Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **19** printed pages and **1** blank page.

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CAMBRIDGE International Examinations

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1 The lungs and the kidneys are part of the excretory system of mammals.

(a) **(i)** State the name of **one** substance that is excreted from the lungs and state where in the body it is produced.

name .....

site of production .....
[2]

(ii) State the name of **one** excretory substance, that is removed by the kidneys, that contains nitrogen.

Explain why it is excreted.

name .....

explanation .....

.....
[2]

(b) Blood is filtered as it flows through the kidneys.

(i) State the name of the structure within a kidney that filters the blood.

.....[1]

(ii) State **two** components of blood that do **not** pass through the filter.

1 .....

2 .....
[2]

(c) The filtrate which is formed from the blood in the kidneys contains many useful substances, which are reabsorbed into the blood.

Fig. 1.1 is a photomicrograph of a cross-section of some of the cells that carry out reabsorption.

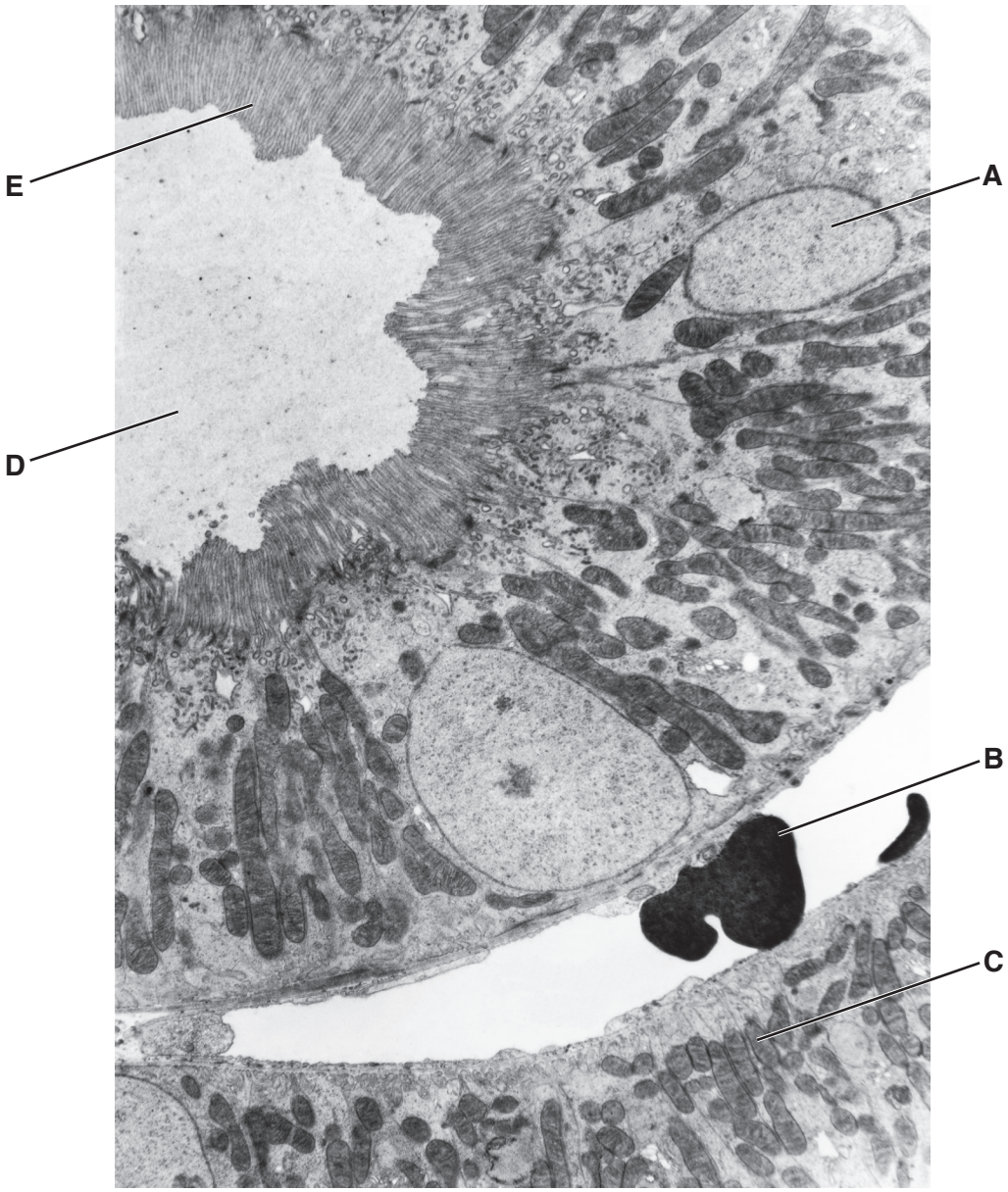

Fig. 1.1

(i) Complete the table by stating the letter in Fig. 1.1 that identifies each structure.

structure	letter on Fig. 1.1
microvilli	
nucleus	
mitochondrion	

[3]

(ii) State **one** function of the nucleus.

.....

.....[1]

(iii) State the name of **one** part of the mammalian body **other than** the kidney that has cells with microvilli.

.....[1]

(iv) The cells that line the kidney tubules, such as those in Fig. 1.1, absorb many compounds from the filtrate.

Use Fig. 1.1 to explain how the cells are adapted for absorption.

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.....[4]

[Total: 16]

2 A person who wanted to begin a fitness programme did some vigorous exercise.

A fitness trainer took a drop of blood from the person's finger before, during and after vigorous exercise and tested it for lactic acid.

(a) Explain why it is important that the equipment used for taking blood is clean (sterile).

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.....[2]

(b) The results of the tests for lactic acid are shown in Fig. 2.1.

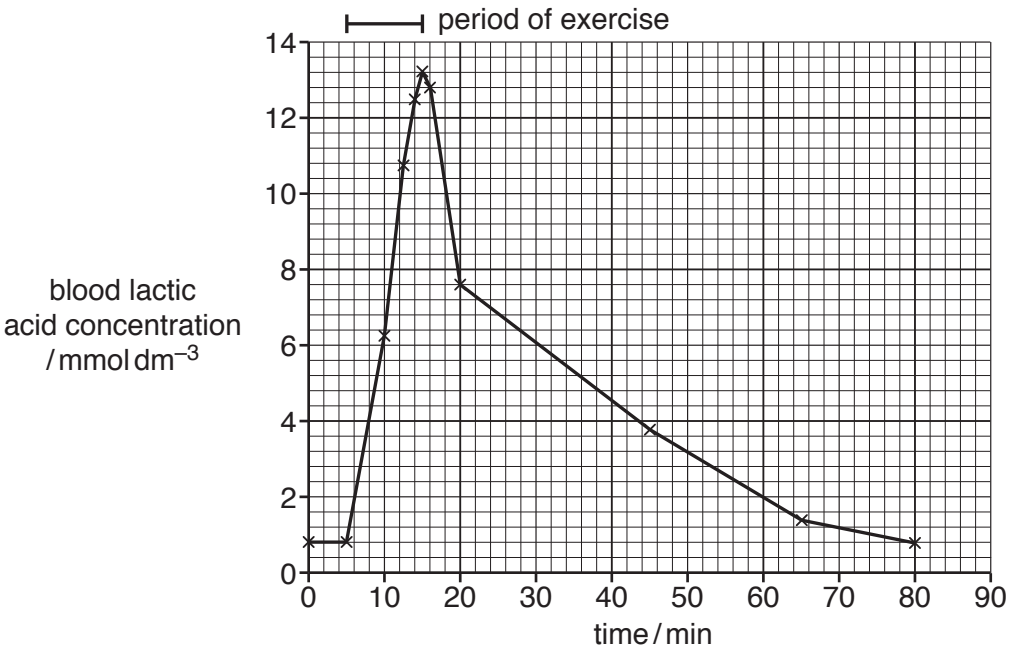

Fig. 2.1

Describe **and** explain the changes in blood lactic acid concentration shown in Fig. 2.1.

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.....[6]

(c) The concentration of lactic acid in the blood of two athletes was investigated. One athlete, **P**, had been training and the other, **Q**, was returning to training after an injury.

Blood samples were taken from both athletes during a training session. The results are shown in Fig. 2.2.

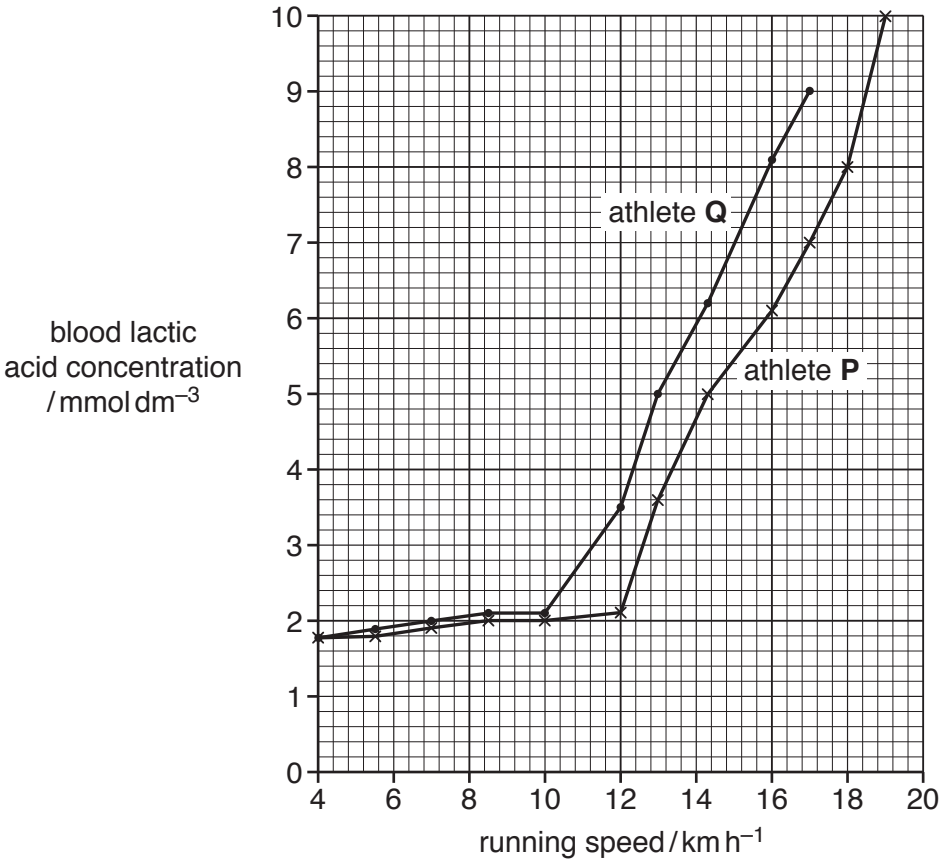

Fig. 2.2

(i) The lactic acid threshold is the level of exercise where the lactic acid concentration begins to increase exponentially.

State the lactic acid threshold for athletes **P** and **Q**.

P ..... km h^{-1}

Q ..... km h^{-1}

[1]

(ii) Suggest a reason for the difference in lactic acid threshold of athletes **P** and **Q**.

.....

.....

.....[1]

(iii) Explain the link between physical activity and breathing.

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.....[4]

[Total: 14]

3 Tasmania is an island off the south coast of Australia. Sheep were introduced to Tasmania in the nineteenth century.

Fig. 3.1 shows the population of sheep in Tasmania from 1820 to 1940. The dashed line shows the trend in the population growth.

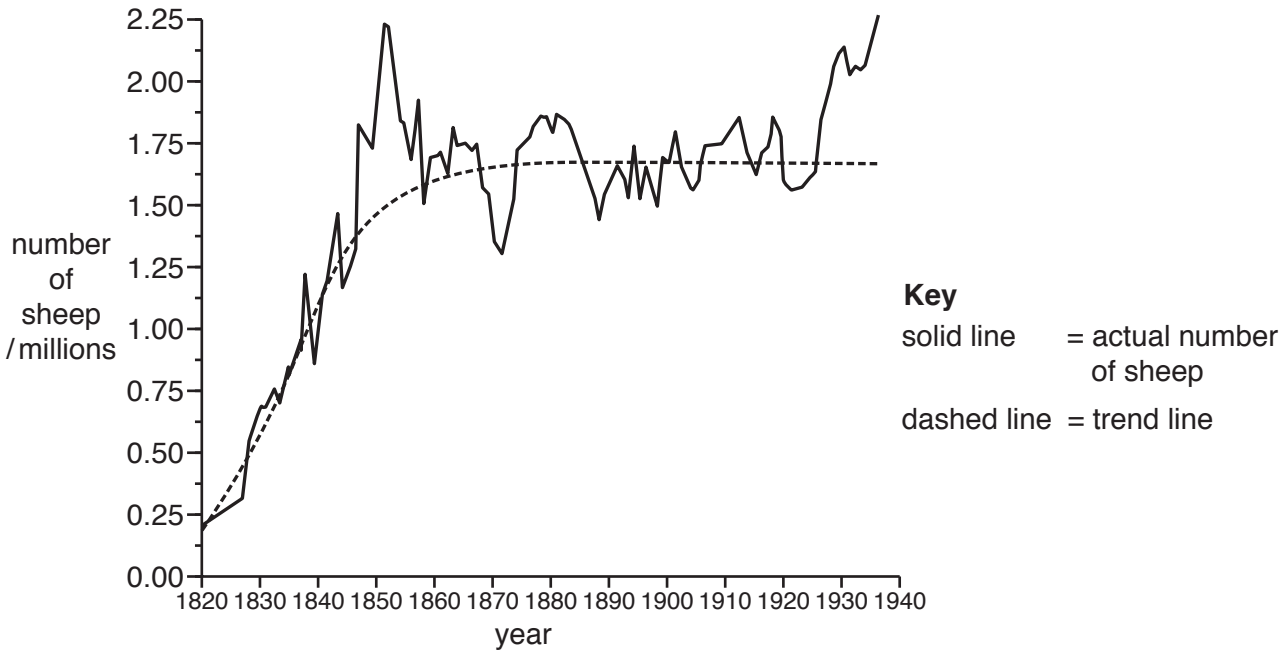

Fig. 3.1

(a) Describe the **trend** in the population of sheep in Tasmania between 1820 and 1940, using the information in Fig. 3.1.

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.....[3]

(b) Explain the change in the **trend** of the population that you described in **3(a)**.

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.....[3]

(c) The sheep that were first introduced to Tasmania were not well adapted to the environment.

Describe how farmers can use selective breeding to improve their sheep so that they are better adapted to the environment.

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.....[4]

(d) Maintaining very large populations of farm animals is unsustainable.

Define the term *sustainable development*.

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.....[2]

[Total: 12]

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4 The garden pea, *Pisum sativum*, is a plant which has flowers that have both male and female parts. *P. sativum* is naturally self-pollinating.

(a) Discuss the advantages and disadvantages of self-pollination.

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.....[4]

(b) Gregor Mendel studied inheritance in the garden pea, *P. sativum*.

The flowers of *P. sativum* that he studied were either purple or white. The gene that controls flower colour has two alleles, **B** and **b**.

When Mendel crossed purple-flowered plants with white-flowered plants all the plants in the next generation had purple flowers.

(i) Table 4.1 shows five genetic terms that can be applied to Mendel's study of the inheritance of flower colour.

Complete Table 4.1 by stating an example of each genetic term. The first one has been completed for you.

Table 4.1

term	example in *P. sativum*
dominant trait	purple flowers
recessive allele	
phenotype	
homozygous genotype	
heterozygous genotype	

[4]

(ii) Test crosses can be used to determine the genotype of a plant with purple flowers.

The genetic diagrams show test crosses for purple-flowered plants with two different genotypes.

Complete the genetic diagrams for test cross 1 and test cross 2.

test cross 1

parental phenotype purple flowers × white flowers

parental genotype Bb × .....

genotypes of gametes .... + ...

offspring genotypes .....

offspring phenotypes .....

test cross 2

purple flowers × white flowers

BB × .....

.... + ...

.....

.....

[5]

(c) Pickerel weed, *Pontederia cordata*, is a plant that grows in shallow water on the edges of ponds and lakes in North America.

A few seedlings of these plants are white. The white seedlings cannot make chlorophyll.

Researchers carried out several crosses using pickerel weed plants.

Their results are shown in Table 4.2.

Table 4.2

cross	number of offspring	
	green	white
1	149	0
2	70	22

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(i) Select suitable symbols for the alleles and state the possible genotypes of the parents for each cross.

cross 1 .....

cross 2 .....
[2]

(ii) It is **not** possible to carry out a test cross with pickerel weed plants.

Suggest why.

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.....[2]

[Total: 17]

5 Fig. 5.1 shows the bacterium *Helicobacter pylori*, which is a human pathogen.

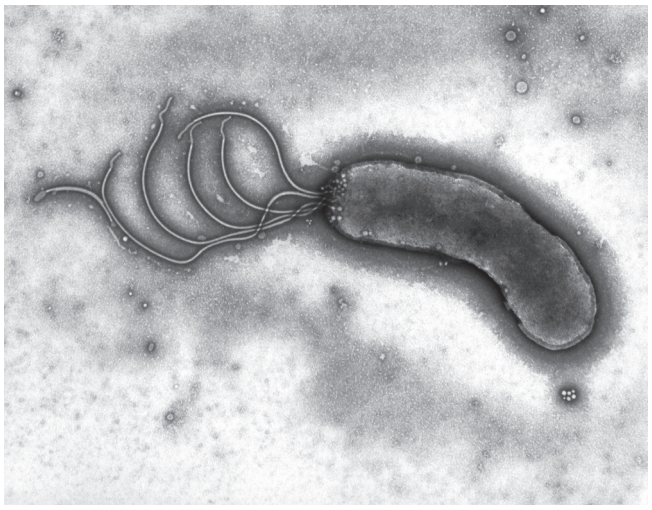

Fig. 5.1

(a) State the genus of *Helicobacter pylori*.

.....[1]

(b) *H. pylori* is placed in the prokaryote kingdom.

State **two** structural features that *H. pylori* shares with other prokaryotes.

1 .....

2 .....
[2]

(c) **(i)** *H. pylori* can cause infections in the stomach.

Suggest how this infection could be treated.

.....[1]

(ii) State **one** natural body defence that is found in the stomach.

.....[1]

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(d) The immune system is not very effective against pathogens, such as *H. pylori*, that live inside the alimentary canal. This means that active immunity and passive immunity do not provide complete protection against *H. pylori* infections.

Explain how active immunity differs from passive immunity.

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.....[4]

[Total: 9]

6 Glucose is absorbed into the blood in the small intestine. Fig. 6.1 shows the human circulatory system and the pathway taken by molecules, such as glucose, when they travel in the blood.

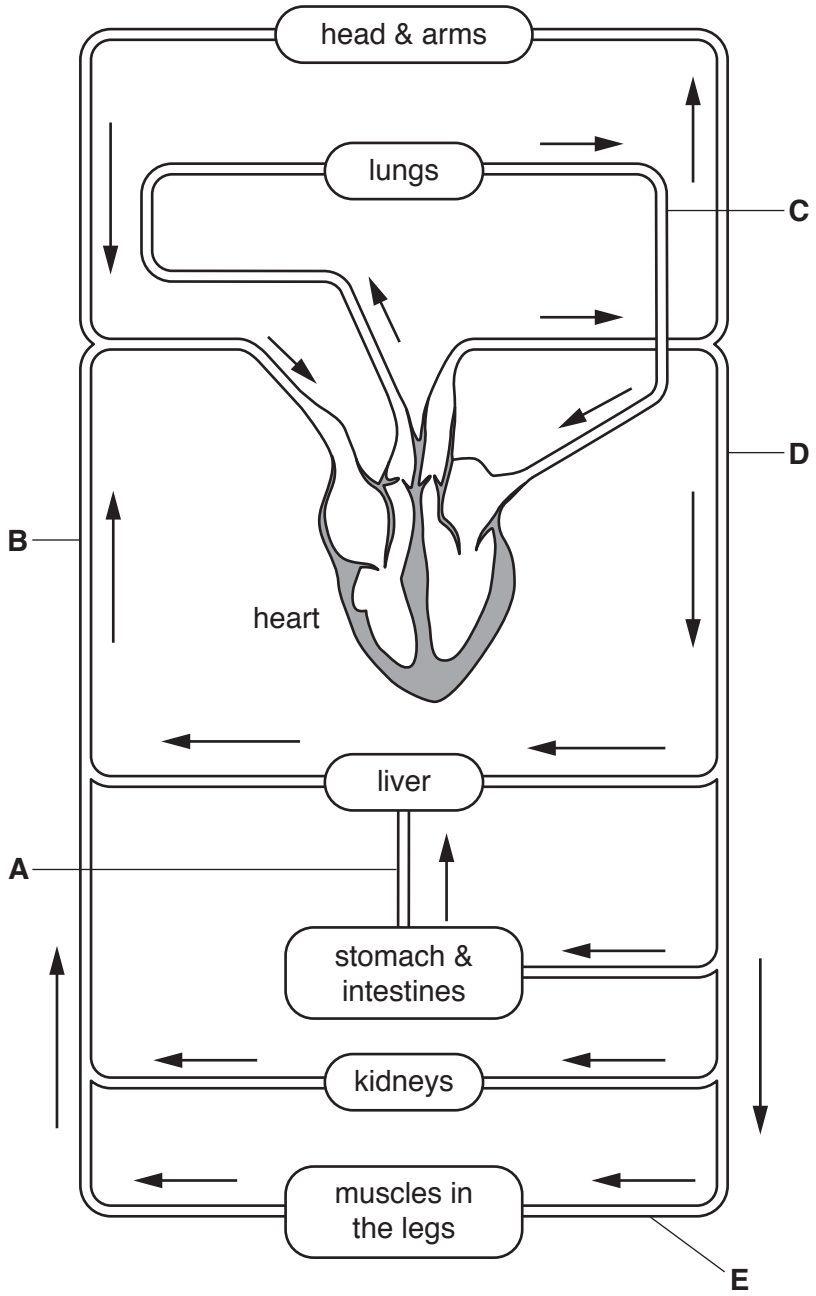

Fig. 6.1

(a) Complete Table 6.1 by naming the blood vessels labelled on Fig. 6.1 and stating whether they contain oxygenated blood or deoxygenated blood. One row has been completed for you.

Table 6.1

letter on Fig. 6.1	name of the blood vessel	oxygenated or deoxygenated blood
A		
B		
C		
D		
E	femoral artery	oxygenated

[4]

(b) Insulin is a hormone that is secreted by the pancreas.

(i) Define the term *hormone*.

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.....[2]

(ii) Describe the role of insulin in the body.

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.....[3]

(c) Explain how blood flow in the skin helps to maintain a constant body temperature in very hot conditions.

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.....[3]

[Total: 12]

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