Biology

Unit 2
Higher Tier

[GBY22] *GBY22*

FRIDAY 16 JUNE, MORNING

TIME
1 hour 45 minutes.

INSTRUCTIONS TO CANDIDATES
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. Do not write with a gel pen.
Answer all thirteen questions.

INFORMATION FOR CANDIDATES
The total mark for this paper is 115.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions 4(b) and 11(b).
Cancer cells are produced by uncontrolled cell division. This results in a tumour.

The diagram shows a malignant tumour and a blood vessel before chemotherapy treatment.

Look at the diagram.

(a) Describe two differences between a cancer cell and a normal cell.

1. __________________________________________________________
   __________________________________________________________ [1]

2. __________________________________________________________
   __________________________________________________________ [1]
The diagram shows the tumour and the blood vessel after chemotherapy treatment.

Look at the diagrams.

(b) Give two ways the tumour has changed after chemotherapy treatment.

1. ________________________________________________________________  [1]

2. ________________________________________________________________  [1]

Chemotherapy is one way of treating cancer.

(c) Give two other ways of treating cancer.

1. ______________________________                        [1]

2. ______________________________                        [1]
2 The diagram shows part of the human circulatory system. The arrows show the direction of blood flow.
Look at the diagram.

(a) Name blood vessels A, B and C.

A _____________________________ [1]
B _____________________________ [1]
C _____________________________ [1]

(b) (i) Complete the diagram by drawing the hepatic portal vein. [1]

(ii) Draw an arrow to show the direction of blood flow in the hepatic portal vein. [1]
3 Blood groups are an example of variation.

(a) (i) Name this type of variation.
______________________________ [1]

(ii) Give **one other** example of this type of variation in humans.
______________________________ [1]

(b) The table shows information about blood groups in the Northern Ireland population.

<table>
<thead>
<tr>
<th>Blood group</th>
<th>Number of people in Northern Ireland</th>
<th>Percentage of population in Northern Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>954 000</td>
<td>53</td>
</tr>
<tr>
<td>A</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>B</td>
<td>180 000</td>
<td>10</td>
</tr>
<tr>
<td>AB</td>
<td>54 000</td>
<td>3</td>
</tr>
</tbody>
</table>

Statistics adapted from the Northern Ireland Blood Transfusion Service "About Blood". © Crown Copyright, 2010 - Contains public sector information licensed under the Open Government Licence v3.0

Look at the table.

(i) The population of Northern Ireland is 1 800 000.

Calculate the number of people in the Northern Ireland population with blood group A.

Show your working.
___________________ [2]
It is preferable that people receive a blood donation of their own blood group.

(ii) Suggest why people with group **AB** in Northern Ireland are at a disadvantage.

____________________________________________________________

____________________________________________________________

__________________________________________________________  [1]

During surgery blood transfusions are often necessary.

(c) What is a blood transfusion?

____________________________________________________________

____________________________________________________________

____________________________________________________________  [1]
4 (a) Penicillin was discovered in 1928.

Name the scientist who discovered penicillin.

___________________________________

(b) The diagram shows the result of the experiment which led to the discovery of penicillin.

Source: CCEA
Use the diagram to help explain how penicillin was discovered.

In this question you will be assessed on your written communication skills, including the use of specialist scientific terms.
5 Some microorganisms cause disease.

(a) Complete the table.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Type of microorganism</th>
<th>How microorganism spreads</th>
<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>gonorrhoea</td>
<td></td>
<td></td>
<td>wear a condom</td>
</tr>
<tr>
<td>mumps</td>
<td>virus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>athlete’s foot</td>
<td></td>
<td>contact</td>
<td>avoid direct contact</td>
</tr>
</tbody>
</table>

(b) Food poisoning is caused by the microorganism *Salmonella*.

(i) What type of microorganism is *Salmonella*?

__________________________________________________________

[1]

A person can suffer the symptoms of food poisoning 1–3 days after eating contaminated meat.

*Salmonella* sometimes survives cooking.

It can be spread on knives, cutting surfaces or by the food handler.

(ii) Use this information to suggest two ways to reduce the risk of spreading *Salmonella*.

1. __________________________________________________________

   __________________________________________________________ [1]

2. __________________________________________________________

   __________________________________________________________ [1]
6 In an experiment the heart rates of two men were measured before, during and after exercise.

The graph shows the results.

(a) Give two variables which had to be controlled during this experiment.
1. ________________________________________________________________________
2. ________________________________________________________________________ [2]

(b) Barry is fitter than Michael.

Use data from the graph to help explain this statement.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________ [4]
The photograph shows a normal blood sample.

Magnification
×500

(a) Identify the parts of the blood labelled A, B and C.

A  ________________________________  [1]
B  ________________________________  [1]
C  ________________________________  [1]

(b) Give two differences, shown in the photograph, between A and C.

1. ______________________________________________________ [1]
   ______________________________________________________
2. ______________________________________________________ [1]
   ______________________________________________________
Part D is a liquid that transports different food substances around the body.

(c) Name two other substances which are transported in this part of the blood.

1. ________________________________
2. ________________________________ [2]

(d) The photograph shows a blood sample from a person suffering from a blood disorder.

Magnification
×500

(i) Describe one difference between this sample and the normal blood sample.

___________________________________________________________
___________________________________________________________ [1]

(ii) Suggest which blood disorder this person suffers from and describe one possible treatment.

Disorder ___________________________

Treatment _________________________________________________
___________________________________________________________ [2]
A pupil carried out an experiment to investigate the effect of placing cylinders of carrot in a range of concentrations of sugar solutions.

He weighed the cylinders and left them in the sugar solutions for two hours.

He then removed, dried and reweighed the cylinders.

(a) Diagram A shows a carrot cell after it had been left in a dilute sugar solution for two hours.

(i) On diagram A, draw a labelled line to show the part of the carrot cell that stops it from bursting.

Diagram B shows a carrot cell after it had been left in a concentrated sugar solution for two hours.
(ii) Describe three differences between the carrot cells shown in diagrams A and B.

1. __________________________________________________________
   __________________________________________________________ [1]

2. __________________________________________________________
   __________________________________________________________ [1]

3. __________________________________________________________
   __________________________________________________________ [1]

(iii) Explain the appearance of the carrot cell in diagram B.

___________________________________________________________
___________________________________________________________
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___________________________________________________________
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___________________________________________________________
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_________________________________________________________ [4]
(b) The pupil repeated the experiment with potato cylinders. The graph shows the results.

(i) Give the concentration of the sugar solution that causes no change in the mass of the carrot cylinders.

_________________________________________________________ [1]

The pupil concluded that the carrot and the potato contained different concentrations of sugar.

(ii) Use data from the graph to help explain this conclusion.

_________________________________________________________
_________________________________________________________
_________________________________________________________
_________________________________________________________
_________________________________________________________
_________________________________________________________ [3]
DNA carries the genetic code for living organisms.

Throughout the 1950s several scientists were involved in working out the structure of DNA.

(a) How did the work of Chargaff, Franklin and Wilkins lead to the discovery of the structure of DNA?

Chargaff
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________ [2]

Franklin and Wilkins
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________ [1]

The work of these scientists led to new scientific knowledge.

(b) Describe how scientific knowledge can be validated.

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________ [2]
10 (a) Genetic engineering is used to produce human insulin.

The diagram shows the stages involved.

human chromosome containing insulin gene

enzyme X

human insulin gene

exposed bases

bacterium

structure A

(i) Name structure A.

[1]
(ii) What type of enzyme is X?

_________________________________________________________ [1]

(iii) What term is given to the exposed bases in the gene and structure A that allows for complementary base pairing?

_________________________________________________________ [1]

(b) The diagram shows a fermenter in which bacteria carrying the human insulin gene are grown.

(i) Explain why the air entering the system has to be sterile.

_________________________________________________________ [1]
The fermenter provides the optimum temperature for growth of bacteria.

(ii) Why is this necessary?

___________________________________________________________

___________________________________________________________ [1]

(iii) Describe how the temperature inside the fermenter is controlled.

___________________________________________________________

___________________________________________________________

___________________________________________________________ [2]

Before the product containing insulin can be used for medical purposes it needs to be downstreamed.

(iv) What processes are involved in downstreaming?

___________________________________________________________

___________________________________________________________

___________________________________________________________ [1]
11 (a) An X-ray was taken of the arteries on the surface of the heart of a patient suffering from heart disease.

The white areas show the blood flow through the arteries on the surface of the heart.

(i) Name the arteries shown in the X-ray.

_______________________________  [1]

(ii) What builds up in the wall of the arteries to cause reduced blood flow?

__________________________________________________________________________

__________________________________________________________________________  [1]

(iii) Give two factors that increase the risk of this type of damage to the arteries.

1. ____________________________________________________________________  [1]

2. ____________________________________________________________________  [1]
The diagrams show three stages of the treatment given to a patient with heart disease.

**Stage 1**
A fine tube is pushed into the partially blocked artery.

The tube is attached to a balloon covered with a metal cage.
(b) **Use the diagrams** to describe what happens in **Stage 2** and **Stage 3**.

Suggest how this treatment helps reduce the risk of the patient having a heart attack.

In this question you will be assessed on your written communication skills, including the use of specialist scientific terms.
12 (a) The diagram shows how treating bacteria with an antibiotic can result in a population of bacteria which are resistant to that antibiotic.

The original population of bacteria shows genetic variation.

(i) What causes this genetic variation?

_________________________________________________________________________ [1]

(ii) Describe and explain the effect of the antibiotic treatment on the original population of bacteria.

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________ [5]
(iii) Describe how this population of antibiotic resistant bacteria could develop into a superbug.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________ [2]
(b) Tuberculosis is a serious infection, which mainly infects the lungs.

(i) Describe how tuberculosis is spread and prevented.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________ [2]

The table shows the number of antibiotic resistant tuberculosis cases in the UK.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of antibiotic resistant tuberculosis cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>493</td>
</tr>
<tr>
<td>2008</td>
<td>555</td>
</tr>
<tr>
<td>2009</td>
<td>496</td>
</tr>
<tr>
<td>2010</td>
<td>873</td>
</tr>
<tr>
<td>2011</td>
<td>835</td>
</tr>
<tr>
<td>2012</td>
<td>2246</td>
</tr>
<tr>
<td>2013</td>
<td>2923</td>
</tr>
</tbody>
</table>


(ii) The number of antibiotic resistant tuberculosis cases changes from 2007–2013.

Describe the trend of this change.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________ [2]
The table shows the number of new antibiotics available for use from 1990 to 2012.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of new antibiotics available for use</th>
</tr>
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<tbody>
<tr>
<td>1990–1999</td>
<td>22</td>
</tr>
<tr>
<td>2000–2009</td>
<td>7</td>
</tr>
<tr>
<td>2010–2012</td>
<td>1</td>
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</tbody>
</table>

Since 2012, twelve new antibiotics were in the final stage of development.

60% of these may become available for use.

(c) Use data from the tables to suggest how the change in the number of antibiotics available for use may affect the number of antibiotic resistant tuberculosis cases after 2013.
13 (a) Describe and explain **two** ways the body can prevent microorganisms from entering.

1. __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________ [2]

2. __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________ [2]

**Read the passage.**

Viruses lack cellular organisation but contain genetic material surrounded by proteins which act as antigens.

The influenza virus reproduces quickly and often has mutations of the antigens. As a result, the influenza virus has many different types, known as strains.

Each year scientists identify the strains of the influenza virus most likely to cause the illness around the world.

Modified forms of the three most likely strains are used to produce an influenza vaccine for the next year.

Once injected into the patient the influenza vaccine takes about two weeks to provide immunity against those strains of the influenza virus.

A pandemic can happen when a previously unknown strain of the influenza virus causes illness in large numbers of people around the world.
(b) Suggest what is meant by a modified strain of the virus and explain why it is used in the vaccine to provide immunity.

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(c) How does this immunity stop the spread of the virus in the body?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
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________________________________________________________________________
________________________________________________________________________

[5] [3]
(d) Suggest why the vaccine for a particular year may be ineffective and not stop a pandemic of influenza.

________________________________________________________________________

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________________________________________________________________________ [4]

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Examiner Number

10503/7