THIS IS A NEW SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

BIOLOGY

Molecules, Biodiversity, Food and Health

F212

OCE/13818

Candidates answer on the Question Paper

OCR Supplied Materials:
- Insert (inserted)

Other Materials Required:
- Electronic calculator
- Ruler (cm/mm)

Tuesday 12 January 2010
Morning

Duration: 1 hour 45 minutes

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **100**.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- Where you see this icon you will be awarded a mark for the quality of written communication in your answer.
- This document consists of **28** pages. Any blank pages are indicated.

Answer **all** the questions.

1 **(a)** A balanced diet is essential for good health.

Complete the following passage by using the most appropriate terms from the list to fill the gaps.

Each term **should not** be used more than once.

haemoglobin **iron** **collagen** **obese**

calcium **anorexic** **sodium**

A balanced diet is one which provides an adequate intake of energy and nutrients for the maintenance of our body. If energy intake exceeds energy usage over a period of time, an individual can become ……..... .

The deficiency disease anaemia can be caused by a lack of the mineral ……..... in the diet. As a result of this deficiency, the body is unable to produce sufficient amounts of the protein ……..... in red blood cells. **[3]**

(b) The Body Mass Index (BMI) is one way of determining whether a person is underweight or overweight.

BMI can be calculated using the formula:

$$\text{BMI} = \frac{\text{mass in kg}}{(\text{height in m})^2}$$

Calculate the BMI of a female of mass 69 kg and a height of 1.67 m.

Show your working. Give your answer to **one decimal place**.

Answer = ... **[2]**

(c) Another way of determining whether a person is underweight or overweight is to use a graph showing the relationship between height and body mass.

Fig. 1.1 is an example of this type of graph.

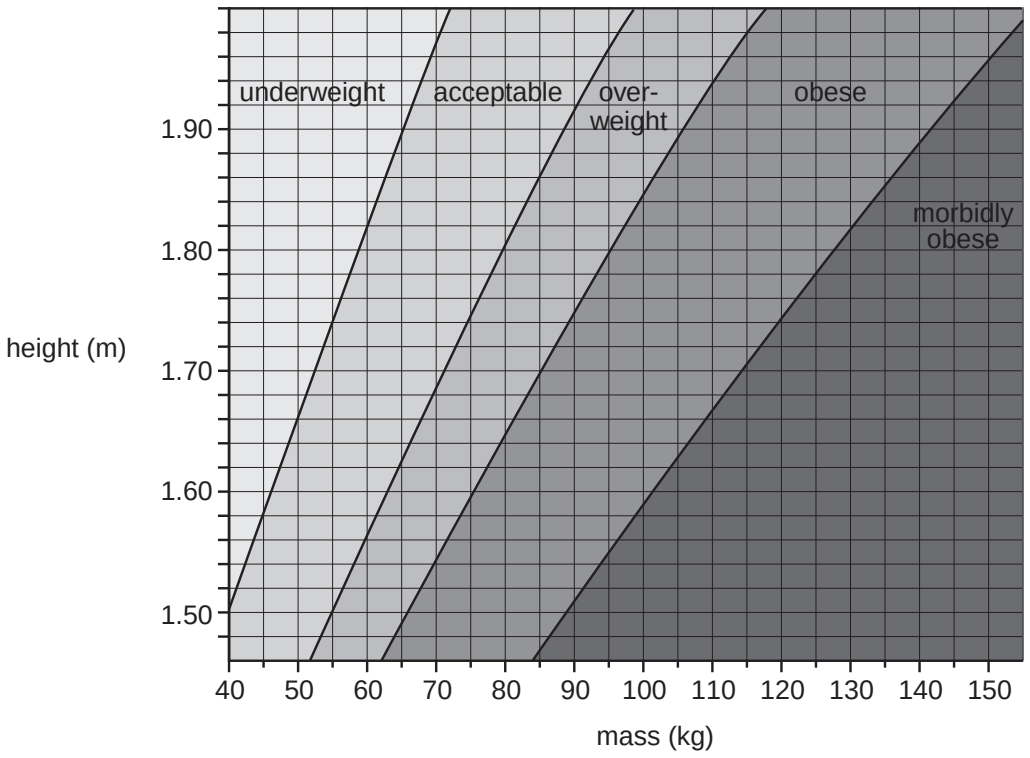

Fig. 1.1

(i) Using Fig. 1.1, state the category into which a female who has a body mass of 69 kg and a height of 1.67 m is placed.

..... **[1]**

(ii) There are many factors that determine the category into which a person is placed. Fig. 1.1 does not take into account all of these factors.

Suggest why the female in **(c)(i)** might be placed in the wrong category.

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..... **[2]**

(d) Name **two** diseases associated with obesity.

1 .....

2 ..... **[2]**

[Total: 10]

2 Fig. 2.1 represents a water molecule.

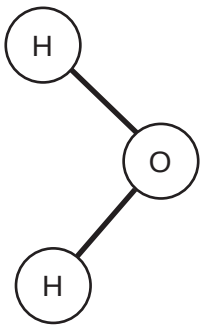

Fig. 2.1

(a) Water molecules are polar. As a result, they attract each other.

Draw a second water molecule on Fig. 2.1.

Your drawing should show:

- the bond(s) between the two molecules
- the name of the bond
- the charges on each atom. **[3]**

(b) Ponds provide a very stable environment for aquatic organisms.

Three properties of water that contribute to this stability are as follows:

- the density of water decreases as the temperature falls below 4 °C so ice floats on the top of the pond
- it acts as a solvent for ions such as nitrates (NO_3^-)
- a large quantity of energy is required to raise the temperature of water by 1 °C.

Explain how these three properties help organisms survive in the pond.

In your answer you should make clear the links between the behaviour of the water molecules and the survival of the organisms.

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..... **[8]**

(c) Water is important in many biological reactions.

Complete Table 2.1 by writing an appropriate term next to each description.

Table 2.1

description	term
the type of reaction that occurs when water is added to break a bond in a molecule	
the phosphate group of a phospholipid that readily attracts water molecules	

[2]

[Total: 13]

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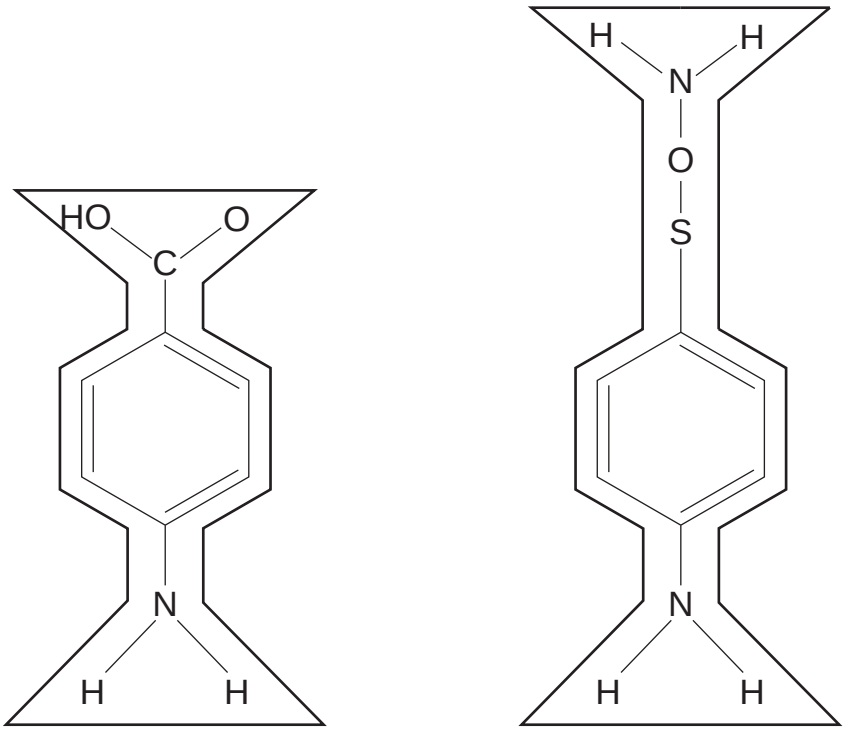
3 **(a)** The enzyme DHPS is involved in the production of folic acid in bacteria.

- The substrate for DHPS is a molecule known as PABA.
- The enzyme DHPS is inhibited by the drug sulfonamide.

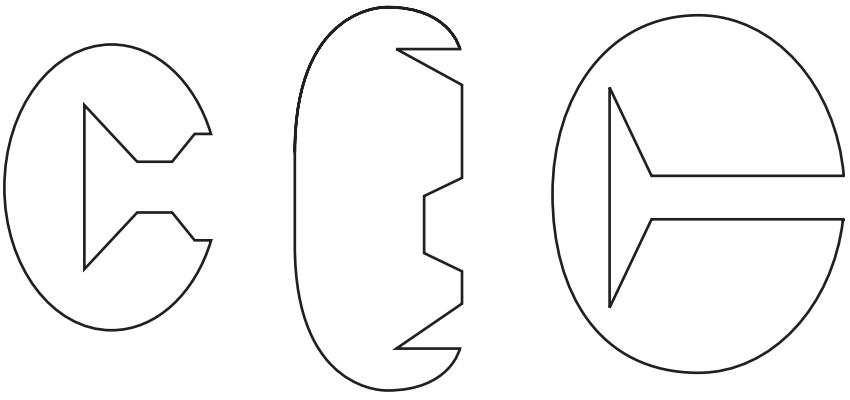
Fig. 3.1 shows the structure of PABA and that of sulfonamide.



PABA **sulfonamide**

Fig. 3.1

(i) Diagrams **X**, **Y** and **Z** represent these enzyme molecules and their active sites.



X **Y** **Z**

State the letter, **X**, **Y** or **Z**, that most accurately represents the enzyme DHPS.

..... **[1]**

(ii) Using the information in Fig. 3.1, explain why sulfonamide acts as a competitive inhibitor of DHPS.

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..... **[3]**

QUESTION 3(b) STARTS ON PAGE 10

(b) Fig. 3.2 shows the effect of increasing the concentration of the substrate (PABA) on the rate of reaction.

- Curve **A** shows the rate of reaction without the presence of the competitive inhibitor sulfonamide.
- Curve **B** shows the rate of reaction in the presence of the competitive inhibitor sulfonamide.

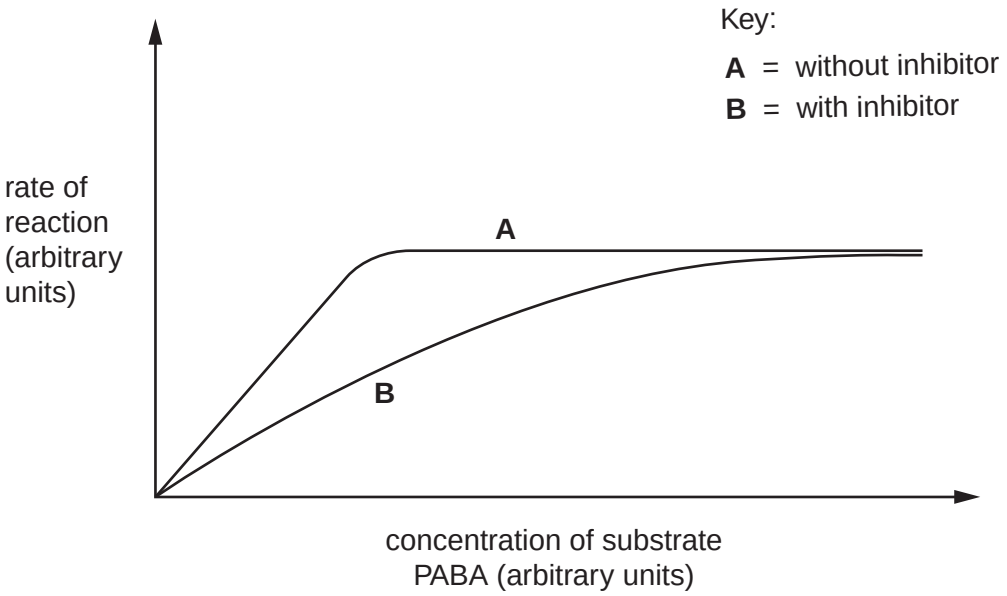

Fig. 3.2

Explain the effect of increasing the concentration of substrate on the rate of reaction;

(i) without inhibitor,

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..... **[3]**

(ii) with inhibitor.

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..... **[2]**

(c) Antibiotic resistance in bacteria is becoming an increasing problem.

Describe how a sulfonamide-resistant population of bacteria could develop.

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..... **[4]**

QUESTION 3(d) STARTS ON PAGE 12

(d) Hospitals can check to see if a strain of bacteria causing an infection is resistant to a range of antibiotics by using a **multodisc**. A multodisc contains different antibiotics.

- The bacteria are isolated from a patient.
- The bacteria are spread on nutrient agar in a Petri dish.
- The multodisc is placed on the agar.

Fig. 3.3 shows a Petri dish with the bacteria, in which is placed a multodisc containing six different antibiotics.

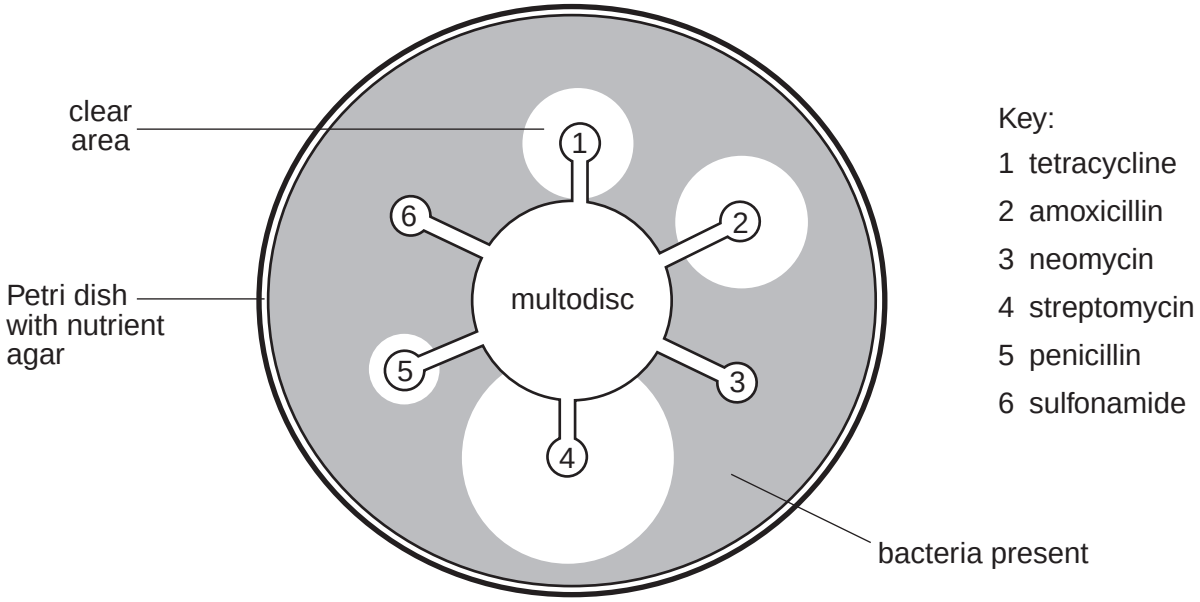

Fig. 3.3

(i) Explain why there are clear areas of agar in the Petri dish.

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..... **[1]**

(ii) Using Fig. 3.3, name the antibiotic that is most effective against the bacteria causing the infection.

..... **[1]**

(iii) Suggest **three** reasons why a hospital might use a multodisc to select the most suitable antibiotic for treating a patient.

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..... **[3]**

(e) Drugs, such as antibiotics, are often first discovered in the natural environment.

Explain why it may become increasingly difficult to discover new drugs in the future.

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[Total: 20]

4 **(a)** Amino acids are the basic building blocks for proteins. Fig. 4.1 shows the amino acid cysteine.

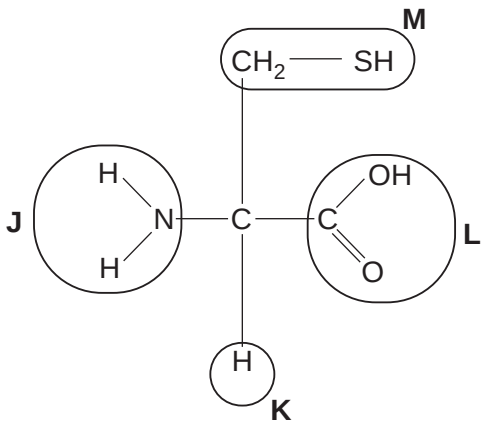

Fig. 4.1

(i) Complete the table by selecting the letter, **J**, **K**, **L** or **M**, that represents the following groups in cysteine.

group	letter
carboxyl	
R group	
amine group	

[3]

(ii) The primary structure of a protein consists of a chain of amino acids.

Describe how a second amino acid would bond to cysteine in forming the primary structure of a protein.

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..... **[3]**

(b) Each amino acid has a different R group.

Describe how these R groups can interact to determine the **tertiary** structure of a protein.

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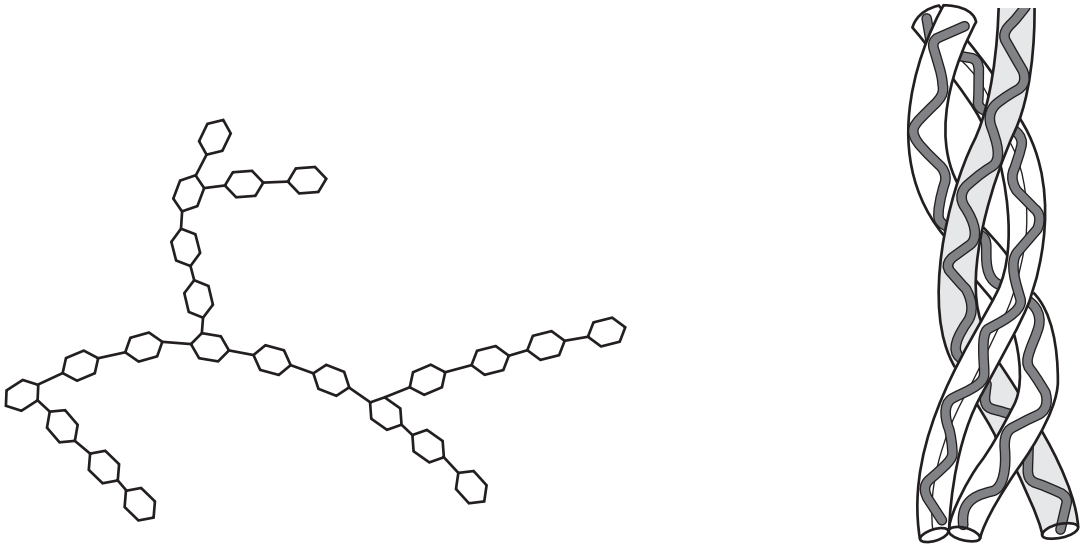
..... **[4]**

(c) Fig. 4.2 shows the structure of two polymers, glycogen and collagen, that are found in mammals.



glycogen collagen

Fig. 4.2

(i) Complete the table below to give three **differences** between the **structure** of glycogen and collagen.

glycogen	collagen

[3]

(ii) Collagen is found in the ligaments which hold bones together at joints.

State **two** properties of collagen that make it suitable for this purpose.

1 .....

2 ..... **[2]**

[Total: 15]

5 **(a)** Coronary heart disease (CHD) can be described as a multifactorial disease. This means that a number of different risk factors contribute to the development of the disease.

Fig. 5.1 shows the percentage of cases of CHD in a population to which each risk factor contributed.

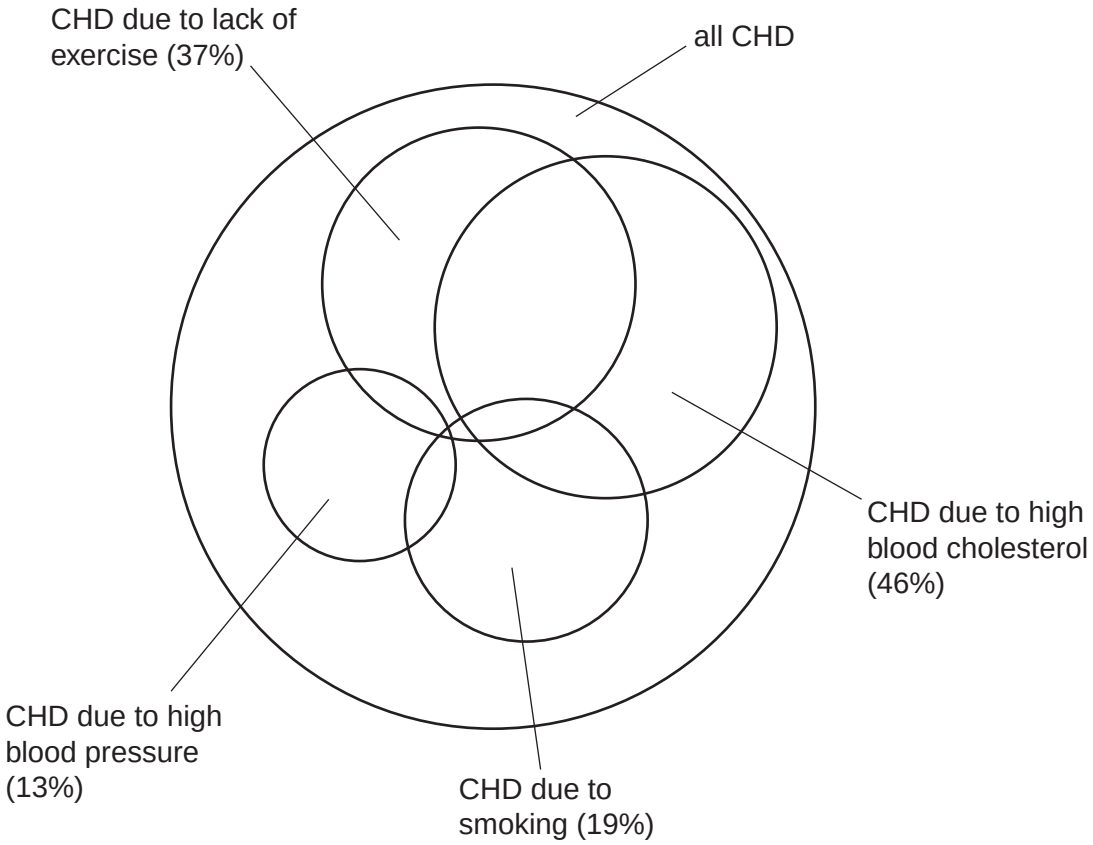


Fig. 5.1

(i) When you add up the different risk factor percentages for the population you find that it is greater than 100%.

Suggest why.

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..... **[1]**

(ii) State **two** further risk factors that are **not** shown in Fig. 5.1.

1 .....

2 ..... **[2]**

(iii) Smoking is a contributing factor in 19% of all cases of CHD.

Table 5.1 lists a number of effects of cigarette smoke.

Use a tick (✓) to indicate which component of cigarette smoke causes each effect.

The first row has been done for you.

Table 5.1

effect	nicotine	carbon monoxide
increases heart rate	✓	
constricts arterioles		
damages the lining of arteries		
reduces the ability of haemoglobin to carry oxygen		
makes platelets sticky		

[4]

(b) Cholesterol is transported in the form of lipoproteins. High levels of low density lipoproteins (LDLs) in the blood are a risk factor in heart disease.

Outline the role of LDLs in the formation of an atheroma.

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..... **[2]**

(c) An atheroma can grow to a point where it restricts blood flow in a coronary artery, causing coronary heart disease (CHD).

Fig 5.2 shows a method of reducing the symptoms of CHD.

A stent is a tubular device, containing a 'balloon', which can be inserted into the damaged artery. The stent can be opened up by inflating the balloon.

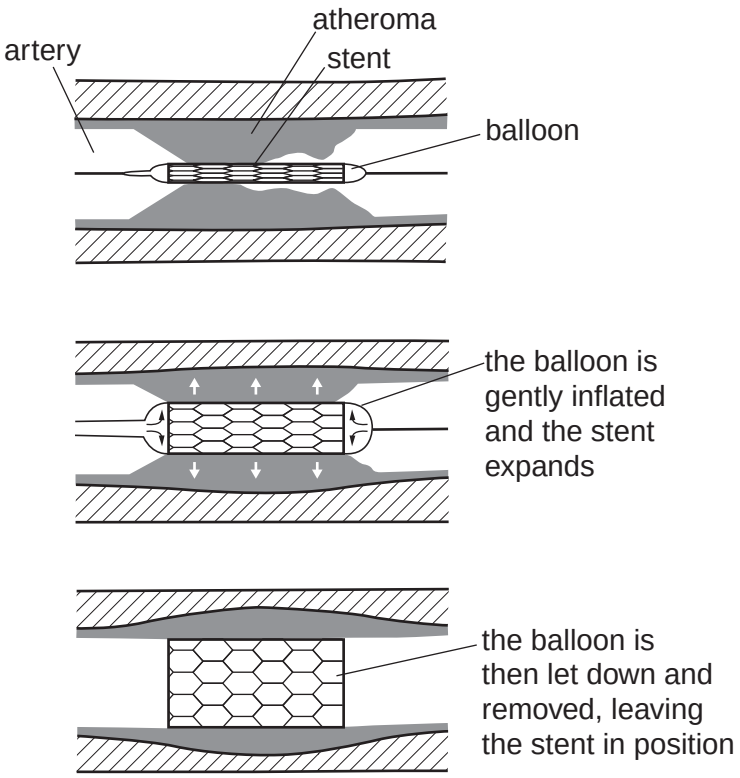

Fig. 5.2

Explain how the inserted stent would reduce the symptoms of CHD.

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..... **[4]**

[Total: 13]

6 DNA and RNA are nucleic acids.

(a) (i) State the components of a **DNA** nucleotide.

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..... **[3]**

(ii) Describe how the structure of RNA differs from that of DNA.

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..... **[2]**

(b) Before a cell divides, the DNA needs to be accurately replicated.

Describe how a DNA molecule is replicated.

In your answer you should make clear how the steps in the process are sequenced.

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QUESTION 6(c) STARTS ON PAGE 22

Turn over

(c) (i) State what a gene codes for.

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..... **[1]**

(ii) Suggest how changing the sequence of DNA nucleotides could affect the final product the DNA codes for.

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..... **[2]**

[Total: 15]

7 Fig. 7.1, **on the insert**, shows a photograph of a part of a heathland habitat. A study was carried out on the biodiversity of this habitat.

(a) Define the terms:

habitat .....

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.....

biodiversity .....

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..... **[3]**

(b) In this study, a student placed his quadrat on areas he considered to have the most biodiversity.

Explain what is wrong with this technique.

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..... **[2]**

(c) The student looked at the abundance of three plants at different distances from the bottom of the slope.

The results table drawn by the student is shown below.

Table 7.1

distance from bottom of slope	percentage cover of each plant species		
	cotton grass	ling	bracken
0 m	76	0	0
10 m	68	0	0
20 m	0	2	0
30 m	0	35	0
40 m	0	50	0
50 m	0	60	7
60 m	0	40	17
70 m	0	10	42
80 m	0	0	68
90 m	0	0	71
100 m	0	0	74

(i) The format of the student's table is incorrect.

Suggest **one** way in which the student could correct the table.

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..... **[1]**

Fig. 7.2 is a graph showing the distribution of cotton grass and bracken at different distances from the bottom of the slope.

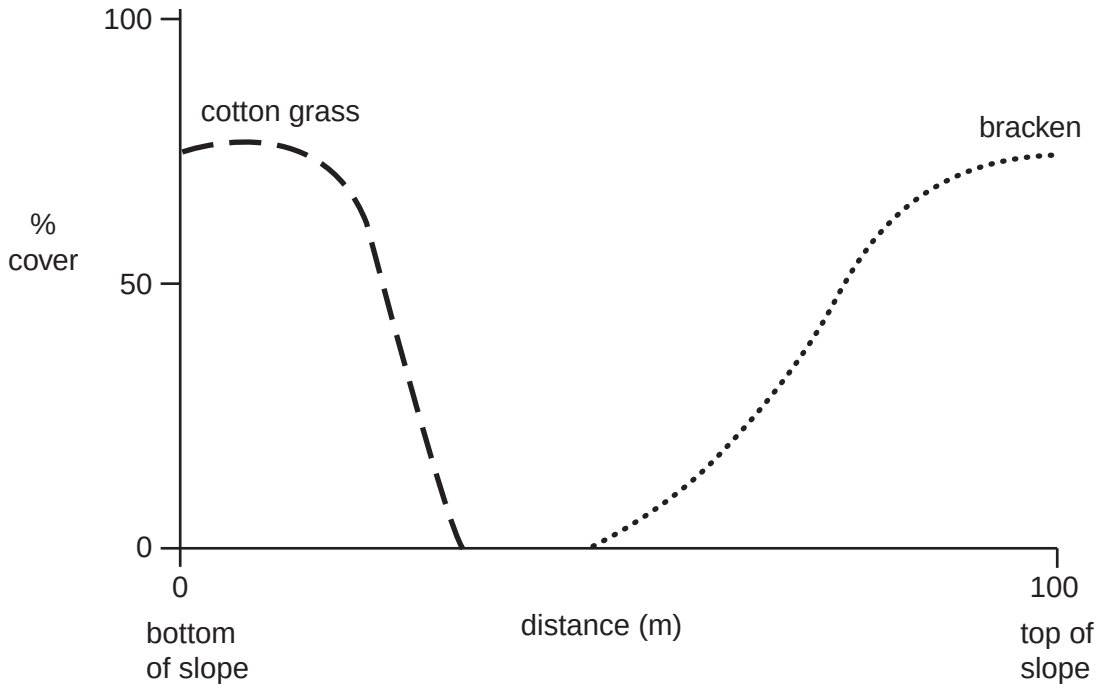

Fig. 7.2

(ii) Using the information in Table 7.1, **sketch on Fig. 7.2** a curve to show the distribution of **ling**. **[3]**

(iii) Describe the distribution of **bracken**.

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..... **[2]**

QUESTION 7(d)(i) STARTS ON PAGE 26

(d) (i) The student was asked to calculate the biodiversity using Simpson's Index of Diversity.

Suggest what additional data he would need to **collect** in order to calculate Simpson's Index of Diversity in this habitat.

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..... **[2]**

(ii) The student calculated Simpson's Index as 0.2. This is a low value.

State the **significance** of this low value for this habitat.

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..... **[1]**

[Total: 14]

END OF QUESTION PAPER

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