GCE AS/A level

1072/02

HUMAN BIOLOGY – HB2

P.M. MONDAY, 1 June 2015

1 hour 30 minutes plus your additional time allowance

Surname

Other Names

Centre Number

Candidate Number 2
<table>
<thead>
<tr>
<th>Question</th>
<th>Maximum Mark</th>
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ADDITIONAL MATERIALS

In addition to this examination paper you will need a ruler and a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink, black ball-point pen or your usual method.

Write your name, centre number and candidate number in the spaces provided on the front cover.

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.
Answer ALL questions.

1. The first lines of defence against disease involve a number of natural barriers and localised defence mechanisms.

Complete the sentences below that describe some first lines of defence. [5]

One of the first lines of defence is the strong connective tissue found in the skin and lining of the buccal cavity. A deficiency in __________________________ can lead to weakened connective tissue and open wounds that can enable micro-organisms to gain entry to the body.

Bacteria naturally present on the skin are called the __________________________ and offer protection by competing with pathogenic micro-organisms.
If bacteria do enter the body through the skin, __________ increases blood flow to the site of infection. White blood cells called __________ also help localise the infection by ingesting bacteria that enter the tissues.

___________ epithelia in the trachea help to reduce the chance of lung infection by moving mucus, which traps bacteria, out of the respiratory system.
2. The diagram opposite shows an artificial gut which contains the normal enzymes and microorganisms found in the human gut. This model allows scientists to follow the digestion of food in detail.

(a) Name the regions of the human gut represented by X, Y and Z in the model gut. [1]

X ______________________________________

Y ______________________________________

Z ______________________________________

(b) Name a carbohydrase added by enzyme pumps A AND C. [1]
2(c) Some protease enzymes added by enzyme pumps B and C are added in the form of inactive precursors.

Explain why these enzymes are not secreted in their active form. [1]

(d) In the artificial gut, the pH of each region is controlled by a pH buffer. Explain why the pH of each region needs to be kept at a certain pH. [1]
In the real human gut the pH of region $Z$ is partly controlled by bile.
Describe the role of bile in digestion. [2]
2(f) SALMONELLA is a Gram-negative, rod-shaped bacterium that can cause food poisoning. Antibiotics can be given to control infection but are generally not used as they encourage the build-up of resistant strains.

(i) Describe how the structure of the cell wall of SALMONELLA reduces the effectiveness of some antibiotics on this species of bacterium. [2]
The chance of passing a gene for antibiotic resistance from one bacterium to another in the gut is estimated at 1 in 10 billion. If the gut contains 10 000 billion bacteria, estimate how many might receive the gene for antibiotic resistance. [1]

Answer

9
The image shows the number of species at different latitudes, with a focus on the Sahara desert. The graphs illustrate the decrease in species number as latitude increases, consistent with the theory of the latitudinal gradient hypothesis. The Sahara desert is highlighted on the map, indicating its arid conditions and low species diversity compared to equatorial regions.
3(a) What term is used to describe the variation in number of species in different places? [1]

(b) Identify TWO habitats where you would expect to find a high number of species. [2]
The diagram opposite shows how the number of different species of a type of butterfly varies with latitude in different parts of the world.

3(c) Describe the general relationship between latitude and number of species shown in the diagram. [1]
3(d) Suggest why there is a decrease in the number of species of this type of butterfly in the region covered by the Sahara desert. [2]
Right coronary artery

Left coronary artery

P

Q
4. The human heart is made of specialised tissue called cardiac muscle. The rate at which the heart contracts can be increased or slowed down in response to environmental stimuli.

(a) State the TWO mechanisms by which the body can regulate the heart rate. [2]

(b) The heart has its own blood supply via the coronary arteries. These are shown in the diagram opposite.

Ischaemic heart disease is caused by the occurrence of clots in a coronary artery.

(i) Describe the effect of a clot in the coronary artery. [2]
4(b) (ii) Suggest why a clot at point P on the diagram opposite page 14 would be more serious than a clot at point Q. [2]
Blood flows through artery

Artery wall

Patches of atheroma developing within inside lining of artery

SECTION OF AN ARTERY
4(c) Study the diagram opposite. Atherosclerosis is a condition that can cause hypertension and can lead to similar effects as a clot in the coronary arteries and also increases the risk of stroke.

(i) Apart from a high cholesterol diet, name TWO OTHER factors that could increase the risk of an atheroma forming. [2]

(ii) Describe and explain how surgical procedures can be used to reduce the effects of an atheroma. [4]
5. The images opposite show two parasites of humans. Both are specialised to survive in different environments. The head louse, PEDICULUS HUMANUS CAPITIS, is an ECTOPARASITE while the tapeworm TAENIA SOLIUM is an ENDOPARASITE.

(a) What is the difference between an ECTOPARASITE and an ENDOPARASITE? [1]
5(b) Describe how these parasites are adapted to reduce the risk of being dislodged from their habitats. [2]
Head lice are usually transmitted by direct contact between affected people.

Describe how TAENIA SOLIUM is transmitted. [2]
FAT
the ENEMY that is shortening Your Life
BANISHED!

NO DIET - NO BATHS
NO EXERCISE!

HOW?
with
SANITIZED
TAPE
WORMS.
Jar Packed
"FRIENDS FOR A
FAIR: FORM"

Easy To
Swallow!

No Ill
Effects!

Prepared By
W. T.
BRIDGE, Chemist
New York

SEND NO MONEY
PARTICULARS NAILED FREE.
5(d) The advert opposite appeared in a magazine in the 1890s claiming that people could lose weight without dieting or exercising by infecting themselves with tapeworms with no ill effects.

Suggest why infecting yourself with tapeworms could lead to weight loss but also cause serious health problems. [2]
<table>
<thead>
<tr>
<th>MONTH</th>
<th>RAINFALL (MM)</th>
<th>NUMBER OF NEW MALARIA CASES</th>
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<tr>
<td>January</td>
<td>130</td>
<td>2000</td>
</tr>
<tr>
<td>February</td>
<td>180</td>
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<td>80</td>
<td>550</td>
</tr>
<tr>
<td>December</td>
<td>105</td>
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5(e) Malaria is an infection also caused by an endoparasite.

(i) Name the parasite that causes malaria. [1]

(ii) Name the vector of this parasite. [1]

(f) The table opposite shows the average figures for rainfall and the number of new cases of malaria in a region of South Africa over a 10 year period.

(i) Describe the general relationship between rainfall and the number of new cases of malaria. [1]
5(f) (ii) Suggest an explanation for this relationship. [2]
pressure changes relative to atmospheric pressure (arbitrary units)

time (seconds)

breathing in , breathing out

- alveolar pressure
- pleural pressure
6(a) Give TWO advantages of humans having internal gas exchange surfaces. [1]
Lungs are enclosed inside the body and so humans have to breathe in actively to get oxygen to the gas exchange surface. Breathing out at rest relies mainly on elastic recoil.

The graph opposite shows how the pressures in the alveoli and the pleural cavity change during breathing in and out.
6(b) The outer pleural membrane is attached to the ribcage and the inner pleural membrane is attached to the outer surface of the lungs. Using your knowledge of ventilation, and with reference to the graph, explain how the outward movement of the ribcage causes the changes in the pleural and alveolar pressures during breathing in. [4]
6(c) State ONE medical use of artificial surfactant and explain why it would be needed. [2]
HIV Antibodies against HIV Infection by HIV few symptoms AIDS Stage 1 Stage 2 Stage 3 concentration per cm³ blood (arbitrary units) time Infection by HIV death
7. The diagram opposite shows how the concentration of HIV and antibodies against HIV change during the course of an infection with HIV.

(a) Describe how the concentration of HIV changes during the FIRST STAGE of the infection. Explain why these changes occur. [3]
7(b) During the final stage of the infection the blood concentration of antibodies against HIV falls while the level of HIV in the blood increases. Over the same period patients begin to suffer from the symptoms of clinical AIDS and eventually die.

(i) Explain why the blood concentration of antibodies against HIV falls during the final stages of the infection. [2]
Suggest why a patient suffering from AIDS might die from a usually non-fatal infection or cancer. [2]
7(c) Explain why it is difficult to develop an effective vaccine against HIV. [2]
8. Answer ONE of the following questions. Any diagrams included in your answer must be fully annotated.

EITHER,

(a) (i) Describe the functions of the different components of human blood.  [5]

(ii) Explain what is meant by the ABO blood group system and its importance in blood transfusion.  [5]

OR,

(b) The sorting of living organisms, including humans, into groups of a manageable size is known as taxonomy or classification.

Describe and explain the principles underlying modern classification.  [10]