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BRITISH COLUMBIA

Biology 12

JUNE 2004

Course Code = BI

Student Instructions

1. Place 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.

Question 1

0 ☐ 1 ☐ 2 ☐ 3 ☐ ▪ (5) ☐ NR ☐

Question 2

0 ☐ 1 ☐ 2 ☐ ▪ (5) ☐ NR ☐

Question 3

0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ ▪ (5) ☐ NR ☐

Question 4

0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ ▪ (5) ☐ NR ☐

Question 5

0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ ▪ (5) ☐ NR ☐

Question 6

0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ ▪ (5) ☐ NR ☐

BIOLOGY 12

JUNE 2004

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

		Value	Suggested Time
1.	This examination consists of **two** parts:		
	PART A: 67 multiple-choice questions	67 marks	80 minutes
	PART B: 6 written-response questions	23 marks	40 minutes
	Total:	**90 marks**	**120 minutes**

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PART A: MULTIPLE CHOICE

Value: 67 marks **Suggested Time: 80 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 on the Response Form that has the letter corresponding to your answer.

1. Lipids are synthesized by which of the following cell structures?

   A. nucleolus
   B. ribosomes
   C. Golgi bodies
   D. smooth endoplasmic reticulum

2. Which organelle is present in large numbers in the interstitial cells of the testes?

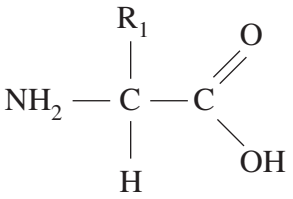
   A. lysosome
   B. nucleolus
   C. rough endoplasmic reticulum
   D. smooth endoplasmic reticulum

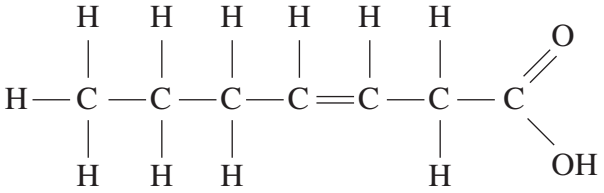
3. What is the function of a buffer?

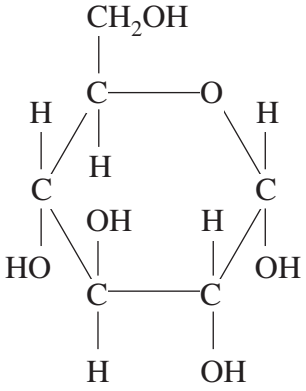
   A. to prevent large changes in pH
   B. to act as a competitive inhibitor
   C. to decrease the energy of activation
   D. to increase the uptake of glucose into cells

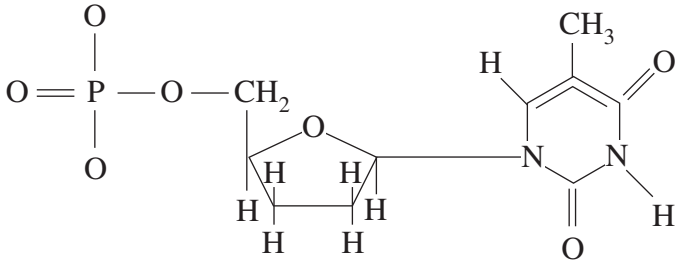
OVER

4. Which of the following is a unit molecule of glycogen?

A. 

B. 

C. 

D. 

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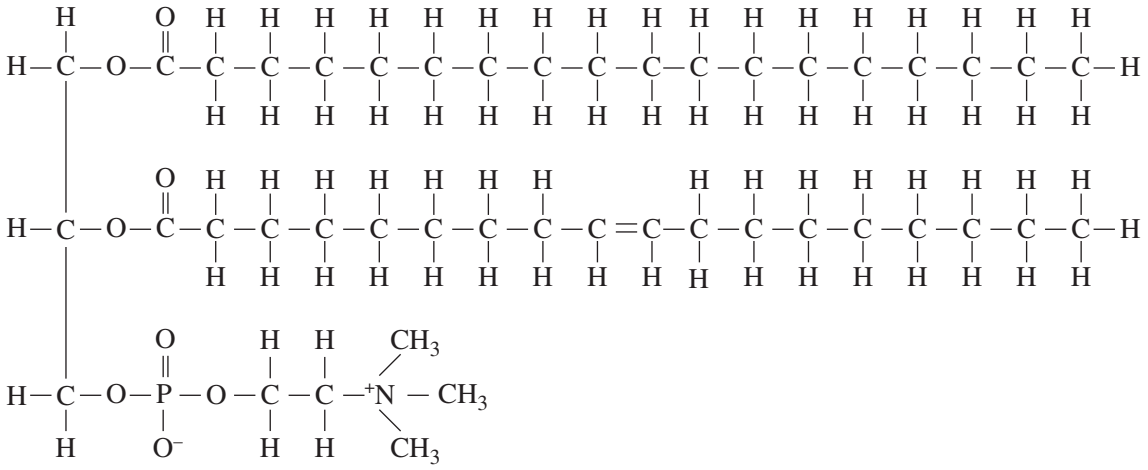
5. Which process can produce maltose?

A. the addition of water during the hydrolysis of a disaccharide
B. the bonding of two saturated fatty acids and the addition of glycerol
C. the bonding of two amino acids and the removal of one water molecule
D. the bonding of two monosaccharides and the removal of one water molecule

Use the following diagram to answer question 6.



6. What is the molecule illustrated above?

   A. ATP
   B. glycogen
   C. neutral fat
   D. phospholipid

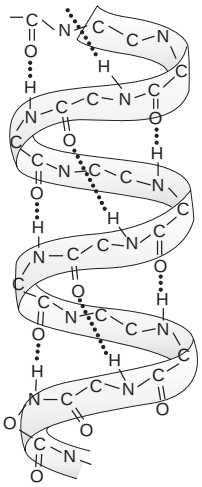
---

7. Which of the following polymers has the empirical formula CH_2O?

   A. DNA
   B. cellulose
   C. cholesterol
   D. saturated fat

OVER

Use the following diagram to answer question 8.



8. What is the unit molecule of the polymer above?

   A. glucose
   B. fatty acids
   C. nucleotides
   D. amino acids

---

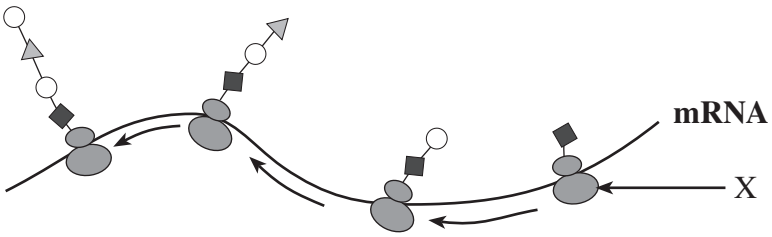
9. Which of the following is a possible use for recombinant DNA?

   A. producing steroid hormones
   B. producing insulin using bacteria
   C. cloning tissue cells for transplant
   D. encouraging nerve cells to regenerate

10. Which of the following is a definition of transcription?

    A. the production of rRNA from tRNA
    B. the production of mRNA from DNA
    C. the production of protein by ribosomes
    D. the production of new DNA before cell division

Use the following diagram to answer question 11.



11. Where is structure **X** produced?

A. in the nucleus
B. in the nucleolus
C. in the ribosomes
D. in the endoplasmic reticulum

---

12. Which of the following carries amino acids to the ribosome?

A. DNA
B. tRNA
C. rRNA
D. mRNA

13. What is the anticodon which corresponds to the DNA base sequence **G A C** ?

A. C T G
B. C U G
C. G A C
D. G U C

OVER

Use the following chart to answer question 14.

Three-letter codons of messenger RNA and the amino acids specified by the codons

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

14. The DNA strand **C G A T G C G A C A T T** undergoes a mutation in which the section coding for the amino acid threonine is lost. Which of the following would be the correct codons after this mutation?

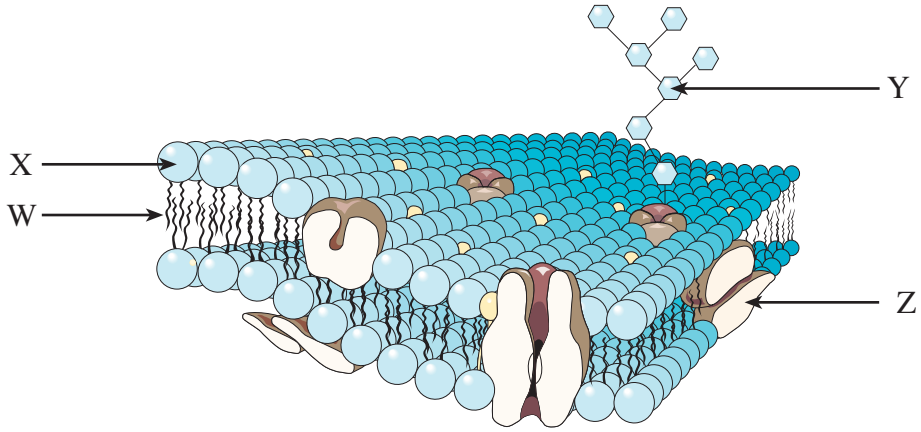
A. A C G C U G U A A
B. G C U A C G C U G
C. G C U C U G U A A
D. G C U A C G U A A

---

15. Which molecule accounts for a cell membrane's flexible and fluid nature?

A. protein
B. glycogen
C. glycolipid
D. phospholipid

Use the following diagram to answer question 16.



16. Which molecule allows cells to be recognized as foreign?

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

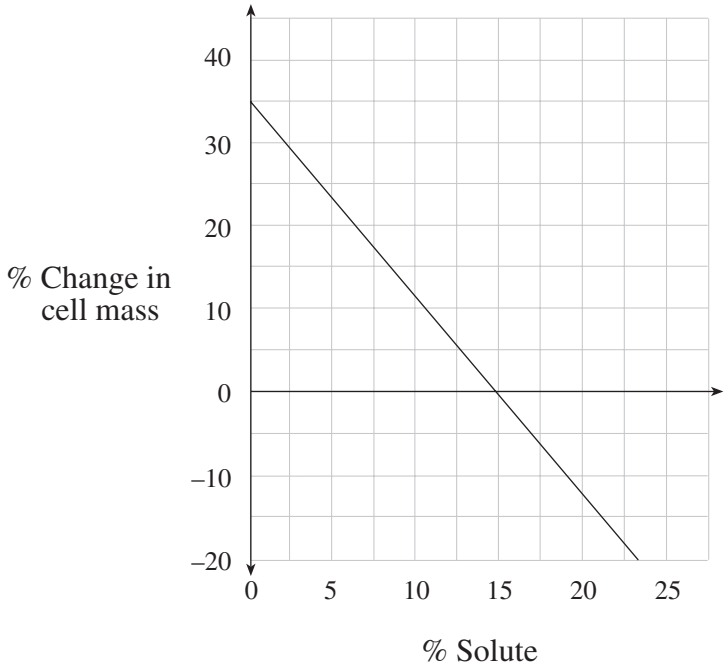
---

17. For which of the following processes is ATP **not** required?

A. osmosis
B. exocytosis
C. pinocytosis
D. active transport

OVER

Use the following graph to answer question 18.



18. The data displayed on the graph above were collected in an experiment studying the effect of changes in solute concentration on the mass of tissue cells. What solute concentration is isotonic to the cells?

A. 0%
B. 15%
C. 23%
D. 35%

---

19. Which of the following characteristics facilitates an increase in the rate at which metabolic wastes leave the cell?

A. a large nucleus
B. a spherical shape
C. an irregularly shaped surface
D. a small surface area to volume ratio

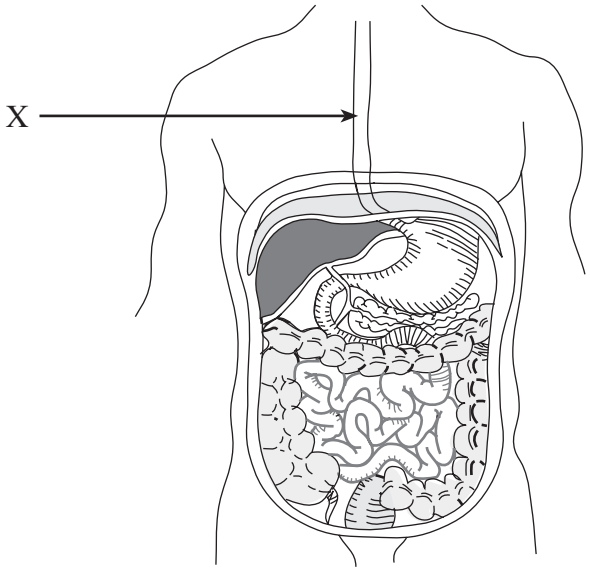
20. Which of the following is a model used to describe enzymatic action?

A. translation
B. transcription
C. lock and key
D. dehydration synthesis

21. Which of the following substances will cause an enzyme to be denatured?

A. vitamins
B. a substrate
C. an inhibitor
D. heavy metal ions

Use the following diagram to answer question 22.

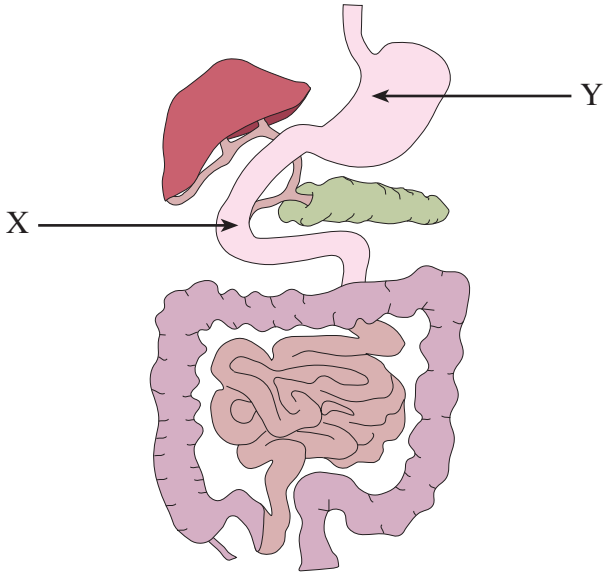


22. What is structure **X**?

A. the aorta
B. the trachea
C. the esophagus
D. the cardiac sphincter

OVER

Use the following diagram to answer questions 23 and 24.



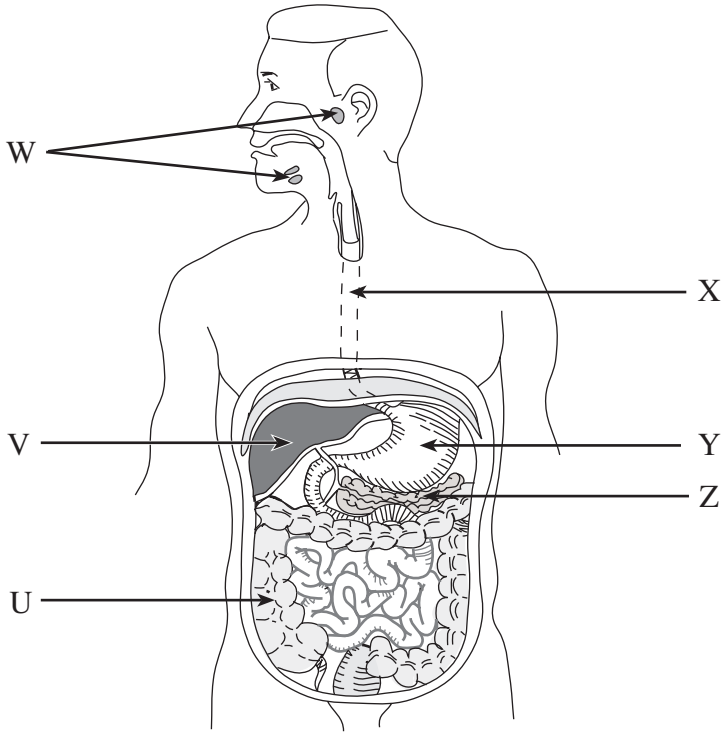
23. What structure is found between organ **X** and organ **Y**?

    A. the appendix
    B. the epiglottis
    C. the pyloric sphincter
    D. the cardiac sphincter

24. What substance aids in the digestion of proteins in structure **X**?

    A. lipase
    B. pepsin
    C. trypsin
    D. amylase

Use the following diagram to answer question 25.



25. Which structures produce secretions which digest starch?

A. U, Y
B. V, W
C. W, Z
D. X, Z

---

26. Which of the following is an effect of gastric secretions on digestion?

A. Trypsin breaks maltose down to glucose.
B. An emulsifier increases the surface area of fats.
C. Sodium bicarbonate increases pH facilitating the action of lipase.
D. Hydrochloric acid maintains a low pH facilitating the action of pepsin.

27. What is peristalsis?

A. physical breakdown of fats by bile
B. breakdown of food products by enzymes
C. storage and compacting of feces in the rectum
D. muscle contractions that assist the movement of food

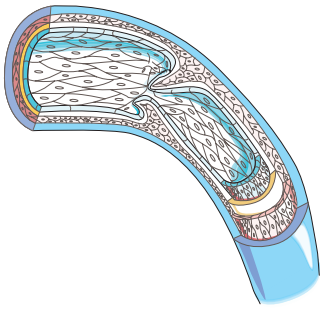
OVER

28. How would decreased secretions by the liver affect digestion?

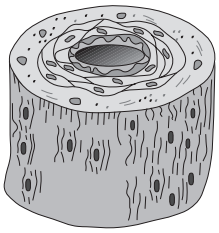
A. by decreasing chemical breakdown of fats
B. by decreasing physical digestion of proteins
C. by increasing absorption of materials into the lymph system
D. by increasing absorption of materials into the intestinal capillaries

Use the following diagrams to answer questions 29 and 30.

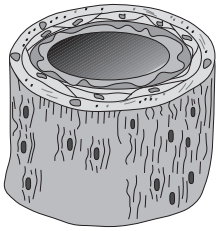
Vessel W



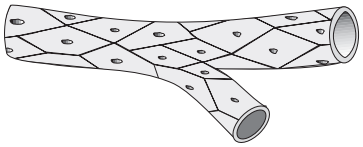
Vessel X



Vessel Y



Vessel Z



29. Which blood vessel carries oxygen and nutrients from the aorta to the heart muscle?

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

30. Which blood vessel exchanges nutrients and wastes with the tissues?

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

31. What circulatory pathway carries blood to the lungs?

A. renal
B. hepatic
C. systemic
D. pulmonary

32. What structure takes up tissue fluids not absorbed by the blood capillaries?

A. lymph vessel
B. subclavian artery
C. hepatic portal vein
D. posterior vena cava

33. What heart structure prevents the AV valves from inverting (turning inside out)?

A. SA node
B. AV node
C. Purkinje fibres
D. chordae tendineae

34. Contraction of which heart chamber forces blood into the aorta?

A. left atrium
B. right atrium
C. left ventricle
D. right ventricle

Use the following list of events to answer question 35.

- secretion of ADH
- dilation of blood vessels
- secretion of acetylcholine
- sympathetic nervous system stimulation

35. **How many** of the events could cause a blood pressure reading of 160/100?

A. 1
B. 2
C. 3
D. 4

OVER

36. Breathing rate is controlled by which of the following?

A. the alveoli
B. the cerebral cortex
C. the anterior pituitary
D. the medulla oblongata

37. What condition initiates exhalation?

A. high oxygen levels in the blood
B. low air pressure in the thoracic cavity
C. low carbon dioxide levels in the blood
D. increased stimulation of the stretch receptors of the alveoli

Use the following table to answer question 38.

Location in the body	Amount of O_2 in the blood (partial pressure mmHg)	Amount of CO_2 in the blood (partial pressure mmHg)
W	40	45
X	42	42
Y	104	40
Z	40	104

38. The data table indicates the amounts of O_2 and CO_2 (partial pressure) in the blood at four different locations in the body. At which location is the blood leaving the lungs?

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

---

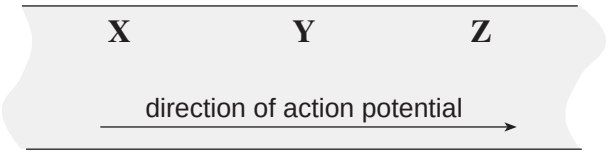
39. Where are interneurons found?

A. within the pacemaker
B. attached to muscle cells
C. between a stretch receptor and a motor neuron
D. between the hypothalamus and the anterior pituitary

40. Which of the following refers to the "threshold" of nerve transmission?

A. the frequency of action potentials which occur down a neuron
B. the action potential created when potassium ions leave the neuron
C. the total polarity change across the membrane during an action potential
D. the minimum level of stimulus necessary for an action potential to occur

Use the following diagram to answer question 41.

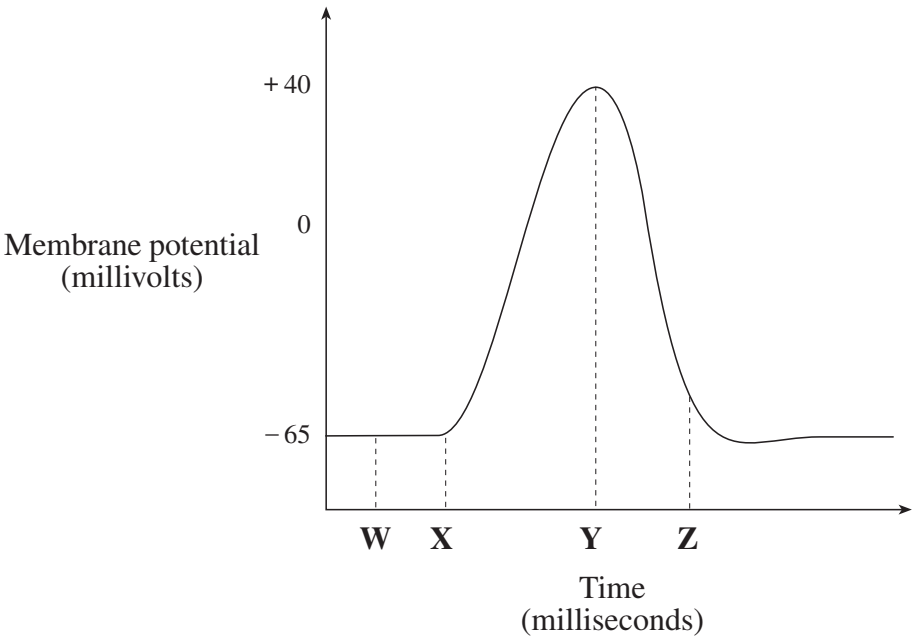


41. The diagram illustrates a section of an axon as an action potential proceeds from **X** to **Z**. If the action potential has proceeded to **Y**, what prevents it from reversing direction?

A. Depolarization occurs at **Z**.
B. Potassium gates are still open at **X**.
C. The sodium-potassium pump stops working at **X**.
D. Negatively charged ions have moved out of the axon at **X**.

OVER

Use the following graph to answer question 42.



42. The graph illustrates changes in membrane potential during the transmission of an action potential. What point on the graph corresponds to the time when repolarization begins?

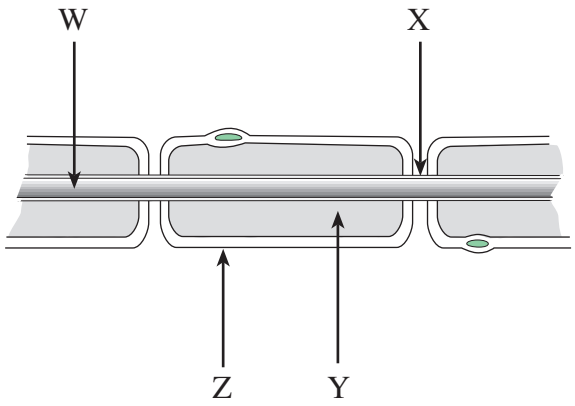
A. W
B. X
C. Y
D. Z

---

43. Which of the following illustrates the "all-or-none" response of a neuron?

A. repolarization will or will not occur
B. depolarization will or will not occur
C. all sodium ions inside the neuron will or will not cross the membrane
D. all potassium ions inside the neuron will or will not cross the membrane

Use the following diagram to answer question 44.



44. Where in the myelinated axon would an action potential occur?

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

---

45. The absorption of what ion begins the process which moves synaptic vesicles toward the presynaptic membrane?

A. calcium
B. chlorine
C. potassium
D. bicarbonate

46. What is the advantage of reflex arcs?

A. They stop the sensation of pain in the brain.
B. They provide a quick response to a stimulus.
C. They take place independently of any nerve function.
D. They allow us to think about an appropriate response to a stimulus.

47. What type of cells carry information to the central nervous system?

A. receptors
B. interneurons
C. motor neurons
D. sensory neurons

OVER

Use the following table to answer question 48.

Time	Heart rate (beats/minute)	Breathing rate (breaths/minute)
X	120	25
Y	65	12

48. The data table indicates the change in heart rate and breathing rate of a person who was under stress. Which of the following could be responsible for the changes shown between time **X** and time **Y**?

    A. Adrenalin is released by the adrenal medulla.
    B. Noradrenalin is released by the sympathetic nervous system.
    C. Noradrenalin is released by the parasympathetic nervous system.
    D. Acetylcholine is released by the parasympathetic nervous system.

---

49. What part of the brain is responsible for memory and thinking?

    A. the thalamus
    B. the cerebrum
    C. the cerebellum
    D. the medulla oblongata

50. What structure transports urine from the bladder to the outside of the body?

    A. the ureter
    B. the urethra
    C. the collecting duct
    D. the distal convoluted tubule

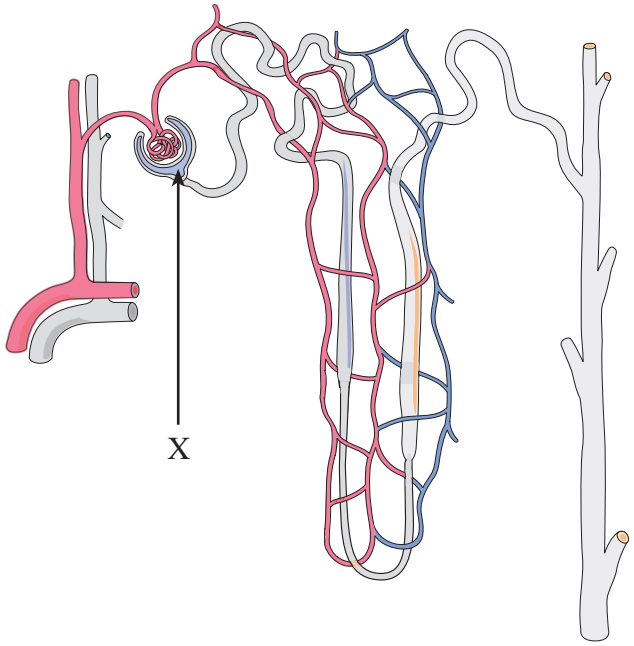
51. Which region of the kidney contains the glomeruli?

    A. the renal cortex
    B. the renal medulla
    C. the adrenal cortex
    D. the adrenal medulla

52. In addition to water, which of the following substances are the main components of urine?

A. urea and salts
B. ammonia and bile
C. amino acids and fatty acids
D. hydrochloric acid and uric acid

Use the following diagram to answer question 53.



53. Which of the following molecules is **not** normally found at **X**?

A. urea
B. water
C. glucose
D. hemoglobin

OVER

54. In which of the following does pressure filtration occur?

A. the glomerulus
B. the afferent arteriole
C. the efferent arteriole
D. the peritubular capillaries

55. Which of the following conditions would lead to an increase in the amount of fluid entering the Bowman's capsule?

A. dehydration
B. a decrease in systolic blood pressure
C. constriction of the efferent arterioles
D. a decrease in the secretion of aldosterone

56. What area of the nephron is the site of hydrogen ion (H^+) excretion?

A. the loop of Henle
B. the collecting duct
C. the distal convoluted tubule
D. the proximal convoluted tubule

57. Which of the following would result from the inhibition of ADH secretion?

A. a decrease in urine volume
B. an increase in the excretion of glucose
C. an increase in the concentration of urine
D. a decrease in the amount of water re-absorbed

58. What structure secretes a hormone to regulate the concentration of sodium and potassium in the blood?

A. the adrenal gland
B. the thyroid gland
C. the hypothalamus
D. the pituitary gland

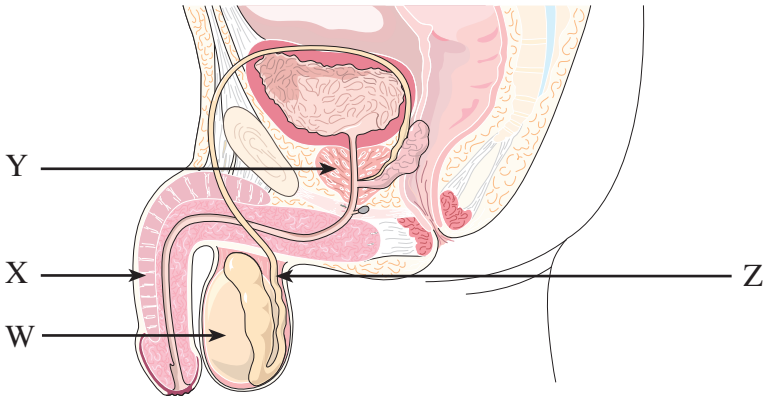
Use the following list of structures to answer question 59.

- testes
- urethra
- vas deferens
- prostate gland
- Cowper's gland

59. **How many** of the structures listed above contribute to the production of semen?

A. 2
B. 3
C. 4
D. 5

Use the following diagram to answer question 60.

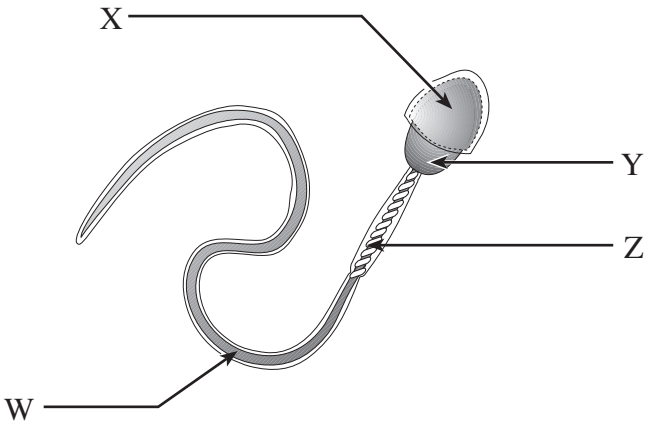


60. Which structure is a target of follicle-stimulating hormone (FSH)?

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

OVER

Use the following diagram to answer question 61.



61. Which part of the cell uses ATP most rapidly?

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

---

62. Which of the following would occur if the concentration of testosterone in the blood was too low?

A. The hypothalamus would produce more GnRH.
B. The testes would produce less luteinizing hormone.
C. The anterior pituitary gland would produce more testosterone.
D. The hypothalamus would produce less follicle-stimulating hormone.

63. Through what structure does the egg travel in order to reach the uterus?

A. the ovary
B. the cervix
C. the vagina
D. the oviduct

64. Where are the hormones produced which cause the endometrium to become secretory during the uterine cycle?

A. in the uterus
B. in the hypothalamus
C. in the corpus luteum
D. in the posterior pituitary

65. What is the result of increased luteinizing hormone secretion on day 14 of the ovarian cycle?

A. ovulation
B. implantation
C. menstruation
D. degeneration of the corpus luteum

66. The onset of uterine contractions results in which of the following?

A. the secretion of less GnRH
B. the secretion of more oxytocin
C. the secretion of less progesterone
D. the secretion of more human chorionic gonadotropin

67. Implantation results in the secretion of what hormone?

A. progesterone
B. luteinizing hormone
C. follicle-stimulating hormone
D. human chorionic gonadotropin

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

OVER

PART B: WRITTEN RESPONSE

Value: 23 marks **Suggested Time: 40 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. You may not need all of the space provided to answer each question.

1. Describe **three** cellular processes which make use of vesicles. **(3 marks)**

2. Describe **two** ways in which enzymes are used during DNA replication. **(2 marks)**

OVER

3. Two digestive enzymes produced by two different glands act on the same substrate. Both enzymes function optimally at a pH of 7.1 to 8.4 and a temperature of 37°C.

a) Describe the similarity of the enzymes' structures and explain why this affects their ability to act on the same substrate. **(2 marks)**

b) What would happen to the rate of the reaction above if the pH was changed to 3.0? Explain your answer. **(2 marks)**

4. Describe **two** digestive reactions which occur as a result of pancreatic secretions. **(4 marks)**

OVER

5. Describe the location of each of the following fetal structures and explain their function in fetal circulation. **(6 marks: 2 marks each)**

oval opening:

venous duct:

umbilical arteries:

6. Describe the events that lead to inhalation after stimulation by the respiratory centre. **(4 marks)**

END OF EXAMINATION