



## Sixth Form Entrance 2018

### BIOLOGY

1 hour

**ANSWER ALL THE QUESTIONS ON THE PAPER**

You are advised to take note of the information and equations given at the start of each question.  
Use of a calculator is permitted.

Name (Capital Letters): .....

Present School: .....

1. Bacteria are found in a wide range of habitats including on humans.

(a) A student took a small sample of bacteria from her mouth and placed the sample on a sterile agar plate. The student then brushed her teeth with toothpaste. She then took another sample from a different part of her mouth and placed it on a second sterile agar plate.

24 hours later, she repeated the experiment but used a different toothpaste. She repeated this four times.

Each agar plate was left for two days and then the diameter of the colony of bacteria was measured and recorded.

The table shows her results.

Condition	Mean diameter of bacterial colony after two days in mm			
	Toothpaste A	Toothpaste B	Toothpaste C	Toothpaste D
Before brushing	4.5	4.4	4.6	4.4
After brushing	2.2	1.5	1.6	1.8

(a) (i) State which toothpaste appears to be the best at reducing bacterial numbers in the mouth. Give a reason for your answer.

(2)

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(a) (ii) Using the table, what evidence is there that shows the student was consistent in the way she removed bacteria from her mouth?

(1)

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(a) (iii) Suggest two variables, other than the way she removed bacteria from her mouth, that she needed to keep constant.

(2)

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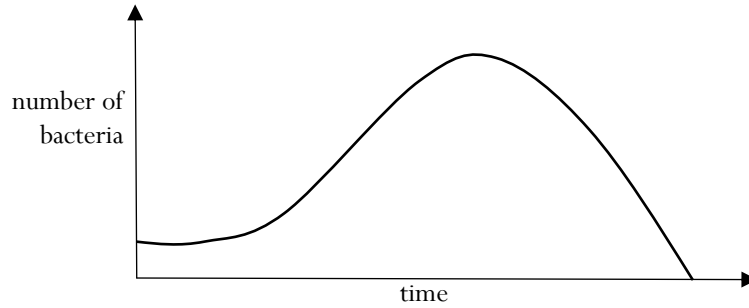
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(b) A species of bacterium has been found that breaks down oil. A sample of these bacteria was placed on some oil and the numbers of bacteria present was estimated each day for three weeks.

The graph below shows the results.



Using the graph, explain the change in numbers of these bacteria.

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(Total for Question 1 = 8 marks)

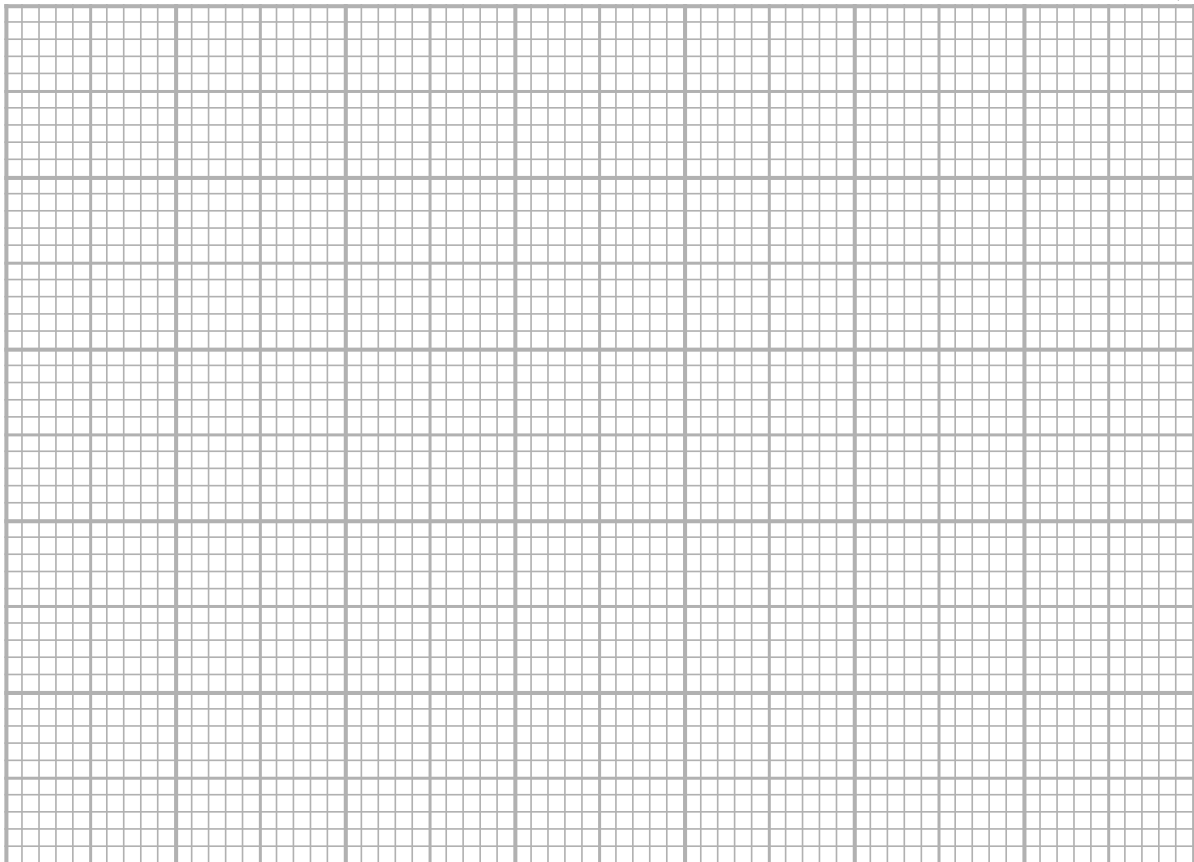
2. In a survey, people of different ages were asked if they thought that animal cloning is a good idea or a bad idea.

The table shows the results of the survey.

Age group	Percentage (%) of age group	
	Good idea	Bad idea
under 24	10.6	89.4
25 to 34	14.2	85.8
35 to 44	13.8	86.2
45 to 54	15.0	85.0
over 55	23.5	76.5

(a) Plot a bar graph to show the data in the table.

(5)



(b) Describe the relationship between age and what people think about animal cloning. (1)

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(c) In the 45 to 54 age group, 18 people think that cloning is a good idea.  
Calculate the total number of people surveyed in this age group. Show your working. (2)

total number of people = .....

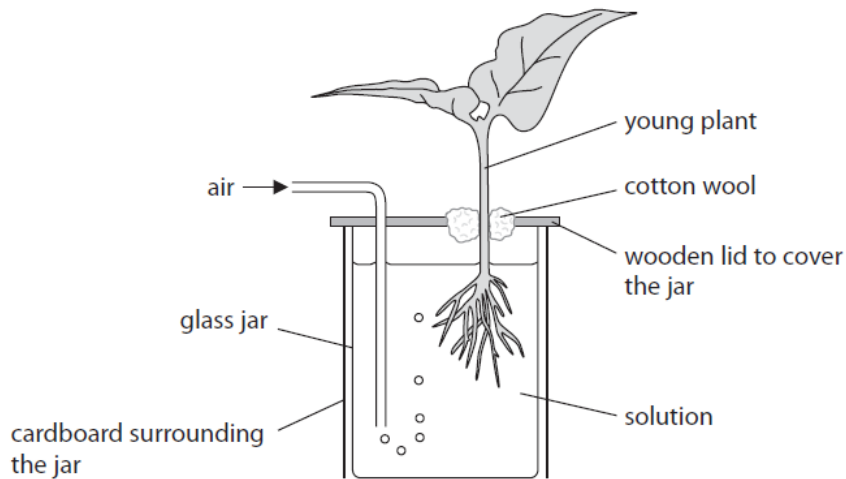
(d) When animals are cloned, they are genetically identical to each other. Suggest two reasons why cloning cows may be a good idea. (2)

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**(Total for Question 2 = 10 marks)**

Exam continues on the next page

3. A student uses this apparatus to investigate the effect of nitrate ions on the growth of plants.



- A young plant is grown in a sterile solution containing all the mineral ions needed for growth.
- The student repeats the experiment with other young plants.
- The student also carries out the experiment with young plants grown in a sterile solution that contains all the mineral ions except nitrate.
- The student measures the length of the stem of each plant every five days.

Some of the student's results are shown in the table.

Time in days	Mean (average) length of stem in mm	
	Solution containing all mineral ions	Solution without nitrate ions
0	23	23
5	30	25
15	45	30
25	98	38
35	145	38
45	160	37
55	163	37

(a) Describe the growth of plants in each solution.

(2)

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(b) Suggest why young plants absorb more mineral ions when air is bubbled through the solutions. (3)

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(c) (i) Suggest why each solution is sterilized at the start of this investigation. (2)

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(c) (ii) Suggest why the glass jar is surrounded by cardboard during this investigation. (2)

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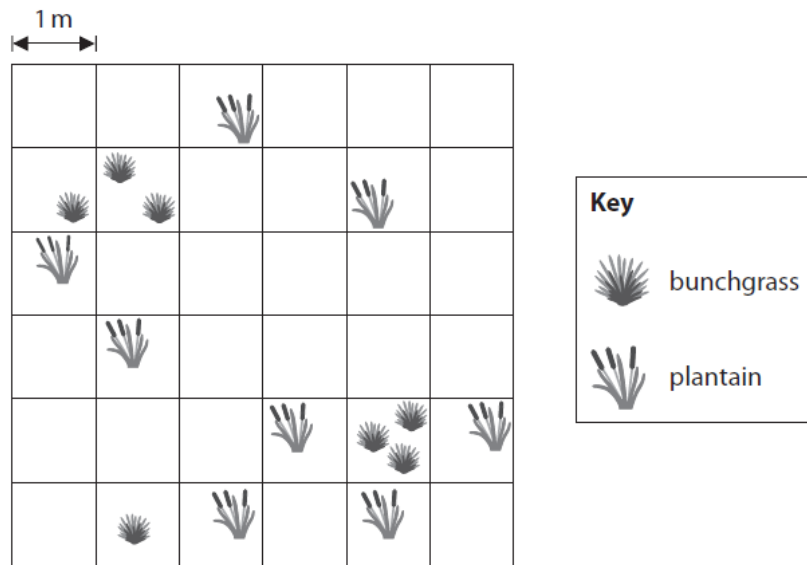
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(d) Identify the dependent variable in this investigation. (1)

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**(Total for Question 3 = 10 marks)**

4. The diagram shows the distribution of two plant species in a small area of a field.



A student uses a square metal frame to help count all the plants in the area.

(a) (i) The student counts the number of plants in all of the squares marked out in the field.

Complete the table to show the number of plants of each species and the mean (average) number of plants per  $\text{m}^2$ .

Species	Number of plants	Mean number of plants per $\text{m}^2$
bunchgrass	7	0.19
plantain		

(2)

(a) (ii) Frequency is another measure that can be used to study distribution.

Frequency is the number of squares that contain at least one plant of the species being counted. This value is expressed as a percentage of the total number of squares sampled.

Complete the table by giving the frequency and percentage of the total number of squares sampled for the bunchgrass.

Species	Frequency	Percentage (%)
bunchgrass		
plantain	8	22

(2)



(b) Suggest how the student could estimate the population size of plantain in a very large field.

(4)

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**(Total for Question 4 = 8 marks)**

5. A student carries out an experiment to investigate the effect of different concentrations of a food dye on diffusion.

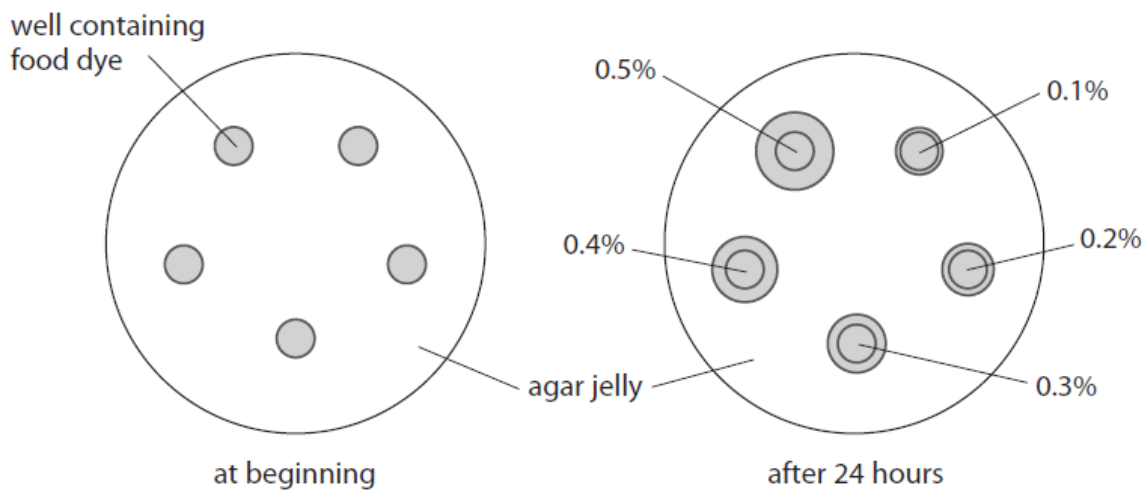
(a) Describe what is meant by the term diffusion.

(1)

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(b) The student adds a different concentration of coloured food dye to each of five wells (holes) in an agar plate.

The diagram shows the agar plate at the beginning of the experiment and after 24 hours.



The student does the experiment using three plates.

For each plate the student measures the diameter of each circle to see how far the food dye has diffused.

The table shows the results.

Concentration of food dye in well (%)	Diameter of circle in mm			
	plate 1	plate 2	plate 3	mean (average)
0.1	0.7	0.6	0.7	0.7
0.2	1.5	1.4	1.4	?
0.3	1.7	1.6	1.7	1.7
0.4	1.9	1.8	1.9	1.9
0.5	1.9	2.0	2.0	2.0

(b) (i) Calculate the mean diameter for the 0.2% concentration of food dye. (2)

mean diameter = ..... cm

(b) (ii) Describe the effect of food dye concentration on diffusion. (2)

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(b) (iii) Explain the relationship between food dye concentration and diffusion. (2)

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(c) State two variables that the student should control in this experiment to ensure that the results are valid. (2)

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**(Total for Question 5 = 9 marks)**

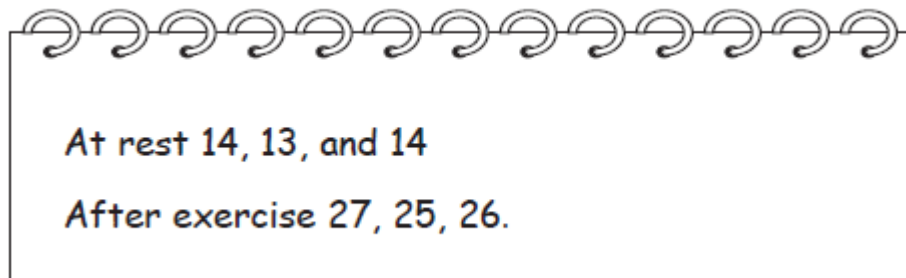
6. A group of students investigate the effect of exercise on breathing rate.

They measure their breathing rate at rest by counting breaths per minute.

They then exercise by running on the spot.

After exercise they measure their breathing rate again.

These are their results.



(a) Display these results in a table.

(2)

(b) Explain how the students could improve their investigation.

(2)

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(c) Suggest why an increased breathing rate occurs during exercise.

(3)

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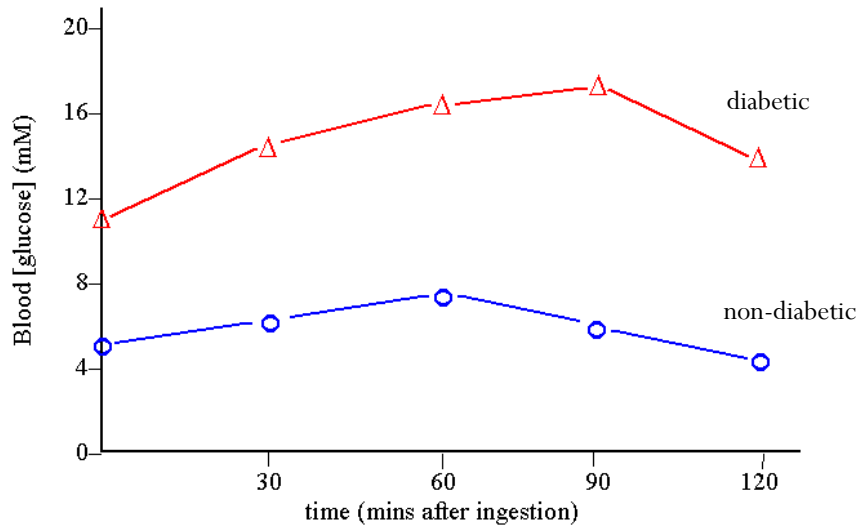
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**(Total for Question 6 = 7 marks)**

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7. The graph shows the blood sugar (glucose) level of a diabetic person and a non-diabetic person for two hours after ingestion (eating) of a sugary food.



(a) Compare the blood glucose of the non-diabetic person with the diabetic person over the first 90 minutes.

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(b) Suggest why the blood sugar level of the diabetic person changes between 90 minutes and 120 minutes.

(1)

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(c) Suggest why the blood glucose level for the non-diabetic person at 120 minutes is different to the level at the start of the investigation.

(1)

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(d) The table shows the expected percentage of people, in two different areas of Wales, with diabetes.

Area	Percentage of people expected to have diabetes	
	2010	2020
Hywel Dda	5.2	7.3
Powys	5.0	7.1

Suggest how the figures for 2020 have been calculated.

(1)

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(e) Give two functions of blood in the human body.

(2)

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(Total for Question 7 = 8 marks)

**END OF TEST**

**Total 60 marks**