**BIOLOGY – FORM IV**  
**TIME: 1H 30MIN**

NAME: _________________________________       CLASS: _____________________________

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<thead>
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<th>Question No.</th>
<th>Section A</th>
<th>Section B</th>
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<tr>
<td></td>
<td>1</td>
<td>2</td>
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<tr>
<td>Max mark</td>
<td>5</td>
<td>7</td>
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<tr>
<td>Actual mark</td>
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TOTAL MARK

<table>
<thead>
<tr>
<th>85% Theory Paper</th>
<th>15% Practical</th>
<th>100% Final Score</th>
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</table>
Answer ALL questions in this section.

1a. Name the acid:
   (i) produced in muscles after heavy exercise ________________
   (ii) produced in the stomach ________________
   (iii) contributing to acid rain formation. ________________ (1, 1, 1 mark)

b. Explain how the stomach is protected from attack by gastric juices.
   ______________________________________________________________________ (1 mark)

c. Name the substance present in pancreatic juice that gives an alkaline environment for the action of enzymes in the small intestine.
   ______________________________________________________________________ (1 mark)

Total: 5 marks

2. The following diagram shows part of the process of digestion.

   a. From the diagram write the letter of the part showing the:
      (i) starch molecule ________________
      (ii) glucose molecule ________________
      (iii) villus ________________
      (iv) artery. ________________ (1, 1, 1, 1 mark)
b. Coeliac disease causes the villi in the small intestine to get smaller. Explain why individuals suffering from this disease become weak.

__________________________________________________ __________________________
__________________________________________________ ______________________
(1 mark)

c. Coeliacs are advised to follow a gluten-free diet. Gluten is a protein found in wheat, barley and oats.

(i) Name the building blocks of proteins.

__________________________________________________ ______________________

(ii) Name the elements that make up proteins.

__________________________________________________ ______________________
(1 mark)

Total: 7 marks

3. The following table lists seven arctic organisms and the food of each organism.

<table>
<thead>
<tr>
<th>Arctic organism</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wolf</td>
<td>caribou, musk oxen, arctic hares, lemmings, arctic fox</td>
</tr>
<tr>
<td>Caribou</td>
<td>arctic plants</td>
</tr>
<tr>
<td>Lemming</td>
<td>arctic plants</td>
</tr>
<tr>
<td>Arctic fox</td>
<td>lemmings, arctic hares</td>
</tr>
<tr>
<td>Polar bear</td>
<td>lemmings, arctic fox</td>
</tr>
<tr>
<td>Arctic hare</td>
<td>arctic plants</td>
</tr>
<tr>
<td>Musk oxen</td>
<td>arctic plants</td>
</tr>
</tbody>
</table>

a. Use the information given in the table above to construct a food web of the coastal arctic region.

(4 marks)
b. As the ice in the Arctic regions continues to melt, there has been a noticeable decline in the number of the Arctic fox that are surviving the harsh winters. Describe the effect of a decrease in the arctic fox population on the Arctic hare population:

(i) after 3 years
_________________________________________________ ________________________

(ii) after 25 years.
_________________________________________________ ________________________
(1, 1 mark)

c. Describe how a low lemming population affects the number of Arctic hares.
_________________________________________________ ________________________ (2 marks)

d. Ice crust formation results from freeze-thaw events in the Arctic region. Explain how ice-crust formation affects the primary consumers in the food web.
_________________________________________________ ________________________ ________________________ (2 marks)
Total: 10 marks

4. Explain the biological significance of each of the following cartoons used in different health campaigns.

a. ________________________________
________________________________
________________________________
________________________________
________________________________
________________________________
(2 marks)

b. ________________________________
________________________________
________________________________
________________________________
________________________________
________________________________
________________________________
(2 marks)

Get ironed like Popeye!
5. The following diagram shows the experimental set up used to investigate the amount of radioactive carbon dioxide that enters different parts of a plant after 24 hours. The amount of carbohydrate transported to other parts of the plant can be found by measuring the amount of radioactivity.

a. Name
   (i) the process that uses carbon dioxide to make carbohydrates
   Name
   (ii) the tissue that transports the carbohydrate along the plant.
   Name
   (1, 1 mark)

b. Sucrose is the main carbohydrate transported in leaf tissues. Sucrose is composed of glucose and fructose. What type of carbohydrate is sucrose?
   Name
   (1 mark)
c. The following table shows the amount of radioactivity in different parts of the plant after 24 
hours.

<table>
<thead>
<tr>
<th>Plant part</th>
<th>Amount of radioactivity in counts per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoot tip</td>
<td>1123</td>
</tr>
<tr>
<td>Leaf exposed to radioactive carbon</td>
<td>11325</td>
</tr>
<tr>
<td>Other leaves</td>
<td>234</td>
</tr>
<tr>
<td>Stem</td>
<td>819</td>
</tr>
<tr>
<td>Seeds</td>
<td>9055</td>
</tr>
<tr>
<td>Roots</td>
<td>842</td>
</tr>
</tbody>
</table>

(i) What evidence in the table above shows that carbohydrate is transported both up and down 
the plant?

(ii) Explain why the ‘other leaves’ contain only small amounts of radioactive carbohydrate.

(i, 1 mark)

d. Describe how carbon dioxide gets into the leaf.

(1 mark)

e. Explain the benefit of:
   (i) the leaf mosaic arrangement in plants

(ii) flat leaf blade

(iii) thin leaf.

(1, 1, 1 mark)

Total: 9 marks

6. During exercise, when muscular activity increases, several changes take place in the body.

a. Explain why the arteries supplying blood to muscles dilate during exercise.

(3 marks)

b. Many athletes have low pulse rates.
   (i) What measure does the pulse rate indicate?
(ii) Explain why athletes have a lower pulse rate than non-athletes.

_____________________________________________________________________________________

_____________________________________________________________________________________

(1, 2 marks)

c. On the last day of the 2002 Winter Olympics, three cross-country skiers were excluded from the games for blood doping. Blood doping is a method of increasing the number of red blood cells in the body in order to promote athletic performance. Explain how blood doping helps athletes to promote their athletic performance.

_____________________________________________________________________________________

(1 mark)

d. The sweat excreted during heavy exercise contains a high concentration of urea. Name:

(i) ONE other fluid that contains the excretory product urea

_____________________________________________________________________________________

(ii) the body organ where urea is produced.

_____________________________________________________________________________________

(1, 1 mark)
e. Give ONE reason why athletes are advised to avoid smoking.

_____________________________________________________________________________________

(1 mark)

Total: 10 marks

7. Normally the right and left sides of the heart are completely separated by a wall called septum. The pressure in the left side of the heart is normally greater than that in the right side of the heart. Occasionally a baby is born with a hole between the right and left atria or between the right and left ventricles. An Atrial Septal Defect (ASD) is a hole in the part of the wall (septum) that separates the atria in the heart.

a. Explain why the pressure in the left side of the heart is normally greater than that in the right side.

_____________________________________________________________________________________

_____________________________________________________________________________________

(2 marks)

b. How does ASD affect the flow of blood in the heart?

_____________________________________________________________________________________

_____________________________________________________________________________________

(2 marks)

c. The coronary arteries supply oxygen-rich blood to the heart muscle. Coronary heart disease (CHD) is a condition where the coronary arteries become narrowed.

What is the effect of CHD on the blood flow to the heart muscle?

_____________________________________________________________________________________

_____________________________________________________________________________________

(2 marks)
d. Heart valve disease occurs when one or more of the heart valves do not work properly. Describe the effect of each of the following heart defects:

(i) a heart valve does not close tightly

(ii) the heart flaps of a valve thicken, stiffen or fuse together.  

(1, 1 mark)  
Total: 8 marks

Section B
Answer question ONE and choose any other TWO. This section carries 45 marks. Write the answers for Section B on a foolscap.

1. Read the following passage and then answer the questions that follow.

Pectinases are one of the upcoming enzymes of fruit and textile industries. These enzymes break down complex polysaccharide of plant tissues called pectin into simpler molecules. The largest industrial application of pectinases is in the fruit juice extraction and clarification. A mixture of pectinases and amylases is used to clarify fruit juices. Pectinases have also been used in conjunction with amylases, lipases and cellulases in textile processing to remove sizing agents from cotton in a safe and eco friendly manner. Pectinases also play an important role in coffee and tea fermentation.

a. From the passage write the term that matches each of the following statements:

(i) the enzyme necessary for herbivores to digest plant material
(ii) the type of carbohydrate formed from many monosaccharide molecules.  

(1, 1 mark)

b. Explain each of the following statements:

(i) Enzymes taking part in a reaction can be used again and again.
(ii) Two enzymes are necessary for the complete breakdown of starch.  

(1, 1 mark)

c. Scientists working in industry often need to know the exact amount of substrate to add to an enzyme catalysed reaction. Explain why scientists do not add neither too little nor more substrate than is needed. 

(2 marks)

d. Lipase is the enzyme that converts fats to fatty acids and glycerol.

(i) Name the site in the gut where lipase is produced.
(ii) Explain how lipase is helped in its action to digest fats.  

(1, 1 mark)

e. In human digestion, pectin goes through the small intestine more or less intact. What is the importance of indigestible portion of foods such as pectin in the digestion process?  

(1 mark)

f. Explain how fermentation is used:

(i) to make products that can be used as fuel
(ii) to produce yoghurt.  

(2, 2 marks)

g. Yeast is used in bread making. Flour, sugar, water and salt are mixed with yeast to produce dough. Describe the structure of bread that results if the dough is:

(i) not left to rise
(ii) left to rise for too long.  

(1, 1 mark)  
Total: 15 marks
2. Leukemia is a type of cancer of the bone marrow characterized by an abnormal increase of white blood cells. Bone marrow is a vital element of the lymphatic system and acts to prevent the backflow of lymph.
   a. What is the biological importance of the bone marrow? (2 marks)
   b. Damage to the bone marrow by displacing the normal bone marrow cells with higher numbers of immature white blood cells results in lack of blood platelets. How does this affect a leukaemia patient? (2 marks)
   c. Lymph has a composition comparable to blood plasma. Discuss. (3 marks)
   d. Explain why large complex organisms require a transport system. (4 marks)
   e. Describe the transport function of blood. (4 marks)

Total: 15 marks

3. Give a biological reason for each of the following statements:
   a. Many animal species that live in arid environments such as deserts have highly efficient loops of Henle. (2 marks)
   b. Blood reaching the glomerulus is under high pressure. (3 marks)
   c. Freshwater fish excrete dilute urine. (2 marks)
   d. The kidneys play an important role in homeostasis. (3 marks)
   e. Each day the kidneys produce about 180 litres of glomerular filtrate, however the daily production of urine is only about 1-2 litres. (2 marks)
   f. Different factors affect the amount of urine produced in a human being. (3 marks)

Total: 15 marks

4. Distinguish between:
   a. palisade mesophyll and spongy mesophyll (4 marks)
   b. trachea and epiglottis (2 marks)
   c. aorta and vena cava (4 marks)
   d. absorption and assimilation (3 marks)
   e. nicotine and tar. (2 marks)

Total: 15 marks

5. On 8th May 1978 Peter Habeler and Reinhold Messner were the first to climb Mount Everest (8848 metres above ground) without an additional supply of oxygen.
   a. Explain the changes taking place in the rate and depth of breathing in response to a reduction in blood oxygen levels. Give a reason for your answer. (3 marks)
   b. Asthma is a disease of the lungs that causes the airways in the lungs to become narrower and inflamed.
      (i) List TWO typical effects of asthma on the body. (2, 1 mark)
      (ii) Name the skeletal protection of the lungs. (2, 1 mark)
   c. Restrictive lung diseases (RLD) are a category of respiratory diseases that restrict lung expansion.
      (i) What is the effect of RLD on the lung volume? (1, 3, 2 marks)
      (ii) Describe the process of inspiration.
      (iii) Describe the role of the nose in preventing the entry of micro-organisms into the body.
   d. Pulmonary embolism (PE) is a blockage of the main artery of the lung. Name the artery of the lung and give its function. (3 marks)

Total: 15 marks