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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE (9–1)

Centre Number | Candidate Number

Time 1 hour 15 minutes

Paper reference **4BI1/2B**

Biology

Unit: 4BI1
PAPER: 2B

November 2021

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.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 70.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.
- Good luck with your examination.

Turn over ▶

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Answer ALL questions.

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

Heart transplant

A heart transplant is an operation to replace a damaged or failing heart with a healthy heart from a donor who has recently died. In the United Kingdom, 200 heart transplants are carried out each year.

A heart transplant may be considered if you have severe heart failure and medical treatments are not helping. Conditions that may eventually require a heart transplant include coronary heart disease and cardiomyopathy, where the walls of the heart have become stretched, thickened or stiff. Some people born with an abnormal heart may also benefit from a heart transplant.

A heart transplant needs to be carried out as soon as possible after a donor heart becomes available. The procedure is performed under general anaesthetic where the patient is unconscious. During the operation, a heart-lung bypass machine is used to keep the patient alive.

A cut is made in the middle of the patient's chest. The patient's heart is removed, leaving behind a section of the right and left atria, the two upper chambers of the heart. The new heart is connected to the aorta, the pulmonary artery, and the remaining part of the atria. The new heart is stimulated to start beating and the patient is taken off the bypass machine.

The patient will need to stay in hospital for around two or three weeks after a heart transplant. The patient will also need to take medicines called immunosuppressants for the rest of their life. Without these medicines, the transplant will not be successful.

After going home, the patient is encouraged to take part in a cardiac rehabilitation programme. This involves following an exercise plan to help regain strength and mobility. They should avoid strenuous activities such as pushing, pulling or lifting anything heavy for 6 to 12 weeks. Most people can start returning to many of their normal activities within a few months.

The patient does not usually need to have a special diet after a heart transplant. A balanced diet can ensure they stay as healthy as possible. They should not smoke and should avoid drinking alcohol.

A balanced diet may also help reduce the risk of some of the side effects of the immunosuppressant drugs including weight gain, osteoporosis and diabetes. Immunosuppressants also make the patient more vulnerable to infections, including food poisoning.

Most people can return to their normal activities after a heart transplant and experience a significant improvement in their symptoms for many years. After a heart transplant, 75% of people will live at least five years.

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(a) Suggest why cardiomyopathy can cause heart failure (lines 6 to 7).

(1)

(b) During the transplant procedure the patient's heart is removed, leaving behind a section of the right and left atria.

Describe the functions of the atria in the body.

(3)

(c) Describe how the blood in the pulmonary artery differs from the blood in the aorta.

(2)

(d) Explain the function of the heart-lung bypass machine (lines 11 to 12).

(3)

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(e) Explain why the patient needs to be given immunosuppressants (lines 19 to 20).

(2)

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(f) Explain why patients should not smoke after their heart transplant (lines 28 to 29).

(2)

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(g) State what is meant by the term **balanced diet**.

(1)

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(h) Calculate the number of patients in the United Kingdom who have a heart transplant in one year that are still alive five years later (lines 2 to 3 and lines 35 to 36).

(2)

number of patients = ...

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(i) Suggest why patients are advised to avoid strenuous activities after their heart transplant (line 24).

(1)

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(j) Suggest why patients are more likely to be at risk of food poisoning after their heart transplant (lines 32 to 33).

(1)

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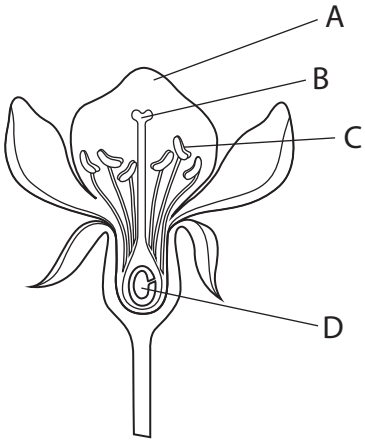
(Total for Question 1 = 18 marks)

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2 Flowers are involved in plant reproduction.

The diagram shows a section through a flower with parts labelled A, B, C and D.



(a) (i) Which part of the flower makes pollen grains?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(ii) What part of the flower is the stigma?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

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(b) After a pollen grain lands on the stigma of a flower, a pollen tube grows.

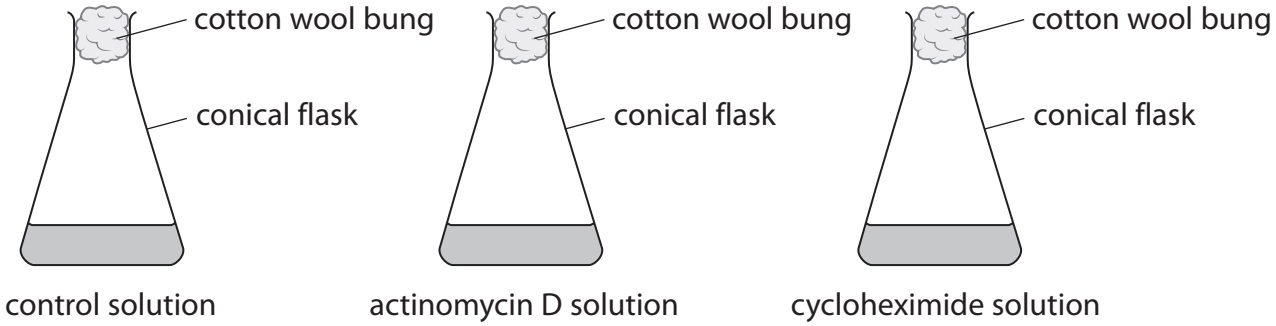
Explain the role of the pollen tube.

(3)

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(c) A scientist investigates the effect of three different solutions on the growth of pollen tubes using this apparatus.

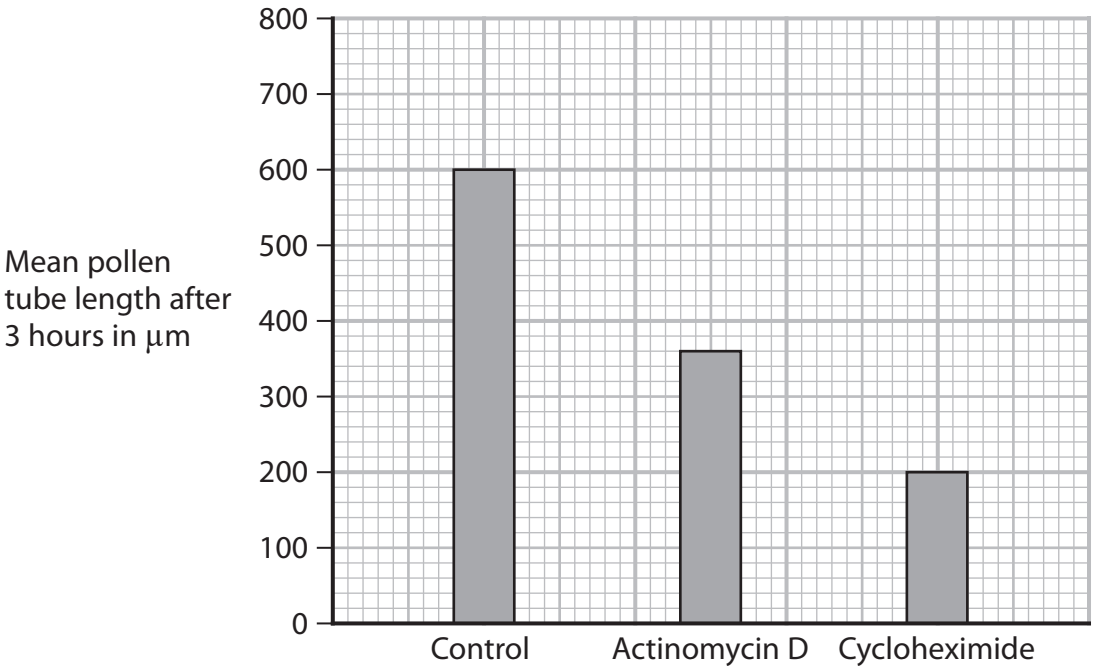


control solution | actinomycin D solution | cycloheximide solution

This is the scientist's method.

- place a different solution in three different flasks
- add pollen grains to the solution in each flask
- leave the grains in each solution for three hours
- take a sample of pollen grains from each solution
- measure the length of the pollen tubes in each sample

The graph shows the scientist's results.



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(i) Calculate the difference between the mean rate of pollen tube growth in the control solution and the mean rate of pollen tube growth in the actinomycin D solution.

Give your answer in μm per hour.

(2)

difference = ... μm per hour

(ii) Actinomycin D prevents transcription and cycloheximide prevents translation.

Use this information and your own knowledge to explain the results of this investigation.

(4)

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(d) Describe a method the scientist could use to observe pollen grains.

(3)

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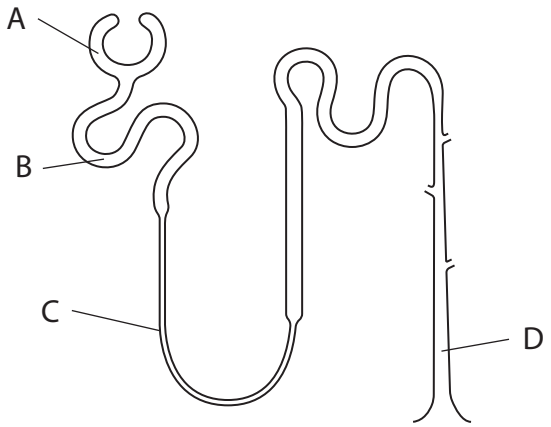
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(Total for Question 2 = 14 marks)

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3 The kidney contains nephrons involved in osmoregulation and excretion.

The diagram shows a nephron.



(a) Which part is the Bowman's capsule?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(b) The table gives the mass of three substances transported in part A and in part D for all kidney nephrons during one day.

Substance	Mass of substance in g	
	part A	part D
glucose	180	0
water	180 000	1500
urea	53	25

(i) Explain the change in the mass of glucose from part A to part D.

(3)

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(ii) Calculate the percentage reabsorption of water by kidney nephrons.

(2)

percentage = ... %

(iii) A substance containing nitrogen is broken down in the liver to produce urea.

Which substance is broken down to produce urea?

(1)

- ☒ **A** fat
- ☒ **B** glucose
- ☒ **C** protein
- ☒ **D** water

(c) A drug called MDMA increases the secretion of ADH.

Explain how this increase affects urine production.

(4)

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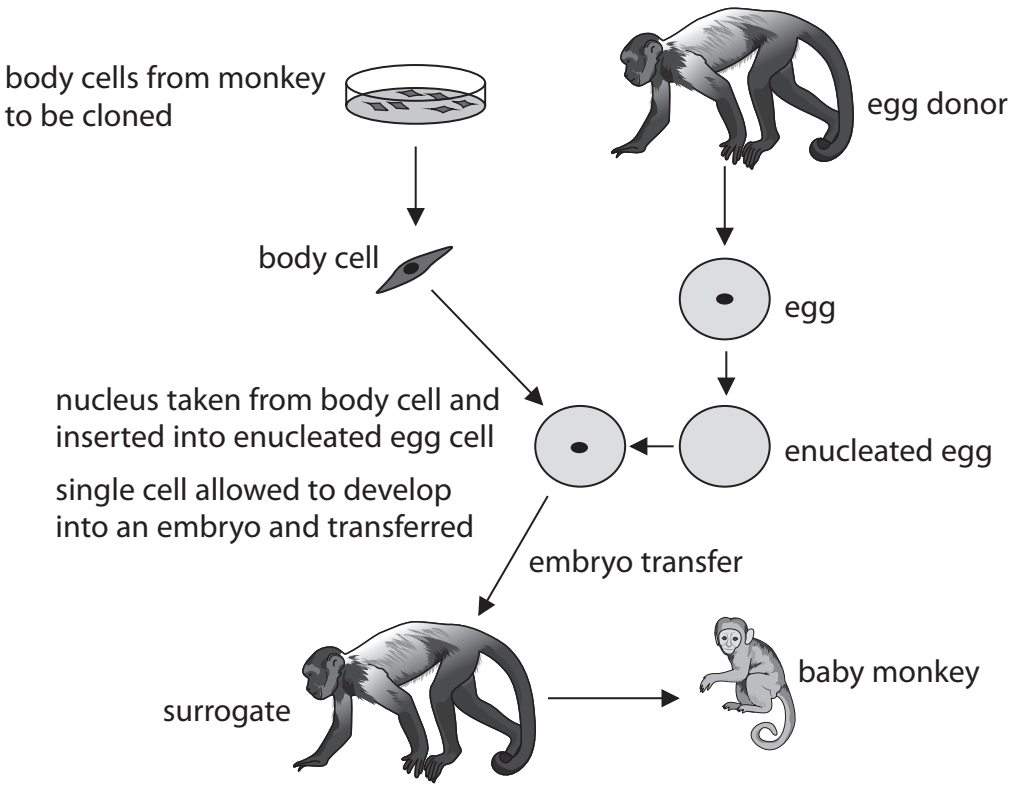
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(Total for Question 3 = 11 marks)

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4 Scientists have produced cloned monkeys.

The diagram shows the procedure used to produce cloned monkeys.



(a) (i) State the meaning of the term **enucleated**.

(1)

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(ii) Describe how the single cell develops into an embryo.

(2)

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(b) Scientists can use adult body cells or fetal body cells to clone monkeys.

The table gives information about cloning using body cells from different sources.

Source of body cells	Number of surrogates used	Number of successful pregnancies	Offspring produced
adult	42	22	2 short-lived
fetus	21	6	2 healthy

Evaluate this data to decide which source of body cells is more successful in cloning monkeys.

(4)

(Total for Question 4 = 7 marks)

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5 Obesity is caused when energy input is greater than energy output.

A student likes to eat potato crisps but is concerned about obesity.

The student has a choice of two different types of crisp to eat.

Describe an experiment the student could use to determine which type of crisp contains the least energy.

(6)

(Total for Question 5 = 6 marks)

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6 A group of students compares the distribution of plant species in two fields using this method.

- use random sampling
- use a 0.5 m × 0.5 m quadrat
- count the number of each species in a quadrat

Repeat this method for five quadrats in each field.

The tables show the students' results.

Species	Field A						
	Number of plants in each quadrat						Number of plants per m^2
	First	Second	Third	Fourth	Fifth	Mean	
dandelion	7	0	6	3	4	4	16
buttercup	2	1	0	3	2	2	6
violet	1	0	2	1	2	1	5
heather	2	3	1	2	1	2	7

Species	Field B						
	Number of plants in each quadrat						Number of plants per m^2
	First	Second	Third	Fourth	Fifth	Mean	
dandelion	7	3	2	1	2		
buttercup	0	0	0	0	0	0	0
violet	0	0	0	1	0	0	0
heather	0	0	0	0	0	0	0

(a) Describe how the students would obtain random samples from each field.

(2)

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(b) (i) Calculate the mean number of dandelions per quadrat in field B.

(1)

mean number = ...

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(ii) Calculate the number of dandelions per m^2 in field B.

(1)

number of dandelions per m^2 = ...

(c) Describe the differences in species distribution in field A and field B.

(2)

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(d) A teacher suggests that there are no buttercups in field B because of poor water drainage from the field.

Describe what further experiment the students could do to investigate this suggestion.

(3)

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(Total for Question 6 = 9 marks)

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7 As an embryo develops, its cells differentiate.

(a) Explain the importance of cell differentiation in the development of the growing embryo.

(2)

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(b) (i) Which of these is a feature of adult stem cells?

(1)

☒ **A** they do not divide

☒ **B** they divide by meiosis

☒ **C** they can become all cell types

☒ **D** they are found in some tissues and organs

(ii) Adult stem cells or embryonic stem cells can be used in medical treatments.

Explain why the choice between these two types of stem cells can cause issues for doctors.

(2)

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(Total for Question 7 = 5 marks)

TOTAL FOR PAPER = 70 MARKS

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