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Surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number | Candidate Number

Biology A (Salters Nuffield)

Advanced Subsidiary

Paper 1: Lifestyle, Transport, Genes and Health

Thursday 25 May 2017 – Afternoon

Time: 1 hour 30 minutes

Paper Reference **8BN0/01**

You must have:
Calculator, HB pencil, ruler

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.
- Show your working in any calculation questions and include units in your answer where appropriate.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You may use a scientific calculator.
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

Information

- The total mark for this paper is 80.
- 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.

Turn over ▶

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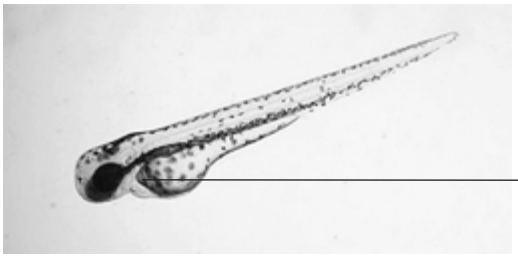
Pearson

Answer ALL questions.

Write your answers in the spaces provided.

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 ☒.

1 The photograph shows a young zebrafish that can be used to investigate the circulatory system. Zebrafish are vertebrates.



(a) The effect of caffeine on the heart rate of zebrafish was investigated.

A zebrafish was placed in water and observed using a microscope. The number of heartbeats in one minute was counted and the heart rate was recorded. This was repeated to give three measurements of heart rate.

The water was replaced with a caffeine solution and the heart rate was recorded. This was repeated to give three measurements of heart rate.

The results of the investigation are shown in the table.

Treatment	Heart rate / beats min^{-1}		
	Repeat 1	Repeat 2	Repeat 3
Water	124	120	112
Caffeine solution	184	172	156

(i) State **one** variable that should have been controlled in this investigation.

(1)

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(ii) Analyse the data to justify a conclusion for this investigation.

(2)

(iii) Explain the advantages of using young zebrafish for this investigation.

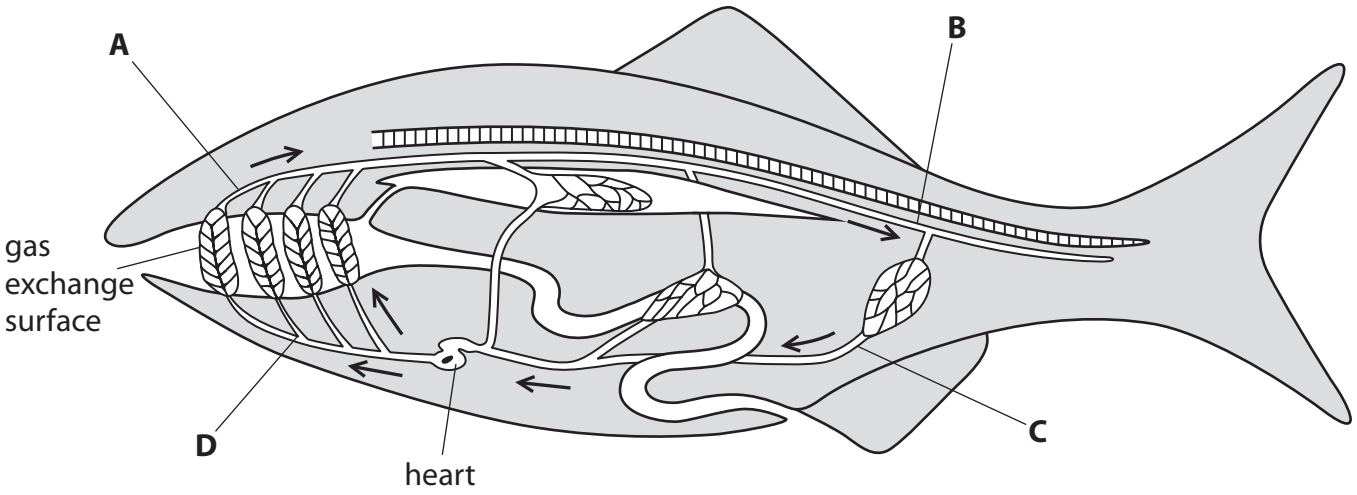
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(iv) Give **one** reason why a different ethical issue has to be considered when using zebrafish instead of *Daphnia* in this investigation.

(1)

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(b) The diagram shows the direction of blood flow in a fish.



(i) Which labelled part of this circulatory system has the lowest concentration of carbon dioxide?

(1)

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

(ii) Which labelled part of this circulatory system has the highest blood pressure?

(1)

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

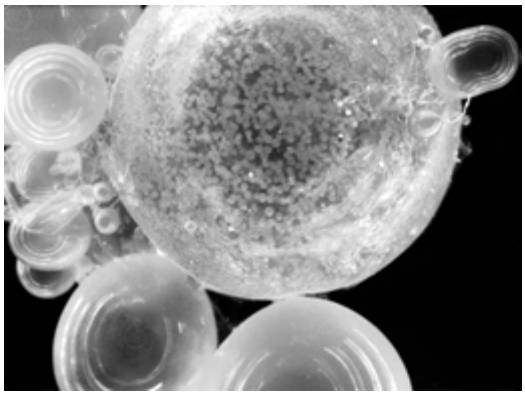
(Total for Question 1 = 8 marks)

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2 All organisms exchange gases with their environment.

(a) Sailor's eyeball (*Valonia ventricosa*) is a single-celled, spherical organism.

One of these organisms can have a diameter of 1 cm to 4 cm.



The table shows the diameter, surface area and volume of different *Valonia ventricosa* cells.

Diameter / cm	1	2	4
Surface area / cm²	3.14	12.57	50.27
Volume / cm³	0.52	4.19	

(i) The volume of a sphere can be calculated using the following equation.

$$V = \frac{4\pi r^3}{3}$$

What is the volume of a cell with a diameter of 4 cm?

(1)

☒ **A** 33.51 cm^2

☒ **B** 33.51 cm^3

☒ **C** 268.08 cm^2

☒ **D** 268.08 cm^3

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(ii) Describe why single-celled organisms, such as *Valonia ventricosa*, do not need a specialised gas exchange surface.

(2)

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(b) Mammalian lungs are adapted for rapid gas exchange.

Explain how the structure of the human lungs enables rapid gas exchange.

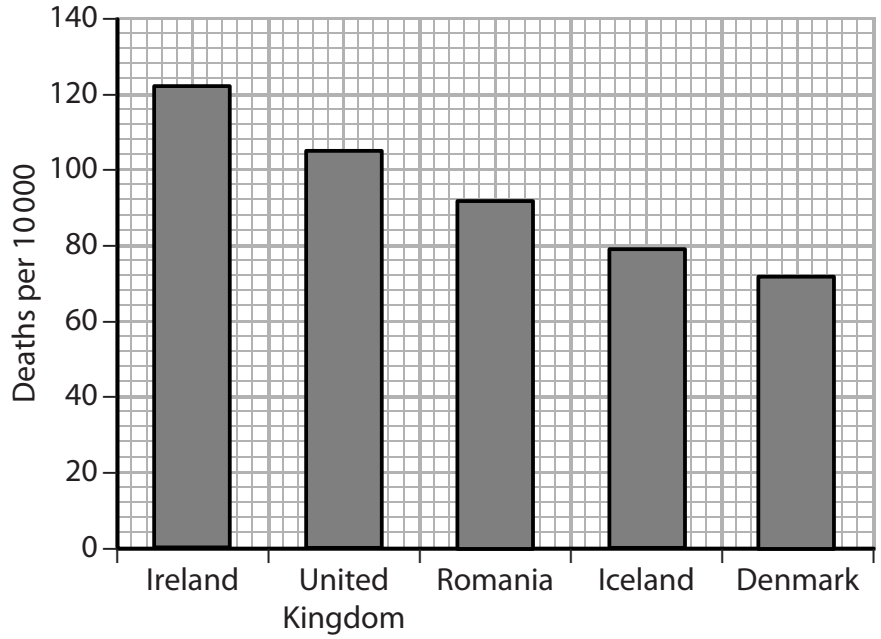
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(c) The graph shows the death rates due to diseases of the respiratory system in some countries.



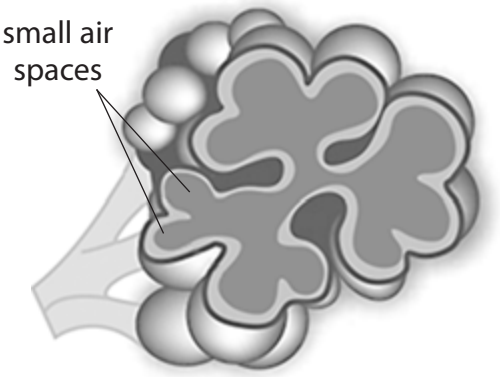
Calculate the probability of dying from a disease of the respiratory system in the United Kingdom.

(2)

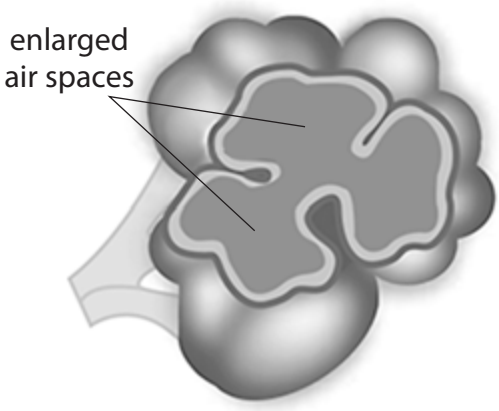
Answer .....

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(d) Emphysema is a disease of the respiratory system that affects the structure of the lungs.



Lung without emphysema



Lung with emphysema

Explain why people with emphysema are given air with a higher concentration of oxygen than atmospheric air.

(2)

(Total for Question 2 = 11 marks)

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3 Blood plasma contains glucose dissolved in water. Glucose is a polar molecule that is taken up by muscle cells and used in the synthesis of glycogen.

(a) Explain why water is a good solvent.

(2)

(b) Describe how glucose enters muscle cells through the cell membrane.

(2)

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(c) The ratio of glucose to glycogen inside a cell can affect the uptake of water by the cell. This results in a change in cell mass.

Cells with different ratios of glucose to glycogen were placed in tissue fluid and the percentage change in cell mass was recorded.

Ratio of glucose to glycogen	Percentage change in cell mass (%)
100:0	25.0
80:20	16.5
60:40	4.0
40:60	0.0
20:80	0.0

Analyse the data to explain the effect of these ratios on the percentage change in cell mass.

(3)

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(d) Glucose is used in the synthesis of glycogen in muscle cells.

(i) Describe the formation of glycogen from glucose.

(2)

(ii) Describe how the structure of glycogen is related to its function as a storage molecule.

(2)

(Total for Question 3 = 11 marks)

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4 Brilliant cresyl blue (BCB) can be used to stain red blood cells. When red blood cells are immersed in a solution of BCB, they take up all the stain and leave the surrounding solution colourless.

The effect of temperature on the uptake of BCB by red blood cells was investigated.

The table shows the results of the investigation.

Temperature / °C	Percentage of stained cells (%)	Colour of solution surrounding red blood cells
10	100	colourless
20	100	colourless
30	100	colourless
40	97	colourless
50	81	pale blue
60	17	blue

It was concluded that the cells were taking up the BCB stain by active transport.

(a) Which component of the cell surface membrane is involved in this process?

(1)

☒ **A** carrier protein

☒ **B** channel protein

☒ **C** cholesterol

☒ **D** glycolipid

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(b) Analyse the data to justify the conclusion of this investigation.

(3)

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(c) Explain **one** way in which this investigation could be improved.

(2)

(Total for Question 4 = 6 marks)

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5 The food we eat contains carbohydrates, lipids and proteins.

(a) Which of the following contains nitrogen atoms?

(1)

☒ **A** carbohydrate

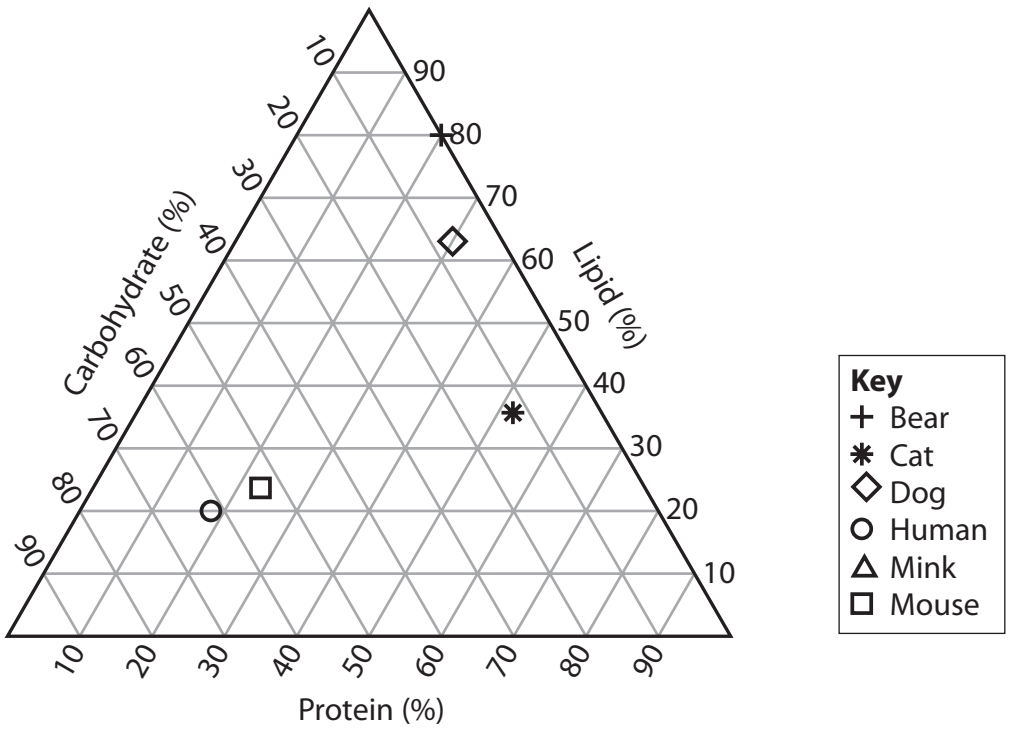
☒ **B** glycogen

☒ **C** lipid

☒ **D** protein

(b) Mammals have diets containing different proportions of carbohydrates, lipids and proteins.

The diagram shows the composition of the average diet of some mammals.



(i) The diet of a dog contains 6% carbohydrate, 64% lipid and 30% protein. This is shown on the diagram as a diamond.

The diet of a mink contains 15% carbohydrate, 50% lipid and 35% protein.

Plot this on the diagram.

(1)

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(ii) Which mammal will have a diet containing food with the highest proportion of ester bonds?

(1)

- ☒ **A** bear
- ☒ **B** cat
- ☒ **C** human
- ☒ **D** mouse

(c) Carbohydrates, lipids and proteins can be used as sources of energy.

The table shows the average daily energy requirements for boys and girls aged 13 to 18.

Age / years	Daily energy requirement / kJ	
	Boys	Girls
13	10 090	9292
14	10 989	9789
15	11 787	9990
16	12 389	10 090
17	12 886	10 291
18	13 187	10 291

(i) Calculate the percentage increase in the average daily energy requirements for boys aged 17 compared with their energy requirements aged 13.

(2)

Answer ..... %

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(ii) Many foods are labelled in kilocalories (kcal). One calorie is equal to 4.18 joules.

Which of the following is the average energy requirements for girls aged 13 in kilocalories (kcal)?

(1)

☒ **A** 2.223 kcal

☒ **B** 222.3 kcal

☒ **C** 2223 kcal

☒ **D** 2 223 000 kcal

(iii) State what will happen to the additional energy if an individual takes in more energy than is required.

(1)

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*(d) People with cystic fibrosis require a higher energy diet than people without cystic fibrosis. They are also more likely to develop problems in the pancreas.

Men with cystic fibrosis are less likely to be able to release sperm.

Discuss why a person with cystic fibrosis could have these symptoms.

(6)

(Total for Question 5 = 13 marks)

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6 Atherosclerosis is more likely to occur in arteries due to the higher blood pressure in these blood vessels.

(a) Explain how the structure of an artery wall is adapted both to withstand and to maintain high blood pressure.

(3)

(b) A person with very high blood pressure has an increased risk of developing atherosclerosis.

(i) Describe how very high blood pressure could result in atherosclerosis.

(3)

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(ii) Explain how atherosclerosis in one part of an artery could increase the likelihood of it developing in another part of the same artery.

(2)

(iii) A haemorrhagic stroke occurs when a blood vessel in the brain bursts.

Which of the following would be the least helpful in reducing damage from this type of stroke?

(1)

- ☒ **A** anticoagulant
- ☒ **B** antihypertensive
- ☒ **C** statins
- ☒ **D** thrombin

(Total for Question 6 = 9 marks)

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7 DNA is a polymer made from monomers called nucleotides.

(a) Describe how nucleotides join together to form DNA.

(2)

(b) Different theories for DNA replication have been suggested. Figure 1 illustrates two of these theories.

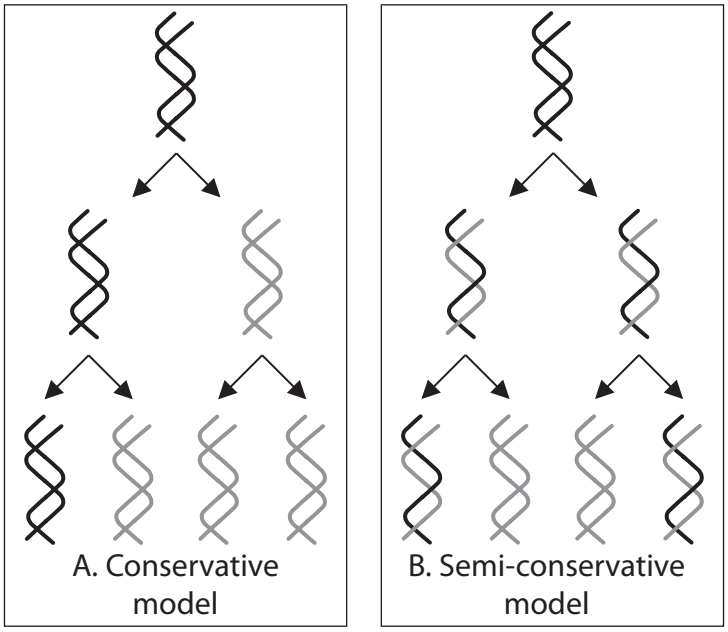


Figure 1

Meselson and Stahl carried out experiments to test these theories for DNA replication.

Figure 2 shows the results from one of their experiments.

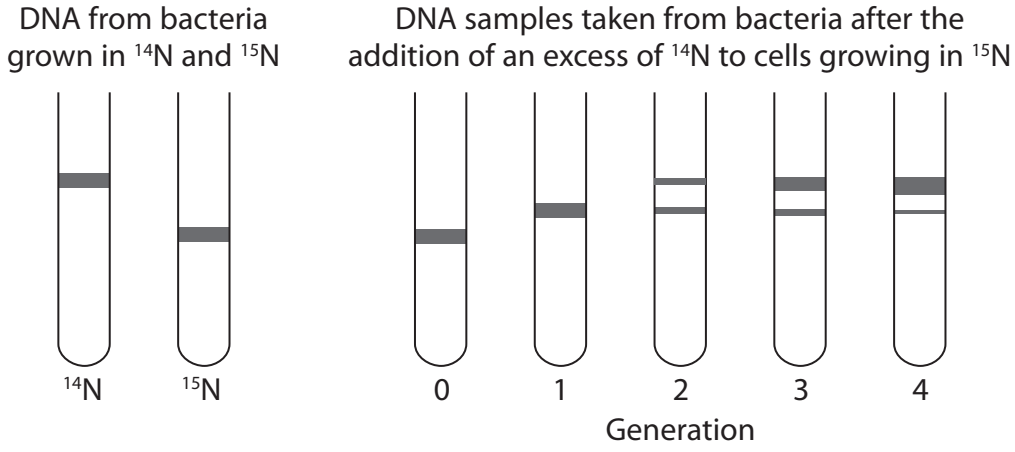


Figure 2

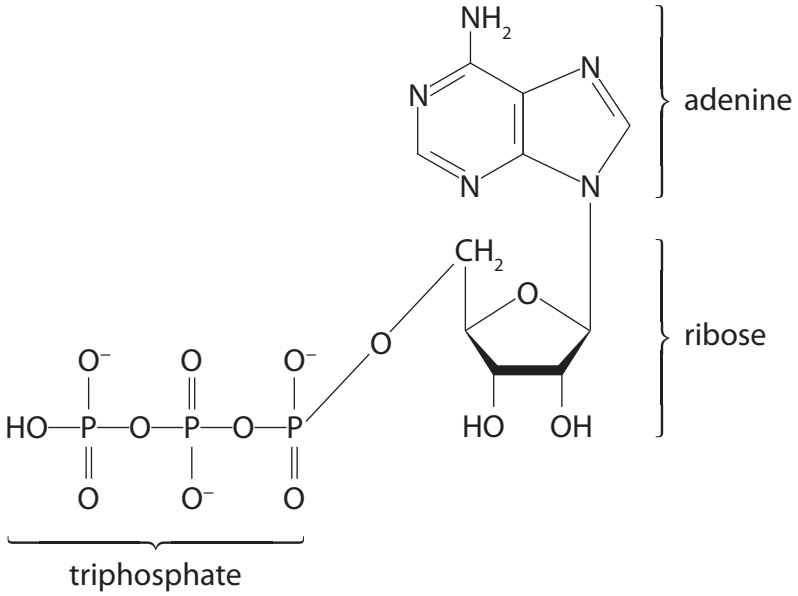
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Analyse the data to explain why Meselson and Stahl accepted one of the models for DNA replication and rejected the other.

(4)

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(c) The diagram shows the structure of ATP.



Compare and contrast the structure of ATP and a DNA nucleotide.

(3)

(Total for Question 7 = 9 marks)

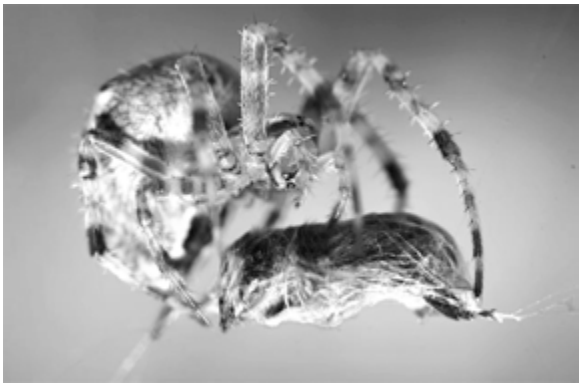
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8 Spiders inject a mixture of digestive enzymes into the body of their prey and feed on the products of this digestion.

The photograph shows a spider with its prey.



(a) State why enzymes are described as biological catalysts.

(1)

(b) One of the enzymes injected into the prey is called arazyme. Arazyme is a protease enzyme that can break down collagen.

(i) Compare and contrast the molecular structure of collagen and an enzyme such as arazyme.

(4)

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(ii) The hydrolysis of collagen results in a decrease in pH. The indicator phenolphthalein is pink at pH 8 and becomes colourless at lower pH values.

Devise an investigation to determine the effect of arazyme concentration on the rate of hydrolysis of collagen.

(4)

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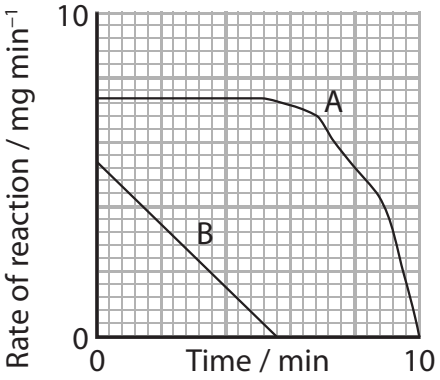
(c) The effect of substrate concentration on the rate of an enzyme reaction was investigated.

Two substrate solutions, A and B, were used. Solution A had a higher concentration than solution B. The optimum pH for the enzyme was pH 7.

The product lowered the pH of the solution.

The rate of reaction was determined at 1-minute intervals for 10 minutes.

The graph shows the results of this investigation.



It was concluded that the product reduces the activity of the enzyme.

Comment on the validity of this conclusion.

(4)

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

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