neutral pH or more basic pH than tissues allows hemoglobin to bind more readily to O₂.**
- **Cooler temperature in the lungs than in the tissues allows hemoglobin to bind more readily to O₂.**
- **Mucus and cilia in the lungs move debris out of the lungs for more efficient gas exchange.**
- **The pleural membranes prevent friction to allow inflation of the lungs.**
- **Stretch receptors in the alveoli inhibit the medulla oblongata thus allowing exhalation to occur.**
- **The alveoli are flexible or elastic for ease of inflation.**

Note: (4 marks: $\frac{1}{2}$ mark each for correct characteristic; $\frac{1}{2}$ mark each for description of correct process)

10. Describe how a nerve impulse moves across a synapse.

(5 marks)

- A wave of depolarization reaches the synaptic ending.
 - The presynaptic membrane becomes permeable to calcium ions.
 - Calcium ions diffuse into the ending.
 - Calcium ions interact with contractile proteins.
 - Synaptic vesicles are pulled to the presynaptic membrane.

 - Vesicles release a neurotransmitter into the cleft via exocytosis.
- OR**
- The synaptic vesicles merge with the presynaptic membrane.

 - Neurotransmitter diffuses across the synaptic cleft.
 - Neurotransmitter attaches to receptors on the postsynaptic membrane.

 - Depolarization of the postsynaptic membrane occurs.
- OR**
- Excitation of the postsynaptic membrane occurs.

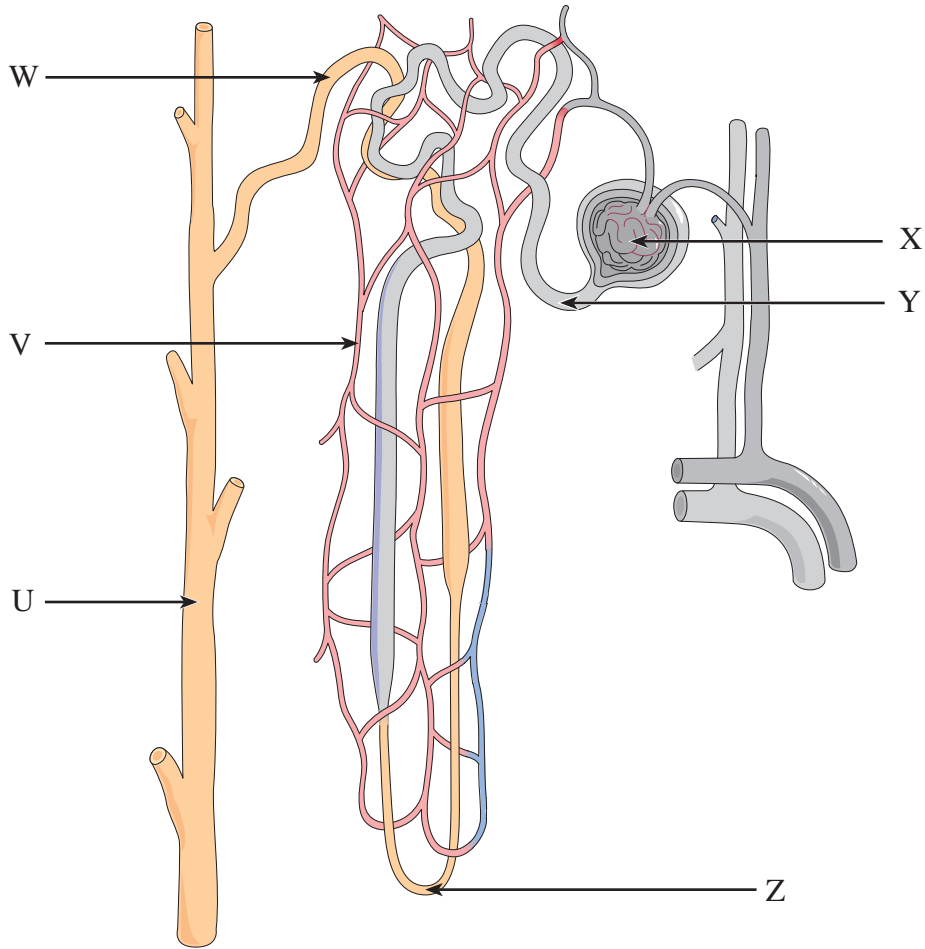
 - Enzymes in the cleft destroy neurotransmitter.
- OR**
- Neurotransmitter is absorbed by endocytosis in the pre-synaptic membrane.

 - Na⁺ channels open in the postsynaptic membrane.
 - A threshold needs to be reached in order for the nerve impulse to form.
 - Inhibition of the postsynaptic membrane occurs.

any four for
1 mark each

Note: (5 marks: 4 marks for description; 1 mark for correct order in process)

Use the following diagram to answer question 11.



11. State a **different** function of each of the labelled structures. (6 marks: 1 mark each)

Part U:

- **Regulates pH.**
 - **Reabsorbs water.**
 - **Takes urine to the renal pelvis.**
 - **Collects urine from many nephrons.**
- } any one for
1 mark

Part V:

- **Takes nutrients from reabsorption to renal vein.**
 - **Provides energy and oxygen to the nephron.**
- } either one for
1 mark

Part W:

- **Reabsorbs water.** (*Note to markers: do **not** accept if student answered “reabsorbs water” for structure U.*)
- **Tubular excretion.**
- **Regulates blood pH.** (*Note to markers: do **not** accept if student answered “regulates pH” for structure U.*)
- **Carries out selective reabsorption of K^+ , H^+ , NaCl and HCO_3^-**
- **Is affected by aldosterone and ADH.**

} any one for
1 mark

Part X:

- **Pressure filtration. (1 mark)**

Part Y:

- **Selective reabsorption.**
- **Passive and active transport of nutrients, salts and H_2O .**

} either one for
1 mark

Part Z:

- **Osmoregulation.**
- **Extrusion of Na^+ .**
- **Maintains salt and water balance.**
- **Reabsorbs water.** (*Note to markers: do **not** accept if student answered “reabsorbs water” for structure W.*)
- **Creates a hypertonic medulla.**

} any one for
1 mark

12. a) Give **one** function of each of the following in a **male**.

(3 marks: 1 mark each)

Luteinizing hormone (LH):

- **Stimulates the production of testosterone. (1 mark)**

Follicle-stimulating hormone (FSH):

- **Stimulates spermatogenesis. (1 mark)**

Testosterone:

- **Gender differentiation.**
- **Stimulates maturation of sperm.**
- **Brings about the development of the primary sex organs.**
- **Brings about and maintains secondary sex characteristics.**

} any one for
1 mark

b) i) Name **two** structures that contribute to the production of seminal fluid.

(2 marks)

- **prostate gland**
- **seminal vesicle**
- **Cowper's gland**

} any two for
1 mark each

ii) Give **two** functions of seminal fluid.

(2 marks)

- **Provides lubrication.**
- **Causes uterine contractions.**
- **Neutralizes the acidity of the vagina.**
- **Provides medium for sperm to swim in.**
- **Contains sugar as an energy source for sperm locomotion.**

} any two for
1 mark each

END OF KEY