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 _____

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	5	
2.	9	
3.	6	
4.	12	
5.	12	
6.	7	
7.	9	
8.	10	
Total	70	

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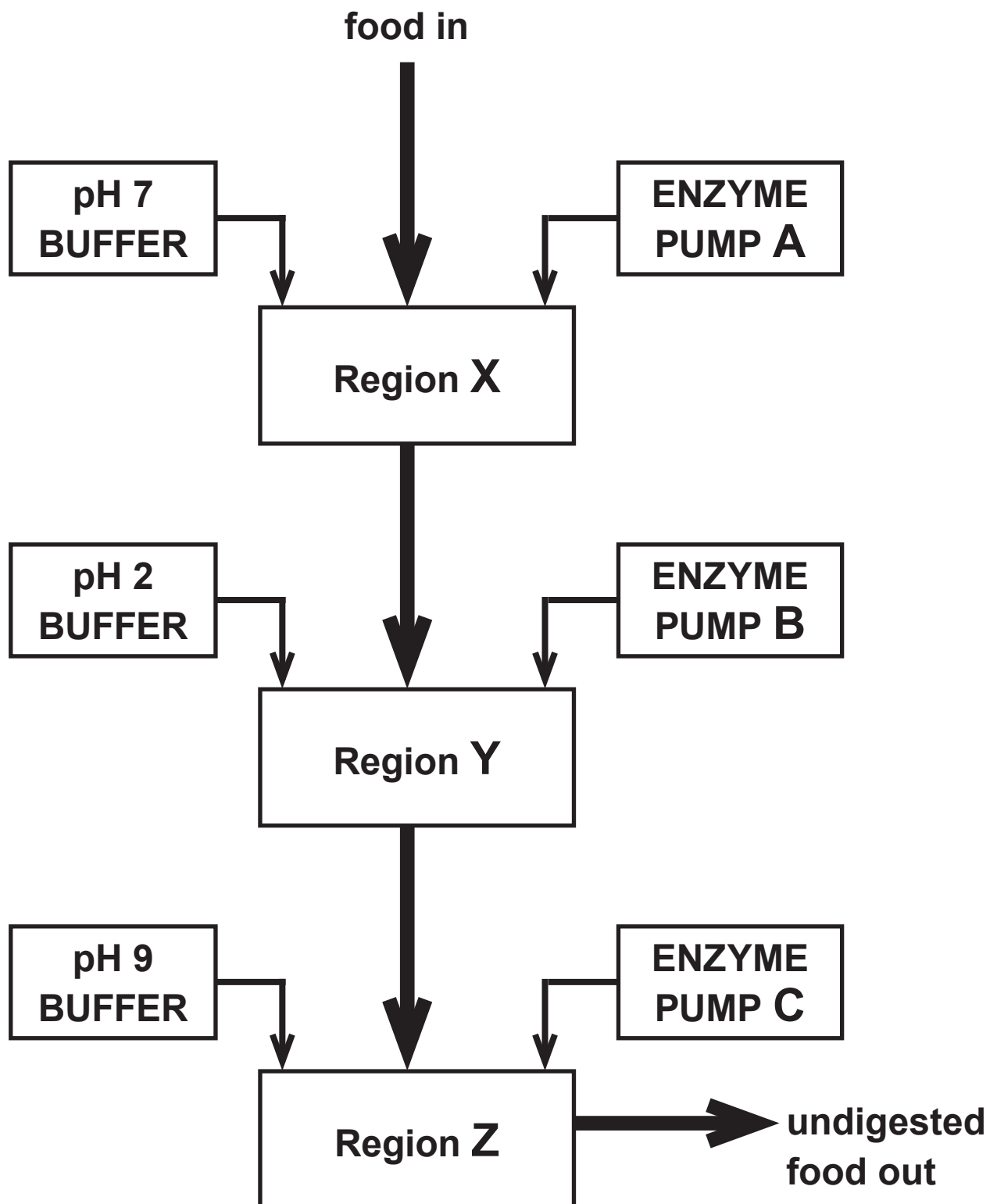
    Complete the sentences below that describe some first lines of defence.   [5]

    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.

5

food in

pH 7 BUFFER		ENZYME PUMP **A**

Region X

pH 2 BUFFER		ENZYME PUMP **B**

Region Y

pH 9 BUFFER		ENZYME PUMP **C**

Region Z → **undigested food out**

2. The diagram opposite shows an artificial gut which contains the normal enzymes and micro-organisms 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]

_____

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(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]

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2(e) **In the real human gut the pH of region Z is partly controlled by bile.**
Describe the role of bile in digestion.   [2]

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_____

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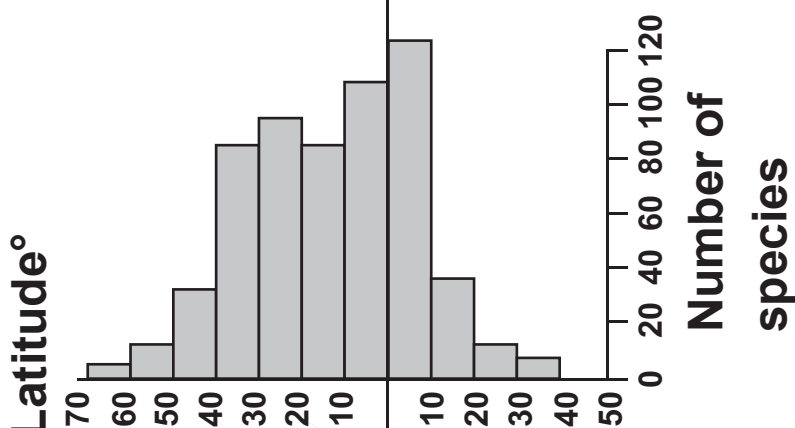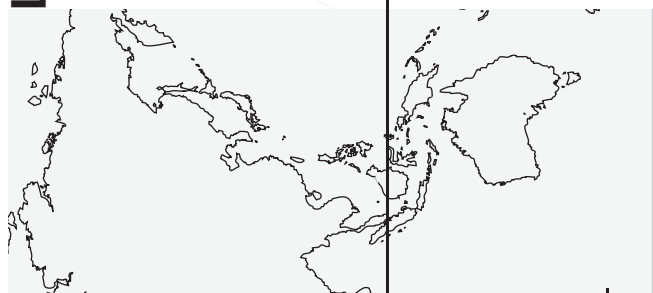
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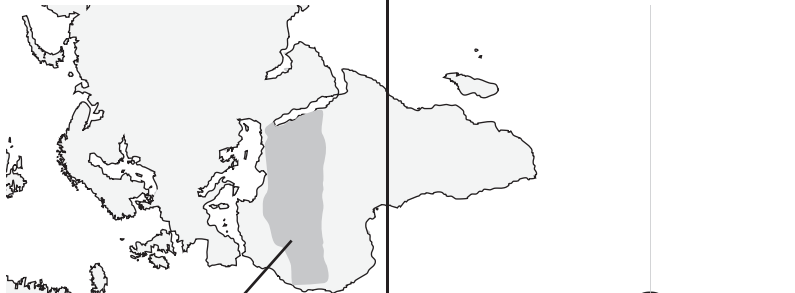**2(f)** **SALMONELLA is a Gram-negative, rod-shaped bacterium that can cause food poisoning. Antibiotics can be given to control infection but are generally not used as they encourage the build-up of resistant strains.**

    (i) **Describe how the structure of the cell wall of SALMONELLA reduces the effectiveness of some antibiotics on this species of bacterium.   [2]**

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2(f) **(ii)** 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

Latitude°

70
60
50
40
30
20
10
10
20
30
40
50

0 20 40 60 80 100 120

Number of
species

Latitude°

70
60
50
40
30
20
10
10
20
30
40
50

0 20 40 60

Number of
species

Latitude°

Sahara
desert

70
60
50
40
30
20
10
10
20
30
40
50

0 20 40 60 80

Number of
species

Equator
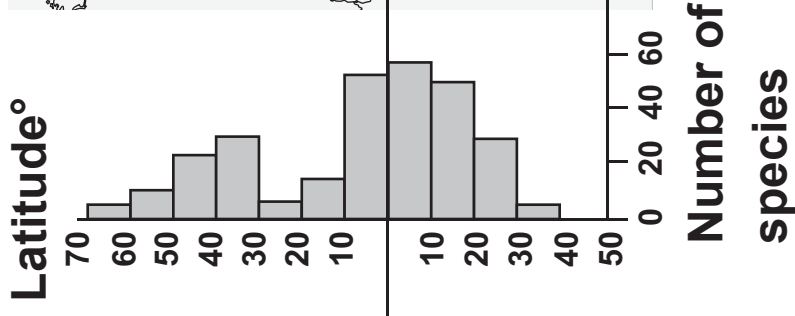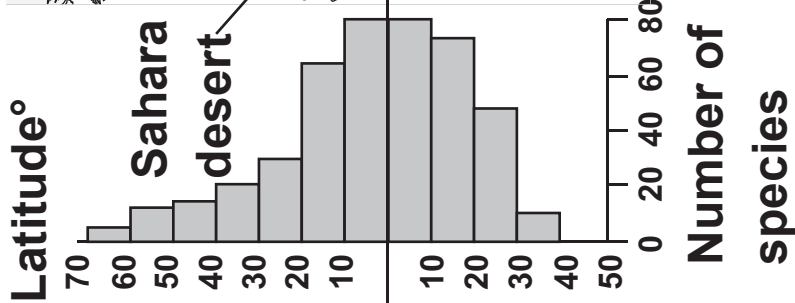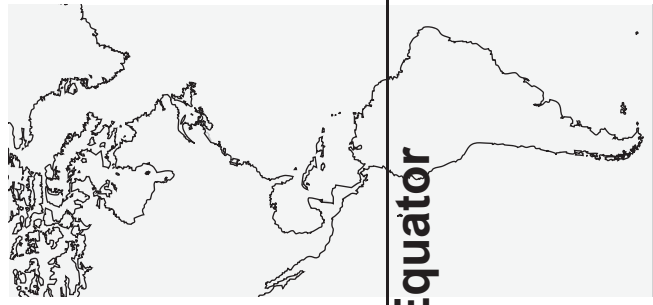
3(a)   What term is used to describe the variation in number of species in different places?   [1]

_____

_____

(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]

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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]**

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6

Left coronary artery

Right coronary artery

P

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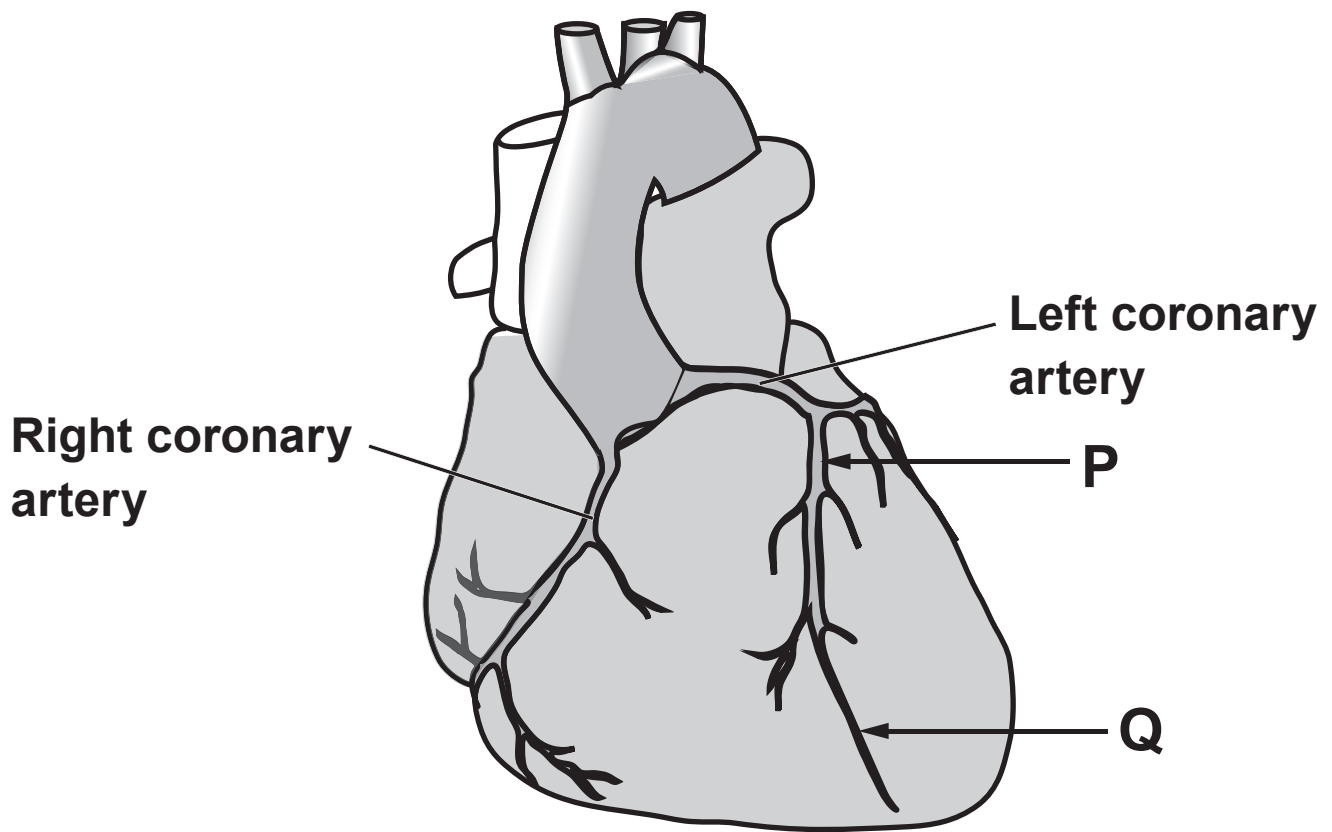
4. The human heart is made of specialised tissue called cardiac muscle. The rate at which the heart contracts can be increased or slowed down in response to environmental stimuli.

(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]

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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]**

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Blood flows through artery

Artery wall —

Patches of atheroma developing within inside lining of artery
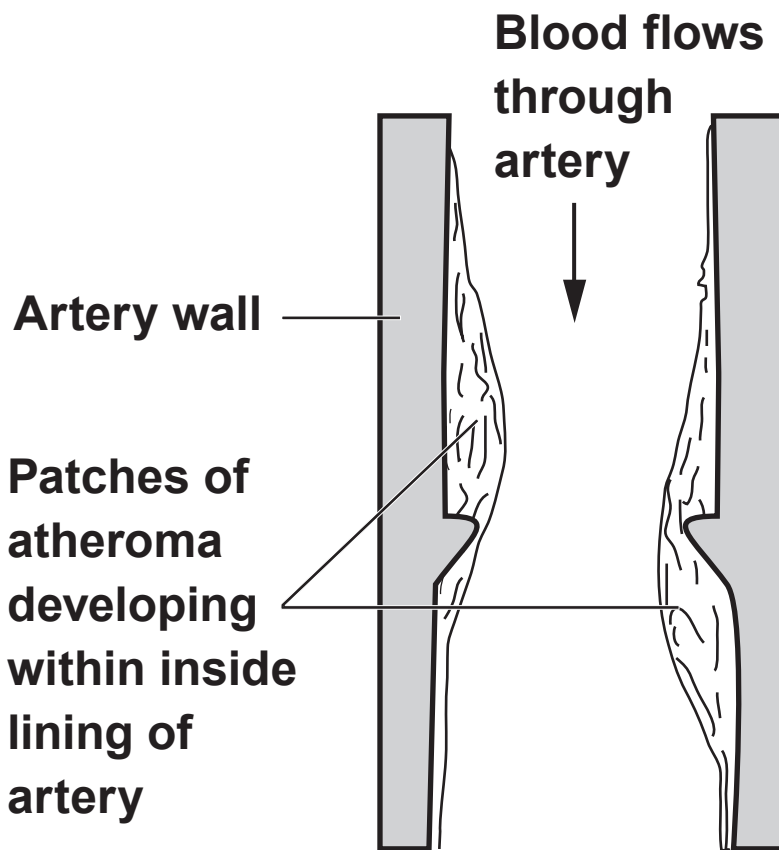
SECTION OF AN ARTERY

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]

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12

Tapeworm
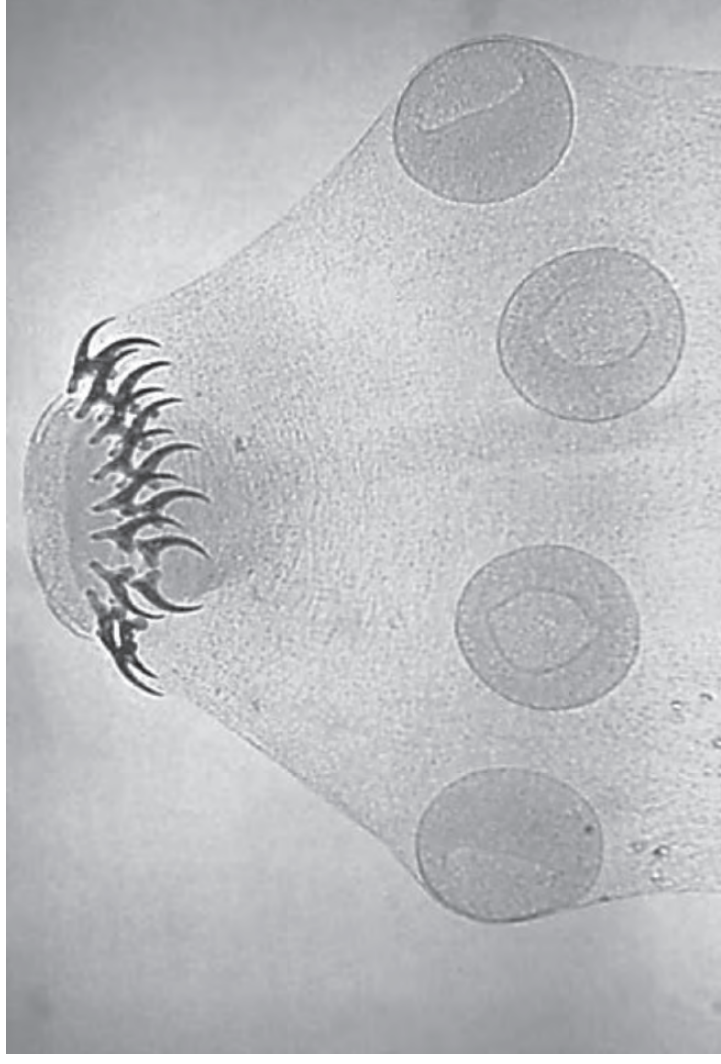
Head Louse
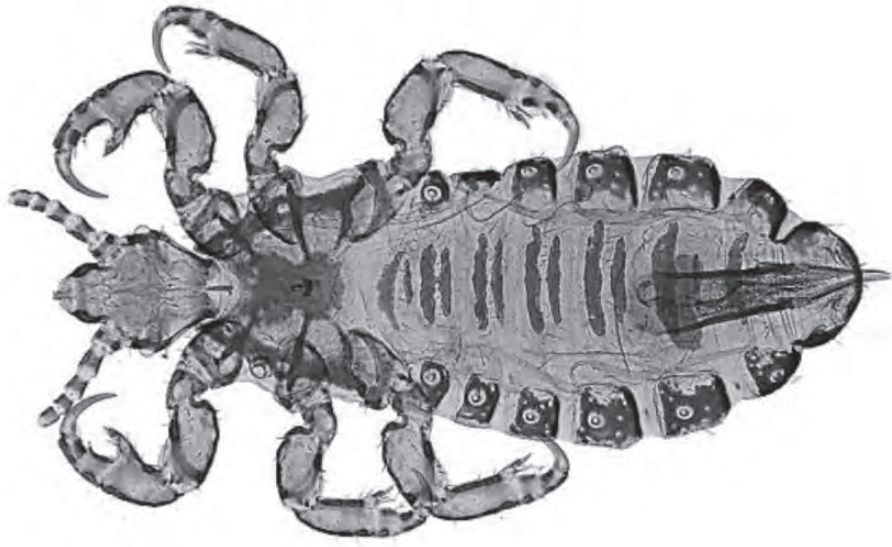
5. The images opposite show two parasites of humans. Both are specialised to survive in different environments. The head louse, PEDICULUS HUMANUS CAPITIS, is an ECTOPARASITE while the tapeworm TAENIA SOLIUM is an ENDOPARASITE.

(a) What is the difference between an ECTOPARASITE and an ENDOPARASITE?   [1]

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5(b) **Describe how these parasites are adapted to reduce the risk of being dislodged from their habitats.   [2]**

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5(c) **Head lice are usually transmitted by direct contact between affected people.**

Describe how TAENIA SOLIUM is transmitted. **[2]**

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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]

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MONTH	RAINFALL (MM)	NUMBER OF NEW MALARIA CASES
January	130	2000
February	180	1600
March	145	1000
April	75	700
May	40	400
June	10	280
July	5	100
August	4	95
September	12	130
October	65	350
November	80	550
December	105	1750

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]

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5(f) **(ii)** **Suggest an explanation for this relationship.   [2]**

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12
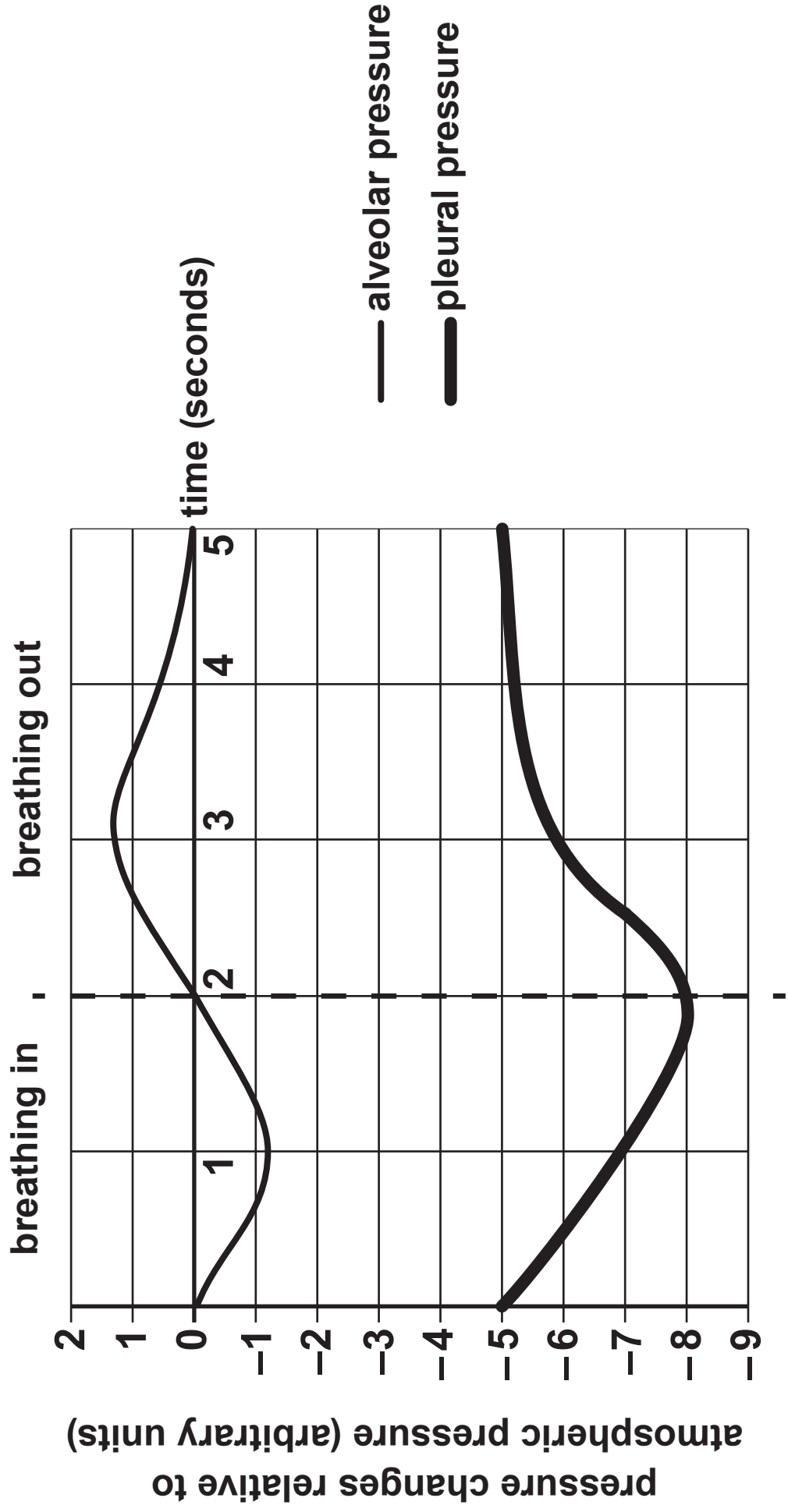
6(a) **Give TWO advantages of humans having internal gas exchange surfaces.   [1]**

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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]**

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6(c) **State ONE medical use of artificial surfactant and explain why it would be needed.   [2]**

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7

AIDS

few symptoms

Antibodies against HIV

HIV

time

death

Stage 3

Stage 2

Stage 1

Infection by HIV

concentration per cm³ blood (arbitrary units)

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]**

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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]

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7(b) (ii) **Suggest why a patient suffering from AIDS might die from a usually non-fatal infection or cancer.   [2]**

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7(c) **Explain why it is difficult to develop an effective vaccine against HIV.   [2]**

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9

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]**

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10

END OF PAPER