AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

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AS BIOLOGY

Unit 2 The variety of living organisms

Tuesday 7 June 2016 Afternoon Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- a ruler with millimetre measurements
- a calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- You may ask for extra paper. Extra paper must be secured to this booklet.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 85.
- The marks for questions are shown in brackets.
- You are expected to use a calculator, where appropriate.
- Quality of Written Communication will be assessed in all answers.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific terminology accurately.

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ANSWER IN THE SPACES PROVIDED

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Answer **all** questions in the spaces provided.

1 Explain what is meant by a

1 (a) (i) phylogenetic group

[1 mark]

1 (a) (ii) species.

[2 marks]

The classification of tigers and clouded leopards is shown in **Table 1**.

Table 1

Taxonomic group	Tiger	Clouded Leopard
Kingdom	Animalia	Animalia
	Chordata	Chordata
	Mammalia	Mammalia
Order	Carnivora	Carnivora
	Felidae	Felidae
	Panthera	Neofelis
Species	tigris	nebulosa

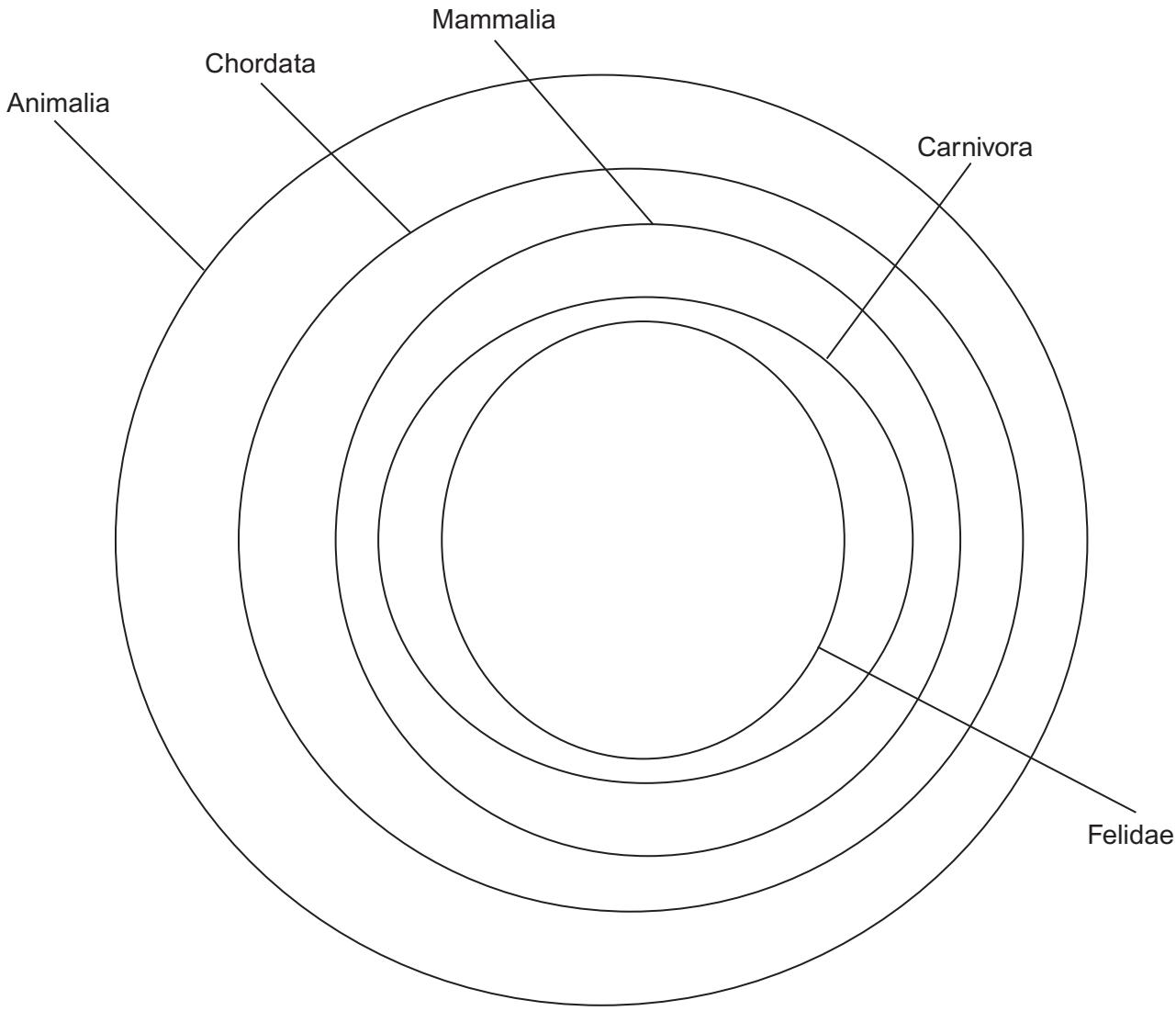
1 (b) Complete **Table 1** by adding the **four** other taxonomic groups to which the tiger and clouded leopard belong.

[1 mark]

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The circles in **Figure 1** represent the hierarchy of taxonomic groups for the classification shown in **Table 1**.

Figure 1



1 (c) Draw additional circles on **Figure 1** and label them to include all the information about the tiger and clouded leopard shown in **Table 1**.

[2 marks]

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Table 2 shows part of the nucleotide sequence in a gene in populations of tigers living in different parts of the world.

Table 2

Siberian tiger	G C A C C G T
South China tiger	A C G C C G C
Sumatran tiger	A C G C C G C

1 (d) Explain what the information in **Table 2** suggests about the phylogenetic relationships between these tigers.

[2 marks]

8

Turn over for the next question

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2 Haemoglobin is a protein. It is made of two alpha polypeptides and two beta polypeptides. Each alpha polypeptide has 141 amino acids and each beta polypeptide has 146 amino acids.

2 (a) What term is used to describe the structure of a protein made of two or more polypeptides?

[1 mark]

_____

2 (b) Calculate the minimum number of DNA bases needed to code for the number of amino acids in one alpha polypeptide.

[1 mark]

Answer = _____

2 (c) Describe the role of haemoglobin in supplying oxygen to the tissues of the body.

[2 marks]

_____

_____

_____

_____

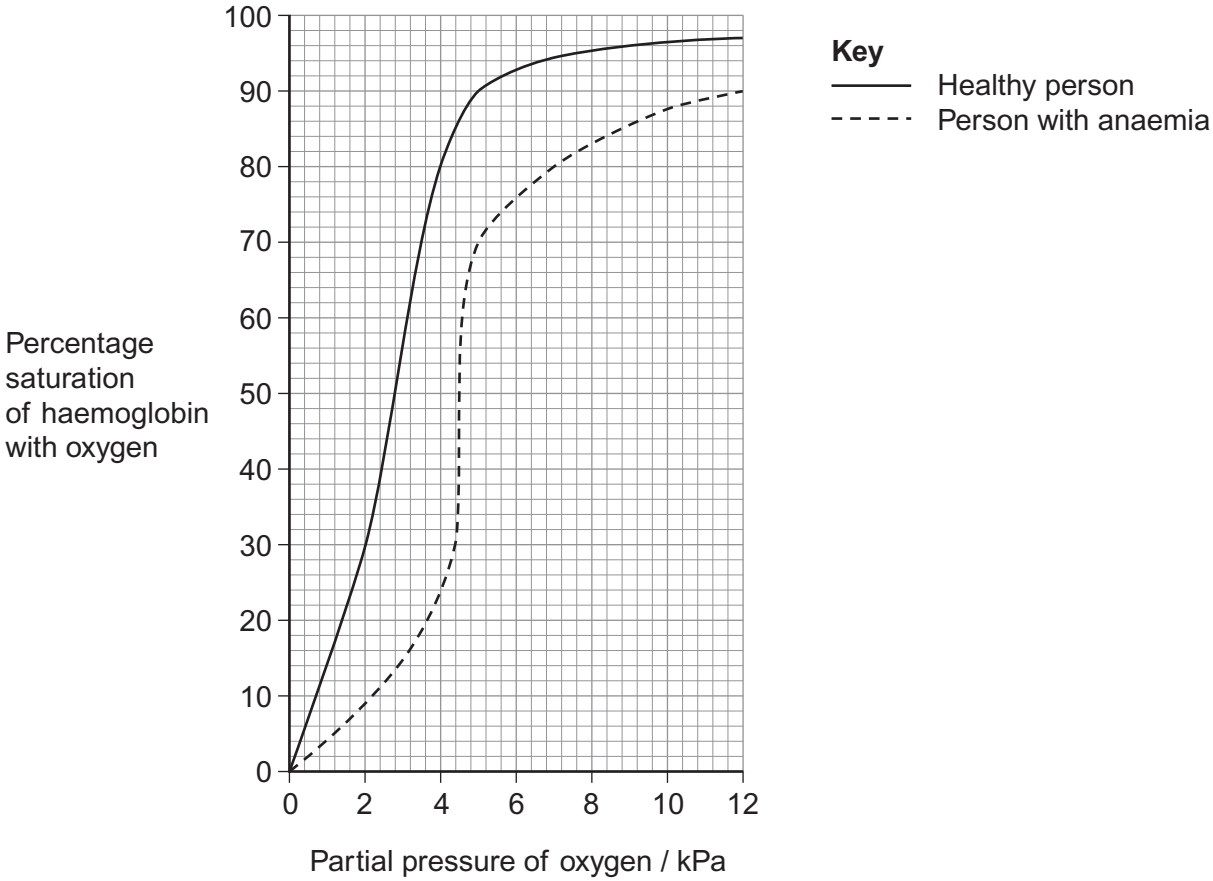
Question 2 continues on the next page

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Anaemia is a condition in which there is a decrease in the concentration of haemoglobin in blood. In some people with anaemia, substances are produced which change the oxygen dissociation curve of haemoglobin.

Figure 2 shows the effect of these substances on the oxygen dissociation curve of haemoglobin.

Figure 2



2 (d) (i) Use information in **Figure 2** to find the difference in the percentage saturation of haemoglobin with oxygen between a healthy person and a person with anaemia at a partial pressure of oxygen of 4 kPa.

[1 mark]

Answer = _____

Do not write outside the box

2 (d) (ii) Explain the advantage to a person with anaemia of the change shown in the oxygen dissociation curve.

[3 marks]

8

Turn over for the next question

Do not write outside the box

3 (a) What is meant by species diversity?

[1 mark]

3 (b) Give **two** pieces of information needed to calculate an index of diversity for a community.

[2 marks]

1 _____

2 _____

3 (c) A scientist investigated the effect sewage entering a river had on the distribution of organisms living in the river. Where sewage entered the river, he found a high density of organisms but a low index of diversity.

Suggest how sewage entering the river could explain the scientist's findings.

[2 marks]

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3 (d) A second scientist repeated the investigation of the first scientist at the same place. The second scientist obtained a high index of diversity.

3 (d) (i) Explain how the second set of results affects the ability of the scientists to make any conclusions about the effect of sewage on the index of diversity.

[2 marks]

3 (d) (ii) Suggest the additional steps that should be taken by the scientists before they are able to make any conclusions about the effect of sewage entering this river.

[1 mark]

8

Turn over for the next question

Do not write outside the box

4 (a) (i) Name the structure through which gases enter and leave the body of an insect.

[1 mark]

4 (a) (ii) Name the small tubes that carry gases directly to and from the cells of an insect.

[1 mark]

4 (b) Explain the movement of oxygen into the gas exchange system of an insect when it is at rest.

[3 marks]

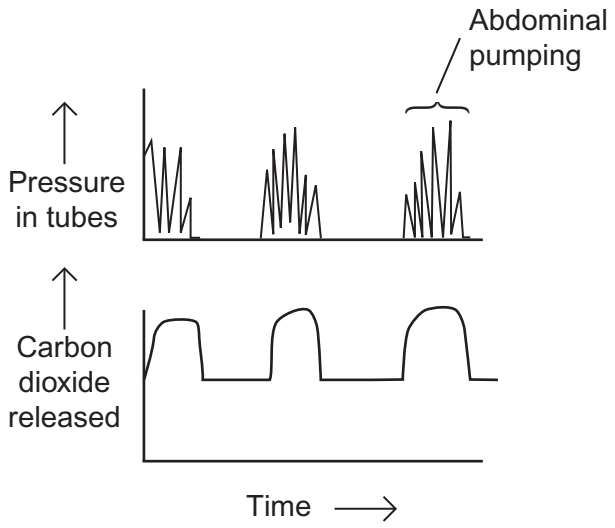
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4 (c) Abdominal pumping takes place during vigorous activity in insects. This causes regular squeezing of the tubes of the gas exchange system.

A scientist investigated the effect of abdominal pumping on the pressure in the tubes and the volume of carbon dioxide released by the insect.

Figure 3 shows his results.

Figure 3



Describe and explain these results.

[3 marks]

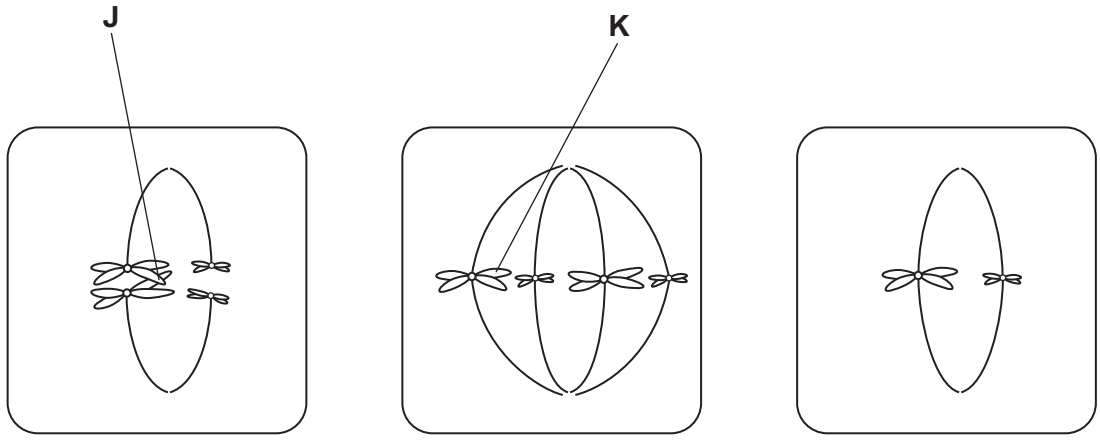
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Turn over for the next question

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5 **Figure 4** shows three cells, **B**, **C** and **D**, from tissues in the same organism. Each cell is in a stage of either mitosis or meiosis.

Figure 4



Cell **B** Cell **C** Cell **D**

5 (a) Complete **Table 3** with a tick if the cell shows the feature.

[2 marks]

Table 3

	Cell B	**Cell C**	**Cell D**
homologous chromosomes are present			
a stage of mitosis			

5 (b) Describe and explain the appearance of chromosome **K** in cell **C**.

[2 marks]

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5 (c) Explain what is happening at point **J** in cell **B**.

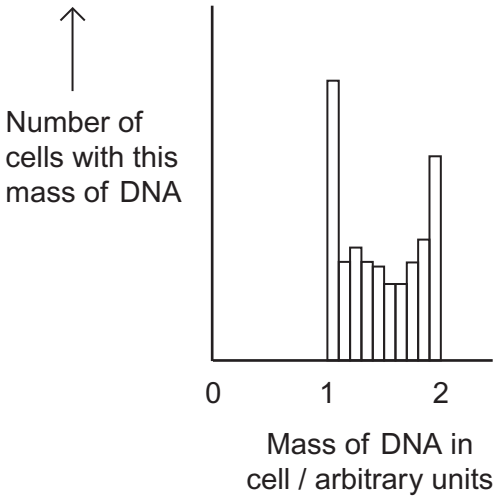
[2 marks]

5 (d) Use information from all three cells in **Figure 4** to explain how the number of chromosomes in cell **D** was produced.

[1 mark]

5 (e) **Figure 5** shows the mass of DNA present in cells of a population of healthy cells where mitosis is occurring.

Figure 5



Explain why some cells contain a mass of DNA between 1 and 2 arbitrary units.

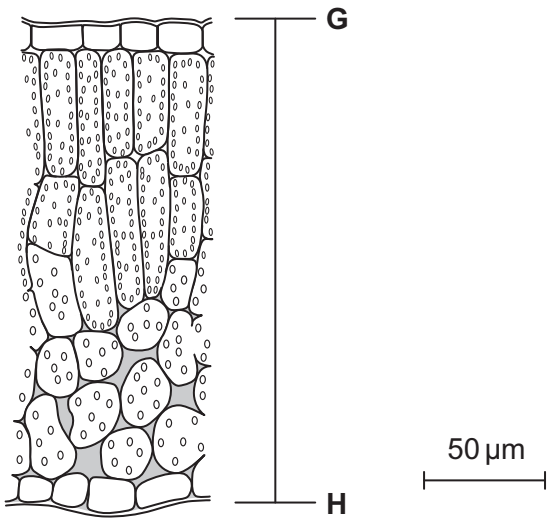
[1 mark]

8

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6 A scientist examined the structure of mustard plant leaves. He viewed temporary mounts of leaf tissues with an optical microscope. **Figure 6** shows a drawing of typical results.

Figure 6



6 (a) Describe how temporary mounts are made.

[2 marks]

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6 (b) Calculate the distance in micrometres between **G** and **H** on the leaf.

[2 marks]

Answer = _____ µm

6 (c) Describe how the scientist could have used the temporary mounts of leaves to determine the mean number of chloroplasts in mesophyll cells of a leaf.

[3 marks]

6 (d) There are many different types of cell in a leaf, each with its own function. What term is used to describe a structure such as a leaf?

[1 mark]

8

Turn over for the next question

Do not write outside the box

7 (a) What is the name of a position of a gene on a chromosome?

[1 mark]

7 (b) What is meant by genetic diversity?

[1 mark]

A geneticist investigated genetic diversity in four different breeds of dog. She compared DNA base sequences of the same genes from a large number of dogs from each breed.

The geneticist calculated the mean genetic diversity for each breed of dog. The value of this mean was between 0 and 1.

- A mean value of 1 shows maximum genetic diversity.
- A mean value of 0 shows no genetic diversity.

Her results are shown in **Table 4**.

Table 4

Breed of dog	Mean genetic diversity	Standard deviation
Airedale terrier	0.51	± 0.03
Bull terrier	0.38	± 0.02
Jack Russell terrier	0.76	± 0.01
Miniature terrier	0.47	± 0.02

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7 (c) What do these data show about the differences in genetic diversity between these breeds of dog?

[3 marks]

7 (d) Miniature terriers were first bred from bull terriers in the 19th century.

Suggest **one** explanation for the observed difference in genetic diversity between miniature terriers and bull terriers.

[2 marks]

7

Turn over for the next question

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8 In mammals, the mesenteric artery connects the aorta to blood vessels of the small intestine.

Sport scientists recorded increases in blood flow in the mesenteric artery after different types of meal. The types of meal were:

- carbohydrate only
- fat only
- protein only.

Typical results are shown in **Table 5**.

Table 5

Type of meal	**Maximum percentage increase in blood flow in mesenteric artery**	**Time taken to reach maximum increase in blood flow in mesenteric artery / minutes**
Carbohydrate only	64	15
Fat only	60	30
Protein only	57	45

8 (a) The sport scientists concluded that the three types of meal had no major effect on maximum percentage increase in blood flow in the mesenteric artery.

What else can be concluded from their results?

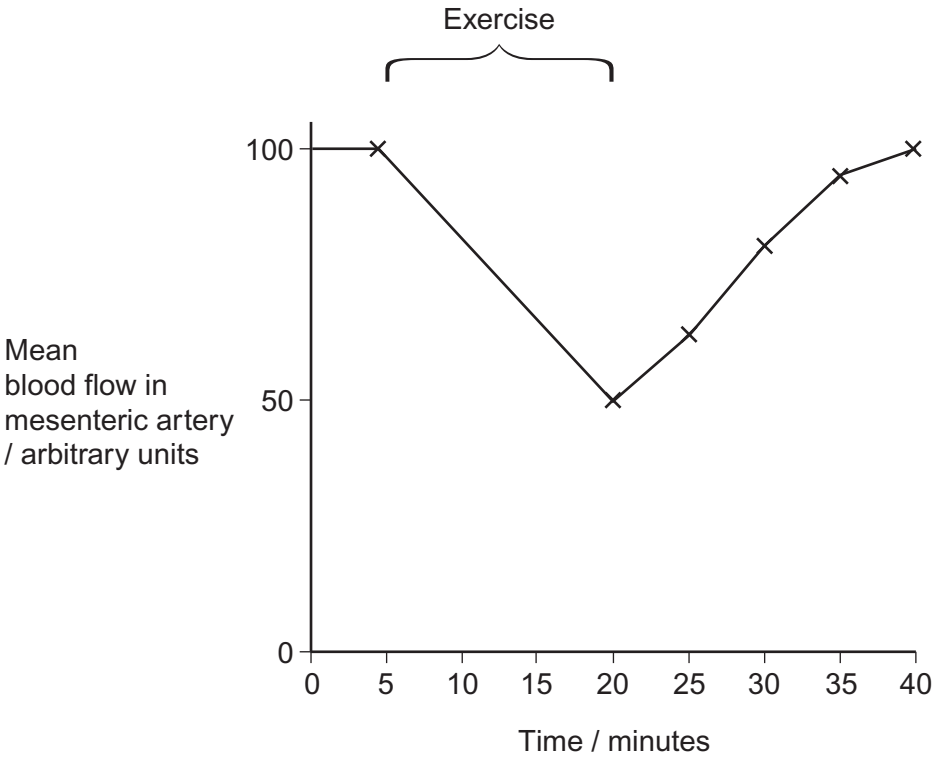
[2 marks]

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In another investigation, the sport scientists recorded blood flow in the mesenteric artery before and after vigorous exercise.

Figure 7 shows their results for a large group of volunteers.

Figure 7



8 (b) Suggest the advantage of the change in blood flow in the mesenteric artery during exercise.

[3 marks]

Question 8 continues on the next page

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8 (c) The sport scientists concluded people should **not** do vigorous exercise after a meal. Does the information from **Table 5** and **Figure 7** support this conclusion?

[4 marks]

8 (d) Blood leaving the kidney eventually returns to the kidney.
Describe the pattern of blood circulation in a mammal that causes blood to return to the kidney.

[6 marks]

15

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9 Scientists investigated the presence of bacteria resistant to the antibiotic neomycin in turkeys, chickens and the farmers who kept the turkeys and chickens. They looked for *Escherichia coli* (*E. coli*) resistant to neomycin. At 46 farms, the scientists obtained samples of bacteria from faeces of turkeys, turkey farmers, chickens and chicken farmers. The turkey farmers very often used turkey food containing neomycin. The chicken farmers did not use chicken food containing neomycin very often.

The bacteria were grown on nutrient agar in cultures. The nutrient agar contained neomycin. Any resistant bacteria grew and divided to form visible colonies.

The results are shown in **Table 6**.

Table 6

Samples taken from	**Percentage of samples of faeces containing *E. coli* resistant to neomycin**
Turkeys	81
Turkey farmers	57
Chickens	24
Chicken farmers	8

9 (a) Suggest **two** hypotheses the scientists were testing in this investigation.

[2 marks]

Hypothesis 1 _____

_____

_____

Hypothesis 2 _____

_____

_____

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9 (b) (i) Describe what the results in **Table 6** show.

[2 marks]

9 (b) (ii) Suggest and explain **one** reason for the observed differences in percentage of neomycin-resistant *E. coli* in turkeys and chickens.

[2 marks]

9 (c) The scientists followed strict safety guidelines when collecting samples of faeces. Apart from the risk of contamination from *E. coli* this was especially important when collecting samples from humans.

Explain why.

[1 mark]

Question 9 continues on the next page

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9 (d) Use the information provided to identify and explain **one** way in which the scientists increased the reliability of their method.

[2 marks]

9 (e) Suggest how the scientists could use DNA to investigate whether the neomycin-resistant bacteria in farmers were identical to the strain of bacteria in the birds they kept.

[2 marks]

9 (f) At one time, most animal feeds contained antibiotics that increased the rate of animal growth. In the UK, fewer animal feeds now contain antibiotics.

Suggest reasons why.

[4 marks]

END OF QUESTIONS

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