

**Biology 12**  
 June 1999 Provincial Examination  
**ANSWER KEY / SCORING GUIDE**

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**CURRICULUM:**

<b>Organizers</b>	<b>Sub-Organizers</b>
1. Cell Biology	A, B, C, D
2. Cell Processes and Application	E, F, G, H
3. Human Biology	I, J, K, L, M, N, O, P

**Part A: Multiple Choice**

<b>Q</b>	<b>K</b>	<b>C</b>	<b>CO</b>	<b>PLO</b>	<b>Q</b>	<b>K</b>	<b>C</b>	<b>CO</b>	<b>PLO</b>
1.	B	K	1	A1	26.	A	K	3	J8
2.	B	U	1	A1	27.	D	U	3	J11
3.	C	U	1	A1	28.	B	H	3	K2
4.	A	U	1	A1	29.	C	H	3	K4
5.	B	U	1	B3	30.	A	U	3	K1, 6
6.	D	U	1	C1	31.	C	U	3	L1
7.	C	K	1	C1; G1	32.	A	K	3	L2
8.	D	H	1	C2, 9	33.	A	H	3	L6, 7, 8
9.	A	H	1	C2, 5	34.	A	K	3	L8
10.	A	K	1	C2, 7	35.	C	U	3	M2
11.	D	U	1	D1	36.	A	U	3	M6
12.	D	H	2	E1	37.	B	U	3	N2
13.	A	H	2	G8	38.	B	U	3	N5
14.	A	H	2	H2	39.	A	U	3	O1
15.	B	H	3	I1, 2, 4	40.	C	K	3	O2
16.	B	H	3	I2	41.	C	H	3	O2
17.	B	U	3	I2	42.	C	K	3	P1
18.	A	U	3	I2	43.	B	U	3	P1
19.	A	H	3	I6	44.	B	K	3	P1
20.	C	U	3	I7	45.	C	U	3	P4
21.	D	K	3	I9	46.	D	K	3	P7
22.	C	K	3	J2	47.	D	K	3	P7, 9
23.	D	H	3	J1	48.	C	U	3	P10
24.	B	H	3	J5	49.	C	H	3	P9, 10, 12
25.	B	U	3	J6	50.	D	U	3	P12

**Multiple Choice = 50 marks**

## Part B: Written Response

<b>Q</b>	<b>B</b>	<b>C</b>	<b>S</b>	<b>CO</b>	<b>PLO</b>
1.	1	K	3	1	D3, 4
2.	2	H	4	2	E1
3.	3	U	3	2	F1, 3
4.	4	U	7	2	G3, 6, 7
5.	5	U	4	2	H6
6.	6	U	4	3	I2
7.	7	K	4	3	J9
8.	8	U	4	3	L5
9.	9	U	4	3	M3
10.	10	K	6	3	N4
11.	11	U	7	3	O4, 2

**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**

- 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. a) Define recombinant DNA.

**(1 mark)**

- **DNA that has genes from two different organisms. (1 mark)**

b) Describe **two** uses for recombinant DNA.

**(2 marks)**

- **Development of frost-resistant crops.**
- **Production of pure and safe vaccines.**
- **Mass production of human proteins and hormones (e.g. insulin, interferon).**
- **Production of hormones for animals (e.g. bGH to increase milk production).**
- **Production of DNA probes (used to determine such things as paternity or body identification at crime scenes).**
- **Enhancement of naturally occurring bacteria for use in environmental cleanup.**
- **Identification of genes for cloning and mapping.**

**any two for  
1 mark each**

2. Give the purpose of each of the following steps in the process of protein synthesis.

a) Ribosome moving along a mRNA:

(1 mark)

- to match codon and anticodon.
- to allow more tRNAs with specific amino acids to join together.
- directs or controls the formation of a polypeptide chain.

} any one for  
1 mark

b) Adenine bonding to thymine:

(1 mark)

- to produce a mRNA during transcription.
- in the DNA molecule, this bonding ensures that the code is copied properly.

} either one for  
1 mark

c) An amino acid bonding to a specific tRNA:

(1 mark)

- to allow the transport of the amino acid to the ribosome.
- to ensure the correct sequence of amino acids.

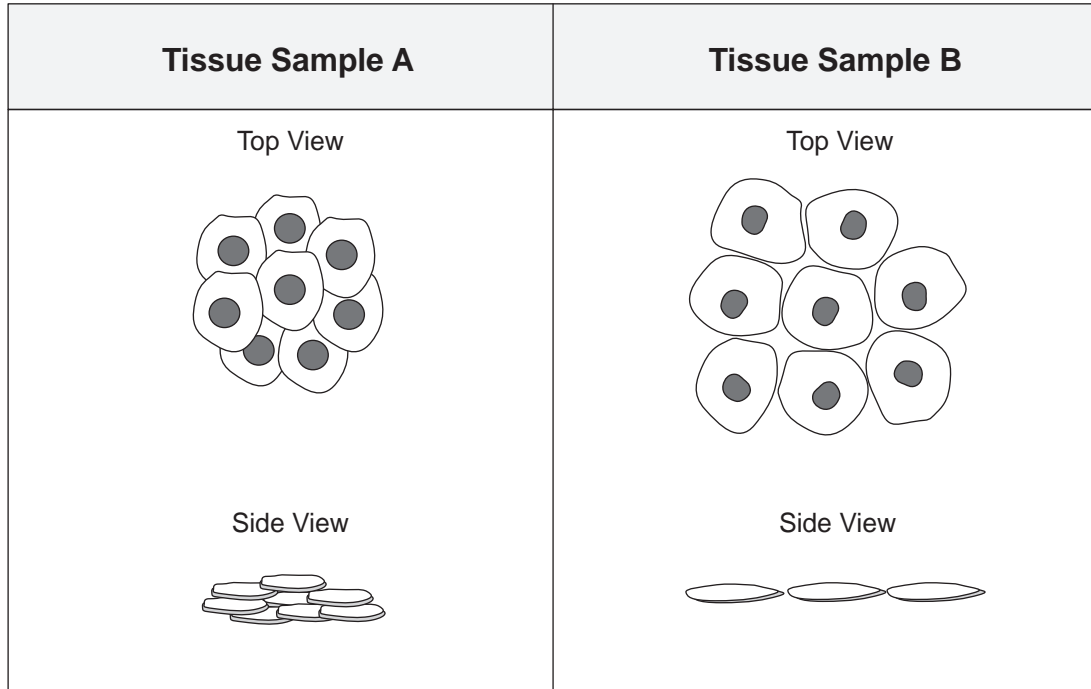
} either one for  
1 mark

d) Forming of peptide bonds:

(1 mark)

- to join adjacent amino acids to produce a protein. (1 mark)

Use the following diagrams to answer question 3.



3. a) The diagrams above were made from samples of epithelial cells taken from healthy tissue and cancerous tissue. Which tissue sample is from the cancerous tissue? **(1 mark)**

• **Tissue Sample A (1 mark)**

b) Give **two** reasons for your answer in a) above.

**(2 marks)**

- There is less cytoplasm.
- There is a loss of contact inhibition.
- There is disorganized growth (anaplasia).
- There is a large nucleus to cytoplasm ratio.

} any two for  
1 mark each

4. An experiment was conducted to determine the concentration of molecules in the cytoplasm of potato cells. The following steps were taken:

1. Five different sugar solutions were added to five numbered test tubes as shown in the data table below.
2. Five potato discs (cut from the same potato) were weighed and one disc was added to each test tube.
3. After 24 hours, the potato discs were removed, blotted dry, and weighed again.

TEST TUBE	CONCENTRATION OF SUGAR SOLUTION (%)	INITIAL POTATO MASS (grams)	FINAL POTATO MASS (grams)	CHANGE IN MASS (%)
1	30.0	5.0	4.0	- 20
2	20.0	4.8	4.3	- 10
3	10.0	5.2	5.5	+ 6
4	5.0	4.7	5.4	+ 15
5	0.0 (distilled water only)	5.1	6.1	+ 20

a) Name and describe the process that allowed the potato cells to gain and lose mass when placed in the sugar solutions. **(2 marks: 1 mark for name; 1 mark for description)**

Name of Process:

- osmosis
  - diffusion of water
  - plasmolysis
- } any one for  
1 mark

Description of Process:

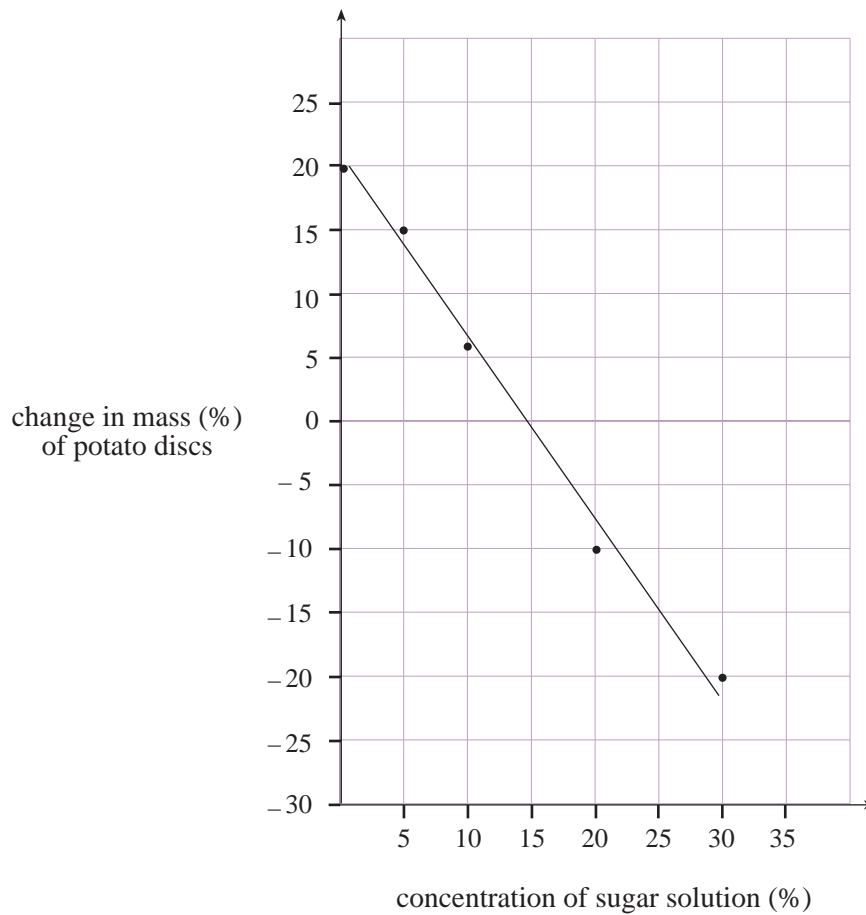
- The movement of water from an area of high water concentration to an area of low water concentration across the cell membrane.
  - The movement of water from an area of lower solute concentration to an area of higher solute concentration across the cell membrane.
- } either one for  
1 mark

b) Explain the change in mass of the potato disc in **test tube 1**. **(2 marks)**

- The potato cells were hypotonic to the sugar solution.
  - The sugar solution was hypertonic to the potato cells.
- } either one for  
1 mark
- Water diffused out of the potato cells.
  - Water left the potato cells by osmosis.
- } either one for  
1 mark

c) Draw a graph that compares the concentration of sugar solution (%) to the change in mass (%) of the potato discs. Label the  $x$ -axis as the concentration of sugar solution (%).

(2 marks)



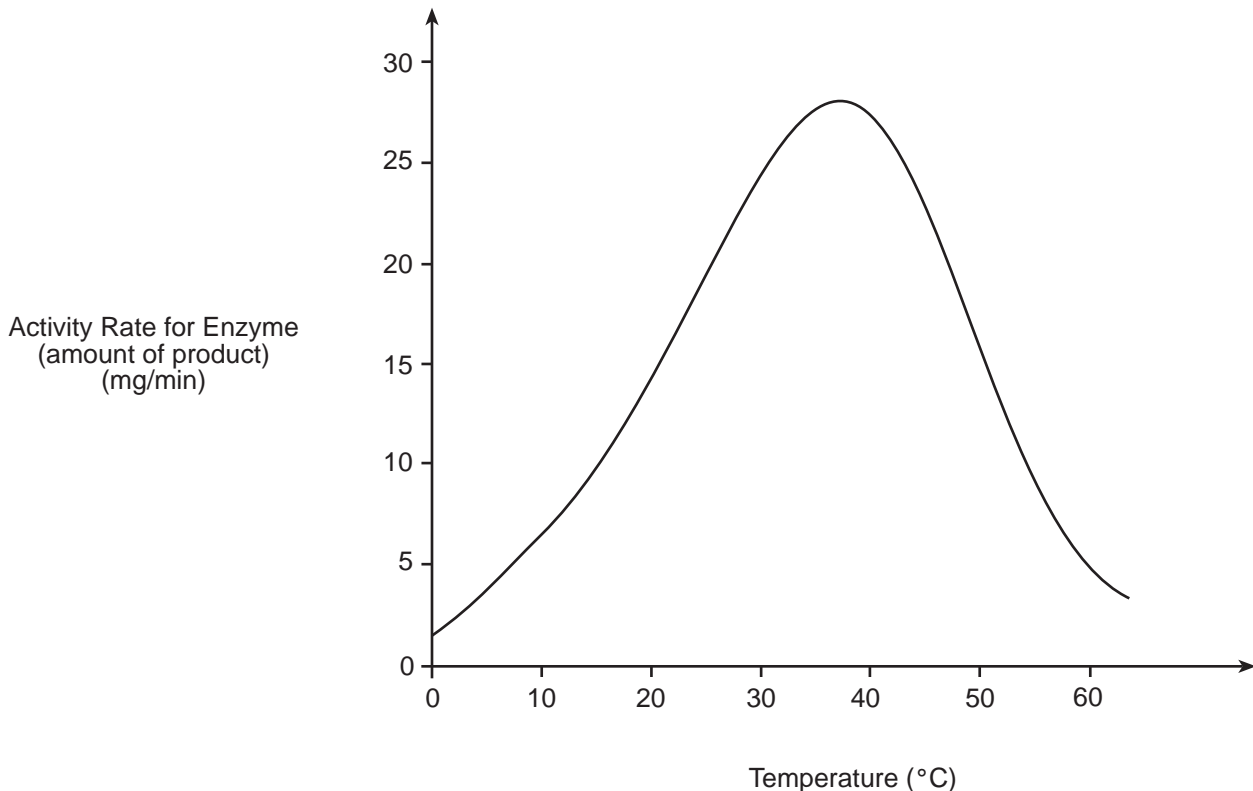
(1 mark for correct scale and labels; 1 mark for plot and line of best fit)

d) Use your graph to determine the concentration of sugar solution (%) that would be isotonic to the cytoplasm of the potato cells.

(1 mark)

• 13%–16%. (1 mark)

5. An experiment was conducted to measure the effect of temperature on an enzyme isolated from the small intestine. Data was collected and graphed as shown below.



Explain why the following temperatures change the activity rate of the enzyme.

0°C to 35°C: (1 mark)

- The molecules move and react faster with increased temperature.
  - As temperature increases from 0°C to 35°C, the rate of enzyme activity increases because the average kinetic energy of the molecules increases.
- } either one for 1 mark

37°C: (1 mark)

- This is the optimum temperature for the enzyme. (1 mark)

45°C to 55°C: (2 marks)

- The hydrogen bonds break and the enzyme loses the shape of its active site.
  - It can no longer combine with the substrate because the kinetic energy of the enzyme and substrate molecules is too great for as many enzyme-substrate complexes to form.
  - Denaturation is beginning to occur.
- } any two for 1 mark each



6. The following substances were isolated from organs found in the digestive system. Name the organ in which each substance was produced and give **one** function of the substance.

**(4 marks)**

SUBSTANCE	ORGAN WHERE PRODUCED	FUNCTION
pepsin	<b>stomach (1 mark)</b>	<b>to convert proteins into polypeptides (1 mark)</b>
nuclease	<b>small intestine or pancreas</b>	<b>to break down nucleic acids into nucleotides (1 mark)</b>

7. a) Describe **one** function of each of the following.

**(3 marks)**

Red blood cells:

- Carry oxygen.
  - Act as a buffer.
  - Carry hydrogen ions.
  - Carry carbon dioxide.
- } any one for  
1 mark

White blood cells:

- Fight infections.
  - Produce antibodies.
  - Phagocytize.
- } any one for  
1 mark

Platelets:

- Initiate blood clotting.
  - Form a temporary clot.
  - Produce serotonin—a vasoconstrictor.
- } any one for  
1 mark

b) Where are red blood cells produced?

**(1 mark)**

- Red blood cells are produced in the bone marrow. (1 mark)

8. Describe the interaction of the lungs, pleural membranes, ribs, and diaphragm during inhalation.

**(4 marks)**

- **The contraction of the diaphragm causes it to move down (flatten).**
- **The contraction of the rib muscles causes the rib cage to move up and out.**
- **Negative pressure within the pleural cavities causes the lungs to expand.**
- **The volume of the thoracic cavity increases.**
- **The pleural membranes seal the lungs, allowing them to inflate.**

} any four for  
1 mark each

9. Explain how an action potential is generated in a neuron.

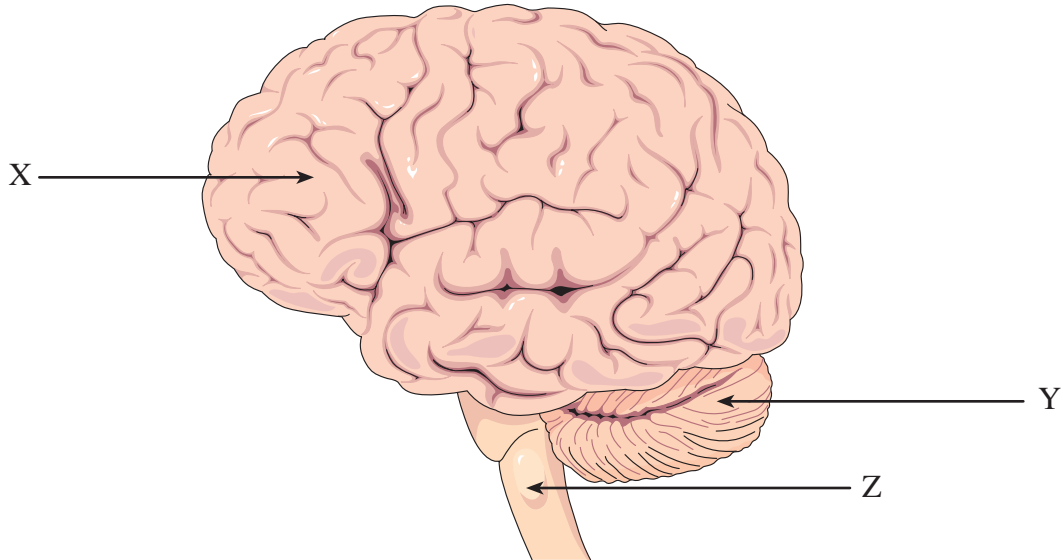
**(4 marks)**

- **A stimulus that is greater than the threshold level initiates the action potential.**
- **There is a spontaneous action potential in the central nervous system.**
- **Sodium ion gates open. (1 mark)**
- **Sodium ions diffuse into the neuron. (1 mark)**
- **Depolarization occurs.**
- **There is a positive charge on the inside and negative charge on the outside of the axon.**

} either one for  
1 mark

} either one for  
1 mark

Use the following diagram to answer question 10.



10. Identify structures **X**, **Y** and **Z** and give **one** function of each.  
(6 marks: 1 mark each for name; 1 mark each for function)

Structure **X**:

Name: • **cerebrum**  
• **cerebral cortex** } either one for  
1 mark

Function: **controls the central nervous system (CNS) (e.g. sensory perception, learning, memory, conscious behaviour, skeletal muscle control) (1 mark)**

Structure **Y**:

Name: **cerebellum (1 mark)**

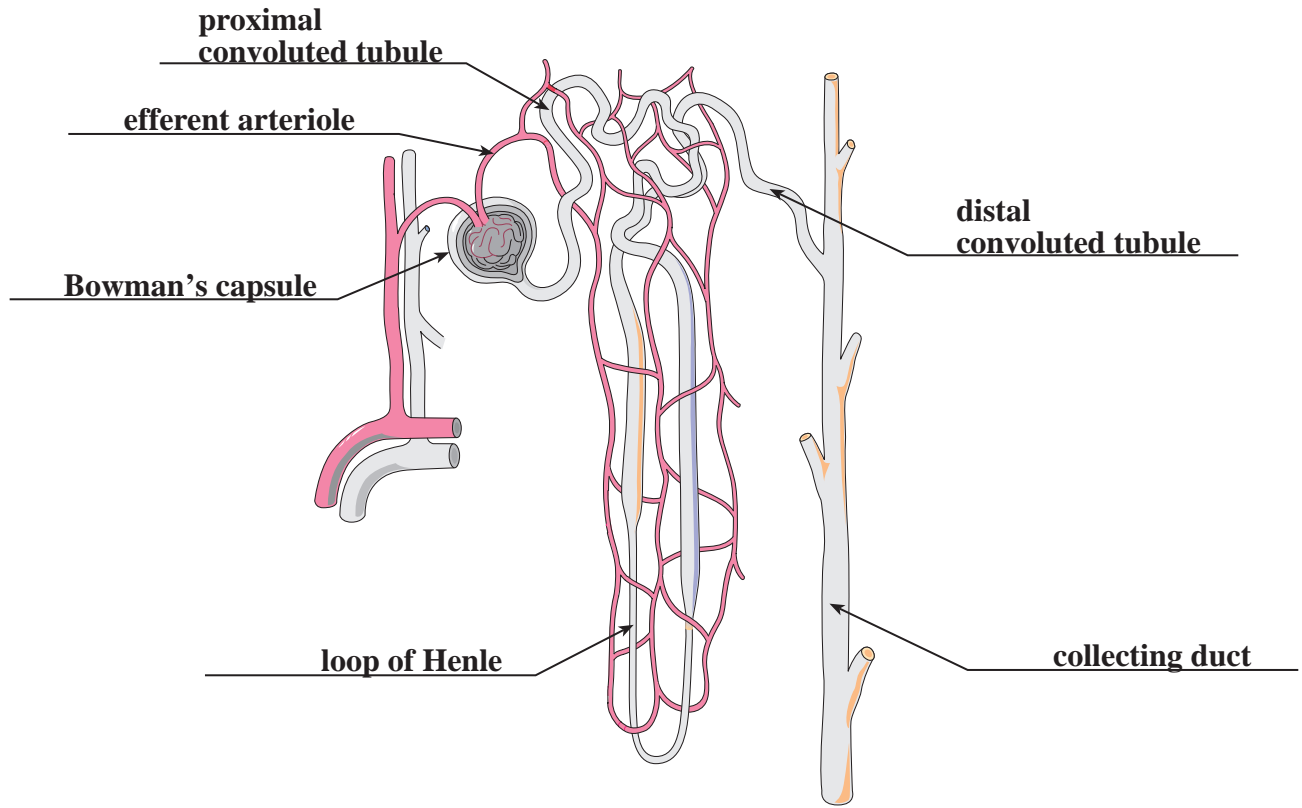
Function: **controls muscle coordination, balance, posture, muscle tone. (1 mark)**

Structure **Z**:

Name: **medulla oblongata (1 mark)**

Function: • **controls the autonomic nervous system (ANS)**  
• **controls blood pressure (or any other specific example).** } either one for  
1 mark

11. a) Using the following diagram, label the parts of a nephron in the blanks provided.  
(3 marks:  $\frac{1}{2}$  mark each)



b) Identify **one** hormone that responds to a decrease in blood volume and explain how this hormone functions to return blood volume to normal levels.

**(4 marks: 1 mark for name; 3 marks for explanation)**

Name: **ADH (1 mark)**

Explanation:

- **ADH makes the walls of the collecting duct or the distal tubule more permeable to water. (2 marks)**
- **An increased amount of fluid/water/solution/extra cellular fluid is reabsorbed by the peritubular capillary network.**
- **The increased water reabsorption increases blood volume to the normal level.**

} **either one for  
1 mark**

**OR**

Name: **aldosterone (1 mark)**

Explanation:

- **Sodium and potassium ions are reabsorbed by active transport at the distal tubule or collecting duct. (2 marks)**
- **This increases the solute concentration of the blood; therefore, more fluid returns from the tissues and the blood volume increases. (1 mark)**

**END OF KEY**