

Biology 12

August 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.	C	K	1	1, 2	A1; E1	26.	A	H	1	3	I6, 7
2.	C	K	1	1, 2	A1; G1	27.	D	H	1	3, 2	I7; J2; G7
3.	C	H	1	1	B1; C2, 4, 10; D1	28.	C	K	1	3	J5
4.	D	K	1	1	B3	29.	D	H	1	3, 1	J9, 11; D2
5.	B	U	1	1	C1, 2	30.	C	U	1	3	J11, 9
6.	C	H	1	1	C4, 1	31.	A	K	1	3	L5, 1
7.	D	H	1	1	C7	32.	B	U	1	3	L3, 7, 1
8.	A	H	1	1	C8, 2	33.	B	U	1	3	L4, 5, 1
9.	C	U	1	1	C9, 2	34.	D	U	1	3	M2
10.	D	K	1	1	D3	35.	B	K	1	3	M1
11.	D	K	1	2	E1	36.	D	H	1	3	M3
12.	A	H	1	2	E1; G7	37.	A	H	1	3	M3
13.	B	K	1	2	F1	38.	D	U	1	3	N2
14.	D	K	1	2	F3, 1	39.	C	K	1	3	N4
15.	B	U	1	2, 1	G1; C11	40.	C	K	1	3	O1
16.	B	K	1	2	G2, 3, 4	41.	B	K	1	3	O1
17.	B	U	1	2	G5	42.	B	U	1	3	O1
18.	C	K	1	2	H1	43.	B	U	1	3	O2, 1
19.	C	H	1	2	H1, 6	44.	C	H	1	3	O2
20.	D	H	1	2	H2	45.	D	U	1	3	O2, 5
21.	D	U	1	2	H1, 3, 6	46.	C	H	1	3	O5
22.	C	K	1	3	I1	47.	A	K	1	3	P1, 2
23.	B	U	1	3	I1, 5	48.	D	K	1	3	P9, 10, 6; N5
24.	A	U	1	3	I1	49.	A	H	1	3	P8, 9, 10; N5
25.	A	K	1	3	I2, 4	50.	A	U	1	3	P12

Multiple Choice = 50 marks

Part B: Written Response

Q	B	C	S	CO	PLO
1.	1	U	4	1, 2	A2, 1, 3; E1
2.	2	U	6	1, 2	D2; E1
3.	3	K	3	2	G3, 4, 2, 5
4.	4	U	5	3	I1, 2, 4
5.	5	K	8	3	J2, 4, 6, 8, 11; K1
6.	6	U	3	3	J12
7.	7	U	3	3	L6
8.	8	U	5	3	M5, 6
9.	9	U	3	3	M2, 4
10.	10	U	5	3	O2
11.	11	U	5	3	P1, 3, 5, 6

Written Response = 50 marks

Multiple Choice = 50 (50 questions)
Written Response = 50 (11 questions)
EXAMINATION TOTAL = 100 marks

LEGEND:

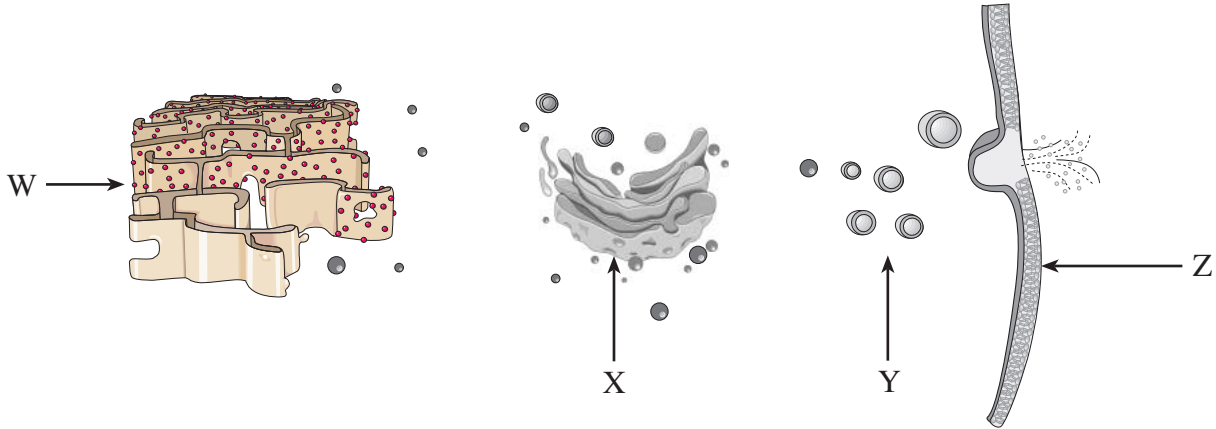
Q = Question Number **B** = Score Box Number **S** = Score
K = Keyed Response **C** = Cognitive Level **CO** = Curriculum Organizer
PLO = Prescribed Learning Outcome

PART B: WRITTEN RESPONSE

Value: 50 marks

Suggested Time: 75 minutes

Use the following diagrams to answer question 1.



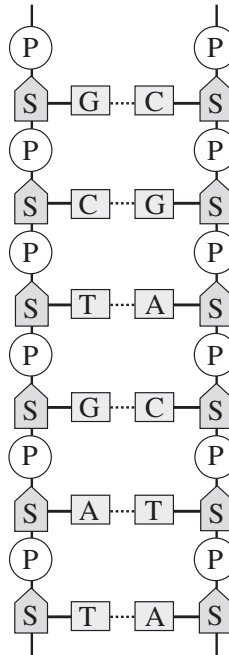
1. Describe how structures **W**, **X**, **Y** and **Z** work together.

(4 marks)

- Smooth endoplasmic reticulum synthesizes lipids.
- Ribosomes on the rough endoplasmic reticulum (**W**) produce proteins.
- Proteins enter the lumen of the rough endoplasmic reticulum (**W**).
- Proteins pinch off the rough endoplasmic reticulum in vesicles.
OR Proteins travel to the smooth endoplasmic reticulum and are carried off in transport vesicles.
- Golgi bodies (**X**) store the proteins.
- There is modification of proteins at the Golgi bodies.
- Golgi bodies package proteins into (secretory) vesicles.
- Vesicles (**Y**) carry cell products from the Golgi to the cell membrane (**Z**).
- Vesicles attach to the cell membrane and products are released through exocytosis. OR Protein is released via exocytosis. OR Vesicles fuse with cell membrane and then releases their contents out of the cell.

any four for
1 mark each

Use the following diagram to answer question 2.



2. a) Describe replication of this molecule.

(3 marks)

- **Unzipping, the breaking of hydrogen bonds between the bases that run down the centre of the DNA molecule, splits the two strands apart.**
- **Complementary base pairing occurs to bond new nucleotides into place along each strand.**
- **DNA polymerase acts as a proofreader.**
- **The adjacent nucleotides join together to form new sugar-phosphate backbones.**
- **The result is two identical copies of DNA.**
- **Two semiconservative copies are made.**

} any three for
1 mark each

b) What is the role of this molecule in determining the structure of a protein?

(1 mark)

- **The sequence of bases in this DNA molecule determines the sequence of amino acids in the resulting protein.**
- **Produce mRNA → tRNA → amino acid.**

} either one for
1 mark

c) Reading top to bottom, determine the mRNA sequence that would be transcribed from the left-hand strand of this molecule. **(1 mark)**

• **C G A C U A (1 mark)**

d) Give the anticodons that are complementary to this mRNA sequence. **(1 mark)**

• **G C U G A U (1 mark)**

3. a) Why do oxygen molecules enter a cell at a different rate than protein molecules. **(1 mark)**

- **Oxygen molecules are smaller.**
- **Oxygen molecules enter by diffusion.**
- **Oxygen is a gas and gases diffuse across the cell membrane more quickly.**
- **Oxygen is neutral / unchanged / non-polar.**
- **Protein molecules are larger.**
- **Protein molecules enter by endocytosis.**

} **any one for
1 mark**

Note to markers:

Do not accept different sizes.

b) State **two** ways to increase the rate of oxygen movement into a cell. **(2 marks)**

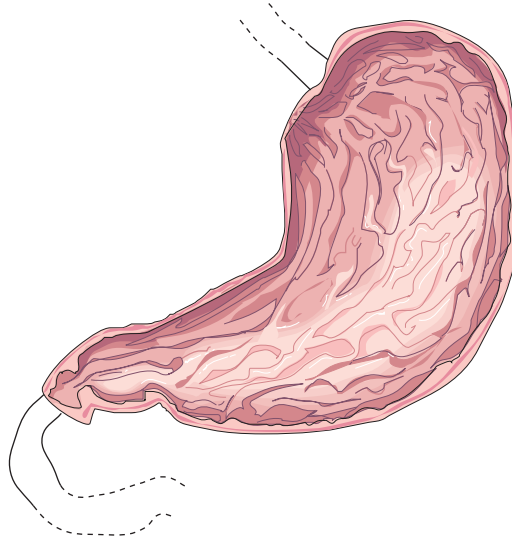
- **increase the temperature**
- **increase the concentration gradient OR explanation of oxygen gradient OR increase the respiratory rate**
- **increase the metabolic rate of the cell**
- **increase cytoplasmic streaming**
- **secretion of thyroxin**

} **any two for
1 mark each**

Note to markers:

Do not accept increase in surface area.

Use the following diagram to answer question 4.



4. Explain how the structure above is well-suited for its function.

(5 marks)

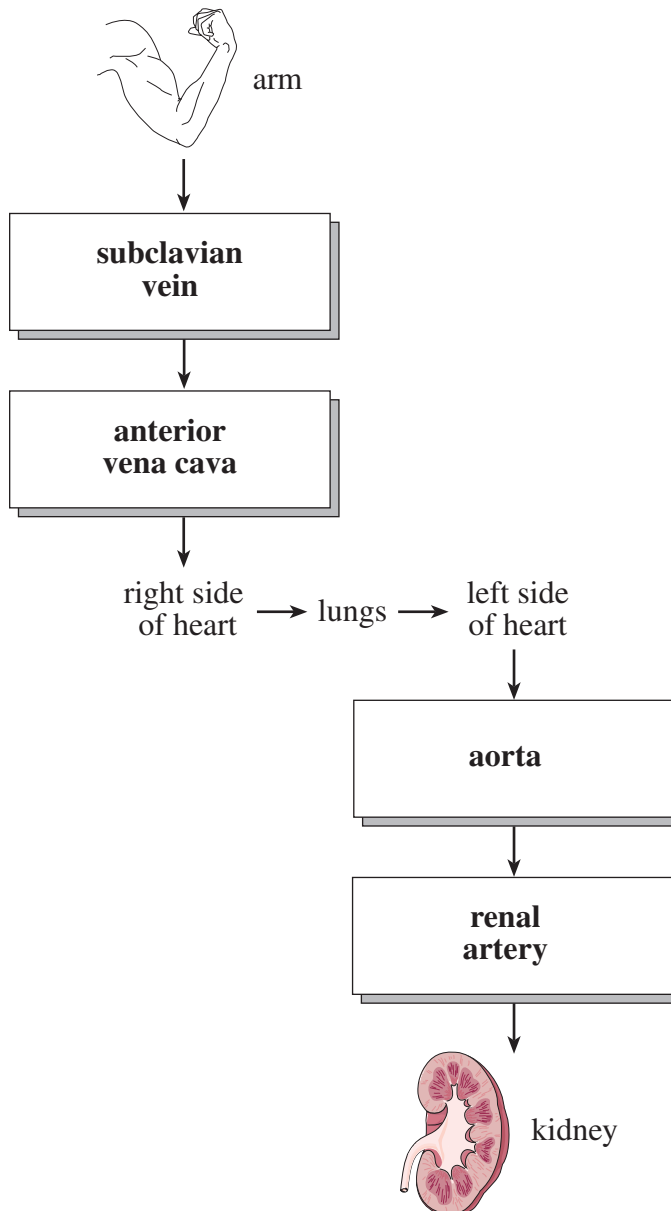
- The stomach has folds that increase the surface area.
- Gastric glands in the lining secrete HCl (hydrochloric acid) that activates pepsinogen / kills bacteria.
- Mucous cells in the lining secrete mucus that protects the stomach lining (prevents auto-digestion or ulcers).
- Cells in the lining secrete pepsinogen to hydrolyze proteins into peptides.
- The stomach can expand to store partially digested food.
- Muscular walls mechanically break down food.
- Smooth muscles move chyme to the pyloric sphincter via peristalsis.
- Cardiac sphincter prevents food from re-entering the esophagus.
- Pyloric sphincter controls the amount of chyme entering the duodenum.
- Cells secrete gastrin to release more gastric juice.
- Gastric glands in lining secrete pepsinogen that will be activated to pepsin and digest proteins → dipeptides.

any five for
1 mark each

Use the following list to answer question 5 a).

- aorta
- renal vein
- renal artery
- subclavian vein
- subclavian artery
- pulmonary artery
- anterior vena cava

5. a) Choose the vessel names from the list above to fill in the boxes that describe the path of blood from the arm to the kidney. (Use only one term per box. Not all of the terms will be used.) **(4 marks)**



b) Give **one** function of each of the following.

(4 marks: 1 mark each)

carotid arteries:

- **transport / carry blood to the head***
- **transport / carry nutrients to the head***
- **transport / carry oxygenated blood to the head***
- **detect / sense hydrogen ion concentrations in the blood**
- **detect / sense carbon dioxide concentrations in the blood**
- **elastic design counteracts effects of high blood pressure / can withstand high blood pressure**

} **any one for
1 mark**

***Note to markers:**

Student must specifically state or identify the head.

lymph veins:

- **transport fats / lipids**
- **carry lymphocytes / white blood cells**
- **carry lymph (from the tissues to the circulatory system [subclavian veins])**
- **carry excess tissue fluid back to circulatory system**
- **carry excess tissue fluid to lymph nodes for cleansing / purification**

} **any one for
1 mark**

antibodies:

- **can be used to determine blood type (blood typing)**
- **combine with antigens, inactivating them / marking them for destruction**
- **fight infection / foreign invaders**
- **provide immunity to pathogens / disease**
- **neutralize antigens / pathogens**

} **any one for
1 mark**

chordae tendineae:

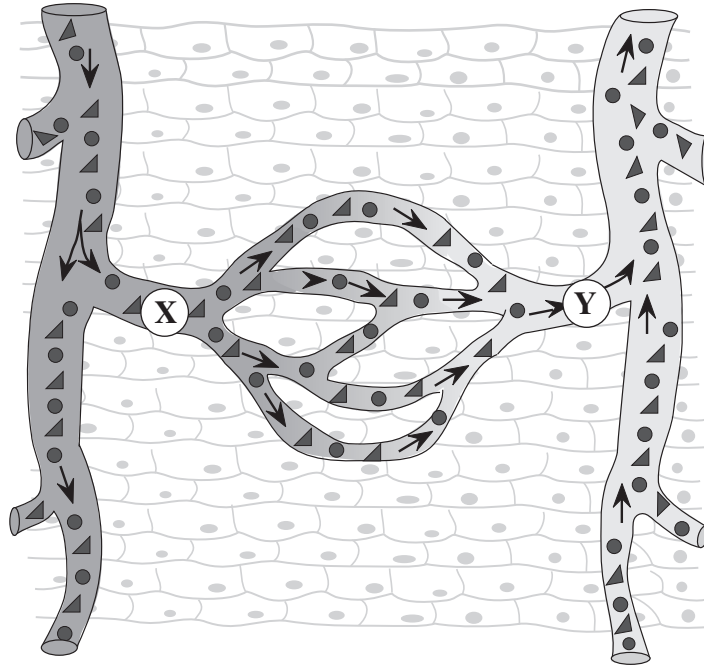
- **prevent the AV (atrioventricular valves) from inverting**
- **prevent heart valves from inverting**
- **anchor AV valves**
- **stabilize / give structural support to AV valves**
- **prevent AV valves from opening in wrong direction**

} **any one for
1 mark**

Note to markers:

Student must identify as either AV or heart valves.

Use the following diagram to answer question 6.



6. Describe what happens to the concentrations of oxygen, carbon dioxide and nutrients in the blood as it moves between points X and Y in the skin. (3 marks)

- The concentration of nutrients decreases. (1 mark)
- The concentration of oxygen decreases (the concentration of oxyhemoglobin decreases). (1 mark)
- The concentration of carbon dioxide increases (the concentration of carbaminohemoglobin increases). (1 mark)

OR

- Oxygen / nutrient concentration high at X and carbon dioxide concentration high at Y. (1 mark)

7. Explain why the breathing rate increases in someone who is exercising strenuously. **(3 marks)**

- **Carbon dioxide concentrations in the blood increase because of increased cellular respiration due to exercising.**
- **The medulla oblongata detects the increased levels of carbon dioxide / hydrogen ions.**
- **The medulla oblongata sends an increasing number of impulses to the diaphragm and rib muscles causing them to contract faster.**
- **Muscles need an increased oxygen supply.**
- **Increased muscle activity needs ATP.**
- **Increased hydrogen ion concentration increases the breathing rate.**
- **Increased carbon dioxide concentration increases the breathing rate.**
- **Muscles need more glucose.**

} any three for
1 mark each

Note to markers:

Do not give marks for the following:

- More oxygen needed by body or just cells.
- Sympathetic nervous system (adrenalin) stimulates an increase in breathing rate (fight or flight reaction).
- More oxygen is used for the production of ATP from glucose.

8. Describe the sequence of events required for a nerve impulse to cross a synapse. (You may use a labelled diagram as part of your answer. You may use a pencil to draw your diagram.)

(5 marks)

- An action potential travelling along an axon reaches a presynaptic membrane.
- Calcium ions flow in.
- Microfilaments contract to pull synaptic vesicles filled with a neurotransmitter.
- Vesicles pulled to the presynaptic membrane.
- The neurotransmitter is released into the synaptic cleft.
- The neurotransmitter diffuses across to the postsynaptic membrane.
- Neurotransmitter binds with a receptor.
- The threshold of the postsynaptic membrane is reached, resulting in the opening of the sodium gates.
- Sodium ions entering the postsynaptic membrane create an action potential (depolarization).
- Enzymes break down excess neurotransmitter / repackaged into vesicles.

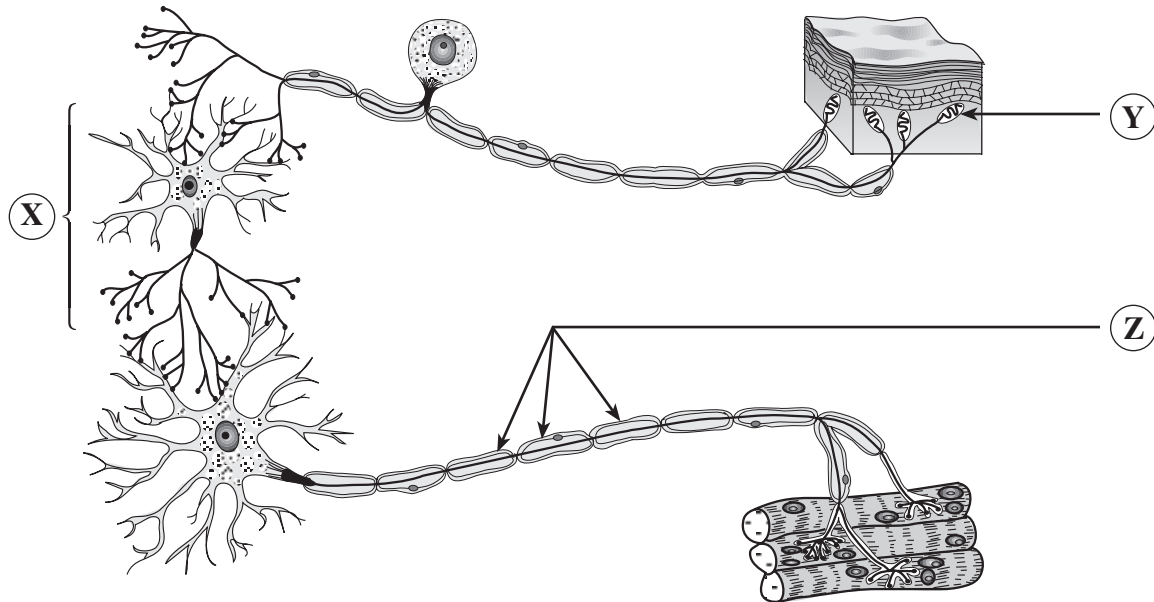
any five for
1 mark each

Note to markers:

Student loses 1 mark for incorrect sequence.

If diagram only, up to full marks awarded if sequence and process is clear.

Use the following diagram to answer question 9.



9. Give **one** function of each of the following structures. (3 marks: 1 mark each)

Structure X:

- transmits nerve impulses to the brain
 - transmits nerve impulses from the sensory neuron to the motor neuron
 - modulates nerve impulses
- } any one for 1 mark

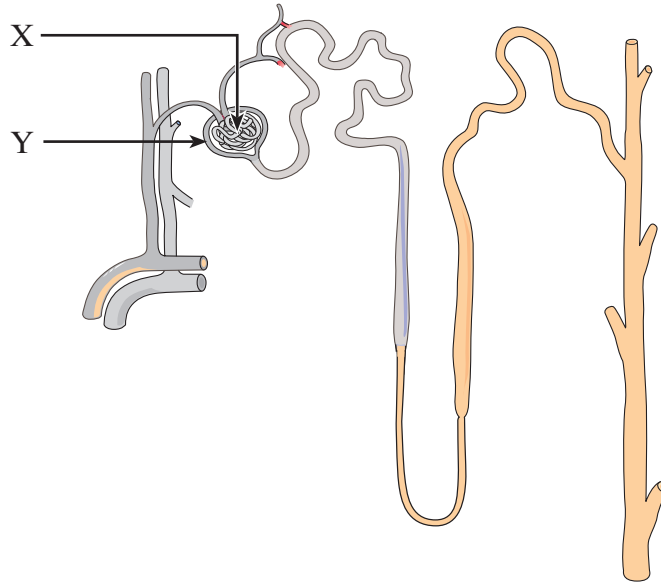
Structure Y:

- receptor of environmental stimuli
 - initiates nerve impulses
 - sends nerve impulses to sensory neuron
- } any one for 1 mark

Structure Z:

- insulates the neuron
 - speeds up nerve impulses
 - helps neurons regenerate
 - causes saltatory conduction of nerve impulses
- } any one for 1 mark

Use the following diagram to answer question 10.



10. a) Identify structure X.

(1 mark)

- **glomerulus (1 mark)**

b) Describe the process that occurs between X and Y.

(2 marks)

- **The materials move from X (glomerulus) to Y (Bowman's capsule).**
- **Pressure filtration.**
- **The materials move due to high blood pressure.**
- **Blood plasma separates into filterable and non-filterable components.**

} any two for
1 mark each

c) Identify **two** components of blood that cannot move into the filtrate under normal conditions.

(2 marks)

- **blood proteins**
- **proteins / enzymes**
- **penicillin**
- **platelets**
- **red blood cells**
- **white blood cells**
- **formed elements**

} any two for
1 mark each

Note to markers:

Student can not receive marks for red blood cells / white blood cells / platelets AND formed elements.

11. a) Give **three** characteristics of semen and describe how each of these characteristics facilitates the function of semen. **(3 marks)**

- Semen contains water for sperm transport.
- Semen contains lubricants for sexual intercourse.
- Semen contains buffers to maintain pH.
- Semen is basic and sperm are more viable in a basic solution.
- Semen contains fructose which provides an energy source for swimming.
- Semen contains prostaglandins which cause the uterus to contract and propel the sperm along.
- Semen contains coagulants which cause the semen to coagulate and remain in the vagina.
- Semen contains sperm which are necessary for fertilization.
- Semen contains mucus which neutralizes acidic urine in urethra of male.

any three characteristics for $\frac{1}{2}$ mark each

AND

any three functions for $\frac{1}{2}$ mark each

b) What would result if luteinizing hormone (LH) was **not** secreted in the male? **(2 marks)**

- There would be no sex drive.
- Sperm would not be able to mature.
- Secondary sex characteristics would not develop.
- The interstitial cells are responsible for testosterone secretion.
- The interstitial cells would not secrete testosterone.
- Decrease negative feedback.

any two for 1 mark each

Note to markers:

Student may give a function of testosterone not listed.

END OF KEY