DULWICH COLLEGE
FOUNDED 1619

Upper School Entrance Examination
Specimen Paper
Biology

Your Last Name	
Your First Name	
Current School	

Time Allowed: 45 minutes

Instructions

- Use black ink or ball point pen.
- **Fill in the boxes at the top of this page.**
- Answer all questions.
- Write your answers in the spaces provided in this booklet. If you run out of space, use the continuation pages at the back of the booklet, taking care to number the question(s) correctly.
- Show all 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 maximum mark for this paper is 45.
- The marks for questions are shown in brackets. Use this as to 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.

for examiners' use	
Question	**Marks**
1	***/ 9***
2	***/ 8***
3	***/ 15***
4	***/ 13***
Total	***/ 45***

Questions

Q1.

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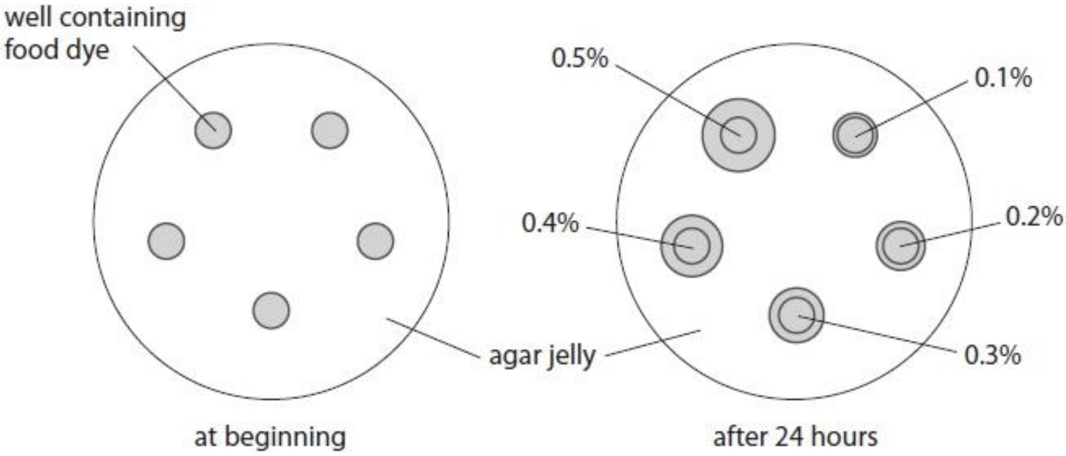
(b) The student adds a different concentration of coloured food dye to each of five wells in an agar plate.

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 he measures the diameter of each circle to see how far the food dye has diffused.
The table shows his results.

Concentration of food dye in well (%)	Diameter of circle in cm			
	plate 1	plate 2	plate 3	average (mean)
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

(i) Calculate the average diameter for 0.2% concentration of food dye.

(2)

average diameter = ... cm

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

(2)

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(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)

1 ....

2 ....

(Total for question = 9 marks)

Q2.

Multicellular organisms have a transport system for nutrients and waste products. In humans this transport system involves the blood.

(a) The table names some components of blood. Complete the table by giving the function of each component and its cell type.

(4)

Component of blood	Function	Cell type
platelet		cell fragment
phagocyte		white cell
lymphocyte		

(b) Suggest the consequence of having too few platelets in the blood.

(2)

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(c) Vaccination causes the body to produce memory cells.

Describe the advantages to the human body of producing memory cells.

(2)

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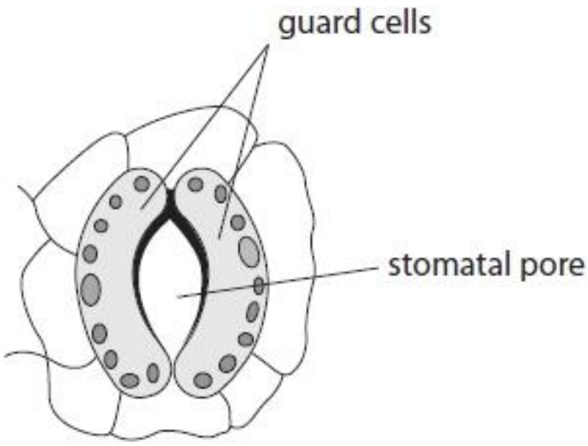
(Total for question = 8 marks)

Q3.

Stomata are pores found mainly on the underside of leaves.



(a) Explain the role of the stomata in

(i) transport in plants

(2)

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(ii) gas exchange in plants

(2)

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(b) An experiment is carried out to examine the effect of the size of stomatal pores on the rate of transpiration.

The data were collected in still air and in moving air.

Size of stomatal pore in μm	rate of transpiration in mg / m^2 / s	
	still air	moving air
0	0	0
4	22	38
8	46	140
12	48	165
16	50	210
20	50	248
24	50	264

(i) Plot a graph to show the effect of stomatal pore size on transpiration rate in still and moving air. Use a ruler to join your points with straight lines.

(6)

(ii) Use the graph to compare the effect of increasing stomatal pore size on transpiration rate in still and moving air.

(2)

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(iii) Explain the effect that moving air has on transpiration rate.

(3)

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(Total for question = 15 marks)

Q4.

(a) The diagram shows one strand of DNA from a section of a gene.

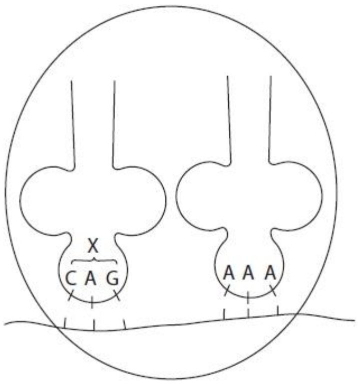
ATTCCGAGT

What would be the complementary sequence of bases on the messenger RNA produced from this strand of DNA?

(1)

- ☐ **A** TAAGGCTCA
- ☐ **B** ATTCCGAGT
- ☐ **C** UAAGGCUCA
- ☐ **D** AUUCCGAGU

(b) The diagram shows a stage during protein synthesis.



Which row gives the correct names for the stage of protein synthesis shown and the sequence of bases labelled X?

(1)

		Stage of protein synthesis	X
☐	**A**	transcription	anticodon
☐	**B**	transcription	codon
☐	**C**	translation	anticodon
☐	**D**	translation	codon

(c) Explain how a mutation in a gene can affect the phenotype of an organism.

(3)

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(d) In an accident at a nuclear power station, radioactive material was released into the surrounding areas of land.

Scientists investigated the impact of this on a species of butterfly.

(Source: septembersun.123rf.com/PAL)

Samples of adult butterflies were collected from an area near the power station two months after the release of the radioactive material.
The percentages of butterflies with abnormalities were calculated.
The butterflies were then mated in the laboratory and the percentage of offspring with abnormalities calculated.
The experiment was repeated with butterflies collected from the same area, 10 months after the release of the radioactive material.

(i) Describe how the scientists could have sampled the population of butterflies in the area.

(3)

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(ii) The results of the investigation are shown in the table.

Butterfly generation	Percentage of butterflies with abnormalities	
	two months after the accident	ten months after the accident
adult	12.4	28.1
offspring	18.3	60.2

The scientists concluded that the increased level of radioactivity has led to an increased rate of mutation of DNA.
Discuss the scientists' conclusion referring to data from the table to support your answer.

(5)

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(Total for question = 13 marks)