

Insert Personal Education Number (PEN) here.

Insert **only** pre-printed PEN label here.

### STUDENT INSTRUCTIONS

1. Insert the stickers with your Personal Education Number (PEN) in the allotted spaces above. **Under no circumstance is your name or identification, other than your Personal Education Number, to appear on this booklet.**
2. Ensure that in addition to this examination booklet, you have an **Examination Response Form**. Follow the directions on the front of the Response Form.
3. **Disqualification** from the examination will result if you bring books, paper, notes or unauthorized electronic devices into the examination room.
4. When instructed to open this booklet, **check the numbering of the pages** to ensure that they are numbered in sequence from page one to the last page, which is identified by

**END OF EXAMINATION**.

5. At the end of the examination, place your Response Form inside the front cover of this booklet and return the booklet and your Response Form to the supervisor.

## BIOLOGY 12

**JUNE 2000**

COURSE CODE = BI

Insert **only** hand-printed PEN here.

Ministry use only.

Question 1:  
1.  .   
(4)

Question 9:  
9.  .   
(7)

Question 2:  
2.  .   
(4)

Question 10:  
10.  .   
(6)

Question 3:  
3.  .   
(3)

Question 4:  
4.  .   
(5)

Question 5:  
5.  .   
(6)

Question 6:  
6.  .   
(6)

Question 7:  
7.  .   
(5)

Question 8:  
8.  .   
(4)

# **BIOLOGY 12**

**JUNE 2000**

COURSE CODE = BI

## GENERAL INSTRUCTIONS

1. Electronic devices, including dictionaries and pagers, are **not** permitted in the examination room.
2. All multiple-choice answers must be entered on the Response Form using an **HB pencil**. Multiple-choice answers entered in this examination booklet will **not** be marked.
3. For each of the written-response questions, write your answer in **ink** unless otherwise instructed in the space provided in this booklet.
4. Ensure that you use language and content appropriate to the purpose and audience of this examination. Failure to comply may result in your paper being awarded a zero.
5. This examination is designed to be completed in **two hours**. *Students may, however, take up to 30 minutes of additional time to finish.*

## BIOLOGY 12 PROVINCIAL EXAMINATION

|   | <b>Value</b>     | <b>Suggested<br/>Time</b> |
|---|------------------|---------------------------|
| 1. This examination consists of <b>two</b> parts: |                  |                           |
| PART A: 50 multiple-choice questions              | 50               | 45                        |
| PART B: 10 written-response questions             | 50               | 75                        |
| <b>Total:</b>                                     | <b>100 marks</b> | <b>120 minutes</b>        |

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## PART A: MULTIPLE CHOICE

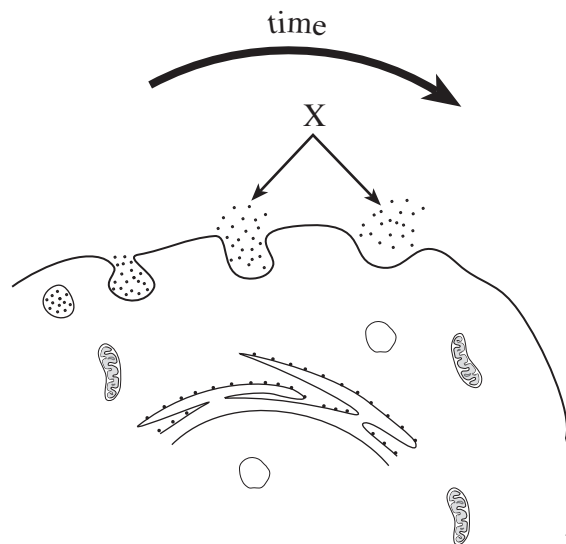
Value: 50 marks

Suggested Time: 45 minutes

**INSTRUCTIONS:** For each question, select the **best** answer and record your choice on the Response Form provided. Using an HB pencil, completely fill in the circle that has the letter corresponding to your answer.

1. Which of the following types of molecules are synthesized at the rough endoplasmic reticulum?
  - A. lipids
  - B. proteins
  - C. nucleic acids
  - D. carbohydrates

Use the following diagram to answer questions 2 and 3.



2. The process shown is an example of
  - A. exocytosis.
  - B. pinocytosis.
  - C. endocytosis.
  - D. phagocytosis.
3. The material labelled **X** could be
  - A. water.
  - B. insulin.
  - C. amino acids.
  - D. sodium ions.

4. How many of the following molecules are produced at ribosomes?

- glycogen
- testosterone
- phospholipids
- salivary amylase
- DNA polymerase

- A. one
- B. two
- C. three
- D. four

5. ~~A small amount of base (hydroxide) and protein tissue were added to a beaker containing a sample of gastric juice and a nut, the contents of the beaker had a pH 2 and peptides were present. The unknown solution must have contained a~~ **DEL T E T E D**

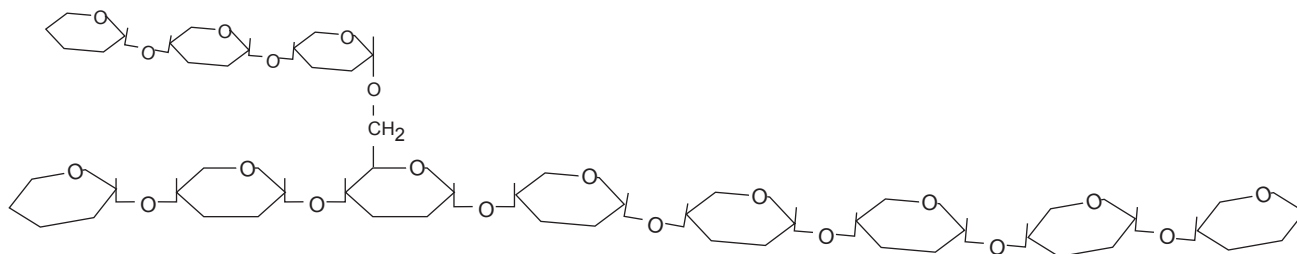
- A. base.
- B. buffer.
- C. peptidase.
- D. polysaccharide.

6. If radioactive nitrogen-15 were available during synthesis, it would show up in which of the following molecules?

- A. cellulose
- B. glycogen
- C. fatty acid
- D. hemoglobin



Use the following diagram to answer question 7.



7. Enzymes required to digest the molecule represented in the diagram are produced in the
- A. liver.
  - B. colon.
  - C. stomach.
  - D. salivary glands.
- 
8. Amino acids are identical in structure **except** for their
- A. amines.
  - B. R-groups.
  - C. peptide bonds.
  - D. acids (carboxyls).
9. Which of the following molecules is broken down and reformed at a higher rate when the cell's metabolic activity increases?
- A. ATP
  - B. DNA
  - C. tRNA
  - D. rRNA
10. A characteristic of unsaturated fatty acids is that they
- A. are made up of glycerol.
  - B. are polymers of glucose.
  - C. are polymers of nucleotides.
  - D. have double bonds between some carbon atoms.

Use the following table to answer question 11.

| Table of mRNA Codons |  |  |  |  |                  |
|----------------------|--|--|--|--|------------------|
| 1st position         | 2nd position   |  |  |  | 3rd position     |
| ↓                    | U  | C  | A  | G  | ↓                |
| U                    | phenylalanine<br>phenylalanine<br>leucine<br>leucine | serine<br>serine<br>serine<br>serine             | tyrosine<br>tyrosine<br>stop<br>stop             | cysteine<br>cysteine<br>stop<br>tryptophan   | U<br>C<br>A<br>G |
| C                    | leucine<br>leucine<br>leucine<br>leucine             | proline<br>proline<br>proline<br>proline         | histidine<br>histidine<br>glutamine<br>glutamine | arginine<br>arginine<br>arginine<br>arginine | U<br>C<br>A<br>G |
| A                    | isoleucine<br>isoleucine<br>isoleucine<br>methionine | threonine<br>threonine<br>threonine<br>threonine | asparagine<br>asparagine<br>lysine<br>lysine     | serine<br>serine<br>arginine<br>arginine     | U<br>C<br>A<br>G |
| G                    | valine<br>valine<br>valine<br>valine                 | alanine<br>alanine<br>alanine<br>alanine         | aspartate<br>aspartate<br>glutamate<br>glutamate | glycine<br>glycine<br>glycine<br>glycine     | U<br>C<br>A<br>G |

11. The genetic disorder sickle-cell anemia occurs when the amino acid valine takes the place of glutamate during translation of a hemoglobin chain. Using the table of codons above, determine the mutation in **DNA** that produces this disorder.

- A. CAG changes to CTC
- B. CTT changes to CAT
- C. CUC changes to CAG
- D. GAA changes to GUU

---

12. Which of the following is **not** a characteristic of benign tumours?

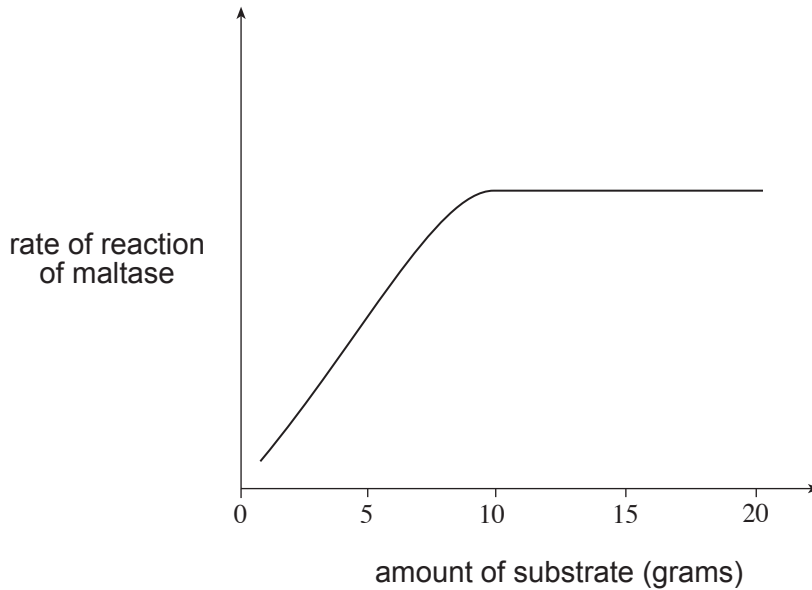
- A. metastasis
- B. loss of contact inhibition
- C. increased vascularization
- D. disorganized and uncontrolled growth (anaplasia)

13. When a wart or mole changes into a skin cancer, it is usually the result of
- ultraviolet radiation destroying an oncogene.
  - a bacterium introducing an oncogene into a cell.
  - ultraviolet radiation changing a proto-oncogene.
  - a bacterium introducing a proto-oncogene into a cell.
14. When  $\text{Na}^+$  (sodium ions) are moved across the cell membrane against the concentration gradient,
- ATP is used.
  - osmosis occurs.
  - diffusion occurs.
  - vesicles are formed.
15. Which of the following molecules will pass through a cell membrane by simple diffusion?
- water
  - an enzyme
  - nucleic acid
  - carbohydrate
16. Red blood cells are placed in a highly concentrated salt solution. Which of the following describes their environment and what would happen to the cells?

|    | ENVIRONMENT<br>INSIDE OF CELLS<br>RELATIVE TO ENVIRONMENT<br>OUTSIDE OF CELLS | ENVIRONMENT<br>OUTSIDE OF CELLS<br>RELATIVE TO ENVIRONMENT<br>INSIDE OF CELLS | WHAT HAPPENS<br>TO THE CELLS |
|----|---|---|------------------------------|
| A. | hypertonic  | hypotonic   | swell                        |
| B. | hypertonic  | hypotonic   | shrink                       |
| C. | hypotonic   | hypertonic  | swell                        |
| D. | hypotonic   | hypertonic  | shrink                       |

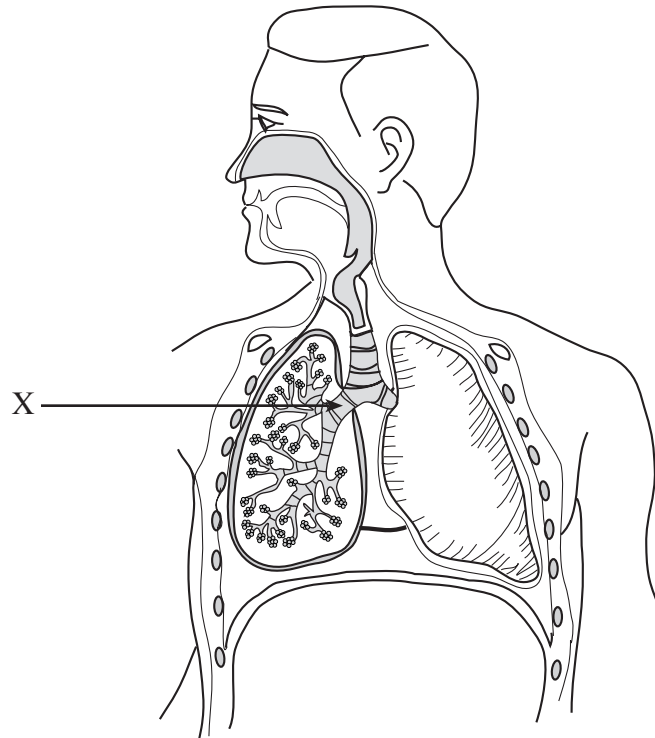
17. A substance that lowers the energy of activation for a metabolic reaction is called
- an enzyme.
  - an initiator.
  - a promoter.
  - an inhibitor.

Use the following graph to answer question 18.



18. When 10 or more grams of maltose were added to a test tube containing maltase,
- A. the saturation of maltase active sites occurred.
  - B. the enzyme-substrate complex became unstable.
  - C. maltase was inactivated by high substrate concentrations.
  - D. high glucose product inhibited maltase by negative feedback.
- 
19. Evidence, either supporting or contradicting an hypothesis, is obtained by
- A. stating a purpose.
  - B. developing a theory.
  - C. reaching a conclusion.
  - D. performing an experiment.
20. Which of the following protects the walls of the stomach from hydrochloric acid?
- A. bile
  - B. pepsin
  - C. mucus
  - D. bicarbonate ions

Use the following diagram to answer question 21.



21. The presence of food at location **X** indicates a malfunctioning

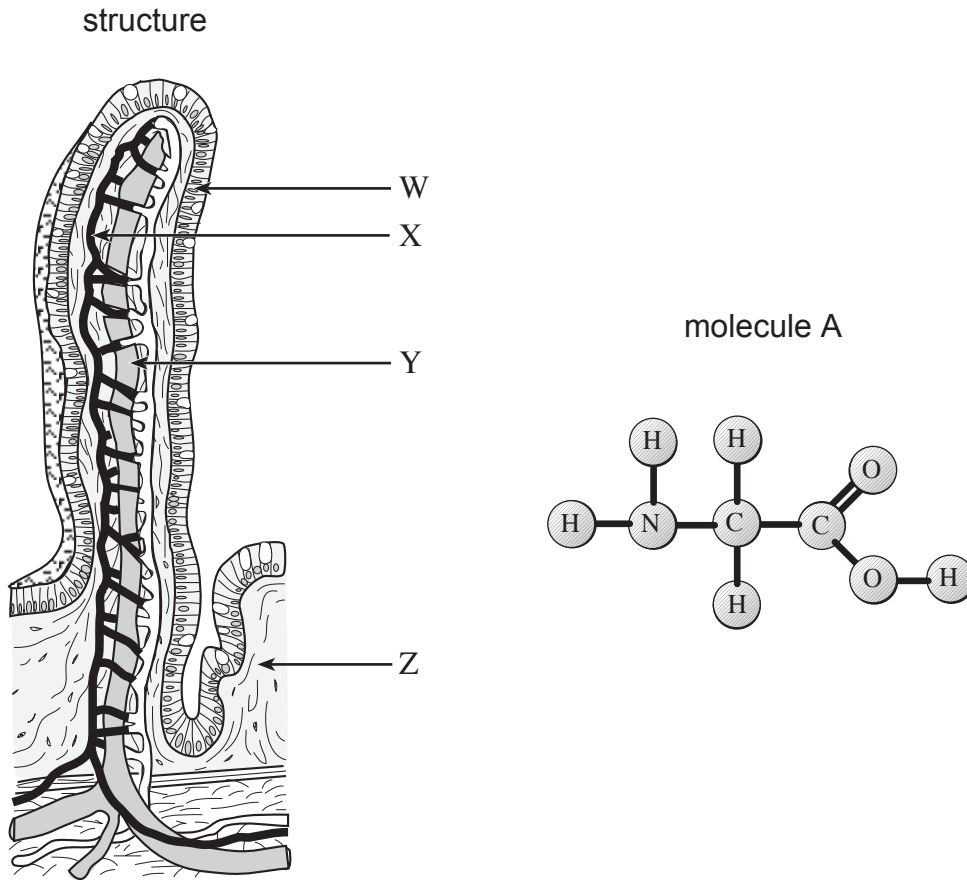
- A. pharynx.
- B. epiglottis.
- C. esophagus.
- D. cardiac sphincter.

22. How many of the following events require substances produced in the liver? **DELETED**

- emulsification of fats
- secretion of peptidases
- capillary fluid exchange
- detoxification of alcohol
- neutralization of pancreatic juice
- a rise in blood glucose levels between meals

- A. three
- B. four
- C. five
- D. six

Use the following diagrams to answer question 23.



23. Where in the structure would molecule A be transported to?

- A. W
- B. X
- C. Y
- D. Z

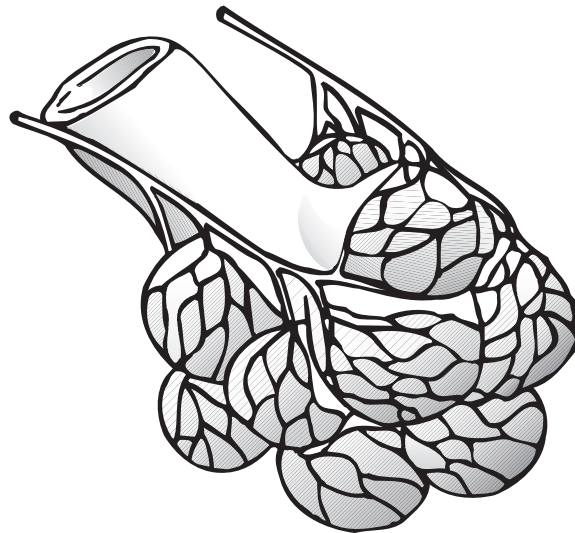
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24. Which of the following has the greatest **total** cross-sectional area of blood vessels?

- A. capillaries
- B. venous system
- C. arterial system
- D. pulmonary system

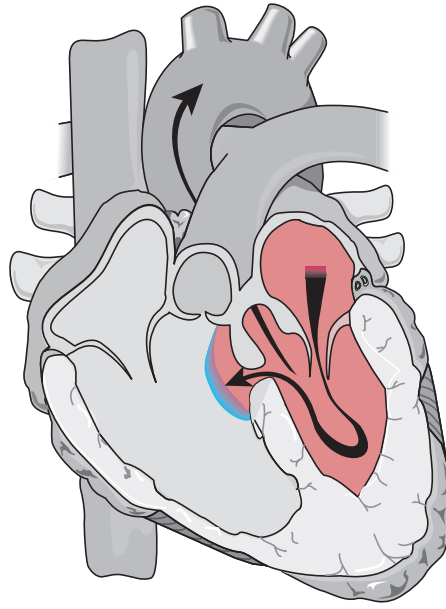
25. In fetal circulation, blood from the placenta enters the posterior vena cava by way of the
- A. umbilical artery.
  - B. ductus venosus (venous duct).
  - C. foramen ovale (oval opening).
  - D. ductus arteriosus (arterial duct).

Use the following diagram to answer question 26.



26. What happens in the tissues of this structure as a result of a lower than normal concentration of plasma proteins in the blood?
- A. Fluid is lost from the tissues due to a decrease in blood pressure.
  - B. Fluid is lost from the tissues due to a decrease in osmotic pressure.
  - C. Fluid accumulates in the tissues due to a decrease in blood pressure.
  - D. Fluid accumulates in the tissues due to a decrease in osmotic pressure.

Use the following diagram to answer question 27.



27. The diagram shows a heart defect that occurs approximately once in every 500 births. Babies born with this defect have
- A. a lower than normal heart rate.
  - B. a decreased production of red blood cells.
  - C. difficulty closing the atria-ventricular valves.
  - D. oxygenated and deoxygenated blood mixed together.
- 
28. How many heart valves would a blood cell travelling from the renal vein to the pulmonary vein pass through?
- A. none
  - B. one
  - C. two
  - D. four
29. The chordae tendineae function to
- A. give support to the septum.
  - B. open the semi-lunar valves.
  - C. open the atrioventricular valves.
  - D. prevent valves in the heart from inverting.

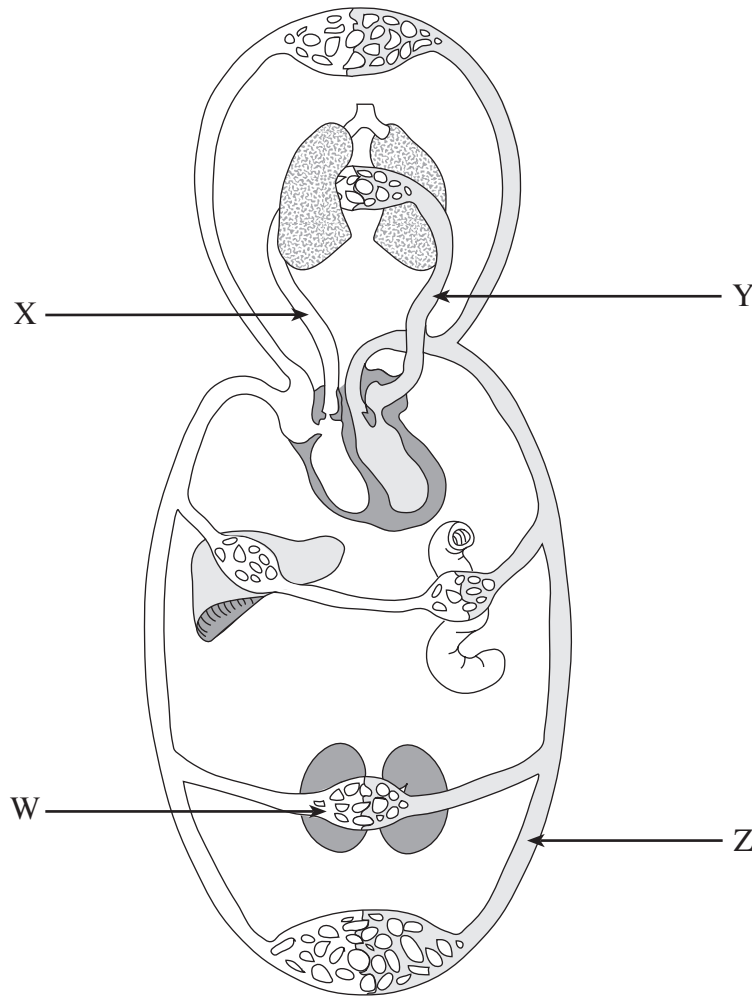


30. Which of the following contains structures that vibrate to produce sound?
- A. larynx
  - B. trachea
  - C. epiglottis
  - D. pleural membranes
31. Which of the following lines the chest cavity?
- A. cilia
  - B. alveoli
  - C. diaphragm
  - D. pleural membranes
32. In the respiratory system, which structure would have the **greatest** surface area to volume ratio?
- A. alveoli
  - B. trachea
  - C. bronchi
  - D. bronchioles
33. During the exhalation of air, the
- A. alveoli contract.
  - B. diaphragm relaxes.
  - C. rib muscles contract.
  - D. thoracic cavity increases in volume.
34. The part of the brain responsible for increasing breathing rate during exercise is the
- A. cerebral cortex.
  - B. corpus callosum.
  - C. pulmonary trunk.
  - D. medulla oblongata.

35. Which of the following events causes the pH of the blood to increase?

- A. reduced hemoglobin is produced
- B. oxygen combines with hemoglobin
- C. carbon dioxide combines with water
- D. bicarbonate and hydrogen ions are produced

Use the following diagram to answer question 36.



36. Which letter indicates where the **greatest** concentration of carbaminohemoglobin is found?

- A. W
- B. X
- C. Y
- D. Z

37. What part of a neuron carries impulses toward the cell body?
- axon
  - dendrite
  - synaptic cleft
  - terminal knob
38. Synaptic vesicles of the sympathetic nervous system contain
- sodium ions.
  - acetylcholine.
  - noradrenaline.
  - potassium ions.
39. The bacterial toxin that causes botulism prevents the release of acetylcholine from pre-synaptic membranes. Which event in the transmission of a nerve impulse would be affected first by this poison?
- the depolarization of an effector
  - the opening of sodium gates in dendrites
  - the production of an action potential at the nodes of Ranvier
  - the operation of the sodium-potassium pump in the neuron membrane

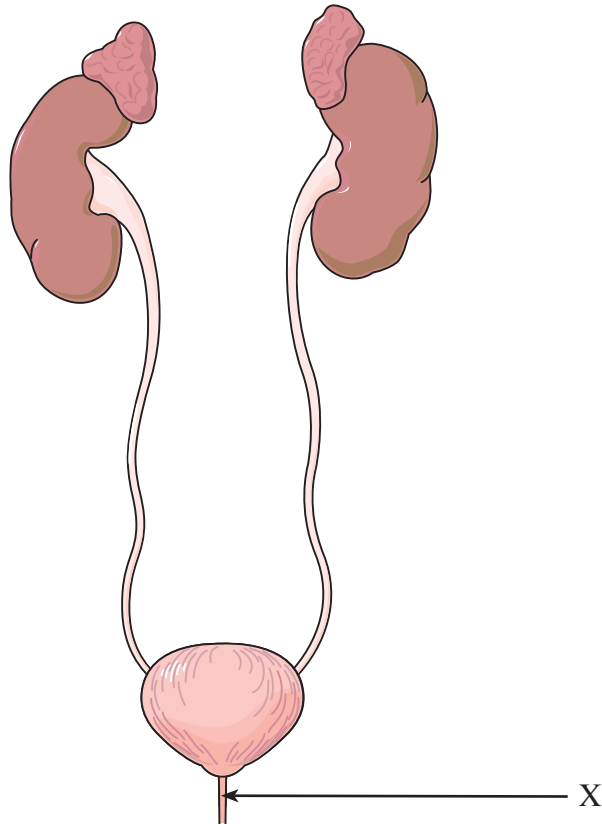
**Use the following table to answer question 40.**

| BLOOD FLOW TO   | NORMAL<br>(mL/min.) | STRENUOUS<br>EXERCISE<br>(mL/min.) |
|-----------------|---------------------|------------------------------------|
| brain           | 750                 | 750                                |
| kidney          | 1 100               | 600                                |
| skeletal muscle | 850                 | 12 500                             |

40. Secretions from which of the following glands would cause the effects shown in the table?
- thyroid
  - adrenal
  - anterior pituitary
  - posterior pituitary

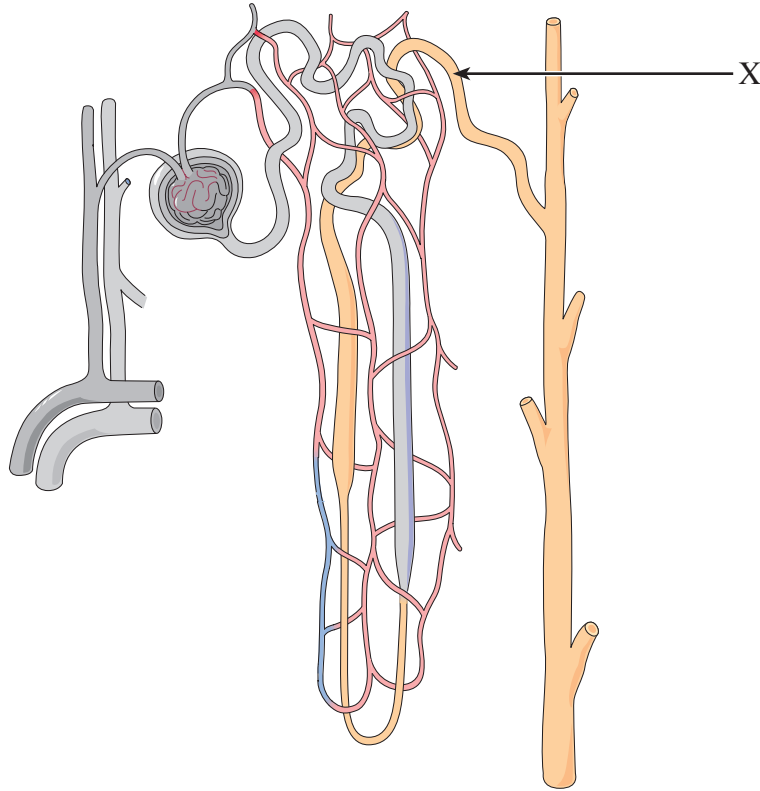
41. Which part of the brain functions to maintain a blood pressure of 120/80 and a body temperature of 37°C?
- A. thalamus
  - B. hypothalamus
  - C. cerebral cortex
  - D. corpus callosum

Use the following diagram to answer question 42.



42. The structure labelled **X** is the
- A. ureter.
  - B. urethra.
  - C. collecting duct.
  - D. urinary bladder.

Use the following diagram to answer question 43.



43. The structure labelled **X** is the
- A. loop of Henle.
  - B. distal convoluted tubule.
  - C. proximal convoluted tubule.
  - D. peritubular capillary network.

Use the following information to answer question 44.

- |   |
|---|
| <ol style="list-style-type: none"><li>1. proximal tubule</li><li>2. renal artery</li><li>3. collecting duct</li></ol> |
|---|

44. Which of the following is the correct sequence of structures from **highest** to **lowest** concentration of urea?
- A. 2, 1, 3
  - B. 2, 3, 1
  - C. 3, 1, 2
  - D. 3, 2, 1

45. Sperm acquire the ability to swim in the
- A. epididymis.
  - B. seminal vesicles.
  - C. seminiferous tubules.
  - D. ductus (vas) deferens.
46. The function of the acrosome is to
- A. produce an energy supply for sperm.
  - B. stimulate development of the follicle.
  - C. contribute nutrients to the seminal fluid.
  - D. release enzymes needed to penetrate the egg.
47. Movement of a fertilized egg in an oviduct occurs with the help of
- A. cilia.
  - B. flagella.
  - C. diffusion.
  - D. active transport.
48. Rising progesterone levels in the blood trigger the pituitary to
- A. release luteinizing hormone (LH).
  - B. release follicle-stimulating hormone (FSH).
  - C. stop releasing luteinizing hormone (LH).
  - D. stop releasing human chorionic gonadotropin (HCG) hormone.
49. The hormone that controls the maturation of eggs in women and the production of sperm in men is
- A. estrogen.
  - B. testosterone.
  - C. luteinizing hormone (LH).
  - D. follicle-stimulating hormone (FSH).

50. Which of the following is an example of positive feedback?

- A. A rise in oxytocin levels causes uterine contractions.
- B. An increase in body temperature produces increased perspiration.
- C. A drop in blood glucose levels stimulates the liver to release glucose.
- D. An increase in thyroxin levels in the blood decreases the amount of thyroid-stimulating hormone (TSH) released from the pituitary.

**This is the end of the multiple-choice section.  
Answer the remaining questions directly in this examination booklet.**

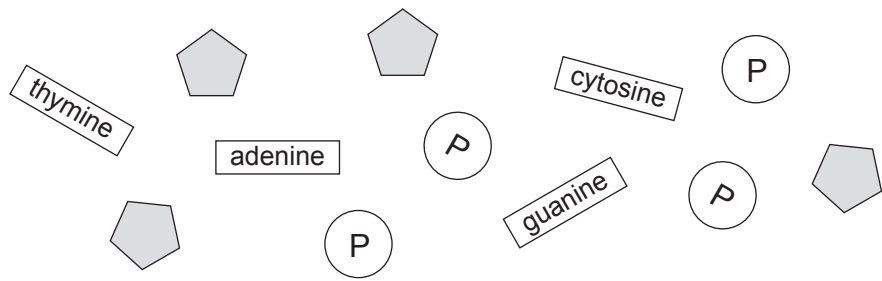
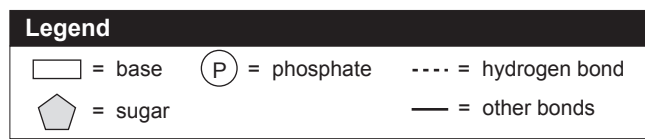
**PART B: WRITTEN RESPONSE**

**Value: 50 marks**

**Suggested Time: 75 minutes**

- INSTRUCTIONS:**
1. Use a **pen** for this part of the examination unless otherwise instructed.
  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 symbols shown below represent parts of a DNA molecule. Construct the DNA molecule by redrawing the parts to make a complete section. **(4 marks)**



**Draw your diagram below using a pencil.**





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3. Describe the following mechanisms of transport across cell membranes.

**(3 marks: 1 mark each)**

osmosis:

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facilitated transport:

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active transport:

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4. An experiment was carried out to measure the effect of pH on enzyme activity. The following steps were performed:

1. An equal volume of hydrogen peroxide was added to eight numbered test tubes at 20°C.
2. The contents of each test tube were maintained at a different pH.
3. An equal mass of liver was added to each test tube. Liver, which contains the enzyme catalase, catalyzes the following reaction:



The time to collect 10 mL of oxygen gas (O<sub>2</sub>) from each tube was measured and recorded in the table below.

| TEST TUBE | pH OF SOLUTION | TIME TO COLLECT 10 mL of O <sub>2</sub> (SECONDS) |
|-----------|----------------|---|
| 1         | 5              | 120   |
| 2         | 6              | 90  |
| 3         | 7              | 50  |
| 4         | 8              | 30  |
| 5         | 9              | 40  |
| 6         | 10             | 60  |
| 7         | 11             | 90  |
| 8         | 12             | 140   |

- a) Draw a graph that compares the time taken to collect 10 mL of oxygen gas ( $O_2$ ) produced to the pH of the solution. Label the  $x$ -axis as pH of solution. (2 marks)  
(Use a pencil to graph the data.)



- b) Using your graph, estimate the time it takes to collect 10 mL of oxygen gas ( $O_2$ ) at pH 6.5. (1 mark)

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- c) Explain what causes the results observed between pH 8 and pH 12. (2 marks)

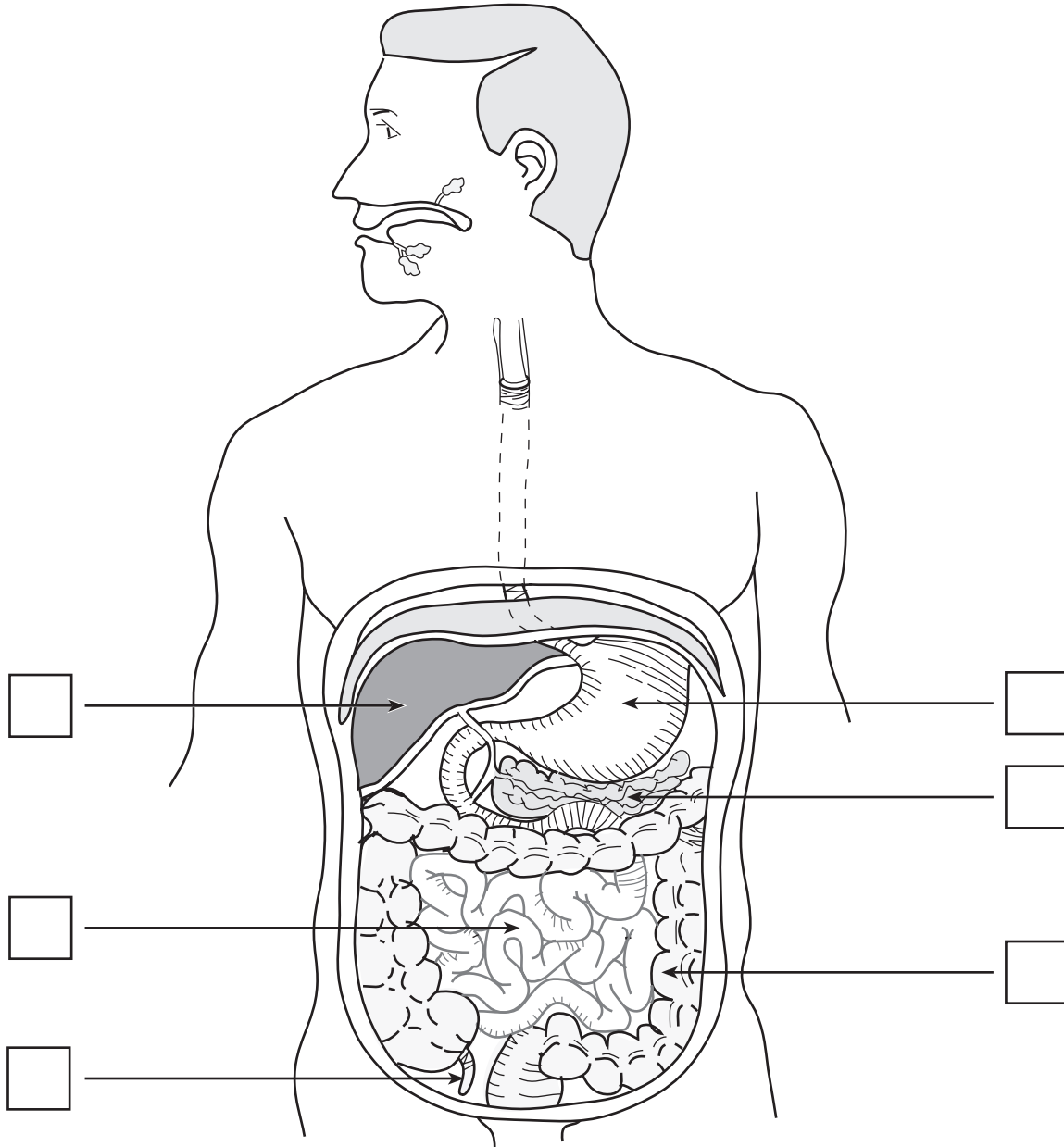
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Use the following diagram to answer question 5.



5. Place the correct number for each of the following descriptions in the appropriate box at the location in the diagram. **Not all the descriptions will be used.** (6 marks)

1. kills bacteria
2. lined with cilia
3. produces thyroxine
4. lipid emulsifier produced here
5. contains bacteria that produce vitamins
6. has no known digestive function in adults
7. where maltose is broken down into glucose
8. hormone that controls blood sugar produced here

6. Describe the concentration of dissolved gases in the following pairs of vessels and explain why the concentrations are different.

pulmonary vein / pulmonary artery:

**(2 marks)**

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posterior vena cava / aorta:

**(2 marks)**

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umbilical vein / umbilical artery:

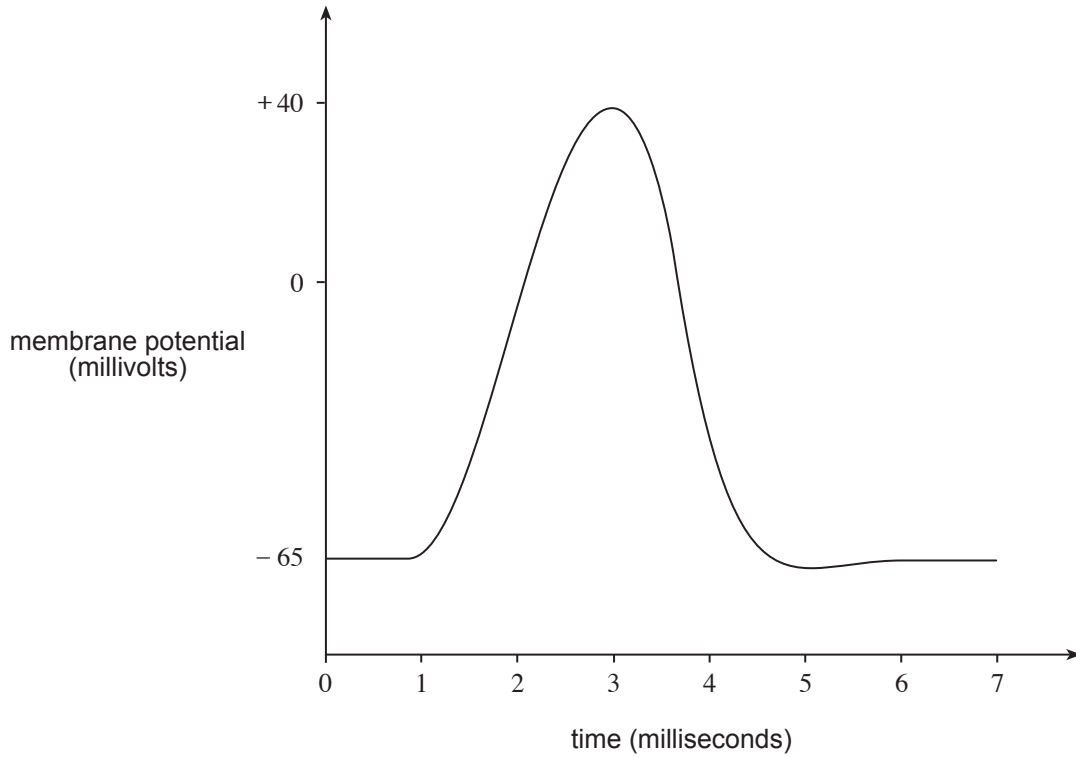
**(2 marks)**

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Use the following graph to answer question 7.



7. The graph shows the change in an axon's polarity before, during and after an action potential.

a) Explain what occurs in the axon at the following times. **(3 marks: 1 mark each)**

From 1 to 3 milliseconds:

---

---

From 3 to 5 milliseconds:

---

---

From 5 to 7 milliseconds:

---

---



b) What would be the effect of increasing the stimulation of the neuron?  
Give reasons to support your answer.

**(2 marks)**

---

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8. Give **one** function of each of the following parts of a reflex arc. **(4 marks: 1 mark each)**

myelin sheath:

---

---

effector:

---

---

interneuron:

---

---

receptor:

---

---

9. Explain how each of the following structures contributes to the formation of urine.

Bowman's capsule:

**(1 mark)**

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proximal convoluted tubule:

**(2 marks)**

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loop of Henle:

**(2 marks)**

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distal convoluted tubule:

**(1 mark)**

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collecting duct:

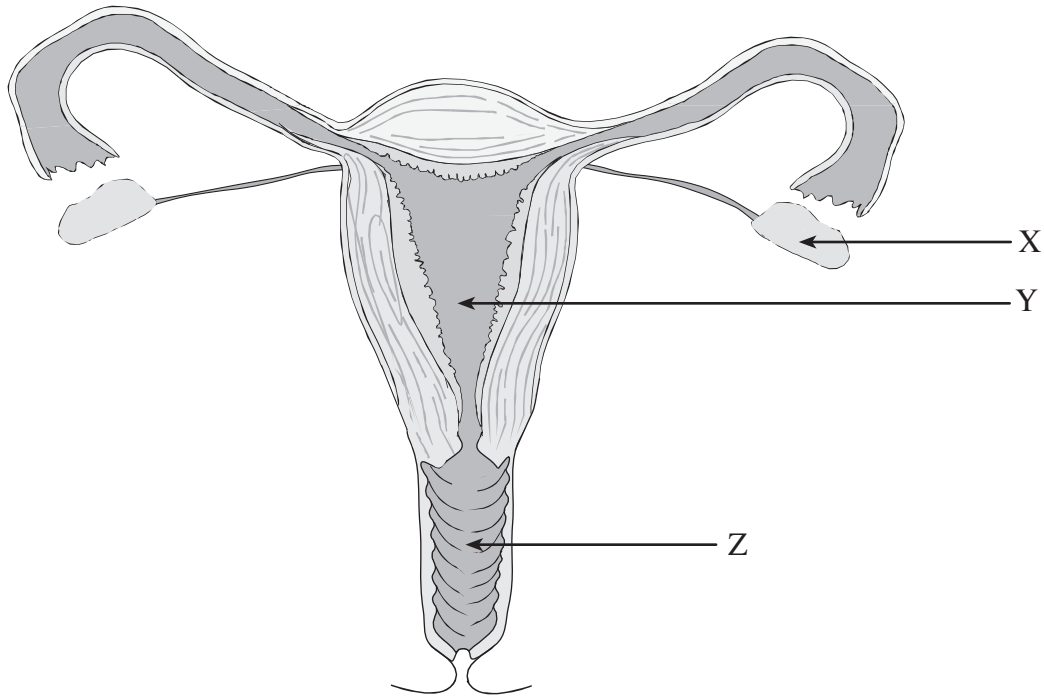
**(1 mark)**

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Use the following diagram to answer question 10.



10. Identify the following structures indicated in the diagram and give **one** function of each.  
(6 marks: 1 mark each for structure; 1 mark each for function)

Structure **X**:

Name: \_\_\_\_\_

Function: \_\_\_\_\_

\_\_\_\_\_

Structure **Y**:

Name: \_\_\_\_\_

Function: \_\_\_\_\_

\_\_\_\_\_

Structure **Z**:

Name: \_\_\_\_\_

Function: \_\_\_\_\_

\_\_\_\_\_

**END OF EXAMINATION**