Candidate Forename | Candidate Surname
---|---
Centre Number | Candidate Number

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
ADVANCED SUBSIDIARY GCE

F221
HUMAN BIOLOGY
Molecules, Blood and Gas Exchange

TUESDAY 12 JANUARY 2010: Morning
DURATION: 1 hour
SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the Question Paper

OCR SUPPLIED MATERIALS:
None

OTHER MATERIALS REQUIRED:
Electronic calculator
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

DC (CW/CGW) MEP10273  24954/2
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INSTRUCTIONS TO CANDIDATES

• Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.

• Use black ink. Pencil may be used for graphs and diagrams only.

• Read each question carefully and make sure that you know what you have to do before starting your answer.

• Answer ALL the questions.

• Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

• The number of marks is given in brackets [ ] at the end of each question or part question.

• The total number of marks for this paper is 60.

• Where you see this icon you will be awarded marks for the quality of written communication in your answer.

• You may use an electronic calculator.

• You are advised to show all the steps in any calculations.
Answer ALL the questions.

1  (a) The cells in the human body and in plants are eukaryotic cells.

State what is meant by a eukaryotic cell.

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________ [1]

(b) The different organelles within a cell may be seen using an electron microscope.

Fig. 1.1 on the loose sheet is an electron micrograph of a plant cell showing cell organelles. The organelle labelled D is shown at a higher magnification in Fig. 1.2.

(i) Name the cell organelles labelled A to C in Fig. 1.1.

A  _____________________________________
B  _____________________________________
C  ___________________________________ [3]

(ii) State ONE function of each of the organelles labelled D to F.

D  _____________________________________
E  _____________________________________
F  _____________________________________ [3]
(c) Fig. 1.3 is an electron micrograph showing a lymphocyte.

Use the scale bar in Fig. 1.3 to calculate the actual diameter of the cell along the line X – Y.

Show your working AND give your answer TO THE NEAREST WHOLE NUMBER.

Answer = ____________ μm [2]

[Total: 9]
A student, Jack, is taking part in an investigation into the effect of exercise on heart rate. Jack started to pedal on an exercise bike and stopped pedalling after 5 minutes.

Jack’s heart rate was measured by taking his pulse rate at rest, and then again at one-minute intervals during the five minutes of exercise.

The procedure was repeated three times and the data were recorded in Table 2.1.

<table>
<thead>
<tr>
<th>time (min)</th>
<th>pulse rate (beats per minute)</th>
<th>replicate 1</th>
<th>replicate 2</th>
<th>replicate 3</th>
<th>mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>64</td>
<td>66</td>
<td>65</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>68</td>
<td>68</td>
<td>70</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>102</td>
<td>92</td>
<td>92</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>118</td>
<td>116</td>
<td>124</td>
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<tr>
<td>4</td>
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</tr>
<tr>
<td>5</td>
<td>140</td>
<td>148</td>
<td>146</td>
<td>145</td>
<td></td>
</tr>
</tbody>
</table>
(a) Describe how **PULSE RATE** can be measured by a method **OTHER THAN** using a pulse rate monitor.

________________________________________________________________________

________________________________________________________________________

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________________________________________________________________________[3]

(b) (i) Using the information in Table 2.1, describe the effect of exercise on Jack’s **HEART RATE**.

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________________________________________________________________________

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________________________________________________________________________[2]
(ii) Explain the effect you have described in your answer to (i).

_______________________________________

_______________________________________

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_______________________________________

_______________________________________

_______________________________________ [3]

(c) (i) State TWO safety precautions that should have been taken before Jack took part in the investigation.

1. ______________________________________

   ______________________________________

2. ______________________________________

   ______________________________________ [2]
(ii) Suggest **ONE** reason why the procedure was repeated three times.

________________________________________

________________________________________

________________________________________[1]

[Total: 11]
3 A circulatory system transports many materials around the body.

Fig. 3.1 shows a diagram of the double circulatory system of the human body. This system is an example of a closed circulatory system.
(a) (i) Explain what is meant by the terms ‘double circulatory system’ and ‘closed circulatory system’.

**double circulatory system**

_______________________________________

_______________________________________

**closed circulatory system**

_______________________________________

_______________________________________

_______________________________________ [2]

(ii) Give **TWO** advantages of a double circulatory system.

_______________________________________

_______________________________________

_______________________________________

_______________________________________

_______________________________________

_______________________________________ [2]
(iii) Give **TWO** reasons why large organisms such as humans need a circulatory system.

_______________________________________

_______________________________________

_______________________________________

_______________________________________

_______________________________________

_______________________________________ [2]

(b) Fig. 3.2 is a diagram of a cross section through **VEIN P FROM FIG. 3.1**.

![Diagram of a cross section through a vein](image)

(i) **NAME** vein P.

_______________________________________ [1]
(ii) Name the parts of the vein labelled Q and R in Fig. 3.2.

Q  _____________________________________

R  _____________________________________  [2]

(iii) Explain how a vein is adapted to carry out its function.

________________________________________________________________________

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________________________________________________________________________  [3]

[Total: 12]
4 (a) Proteins are an important component of blood plasma. Some of these proteins are enzymes.

Fig. 4.1 shows a diagram of the enzyme, thrombin, found in blood plasma, together with its substrate.
Enzymes such as thrombin are globular proteins.

(i) Describe the TERTIARY structure of a globular protein.

In your answer, you should use appropriate technical terms, spelt correctly.

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[4]
(ii) Explain how the structure of the enzyme thrombin enables it to catalyse the conversion of fibrinogen to fibrin during the blood clotting process.

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________________________________________________________________________ [3]
Afibrogenaemia is a rare condition in which there is a low concentration of fibrinogen in the blood.

Describe **AND** explain the effect of a low concentration of fibrinogen on blood clotting time.
5 (a) Humans have a specialised gas exchange surface in the lung.

Fig. 5.1 on the loose sheet is a photomicrograph of the tissue in the lung.

Describe HOW the lung provides each of the following four conditions needed for an efficient gas exchange surface:

- large surface area
- thin surface
- steep diffusion gradient across the surface
- protection from drying out.

large surface area

__________________________________________
__________________________________________
__________________________________________

thin surface

__________________________________________
__________________________________________
__________________________________________
(b) Elastic fibres are found in the lung.

(i) State where elastic fibres are found in the lung.

__________________________________________________________________________ [1]

(ii) Describe the role of these elastic fibres.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________ [2]

[Total: 8]
Lipids are a group of substances that are insoluble in water.

(a) Triglycerides are examples of lipids that are often used as energy stores in humans.

Fig. 6.1 is a diagram of a triglyceride molecule.

(i) Name the type of bond labelled Z on Fig. 6.1.
(ii) Describe how bond Z is formed.

In your answer, you should use appropriate technical terms, spelt correctly.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

[3]

(b) A phospholipid is another example of a lipid molecule.

(i) State TWO ways in which the STRUCTURE OF A PHOSPHOLIPID molecule differs from a triglyceride molecule.

1 ______________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2 ______________________________________________________________________
________________________________________________________________________

[2]
(ii) Describe the properties of phospholipid molecules that help them to carry out their function in cells.

__________________________________________________________________________________

__________________________________________________________________________________

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__________________________________________________________________________________ [3]

[Total: 9]

END OF QUESTION PAPER
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