| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 2 |

# GCE AS/A level

1072/02

## HUMAN BIOLOGY – HB2

P.M. TUESDAY, 15 January 2013

1½ hours

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1** | **11** | |
| **2** | **7** | |
| **3** | **7** | |
| **4** | **10** | |
| **5** | **12** | |
| **6** | **13** | |
| **7** | **10** | |
| **Total** | **70** | |

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**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.

Examiner only

**1.** *(a)* Complete the following paragraph about the heart and heartbeat by inserting the most appropriate **word or words**. (Abbreviations will not be accepted). [7]

The events occurring during the beating of a human heart are called the cardiac cycle. In an average adult heart, at rest, there are approximately ..... cycles per minute.

Cardiac muscle is ..... which means it can contract and relax without nervous stimulation. Each cycle is started in a specialised part of the muscle in the wall of the ..... called the ..... . This sets up a wave of excitation causing the cardiac muscle to contract.

After a short delay the wave passes to the ventricles via the ..... .

The wave passes to the base of the ventricles via the ..... causing the ventricles to ..... from the base upwards.

*(b)* The human circulatory system is described as being a closed and double circulation. With reference to the above sentence, state the meaning of the terms:

(i) closed; [2]

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(ii) double. [2]

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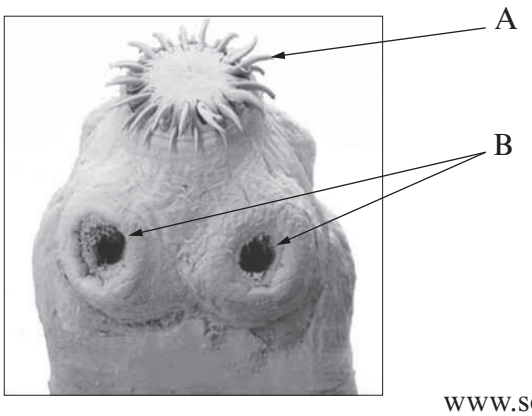
Examiner only

**2.** The electron micrograph below shows the head of *Taenia solium* (pork tapeworm).




www.sciencephoto.com

*(a)* Name structures A and B and explain their importance to the life of the tapeworm. [3]

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*(b)* Explain why the tapeworm has a very simplified digestive system. [3]

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*(c)* The adult tapeworm's respiration is mainly anaerobic.
Suggest why the tapeworm respires anaerobically. [1]

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**Turn over.**

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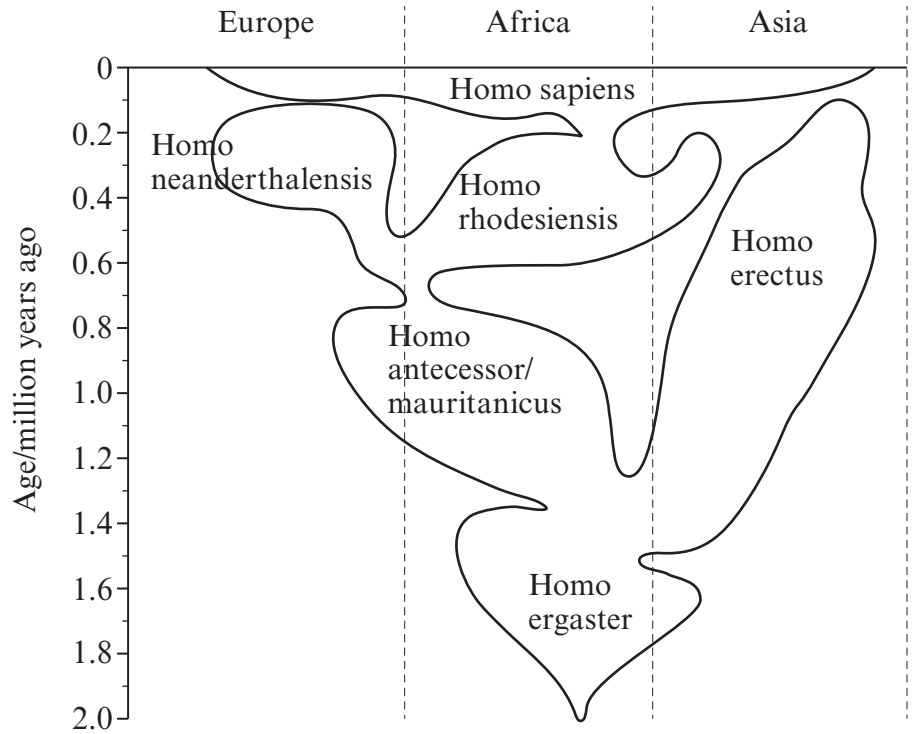
**3.** Recently discovered fossilised skulls from Ethiopia have resulted in different theories about the evolution of *Homo sapiens*.

The diagram below illustrates one of these theories called the 'Out of Africa theory'.




*(a)* Use the diagram above to answer the following questions.

(i) Which species shows the greatest geographical distribution? [1]

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(ii) State **three** ways in which the information given supports the 'Out of Africa' model of modern human evolution. [3]

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*(b)* Explain why *Homo erectus* is likely to yield far more fossil evidence than *Homo antecessor/ mauritanicus*. [3]

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**Turn over.**

Examiner only

**4.** The bacterium, *Vibrio cholerae* is the causative agent of cholera. It produces a toxin which causes water and ions, such as sodium, chloride and potassium to be released from the blood into the intestine. This can result in death within 24 hours.

A new strain of the bacterium arose in the Far East in the 1960s and gradually replaced existing strains throughout much of the world but not in Western Europe.

This new strain is much more vigorous than the strain it replaced and the bacteria can continue to appear in faeces up to three months after a patient has recovered. In addition, it can survive in water for up to fourteen days. Cholera may be spread directly or indirectly and humans are the only reservoir of infection.

*(a)* Identify the **type** of bacterium to which *Vibrio cholerae* belongs. [1]

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*(b)* Describe how cholera may be transmitted. [1]

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*(c)* Use the information in the passage to suggest how the toxin can lead to the death of a cholera patient. [3]

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*(d)* Suggest **two** reasons why the new strain of cholera has not become established in Western Europe. [2]

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Examiner only

*(e)* The antibiotic tetracycline is sometimes given to cholera patients.

(i) Describe **one** way in which the antibiotic can affect the *Vibrio cholerae.* [1]

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(ii) Explain why tetracycline is not routinely used to treat all cases of cholera. [2]

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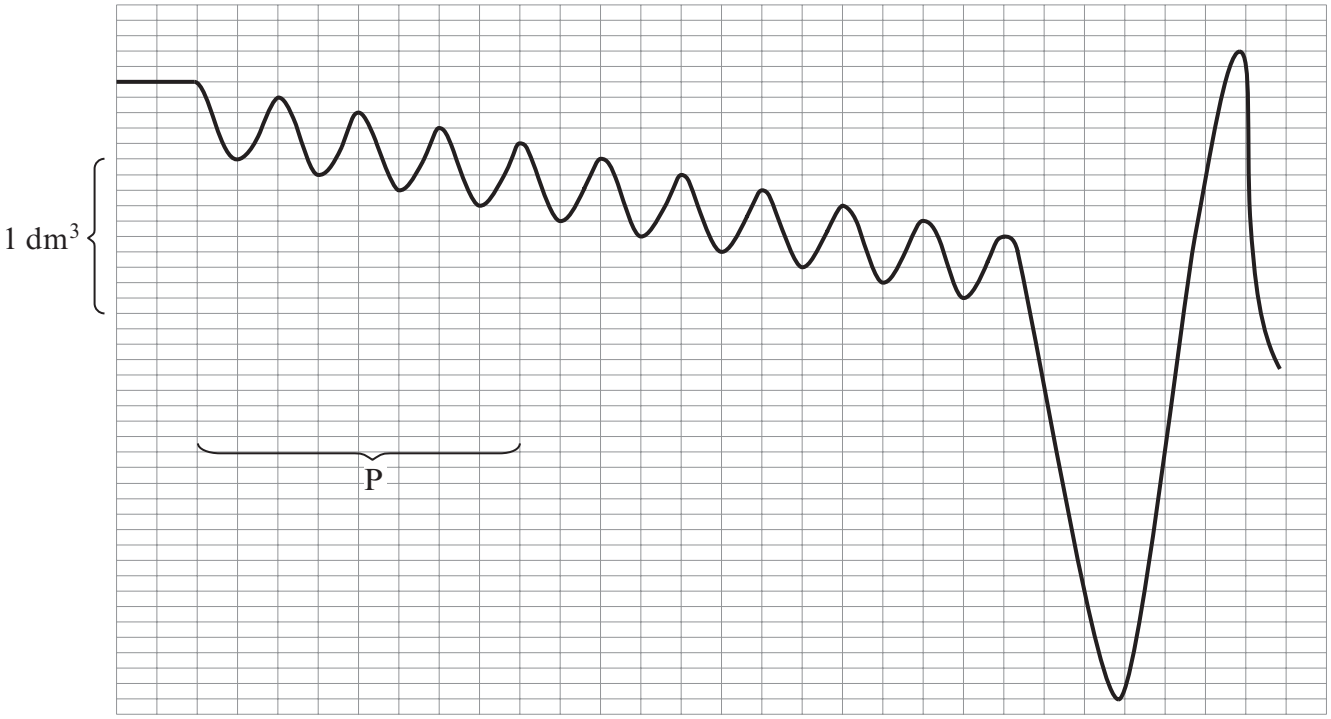
**Turn over.**

Examiner only

**5.** A spirometer is used to measure the volumes of air breathed in and out of the lungs. A person breathes through a length of tubing which is connected to an oxygen chamber and a container of soda lime. As the student breathes in and out the oxygen chamber moves down and up respectively. These movements are recorded on a revolving drum.

The spirometer trace below is from a person who breathed normally at rest and then took a deep breath.




*(a)* Clearly label the spirometer trace above to show:

(i) tidal volume; [1]

(ii) vital capacity. [1]

*(b)* Calculate the total volume of oxygen breathed in by the person indicated by the portion of the trace marked P on the trace above.
Show your working. [2]

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Examiner only

*(c)* Explain the purpose of the container of 'soda lime'. [2]

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*(d)* Describe a safety precaution that should be observed before using the spirometer and explain its importance. [2]

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*(e)* Explain why only some of the oxygen taken in with each breath can take part in gaseous exchange. [2]

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*(f)* Explain why the spirometer cannot be used to measure the **total** volume of the lungs. [2]

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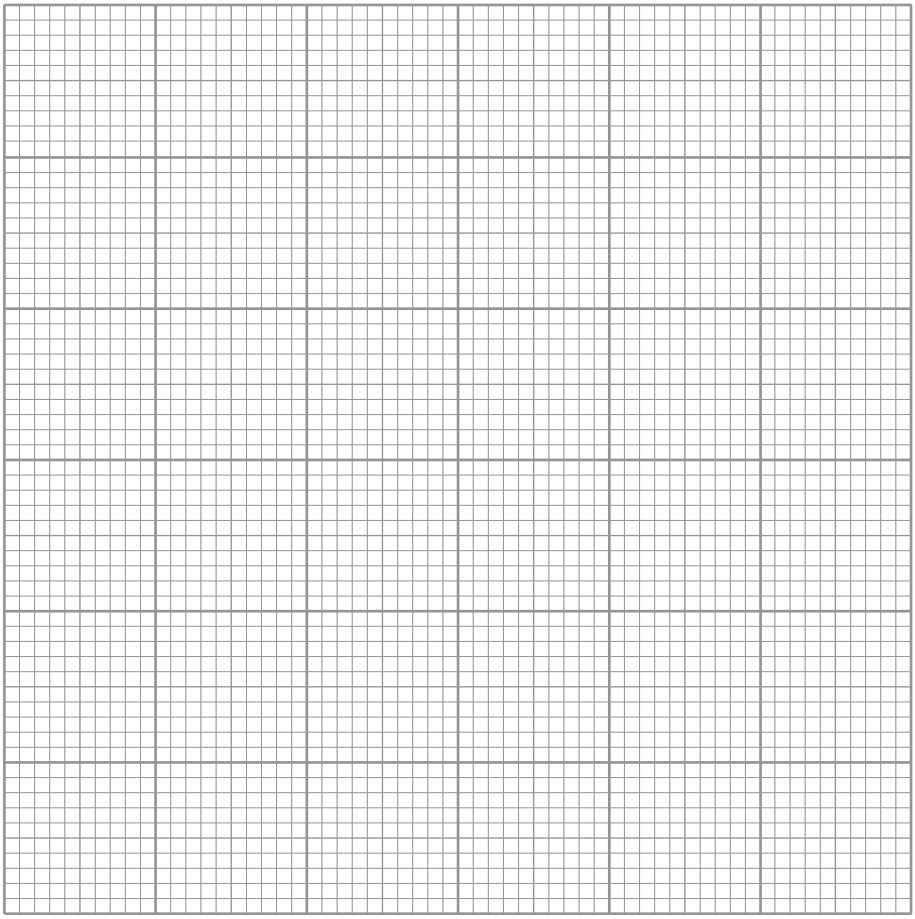
**Turn over.**

Examiner only

**6.** The table below shows the percentage saturation of human haemoglobin with oxygen at various partial pressures of oxygen ($ppO_2$).
The readings were taken at two different pH values.

| Partial pressure of oxygen ($ppO_2$)/(kPa) | Percentage saturation of haemoglobin with oxygen (%) | |
|---|---|---|
| | pH 7.2 | pH 7.4 |
| 0 | 0 | 0 |
| 2 | 20 | 35 |
| 4 | 60 | 70 |
| 6 | 80 | 85 |
| 8 | 89 | 93 |
| 10 | 91 | 93 |

*(a)* On the graph paper below use the figures given in the table above to plot a graph of partial pressure of oxygen against percentage saturation of haemoglobin for both pH values. [5]



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*(b)* The $ppO_2$ in muscle tissue fluid during exercise is 1.5kPa.

(i) On your graph mark this point with an arrow to show the **percentage saturation of haemoglobin**, at **pH 7.2**, in the tissue fluid of muscles. [1]

(ii) What is the name given to the difference between the two curves caused by a change in pH? [1]

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(iii) What could account for the lowering of tissue fluid pH in the muscle at this point? [2]

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(iv) Explain how this would be an advantage during exercise. [1]

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*(c)* (i) On the graph opposite, draw and **label** a curve that would show a dissociation curve for foetal haemoglobin. [1]

(ii) Explain how the position of the foetal haemoglobin curve when compared with that of the mother gives an advantage to the foetus. [2]

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**7.** Answer **one** of the following questions.

Any diagrams included in your answer must be fully annotated.

**Either,** *(a)* Describe the different ways in which immunity can be acquired. (Details of humoral and cell mediated responses are not required.) [10]

**Or,** *(b)* Describe how, starting at the stomach, the **structure** of the alimentary canal enables it to perform the functions of digestion and absorption. (Details of specific enzymes are not required). [10]

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Examiner only

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**END OF PAPER**

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