Write your name here

Surname	Other names

Centre Number | Candidate Number

Edexcel GCE

Biology

Advanced Subsidiary

Unit 1: Lifestyle, Transport, Genes and Health

Tuesday 12 January 2010 – Morning
Time: 1 hour 30 minutes

Paper Reference
6BI01/01

You do not need any other materials.

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.*

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.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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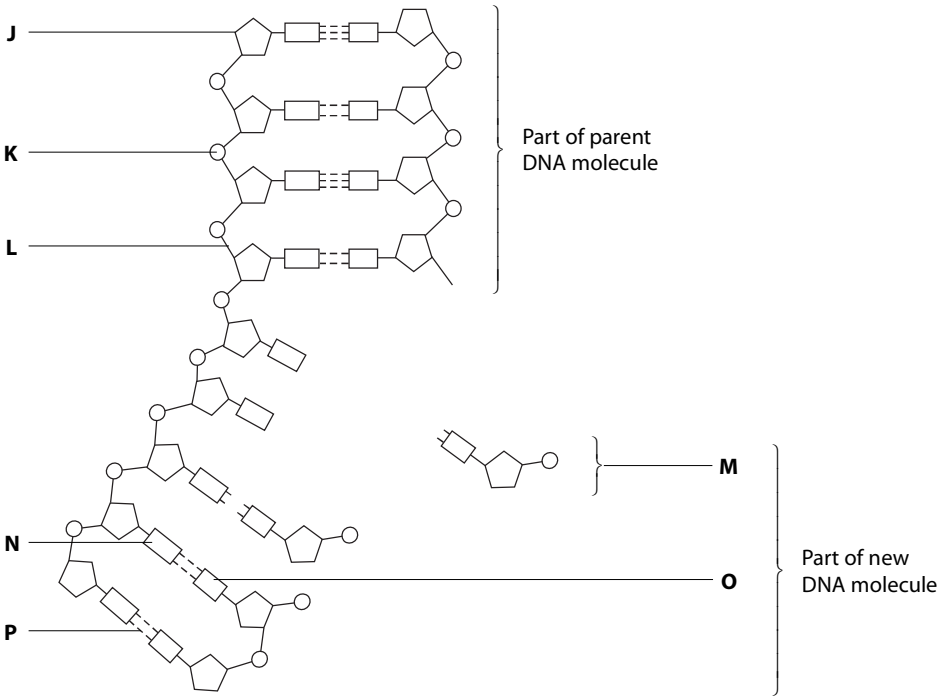
Answer ALL questions.

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 DNA is a very important molecule in living organisms as it carries the genetic code that controls all characteristics. When a cell divides, the DNA molecule replicates so that each resulting daughter cell is genetically identical to the original parent cell.

The diagram below shows part of this process of DNA replication.



For each of the statements below, put a cross in the box that corresponds to the correct statement about DNA structure or DNA replication.

(a) The structure labelled **J** is

(1)

- ☒ **A** ribose
- ☒ **B** α glucose
- ☒ **C** β glucose
- ☒ **D** deoxyribose

(b) The structure labelled **K** is a

(1)

- ☒ **A** phosphate group
- ☒ **B** phosphorus atom
- ☒ **C** sulphate group
- ☒ **D** potassium atom

(c) The bond labelled **L** is a

(1)

- ☒ **A** peptide bond
- ☒ **B** phosphodiester bond
- ☒ **C** hydrogen bond
- ☒ **D** glycosidic bond

(d) The structure labelled **M** is a

(1)

- ☒ **A** polynucleotide
- ☒ **B** mononucleotide
- ☒ **C** polypeptide
- ☒ **D** mononucleoside

(e) If the base labelled **N** on the parent DNA molecule is adenine, the base labelled **O** on the new DNA molecule is

(1)

- ☒ **A** uracil
- ☒ **B** guanine
- ☒ **C** thymine
- ☒ **D** cytosine

(f) The bond labelled **P** is a

(1)

- ☒ **A** peptide bond
- ☒ **B** phosphodiester bond
- ☒ **C** hydrogen bond
- ☒ **D** glycosidic bond

(Total for Question 1 = 6 marks)

2 Read through the following passage on protein synthesis, then write on the dotted lines the most appropriate word or words to complete the passage.

(6)

Protein synthesis involves two stages. The first stage is ..... and takes place in the nucleus of the cell. During this stage, a molecule called ..... is made using the antisense DNA strand as a template.

The second stage, known as ..... , takes place in the cytoplasm of the cell on structures called ..... . During this stage, ... molecules enable the amino acids attached to them to line up in the correct order. The amino acids are joined together by the formation of ..... bonds.

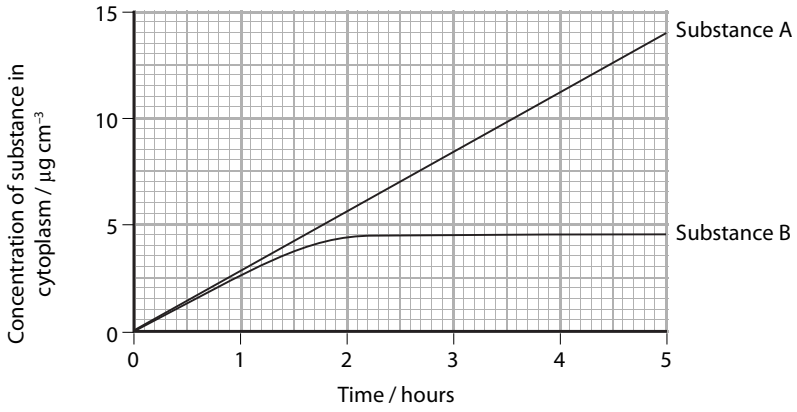
(Total for Question 2 = 6 marks)

3 *Amoeba* is a single-celled aquatic organism. Substances in the water can enter the cell by a variety of mechanisms.

An experiment was carried out to compare the uptake into *Amoeba* of substance A and substance B.

Some of these organisms were placed in a solution containing equal concentrations of both substances and kept at 25 °C. The concentration of substances A and B, in the cytoplasm of these organisms, was measured every 30 minutes over a period of 5 hours.

The results of this experiment are shown in the graph below.



(a) Using the information in the graph, compare the uptake of substance A with the uptake of substance B during this period of 5 hours.

(3)

*(b) Substance B enters the cells by diffusion. Describe and explain how the results of this experiment support this statement.

(4)

(c) Substance A enters the cells by active transport. Give **two** differences between active transport and diffusion.

(2)

1 .....

.....

2 .....

.....

(Total for Question 3 = 9 marks)

4 Many animals have hearts that pump blood through a network of blood vessels.

(a) The table below refers to blood flow in the four major blood vessels of the human heart. If the statement is correct, place a tick (✓) in the appropriate box and if the statement is incorrect, place a cross (✗) in the appropriate box.

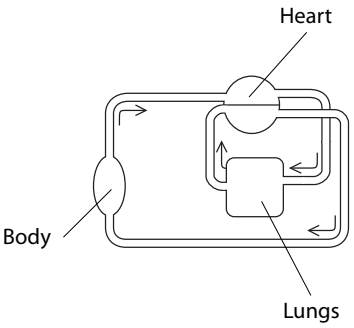
(4)

Name of blood vessel	Carries blood away from the heart	Carries oxygenated blood
Aorta		
Vena cava		
Pulmonary artery		
Pulmonary vein		

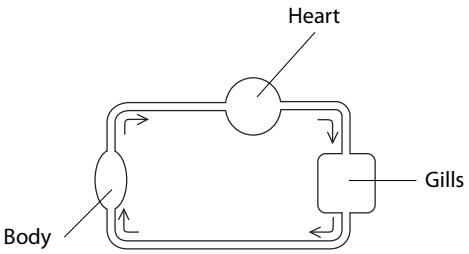
(b) Humans and fish are both animals that have a heart and a network of blood vessels. However, there are some differences in their circulatory systems.

The diagrams below illustrate a human circulatory system and the circulatory system in a fish.

Human circulatory system



Fish circulatory system



The arrows show the direction of blood flow.

(i) Using the information in the diagram, describe the circulation of blood in a fish.

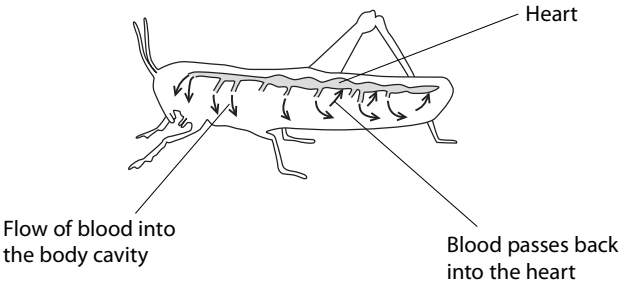
(3)

(ii) Using the information in both diagrams, suggest the advantages that the human circulatory system has compared with that of a fish.

(2)

(c) The heart of an insect is a long tube. It pumps blood into the body cavity so that blood surrounds the cells. The blood then passes back into the heart from the body cavity.

The diagram below illustrates the circulatory system of an insect.



Suggest why the insect does not need blood vessels to transport its blood around the body.

(2)

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.....

(Total for Question 4 = 11 marks)

5 There are many venomous (poisonous) snakes in the world. Many of the venoms from these snakes affect the blood clotting process.

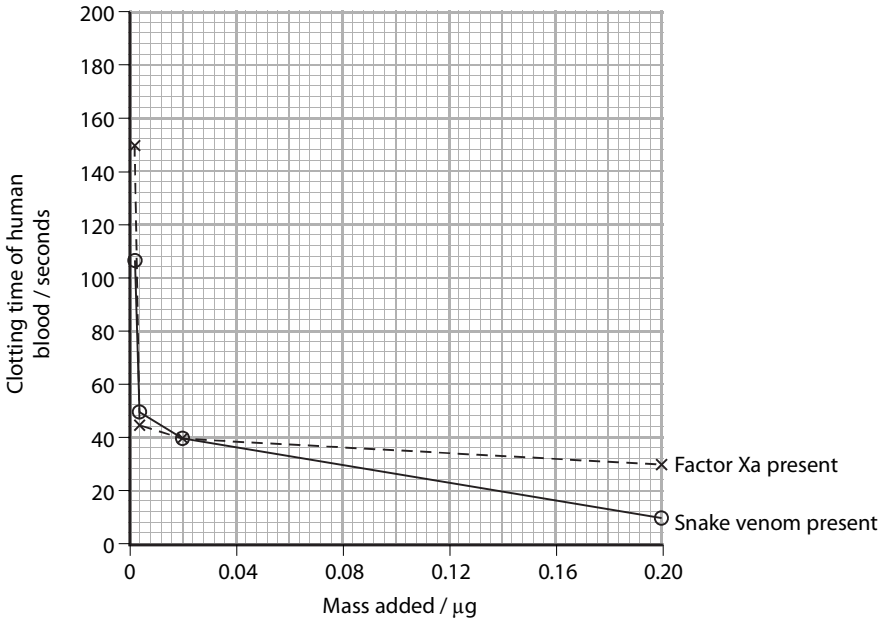
*(a) Describe the blood clotting process.

(4)

(b) Factor Xa is a clotting factor present in human blood.

An experiment was carried out to investigate the time taken for human blood to clot in the presence of different masses of Factor Xa. The experiment was repeated using snake venom in place of Factor Xa.

The graph below shows the results of these experiments.



(i) Using the information in the graph, describe the effect of the snake venom on the clotting time of human blood.

(3)

(ii) Suggest why the clotting time of the human blood with snake venom added was compared with the clotting time in the presence of Factor Xa.

(1)

(c) The component of the snake venom that affects blood clotting is an enzyme.

(i) Describe the structure of an enzyme.

(3)

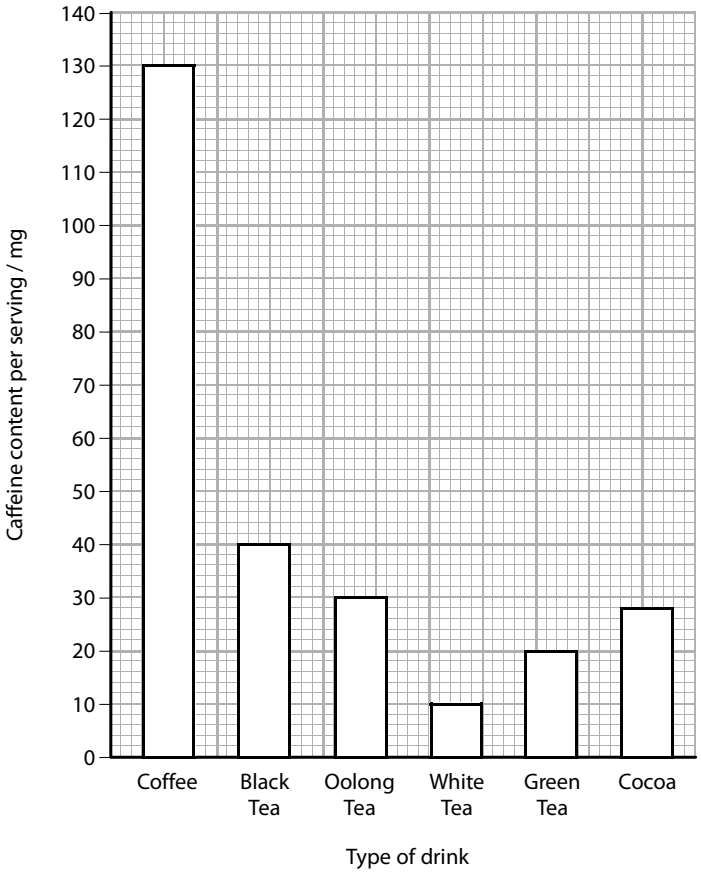
(ii) Suggest how the enzyme in the snake venom could be involved in the blood clotting process.

(2)

(Total for Question 5 = 13 marks)

6 A number of different drinks contain the drug caffeine. These drinks may be consumed to increase mental alertness. Caffeine also increases the heart rate and can interrupt sleep in some people.

A student found that certain drinks affected her sleep, so she carried out some research into the caffeine content of these drinks. The graph below shows the caffeine content of the drinks that the student researched.



(a) Using the information in the graph, describe the conclusions that the student could make about the caffeine content of these drinks.

(3)

(b) A friend of the student suggested that herbal tea might have a lower caffeine content than these drinks. The student decided to use *Daphnia* to compare the caffeine content of herbal tea with the caffeine content of these other drinks.

(i) Describe an experiment that the student could perform, using *Daphnia*, to confirm that herbal tea has the lowest caffeine content.

(4)

(ii) The friend did not agree with using *Daphnia* in this experiment. Give **one** ethical reason for the use of invertebrates and **one** ethical reason against the use of invertebrates in experiments of this type.

(2)

Reason for the use of invertebrates .....

.....

.....

.....

Reason against the use of invertebrates .....

.....

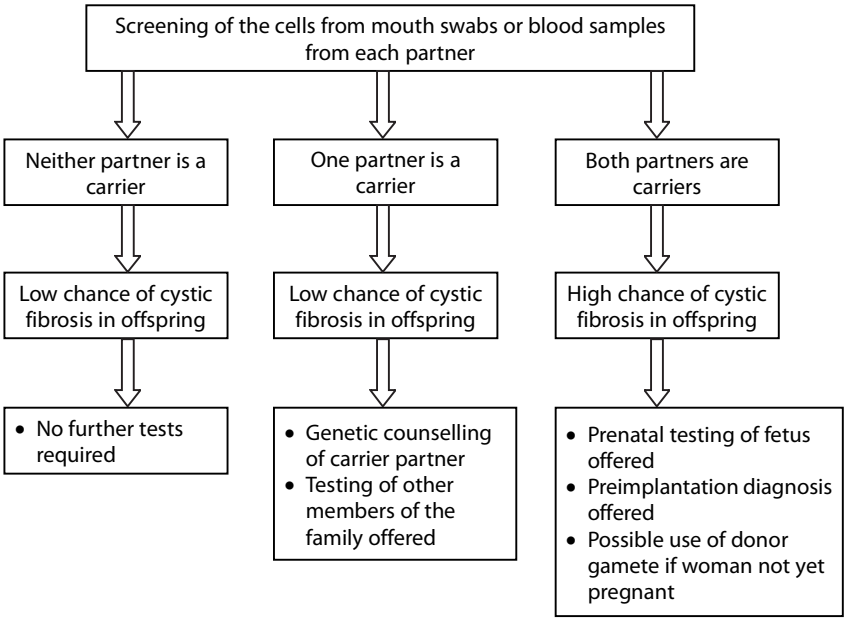
.....

.....

(Total for Question 6 = 9 marks)

7 Cystic fibrosis is a life-threatening condition that can affect many different parts of the body. It is a recessive genetic trait. Genetic screening can be used to test for the presence of recessive alleles. A person found to possess a recessive allele is called a carrier.

The diagram below illustrates a risk analysis following the screening for recessive alleles of a couple, who are planning a pregnancy.



(a) Suggest why cells from mouth swabs or blood samples are used rather than gametes.

(2)

(b) Explain why it is necessary to test for several different recessive alleles in the screening for cystic fibrosis.

(2)

(c) In the risk analysis shown, if neither partner is a carrier then it is considered that the chance of having a child with cystic fibrosis is low. Explain why the probability of having a child with cystic fibrosis is low and **not** zero.

(2)

(d) In the risk analysis shown, if one of the partners is found to be a carrier then screening for cystic fibrosis may be offered to other family members. Explain why this screening is offered to other family members.

(2)

(e) Using your knowledge of monohybrid crosses, calculate the probability of having a child with cystic fibrosis if both partners are found to be carriers. Draw a genetic diagram to explain how you calculated this probability.

(5)

Answer .....

(Total for Question 7 = 13 marks)

8 Obesity is a significant problem in western countries and an increasing problem in other parts of the world. An obese person has a greater risk of developing heart disease.

Body Mass Index (BMI) is one measure used to help decide if a person's weight is reasonable for their height. The BMI can be calculated by dividing mass in kilograms by height in metres squared. A table is then used to judge if the BMI is reasonable or not. A copy of this table is shown below.

BMI range	Less than 18.5	18.5 to 24.9	25.0 to 29.9	30.0 to 39.9	40.0 or above
Description	Underweight	Healthy weight	Overweight	Obese	Morbidly obese

(a) A man was concerned that he was overweight and could be at risk from coronary heart disease. He was 1.8 m tall and had a mass of 83.0 kg.

(i) Calculate this man's body mass index (BMI) using the formula below.

$$\text{BMI} = \frac{\text{mass in kilogrammes}}{(\text{height in metres})^2}$$

(2)

Answer .....

(ii) Using the information in the table, interpret this man's BMI.

(2)

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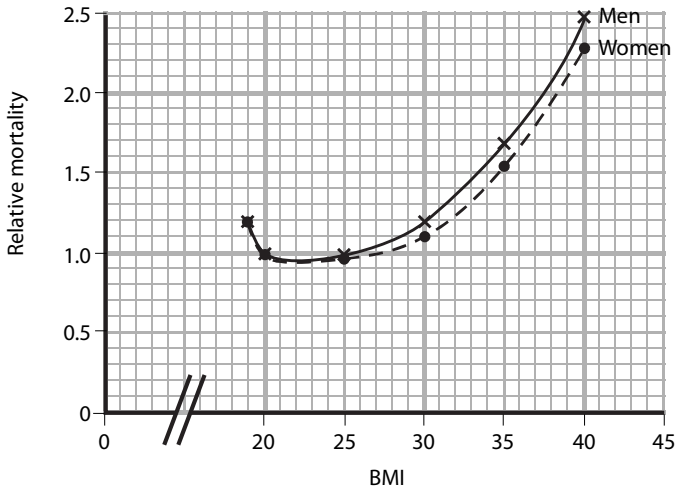
.....

(b) The graph below shows one analysis of relative mortality compared with BMI, for men and women.



Compare the effect of BMI on relative mortality for men and women.

(3)

(c) (i) A relative mortality of 1.2 or less indicates a low risk of dying. Using the information given, discuss whether or not a woman with a BMI of 32.5 should be concerned about her risk of dying.

(2)

*(ii) Cardiovascular disease (CVD) is responsible for many deaths.

Describe two changes that this woman may be able to make to her lifestyle, to reduce her risk of dying from CVD. Explain how each change would reduce the risk.

(4)

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

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