



Name	
Current School	

Biology

Entrance exam for: 16+ (Sample)

Time allowed: 45 minutes

Total marks: 45

Please read this information before the examination starts

- There are 30 multiple choice questions in the first section of this paper.
- Choose the answer you consider correct and record your choice on the separate answer sheet.
- Each correct answer will score one mark. A mark will be deducted for a wrong answer.
- For the second section of the paper there is one 15 mark question.
- For this section you should answer in the answer boxes provided.
- Calculators may be used.

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Marks awarded:	
Comments:	

1 Which process in plant cells uses chlorophyll?

- A growth
- B nutrition
- C movement
- D respiration

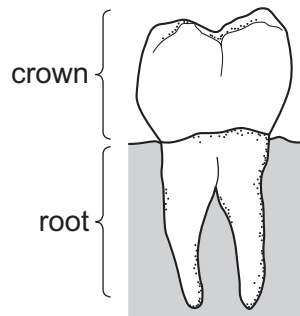
2 The table shows the scientific names of four members of the cat family.

common name	scientific name
leopard	<i>Panthera pardus</i>
lion	<i>Panthera leo</i>
ocelot	<i>Leopardus pardalis</i>
tiger	<i>Panthera tigris</i>

Which statement is correct?

- A All four cats are members of the same species.
- B The leopard and the ocelot are members of the same genus.
- C The leopard, lion and tiger are members of the same genus.
- D The leopard, lion and tiger are members of the same species.

3 The diagram shows a type of tooth.

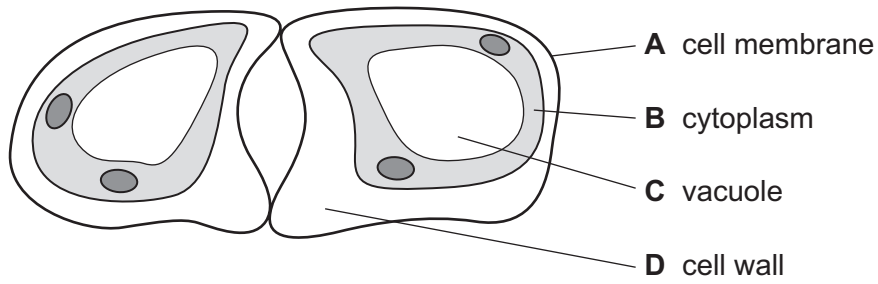


Use the key to identify the tooth.

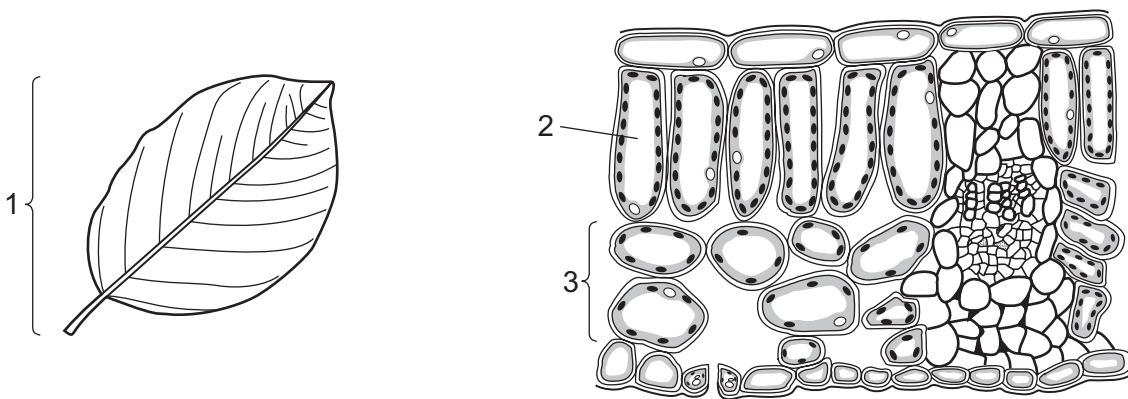
- 1 the root is divided into two parts go to 2
- the root is not divided into two parts go to 3
- 2 the height of the crown is greater than the length of the root **A**
- the height of the crown is less than the length of the root **B**
- 3 flattened crown **C**
- ridged crown **D**

4 The diagram shows a student's drawing of guard cells.

Which label is **not** correct?



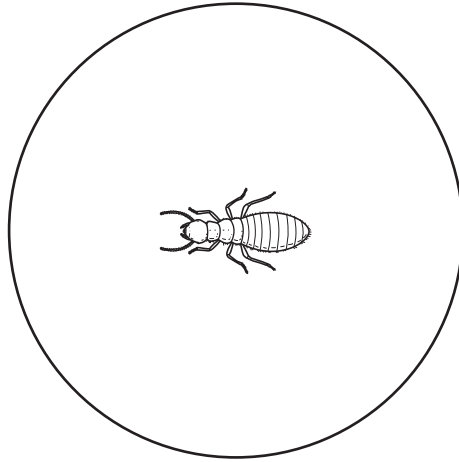
5 The diagrams show a leaf and its internal structure.



What are the levels of organisation of the labelled structures?

	1	2	3
A	cell	tissue	organ system
B	organ	cell	tissue
C	organ system	tissue	cell
D	tissue	cell	organ

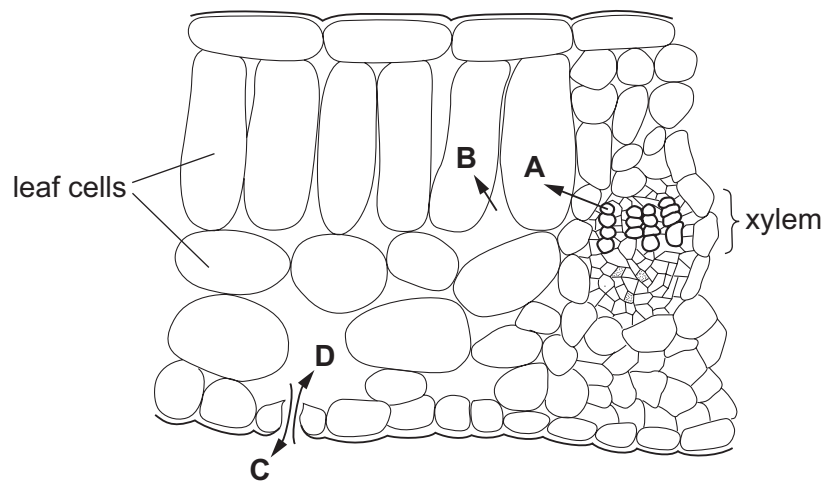
- 6 The diagram shows an insect as seen using the low power lens of a microscope.
The actual diameter of the circle is 0.3 cm.



What is the approximate size of this insect in millimetres?

- A** 0.1 mm **B** 1.0 mm **C** 2.0 mm **D** 3.0 mm
- 7 The diagram shows part of a section through a leaf.

Which arrow represents the diffusion of oxygen during photosynthesis?



- 8 What helps to support plants?
- A** pressure inwards on the cell vacuoles
B pressure inwards on the chloroplasts
C pressure outwards on the cell walls
D pressure outwards on the nuclei

9 Which of these is digested by protease?

A ■

B ●

C ■—■—■—■

D ●—●—●—●

key

■ amino acid

● glucose

— chemical bond

10 Which enzyme is used to produce clear apple juice?

A amylase

B lipase

C pectinase

D protease

11 What is the optimum pH for stomach enzymes?

A pH2

B pH7

C pH9

D pH12

12 What are the raw materials necessary for photosynthesis?

A carbon dioxide and water

B light and a suitable temperature

C oxygen and carbon dioxide

D water and a suitable temperature

13 In plants, which substance contains magnesium ions?

A cellulose

B chlorophyll

C haemoglobin

D starch

14 What must be increased in the diet of a person suffering from constipation?

A fats

B fibre

C iron

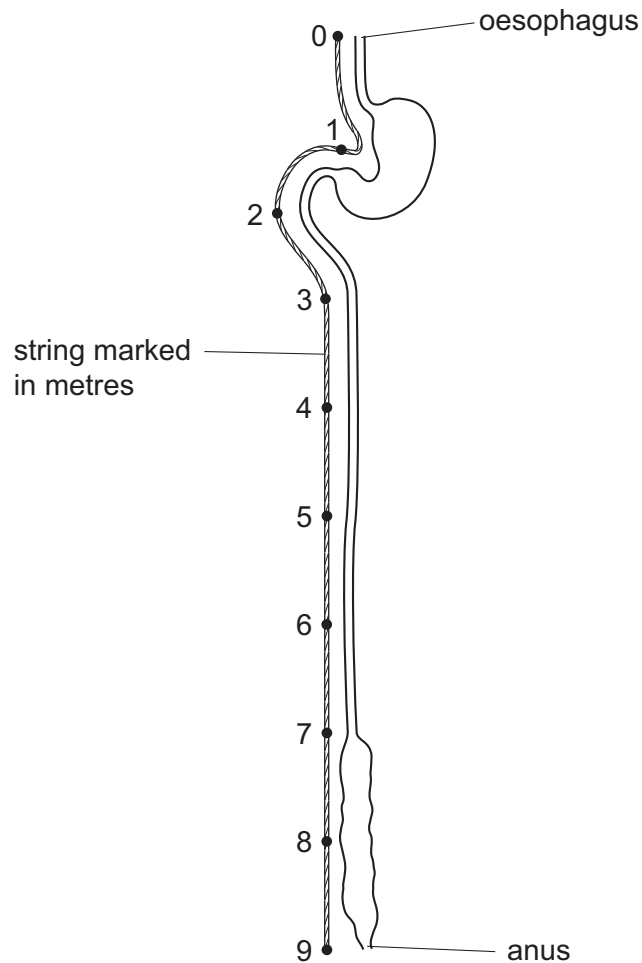
D protein

[Turn over

15 Which chemical reaction takes place in the mouth?

- A Fats are digested into fatty acids and glycerol.
- B Fats are digested into simpler sugars.
- C Starch is digested into simpler sugars.
- D Starch is digested into amino acids.

16 The diagram shows the human alimentary canal, with a string marked in metres beside it.



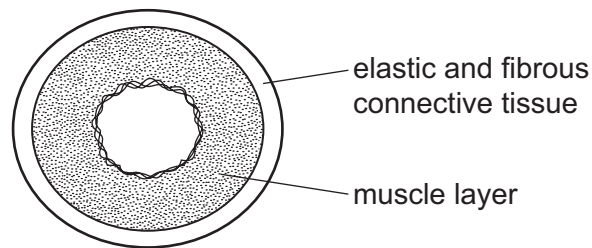
How long is the small intestine?

- A 2 m
- B 6 m
- C 8 m
- D 9 m

17 What is a description of transpiration?

- A exchange of gases between the leaf and the atmosphere
- B loss of water vapour from the leaves and stems of a plant
- C movement of water from the roots to the leaves
- D movement of water through the cells of the leaf

- 18 Which tissue transports water from the roots to the leaves in a plant?
- A cortex
 - B epidermis
 - C mesophyll
 - D xylem
- 19 On which organ is an ECG performed?
- A brain
 - B colon
 - C ear
 - D heart
- 20 The diagram shows a cross-section through a human blood vessel.



- Which type of blood vessel does the diagram show?
- A an artery
 - B a capillary
 - C a vein
 - D a ventricle
- 21 Which are both chemical barriers to the transmission of pathogens?
- A mucus and stomach acid
 - B mucus and white blood cells
 - C skin and hairs in the nose
 - D skin and stomach acid

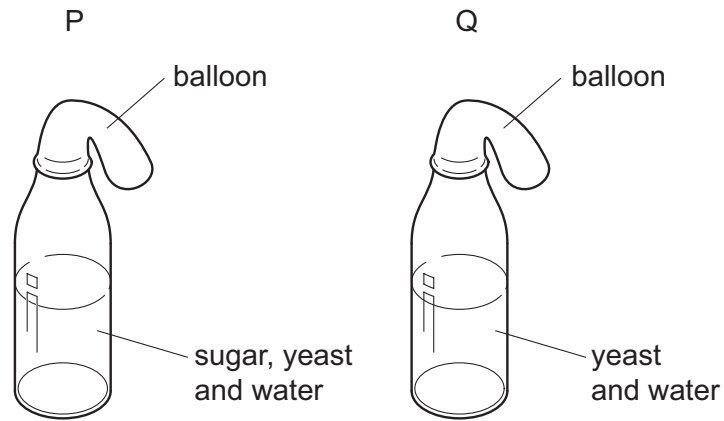
22 The table shows the approximate composition of inspired and expired air.

gas	percentage of gas in inspired air	percentage of gas in expired air
P	78.10	78.10
Q	20.90	16.00
R	variable	variable
S	0.04	4.00

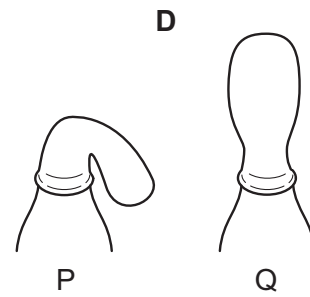
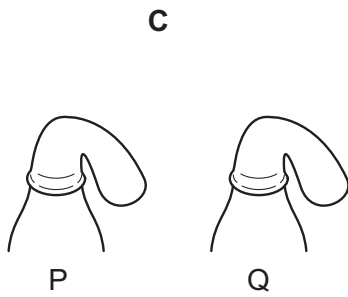
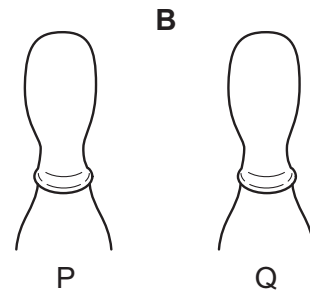
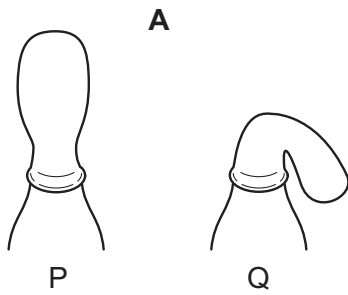
What is the name of gas S?

- A carbon dioxide
- B nitrogen
- C oxygen
- D water vapour

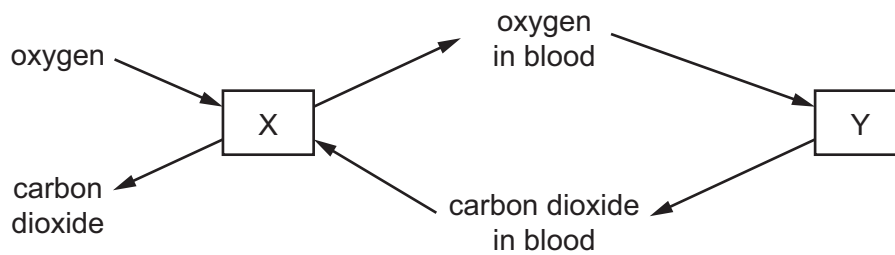
23 In an experiment to investigate anaerobic respiration, two bottles are set up in a warm room, as shown.



What would happen to each balloon after one day?



- 24 The diagram represents the exchange of gases during breathing and during respiration in the body.



What is represented by X and by Y?

	X	Y
A	lungs	air
B	lungs	body cells
C	body cells	air
D	body cells	lungs

- 25 The table shows information about urea.

Which row is correct?

	substance that urea is made from	organ that makes urea	organ that excretes urea
A	amino acids	kidney	bladder
B	amino acids	liver	kidney
C	fatty acids	kidney	bladder
D	fatty acids	liver	kidney

- 26 What is the most important function of sweating?

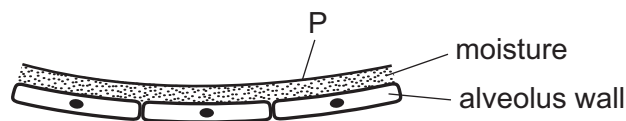
- A** to remove excess heat from the body
- B** to remove excess salts from the body
- C** to remove excess urea from the body
- D** to remove excess water from the body

- 27 What shows the order in which these structures are involved in a reflex action?
- A** effector → motor neurone → relay neurone → sensory neurone → receptor
- B** effector → sensory neurone → motor neurone → relay neurone → receptor
- C** receptor → sensory neurone → relay neurone → motor neurone → effector
- D** receptor → motor neurone → sensory neurone → relay neurone → effector
- 28 The diagram shows a person sweating in hot weather.



What part is played by sweat glands during the process of sweating?

- A** effector
- B** receptor
- C** sense organ
- D** stimulus
- 29 The diagram shows the gas exchange surface of a person who has just smoked a cigarette. Substance P can cause cancer.



What is substance P?

- A** carbon dioxide
- B** carbon monoxide
- C** nicotine
- D** tar

30 Which method of birth control works by preventing an egg from being released?

- A condom
- B contraceptive pill
- C monitoring body temperature
- D vasectomy

31a.

Hypoxia is a condition in which tissues of the body are deprived of an adequate oxygen supply. A study was carried out in rats to examine the effects of continuing hypoxia on the structure of the diaphragm, and to determine whether nitric oxide is implicated in adaptation of the diaphragm to hypoxia. The diaphragm helps to supply oxygen to tissues and organs in the body by ventilating the lungs.

A group of 36 adult male rats were kept for 6 weeks in low oxygen while 36 adult male rats were kept in normal oxygen levels.

		Body mass / g	Erythrocytes / % of total blood volume	Mass of right ventricle muscle / mg
1 week	Control	305.7 ± 7.4	39.3 ± 1.7	154.3 ± 7.4
	Hypoxia	*238.3 ± 5.0	*62.6 ± 1.9	*194.8 ± 8.9
2 weeks	Control	302.3 ± 5.0	39.6 ± 1.1	157.8 ± 3.4
	Hypoxia	*229.7 ± 4.6	*70.1 ± 1.0	*204.7 ± 11.2
3 weeks	Control	325.0 ± 10.3	45.0 ± 0.7	166.8 ± 3.6
	Hypoxia	*255.0 ± 8.3	*71.3 ± 1.0	*238.7 ± 18.9
6 weeks	Control	369.8 ± 5.9	43.0 ± 2.6	164.7 ± 3.9
	Hypoxia	*277.5 ± 7.9	*75.1 ± 1.4	*251.3 ± 8.0

Key: * indicates significant difference from corresponding control value (student's *t*-test, *p*<0.05)

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Outline the effect of hypoxia on body mass and erythrocyte percentage. [1 mark]

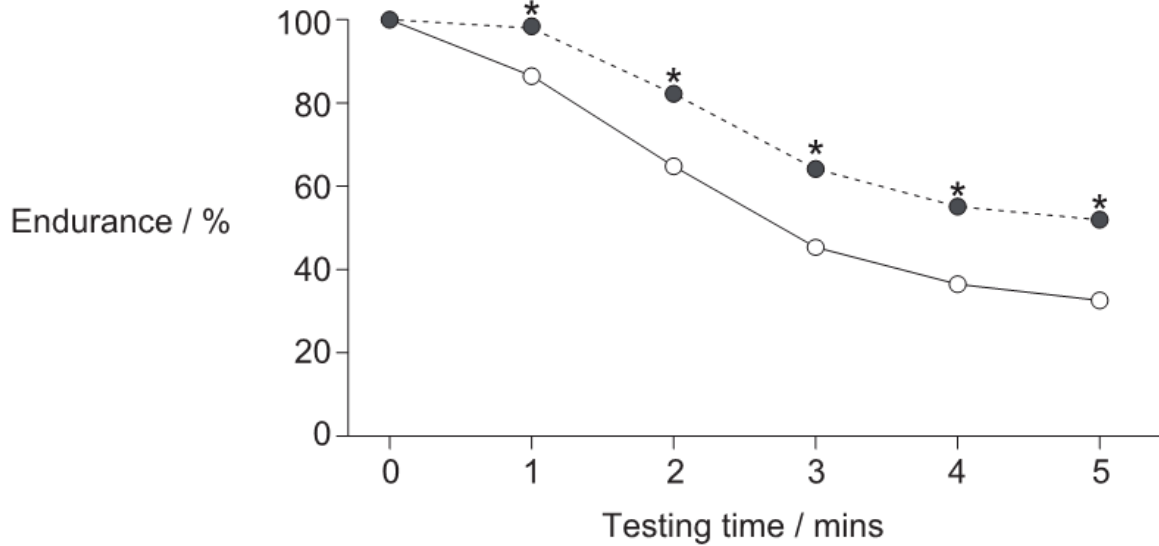
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31b.

The graph shows the effect of hypoxia on the endurance of rats' diaphragm muscle after 6 weeks. Endurance is the change in force measured as a percentage of the initial force.



Key: * indicates significant difference from control ($p < 0.0001$)

--●-- hypoxia

—○— control

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Using the data in the graph, deduce whether hypoxia increases **or** decreases the endurance of the rats' diaphragm muscle. [2 marks]

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31c.

Using the data presented in this question, explain the effect of hypoxia on the body. [2 marks]

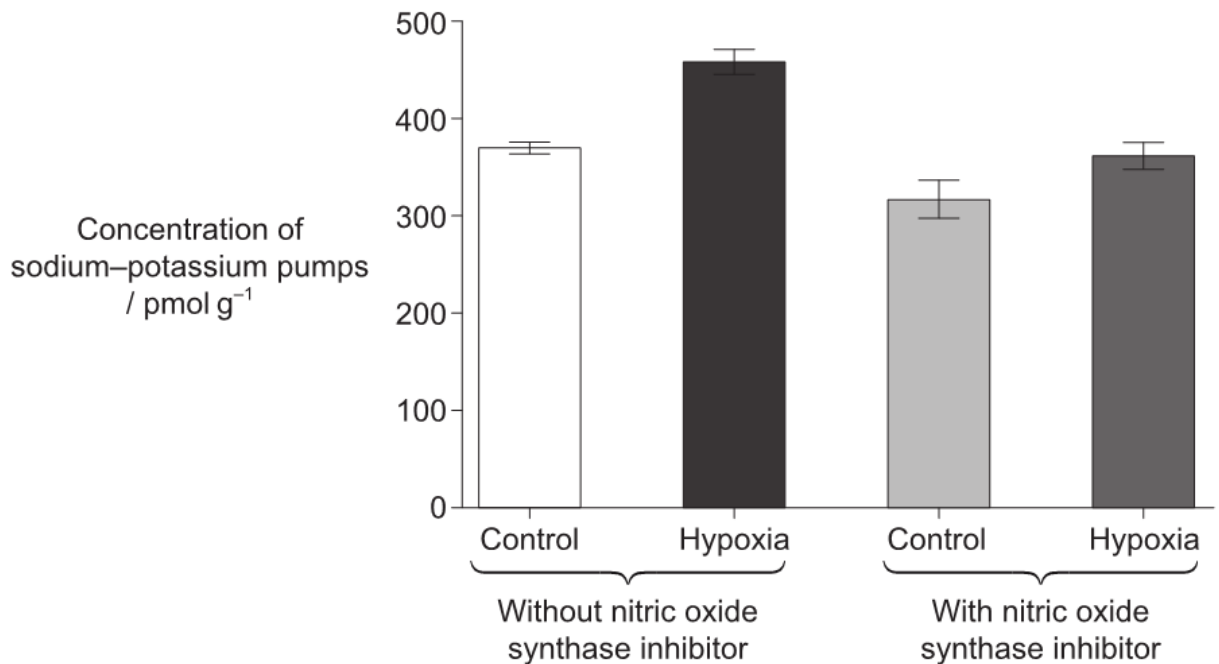
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31d.

The sodium–potassium pump plays a role in muscle activity. Nitric oxide may have a role in the recovery of hypoxic muscles. The production of nitric oxide can be blocked with an inhibitor of the enzyme nitric oxide synthase. The graph shows the concentration of sodium–potassium pumps in the diaphragm of control and hypoxic rats without and with nitric oxide synthase inhibitor.



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Analyse the graph to obtain **two** conclusions about the concentration of sodium–potassium pumps.

[2 marks]

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31e.

Muscle fibres are stimulated to contract by the binding of acetylcholine to receptors in their membranes and the subsequent depolarization.

Suggest a reason for increasing the concentration of sodium–potassium pumps in the membranes of diaphragm muscle fibres. *[1 mark]*

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31f.

Skeletal muscle contractions can take two different forms: if they are stimulated by a single action potential they take the form of a twitch and if they are stimulated by a series of action potentials the contraction is longer lasting (tetanic). The table shows the effects of hypoxia on the force of twitch and peak tetanic contraction in the diaphragm.

		Twitch contraction / N cm⁻²	Peak tetanic contraction / N cm⁻²
Diaphragm	Control	4.0 ± 0.7	20.0 ± 2.3
	Hypoxia	2.8 ± 0.4	14.2 ± 1.8

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Outline the effect of hypoxia on the force of contraction of the diaphragm. *[1 mark]*

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31g.

Hypoxia caused a 13 % increase in the surface area to volume ratio of the diaphragm. Suggest a reason for this change. *[1 mark]*

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31h.

Using all relevant data in the question, evaluate the effectiveness of the rats' adaptation to hypoxia.

[3 marks]

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31i.

Discuss the advantages and disadvantages of using rats as models in this investigation. *[2 marks]*

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