INTI INTERNATIONAL UNIVERSITY

FOUNDATION IN SCIENCE (CFSI)
BIO1204: BIOLOGY 2
FINAL EXAMINATION: JUNE 2015 SESSION

Instructions: This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) Fig. 1.1 is an electron micrograph of cells from the lining of the small intestine.

Fig. 1.1

(i) Identify the structures labeled A and state the role for the cell.

(2 marks)

(ii) There are many mitochondria in cell B. Suggest why cell B contains a large number of mitochondria.

(1 marks)

(iii) There are many goblet cells within the epithelium lining the trachea and the bronchi in the gas exchange system.
Describe the role of goblet cells in the gas exchange system.

(3 marks)

(iv) State **ONE (1)** ways in which the cells lining the alveoli in the lungs differ from cell B shown in Fig. 1.1.

(1 mark)

(b) Explain the digestion of fat in human. Include organs and enzymes involved.

(8 marks)

(c) Copy and complete Table 1.1 by numbering each event to show the sequence occurring in the initiation and control of one heart beat. Use 1 as the first event in the sequence.

Table 1.1

Event	Sequence
Impulses pass down septum through conducting fibres known as the bundle of His	
Atrioventricular node sends out impulses	
Impulses travel across atrial walls	
Impulses reach base of ventricles (apex of heart)	
Impulses pass up through Purkyne fibres in ventricle walls	
Sinoatrial node sends out impulses	

(3 marks)

(d) Figure 1.2 shows three stages in the cardiac cycle.

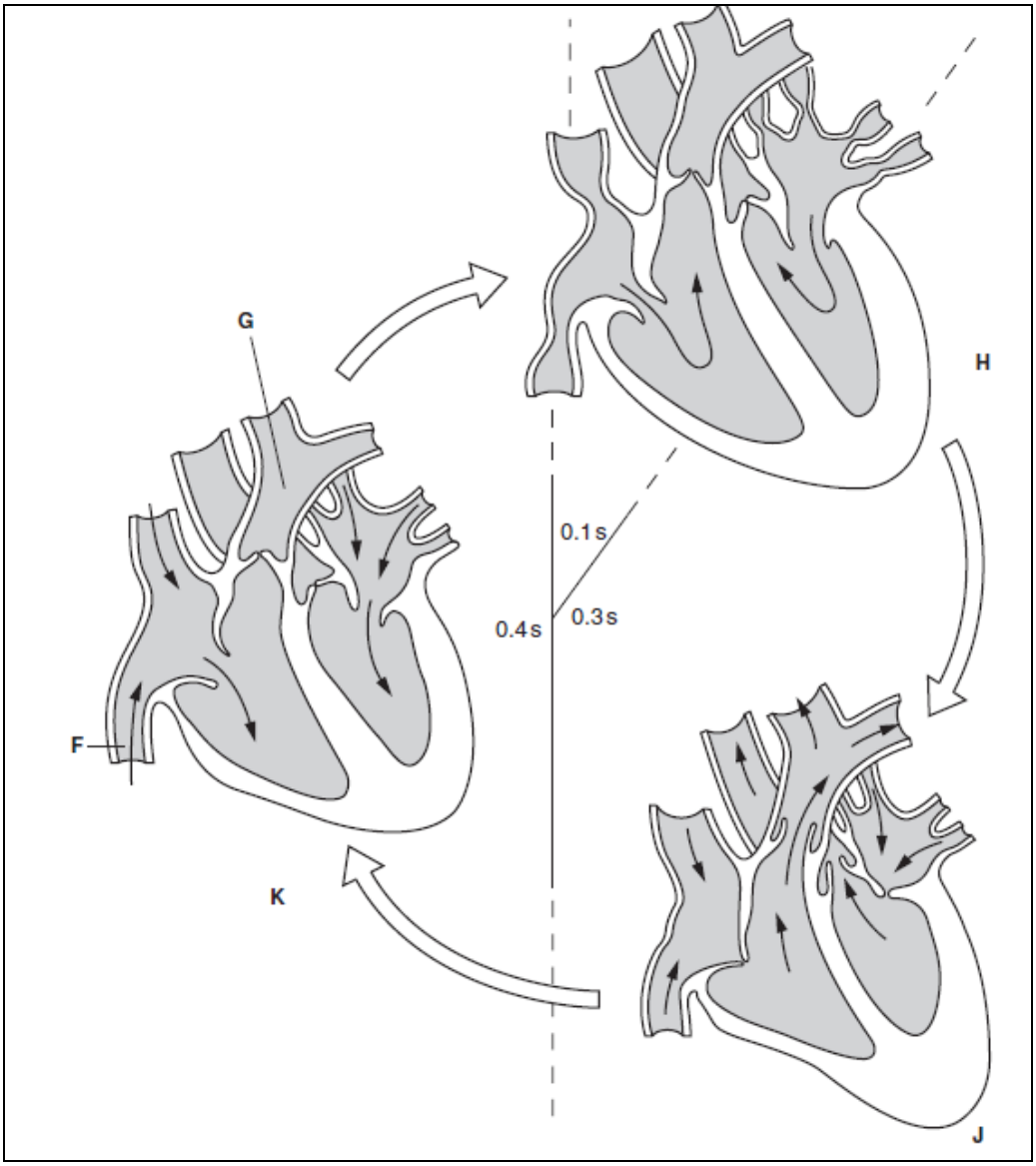

Fig. 1.2

(i) Fig. 1.1 indicates that one heart beat takes 0.8 second. State the heart rate in beats per minute.

(1 mark)

(ii) Complete the table to show what is happening to the following parts of the **left** side of the heart at each of the stages, **H**, **J** and **K** as shown in Fig. 1.1.

Stage	Left atrium	Left ventricle	AV valve	Aortic valve
H	contracts to force blood into left ventricle	(A)……	Open	Closed
J	(B)……	(C)……	Closed	(D)……..
K	(E)……	relaxes and fills with blood from left atrium	Open	(F)……

(6 marks)

Question 2

(a) Phagocytes and lymphocytes are part of the body's cellular response to infection by pathogens. **Fig. 2.1** shows the origin and maturation of phagocytes and lymphocytes.

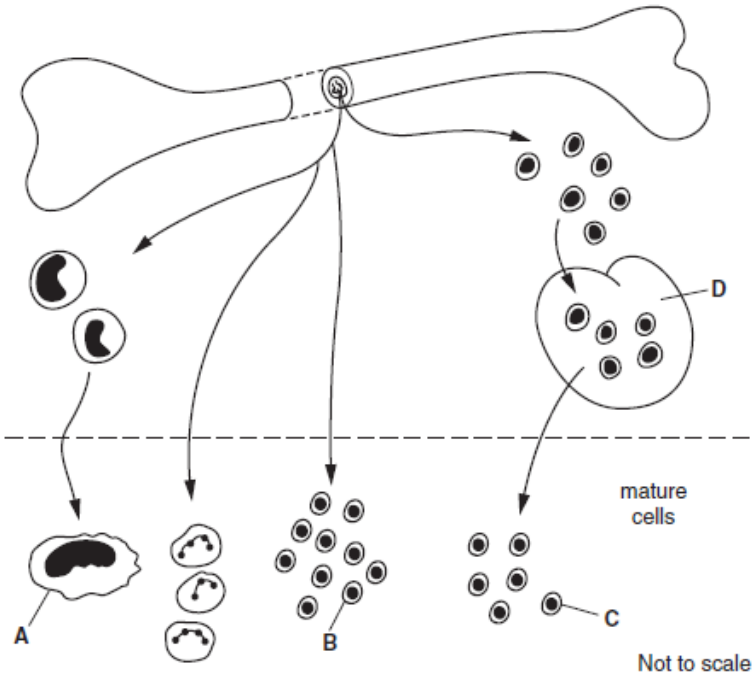

Fig. 2.1

(i) Name the site of origin of phagocytes and lymphocytes.

(1 mark)

(ii) Identify cell labeled A, B, C and organ D.

(2 marks)

(iii) Explain the roles of the cells, A, B and C in an immune response. In your answer use the terms antigen and non-self.

(6 marks)

(b) Samples of blood of Janet and Calvin were tested to determine the blood type. Table below shows the result of the test.

Patient	Anti-A serum	Anti-B serum	Anti-D serum
Janet	No Agglutination	No agglutination	Agglutination
Calvin	Agglutination	No agglutination	No agglutination

(i) Identify the blood type for Janet and Calvin including rhesus type.

(1 mark)

(ii) To whom should Janet **NOT** give blood to? Why?

(3 marks)

(c) During the process of the excretion of nitrogenous waste in mammals, blood passes from the renal artery into networks of capillaries called glomeruli. Fig. 2.2 shows the capillaries and the Bowman's capsule cells.

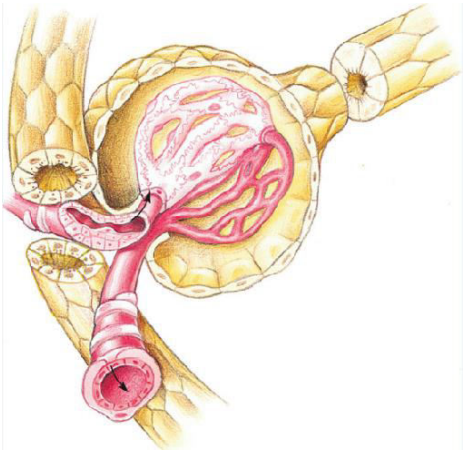

Fig. 2.2

(i) Describe **TWO (2)** ways how the composition of the glomerular filtrate differs from blood plasma.

(2 marks)

(ii) Ultrafiltration involves the removal of small molecules, including urea, from the blood into the renal capsule. Explain what is required for ultrafiltration to occur.

(2 marks)

(d) Fig. 2.3 shows a section through the proximal tubule of kidney nephron showing details of cell structure as seen with the electron microscope.

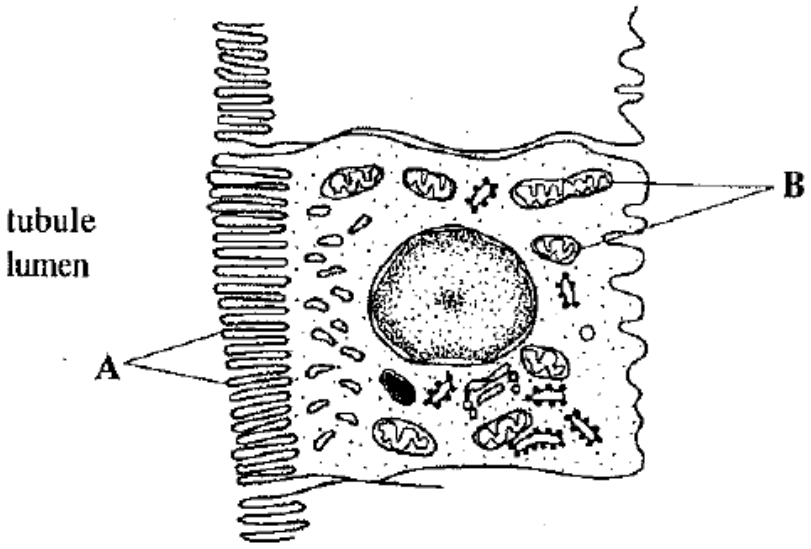

Fig. 2.3

(i) Identify structure labeled A and B.

(2 marks)

(ii) Describe **THREE (3)** adaptations of proximal tubules to perform its function efficiently.

(6 marks)

Question 3

(a) Neurones transmit impulses from one part of a mammal's body to another.
Table 3.1 contains statements that refer to motor and sensory neurons.
Complete the table, indicating with the letters M, S or B, whether each statement applies to:
• motor neurons only (M)
• sensory neurons only (S)
• both motor and sensoryn neurons (B).
The first one has been done for you.

Table 3.1

Statement	Letter
is myelinated	**B**
may form a synapse with an intermediate (relay) neurone	(i)
cell body lies within the CNS	(ii)
Dendrites are usually longer than axon	(iii)
cell body lies within spinal nerve	(iv)
has many dendrites	(v)

(5 marks)

(b) A synapse is a junction between two or more neurones.
Describe how an action potential arriving at a presynaptic membrane of a neurone can result in the depolarisation of the membrane of a post-synaptic neurone.

(6 marks)

(c) Describe how thyroid and parathyroid glands regulate calcium levels in the blood.

(5 marks)

(d) Fig. 3.1 shows simplified processes that occur in the human menstrual cycle.

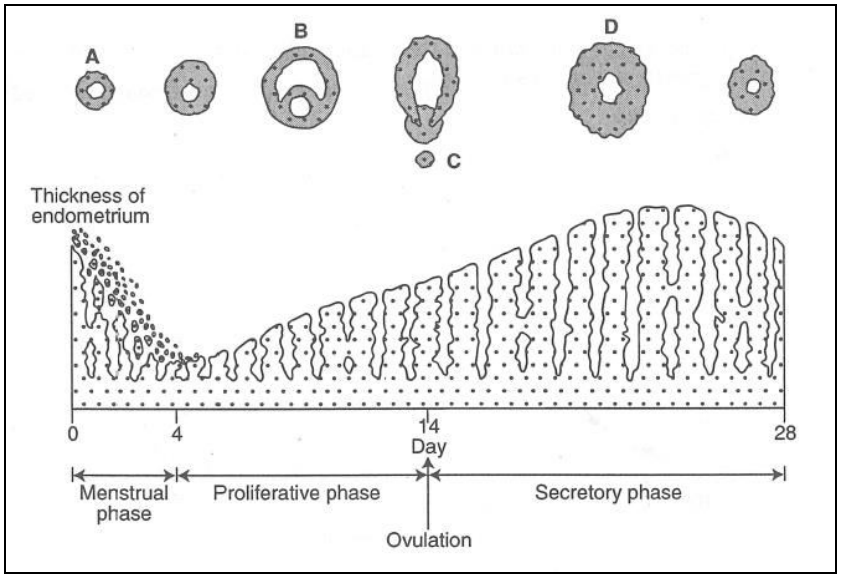

Fig. 3.1

(i) Name structures labeled A, C and D.

(3 marks)

(ii) Explain the relationship between the breakdown of the endometrium on the first four days of a menstrual cycle with the concentration of progesterone.

(2 marks)

(iii) What is the relationship between the development of structure A into B with the increase in the thickness of the endometrium from the 4^{th} day until the 13^{th} day of the menstrual cycle?

(2 marks)

(iv) Explain the relationship between structure D with the increase in the thickness of the endometrium from the 14^{th} day of the menstrual cycle.

(2 marks)

Question 4

(a) Table 4.1 contains some information about xylem vessels and phloem sieve tube elements in plants. Complete Table 4.1.

Table 4.1

Features	Xylem vessels	Phloem sieve tube elements
Living cells	(i)	yes
Substances transported	(ii)	(iii)
Direction of flow of substances	One direction, roots to leaves	(iv)
Permeability of cell walls to water	Not permeable	(v)
Cell wall material	(vi)	Cellulose

(6 marks)

(b) Fig. 4.1 shows transverse sections of a root and a stem.

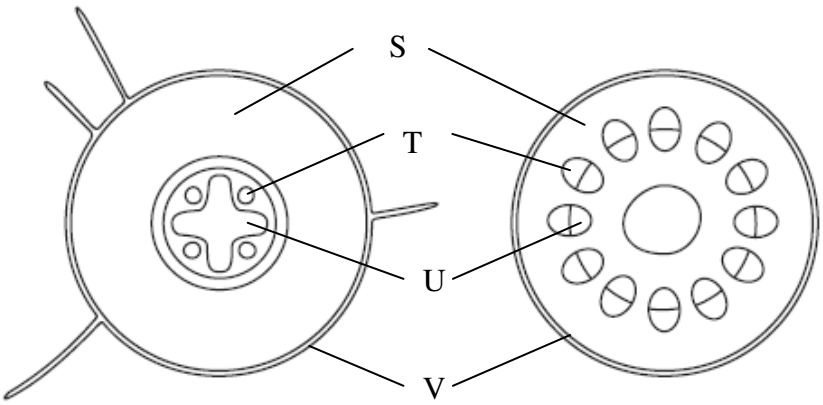

Fig. 4.1

(i) To which group does this plant (shown in Fig. 4.1) belong to?

(1 mark)

(ii) Identify tissues labeled S, T, U and V and state **ONE (1)** function of S, T, U and V.

(6 marks)

(c) (i) State **THREE (3)** benefits that are provided by fungi in a plant's root.

(3 marks)

(ii) What are the **TWO (2)** special properties of water that help transpiration to pull xylem sap up the tree? Briefly explain your answer.

(4 marks)

(d) Fig. 4.2 shows the exposure of plant species X to various periods of light (unshaded bars) and dark (shaded bars). In some cases the dark period was interrupted by periods of light. The effect on flowering is shown in each case. Critical night length for the plant is 12 hours.

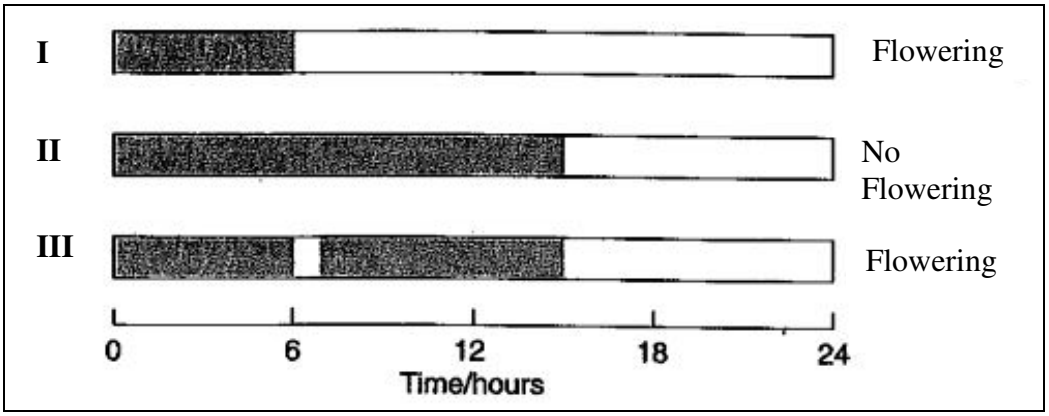

Fig. 4.2

(i) To which photoperiodic group does the plant belong? Why?

(2 marks)

(ii) Explain the result of treatment labeled II and III.

(3 marks)

Question 5

(a) Corals are simple marine animals and usually exist in colonies of thousands of individuals. **Fig. 5.1** shows a coral colony.

Fig. 5.1

Corals absorb calcium carbonate from the sea to build their skeletons, which help to form large coral reefs. Coral reefs provide a home for about 25% of known fish species and have the highest biodiversity of any marine ecosystem.

(i) Corals, although they are animals, are sometimes mistaken for members of the plant kingdom. State **TWO (2)** ways in which corals differ from plants.

(2 marks)

(ii) Outline what is meant by the term ecosystem.

(2 marks)

(iii) Coral reefs are at risk of damage due to human activities. All the coral reefs in **THREE (3)** regions were classified as being at low, medium or high risk of damage. **Table 5.1** shows the areas of coral reef at risk of damage in these three regions. Complete **Table 5.1**, giving your answers to the nearest whole number.

Table 5.1

region	area of coral reef at risk of damage / 1000 km^2			percentage of coral reef at high risk of damage
	low	medium	high	
Caribbean Sea	9	8	7	29
Indian Ocean	20	15	10	
Pacific Ocean	60	30	9	

(1 mark)

(iv) Suggest **FOUR (4)** ways how human activities could damage coral reefs.

(4 marks)

(b) Lancaster Sound in the Canadian Arctic is a very productive marine environment and supports large populations of sea birds and marine mammals.
Studies of the area have shown the importance of Arctic cod, *Boreogadus saida*, in the flow of energy to marine birds, such as guillemots and fulmars, and marine mammals, such as narwhals and belugas. Arctic cod forms the main, or only, source of food for many such animals.
The flow of energy through the food web in Lancaster Sound is shown in **Fig. 5.2**.

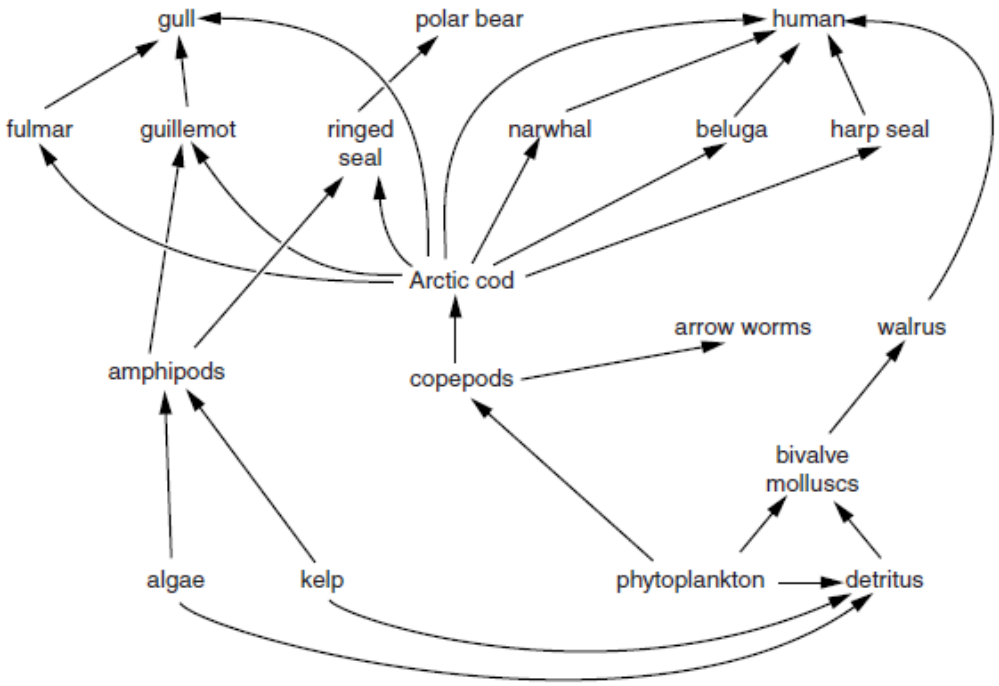

Fig. 5.2

(i) Name the trophic levels occupied by the following organisms in the food web in **Fig. 5.2**.
(a) kelp
(b) arrow worms
(c) narwhals

(3 marks)

(ii) The population of polar bears in the Lancaster Sound area is quite small in comparison to populations of animals that feed on Arctic cod. Using **only** the information shown in **Fig. 5.2**, explain why the population of polar bears is small.

(4 marks)

(iii) Populations of many fish species are under threat of extinction as a result of over-fishing. Explain the likely consequences of over-fishing of Arctic cod.

(3 marks)

(c) Fig. 5.3 illustrates the accumulation of gases in the atmosphere as a result of human activities.

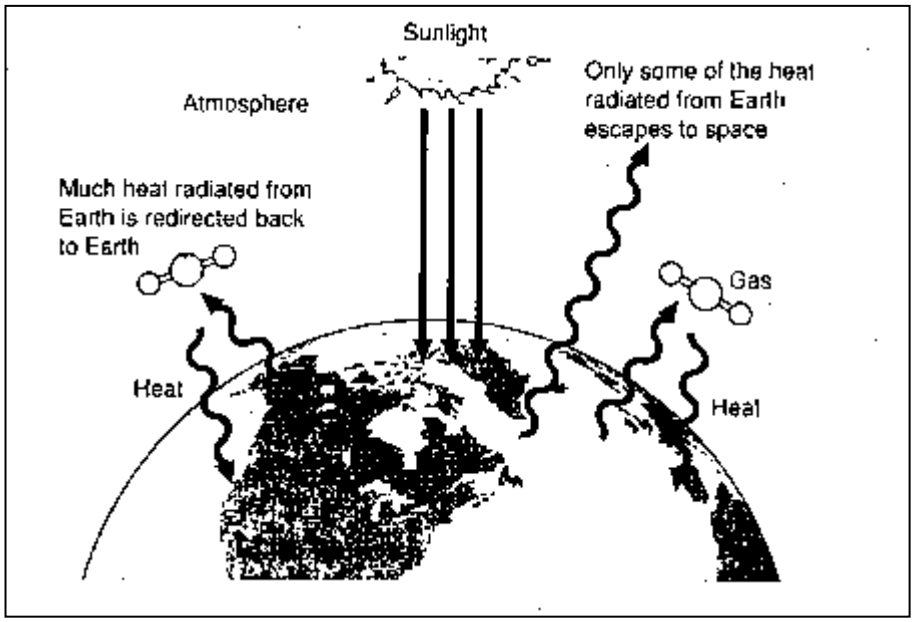

Fig. 5.3

(i) Give **TWO (2)** examples of gases that accumulate in the atmosphere as a result of human activities.

(2 marks)

(ii) State **TWO (2)** probable effects of global warming.

(2 marks)

(iii) Suggest **TWO (2)** ways to reduce greenhouse gases in the atmosphere.

(2 marks)

-THE END-

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