INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer all questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.
You are reminded of the necessity for good English and orderly presentation in your answers.
The quality of written communication will affect the awarding of marks.
1. (a) Kidneys can become damaged by injury or disease.

(i) Give **four** possible effects of kidney failure. [4]

(ii) Suggest why heart disease or the loss of a large volume of blood can lead to kidney failure. [2]
Patients with kidney failure can be treated using dialysis.

During dialysis blood can be taken from an artery, large vein or a fistula which is created by surgically connecting an artery directly to a vein. The picture below shows the appearance of such a fistula.

(b) Explain the appearance of the vein shown in the photograph above which forms the fistula.  [2]
(c) The blood from the patient is passed through a haemodialysis tube. The tube is made from thousands of very small hollow fibres each made from a partially permeable membrane with pores of various sizes. The partially permeable membrane blocks the passage of cells, platelets and large proteins but will allow solute molecules through. The dialysis fluid lacks substances such as urea, contains the same concentration of ions such as potassium and calcium and has the same water potential as blood from a person who has functional kidneys.

The following show a picture of a haemodialysis tube and a diagram representing how it is used.

(i) State why the dialysis fluid has to be constantly replaced. [1]
(ii) Explain why the dialysis fluid moves in the opposite direction to the flow of blood. [1]

(iii) Explain why during some dialysis treatments calcium ions diffuse from the patient’s blood into the dialysis fluid but during others they diffuse from the dialysis fluid into the patient’s blood. [1]

(d) Transplanted kidneys are more efficient than dialysis but there are some issues concerning the technique.

Suggest two reasons against the use of kidney transplants. [2]

(e) The kidney also acts as an endocrine organ. What is meant by the term endocrine organ? [1]
2. The electron micrograph shows a cross section of muscle.

(a) Name the molecules labelled A and B in the micrograph above. [2]

A .................................................................
B .................................................................

(b) Draw a labelled diagram in the space below showing the structure of one sarcomere. [4]
(c) Describe the function of calcium ions in

(i) the transmission of a nerve impulse across a neuro muscular synapse; [2]

(ii) the contraction of the muscle. [2]
3. (a) The diagram below shows an aerobic fermenter used for the production of the antibiotic Penicillin.

(i) Give two advantages of using microorganisms in industrial fermentation. [2]

(ii) At the end of the fermentation process the penicillin is extracted, the fermenter emptied and the procedure is repeated. What is the general name given to this method of fermentation? [1]

(iii) State three ways by which the risk of contamination of the culture is reduced. [2]
(iv) Suggest **two** reasons why it is necessary to reduce contamination. [2]

(v) Explain why it is necessary to circulate cold water through the outer jacket. [2]
(b) The graph below shows the penicillin production, carbohydrate levels and the biomass of the fungus Penicillium notatum.

(i) Describe the relationship between the P. notatum biomass, carbohydrate levels and production of penicillin. [2]

(ii) Suggest the benefit to the fungus P. notatum of producing an antibiotic. [2]
4. The diagram shows the changes in the potential difference across the membrane of a neurone during the passage of an action potential.

(a) Describe how the resting potential is maintained in the neurone. [3]
(b) Describe the changes which are taking place in the membrane at points A and B. [5]

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B ..........................................................................................................................................................................................................
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(c) Multiple sclerosis is caused by the immune system destroying the myelin sheath of neurones. Explain why this condition leads to a slowing down of the transmission of a nerve impulse. [3]
(d) Some chemicals such as organophosphorous insecticides increase the activity of the nervous system and others such as Beta-blockers reduce the activity of the nervous system. Suggest two ways in which the chemicals could increase the activity of the nervous system and two ways in which the activity could be decreased. [4]

(i) Increase in activity.

I ....................................................................................................................................................................................

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II ....................................................................................................................................................................................

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(ii) Decrease in activity.

I ....................................................................................................................................................................................

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II ....................................................................................................................................................................................

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For each stage of the respiratory cycle shown in the table below use ticks (√) to indicate which statements are correct.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Glycolysis</th>
<th>Link reaction</th>
<th>Krebs cycle</th>
<th>Oxidative phosphorylation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substrate level phosphorylation takes place</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAD is reduced</td>
<td>√</td>
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<tr>
<td>FAD is reduced</td>
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<tr>
<td>Dehydrogenation takes place</td>
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<tr>
<td>Decarboxylation takes place</td>
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<tr>
<td>Oxygen is used</td>
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<tr>
<td>ATP is produced</td>
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<tr>
<td>Takes place in the cytoplasm</td>
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<tr>
<td>Takes place in the mitochondrial matrix</td>
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<tr>
<td>Takes place in the inner mitochondrial membrane</td>
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<tr>
<td>Coenzyme A is used as an acceptor</td>
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</tbody>
</table>
6. It has been estimated that in the UK every year 150 000 people suffer from cerebrovascular accident (CVA), commonly known as a stroke.

(a) Describe what causes a CVA and suggest factors which could increase the risk of suffering a CVA. [3]

(b) Give two common symptoms which can result from CVA. [2]

(c) Suggest two ways of treating a patient suffering from a CVA. [2]
7. **Answer one** of the following questions.

Any diagrams included in your answer must be fully annotated.

**Either, (a)** Describe the photolysis of water and the light independent stage of photosynthesis. Explain the importance of these processes for the continued life of humans.  

**Or (b)** Describe the role of bacteria in the nitrogen cycle. Explain why humans need a supply of organic nitrogen molecules and suggest how humans can improve the recycling of nitrogen.