Write your name here

Surname	Other names

Pearson Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Biology

Unit: 4BI0
Paper: 2BR

Friday 9 June 2017 – Morning
Time: 1 hour

Paper Reference
4BI0/2BR

You must have:
Calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Pearson

Answer ALL questions.

1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Blood doping

In 2015, information was revealed from 12 539 blood tests involving 5000 athletes. The information suggested that there had been extensive cheating by athletes at the world's major sporting events between 2001 and 2012.

Many athletes had blood samples that showed more variation in blood composition over time than would be expected. This variation led to the suspicion that these athletes were cheating. In total, 12 per cent of the individual blood tests showed more variation than expected.

The World Anti-Doping Agency (WADA) concluded that these athletes had been involved in a process called blood doping, in an attempt to improve their chances of winning. Blood doping is the use of certain techniques or substances to increase the number of red blood cells to improve an athlete's stamina and performance.

One method of blood doping uses blood transfusion. A volume of blood is removed from an athlete's body one month before competition. This blood is vacuum-sealed and stored in a fridge. In the weeks that follow, the body increases red blood cell production to make up for the red blood cells that were removed. Eventually, the athlete's body replaces all of the blood that was removed. A few days before the race, the red blood cells from the stored blood are transfused back into the athlete's body. This increases the number of available red blood cells.

This transfusion can cause significant health risks for the athlete. Unnaturally high red blood cell levels increase the risk of heart attack, stroke and pulmonary embolism. Dehydration as a result of exercise can make matters worse.

Another method of blood doping involves the use of a synthetic form of the hormone EPO. This hormone is a peptide produced naturally by the human body. It is released from the kidneys and stimulates the bone marrow to produce red blood cells. Synthetic EPO can be developed and injected into the body. Urine tests for the detection of synthetic EPO have been improved.

WADA states that transfusions for blood doping have been happening for decades. However, the recent publicity about blood doping is likely to be the result of better detection of synthetic EPO.

(a) Calculate the number of blood tests that gave more variation than expected (lines 1, 6 and 7).

Show your working.

(2)

number of blood tests = ...

(b) Stamina means that an athlete can run for a long time because their muscles can keep contracting (lines 10 and 11).

Explain how an increase in the number of red blood cells helps to improve stamina.

(4)

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(c) Suggest why the blood taken from an athlete is vacuum-sealed and stored in a fridge (lines 13 and 14).

(3)

(d) Name the mineral ion in the diet required for red blood cell production.

(1)

(e) Suggest why an athlete uses their own blood for blood doping rather than blood from someone else.

(2)

(f) Suggest how dehydration increases the risk of a heart attack (lines 20 and 21).

(2)

(g) An embolism is a blockage in a blood vessel that may be caused by a clot.

Explain why a pulmonary embolism is a health risk (line 20).

(2)

(h) State how EPO is carried from the kidneys to the bone marrow (lines 23 and 24).

(1)

(Total for Question 1 = 17 marks)

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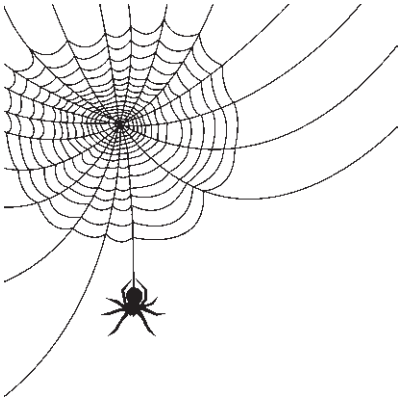
2 Spiders produce silk to make webs to catch their prey.



(a) Spiders secrete digestive enzymes on to their prey.

Suggest an enzyme a spider uses to digest the muscles of its prey.

(1)

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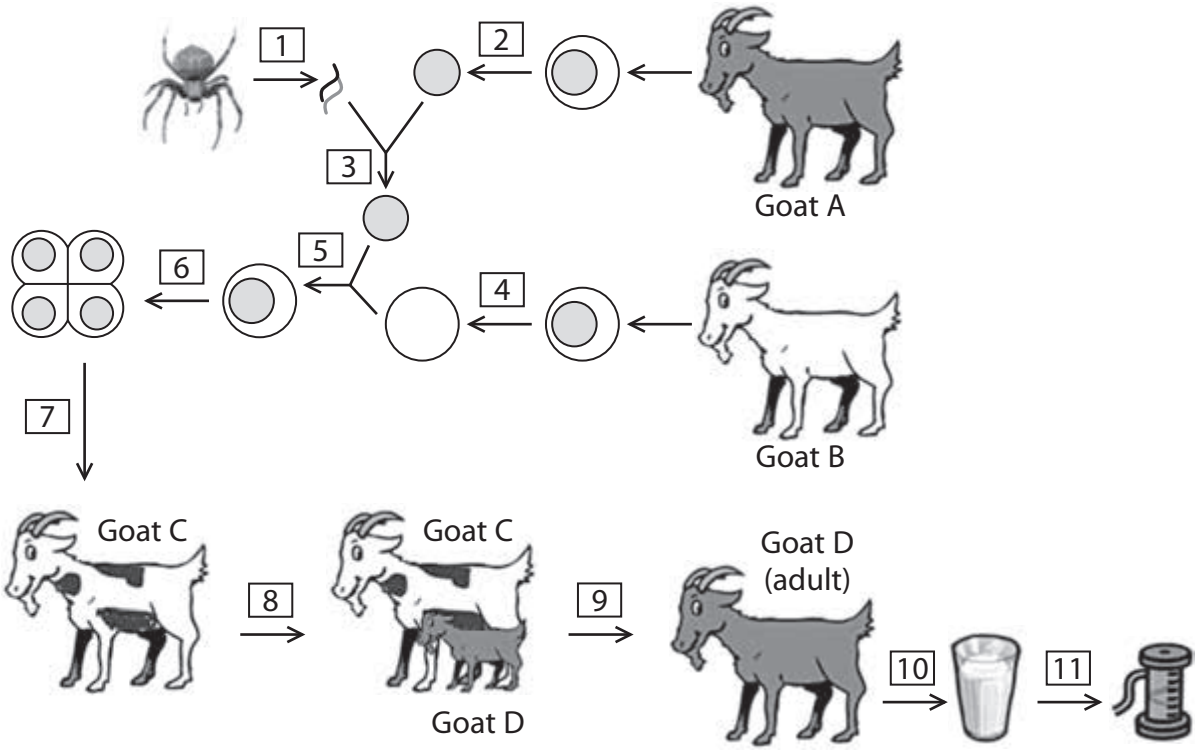
(b) Spider silk can be used to make clothes.

Scientists have produced transgenic goats that have spider silk in their milk.

The diagram shows the stages needed to produce these transgenic goats.



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The table describes stages in this diagram.

Complete the table by matching each description to its correct stage number in the diagram.

Each number may be used once, more than once or not at all.

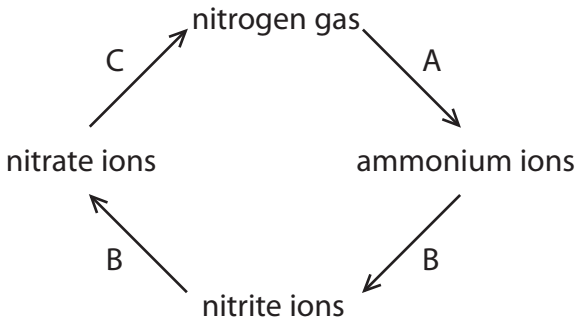
One has been done for you.

(5)

Description of stage	Stage number
cutting a gene	1
cell division by mitosis to produce an embryo	
implantation into a surrogate mother	
enucleation of a haploid cell	
production of milk containing silk	
use of an electric shock	

(Total for Question 2 = 6 marks)

3 The diagram shows a simplified version of the nitrogen cycle.



(a) Name the processes A, B and C shown on the diagram.

(3)

A .....

B .....

C .....

(b) Process C reduces the availability of nitrates to plants and happens in anaerobic conditions.

(i) What is meant by anaerobic conditions?

(1)

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(ii) Name the group of organisms that live in anaerobic conditions and carry out process C.

(1)

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(c) Farmers can add chemical fertiliser to the soil to increase the availability of nitrates to plants.

(i) Give one effect of adding too much nitrate to the soil.

(1)

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(ii) Give another way that farmers can increase the fertility of the soil without using chemical fertilisers.

(1)

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(Total for Question 3 = 7 marks)

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4 Coat colour in horses is controlled by a gene that has two alleles.

The C^W allele codes for the production of white hairs and the C^R allele codes for the production of red hairs.

When a red-coated horse is crossed with a white-coated horse, the foal (offspring) has a roan colour coat.

This colour is seen because each hair is either white or red. It is the mixture of these hairs that produces the roan colour.

(a) (i) Use the symbols C^W and C^R to show how the red-coated parent and the white-coated parent can produce a roan-coated foal.

(3)

Parents

Gametes

Offspring genotype

(ii) The roan-coated foal is later mated with another roan-coated horse.

Give the possible genotypes and phenotypes of their offspring.

(2)

(iii) A roan-coated horse is mated with a white-coated horse.

What is the probability of producing a white-coated offspring?

(1)

probability = ...

(b) The height of pea plants is also controlled by a gene that has two alleles.

The height can either be tall or dwarf.

Explain how the control of height in pea plants differs from the control of coat colour in horses.

(2)

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(c) Horses usually produce one offspring from each pregnancy.

Scientists often study genetics using organisms such as mice.

Suggest an advantage of using mice rather than horses to study genetics.

(1)

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(Total for Question 4 = 9 marks)

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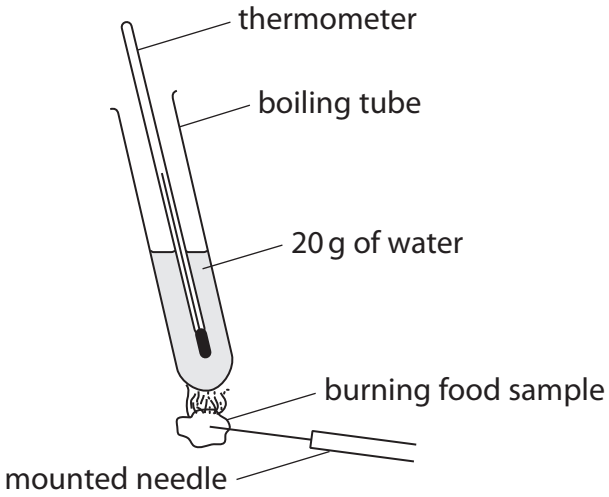
5 A student carries out an experiment to find the energy value of some food samples.

He uses this method.

- place 20 grams of water in a boiling tube
- use a thermometer to measure the temperature of the water
- weigh a small sample of food and record its mass
- set fire to the food sample by holding it on a mounted needle in a Bunsen flame
- quickly transfer the burning food so that it is under the boiling tube
- allow the food sample to burn, relighting it in the Bunsen flame if required, repeating this until the sample does not relight
- measure the new temperature of the water in the boiling tube

The student repeats this method for a number of different foods.



(a) State two safety precautions that the student should take when carrying out this experiment.

(2)

1 .....

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2 .....

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(b) The student records the mass of food and the change in water temperature.

For each food sample, he calculates the energy released in joule (J) using this formula

$$\underset{\text{in J}}{\text{energy released}} = \underset{\text{in g}}{\text{mass of water}} \times \underset{\text{in °C}}{\text{temperature rise}} \times 4.2$$

He then calculates the energy released in joule per gram (J per g).

The table shows his results.

Food	Mass of food before burning in g	Change in water temperature in °C	Energy released from food sample in J	Energy released from food sample in J per g
marshmallow	0.2	5	420	2100
popcorn	0.1	4		3360
cheese biscuit	0.1	7	588	5880

(i) Calculate the energy released from the sample of popcorn.

(2)

energy released = ... J

(ii) Explain why the student calculates the energy released in J per g.

(2)

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(c) The energy value given on the packet of popcorn is 14 800 J per g.

(i) Suggest why there is a difference between the student's calculation of the energy released and the energy value on the packet.

(3)

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(ii) Describe two ways the student could modify the apparatus to make his calculation of the energy released closer to the energy value on the packet.

(2)

1 .....

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2 .....

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(Total for Question 5 = 11 marks)

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6 The photograph shows a cow with her calf.

(a) Scientists investigated the success of transferring cloned embryos into surrogate cows.

In total, 2170 cloned embryos were transferred resulting in 535 pregnancies.

From these pregnancies, 103 calves were born.

Calculate the percentage of embryos that successfully developed into newborn calves.

Show your working.

(2)

percentage of embryos = ...

(b) The formation of a placenta is needed for the successful development of an embryo into a fetus.

(i) Name the part of the female reproductive system where the placenta forms.

(1)

.....

(ii) Suggest how the structure of the placenta is adapted to allow the exchange of substances between the mother and the fetus.

(4)

(c) Calves feed on milk from their mothers.

Suggest how the components of milk help calves to develop.

(3)

(Total for Question 6 = 10 marks)

TOTAL FOR PAPER = 60 MARKS

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