



**ADVANCED SUBSIDIARY GCE  
BIOLOGY**

Molecules, Biodiversity, Food and Health

**F212**

Candidates answer on the Question Paper

**OCR Supplied Materials:**

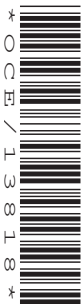
- Insert (inserted)

**Other Materials Required:**

- Electronic calculator
- Ruler (cm/mm)

**Tuesday 12 January 2010  
Morning**

**Duration: 1 hour 45 minutes**



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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**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:

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

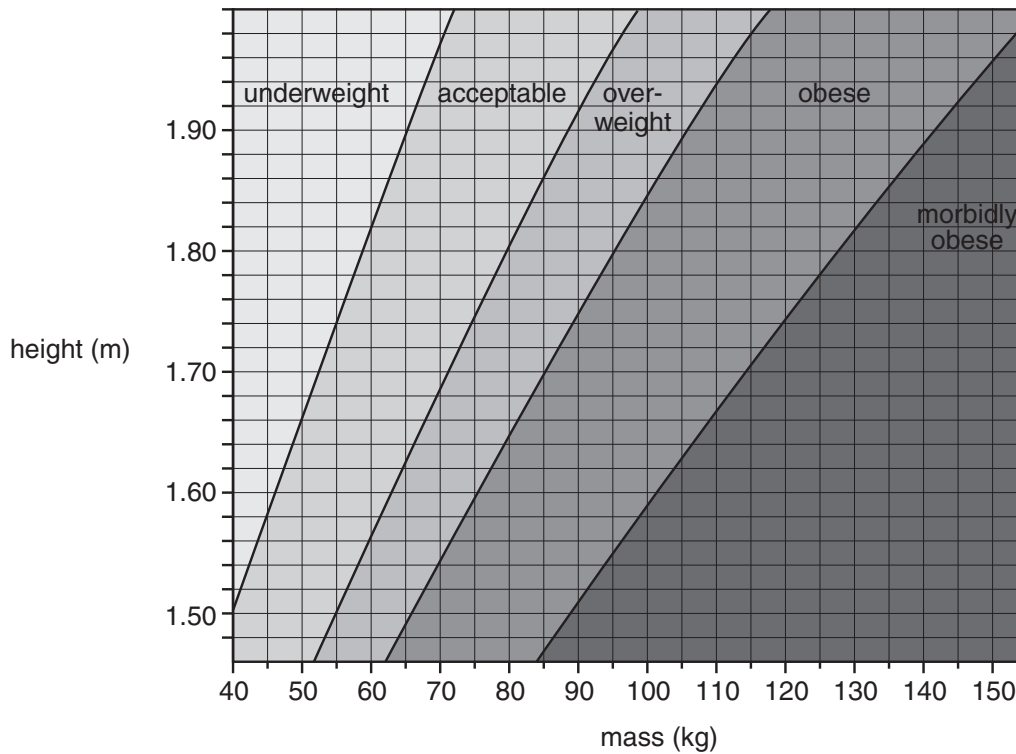
Calculate the BMI of a female of mass 69 kg and a height of 1.67 m.

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.

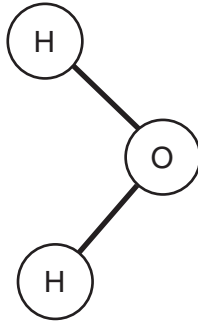
1 .....

2 ..... [2]

[Total: 10]

Turn over

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  $4^{\circ}\text{C}$  so ice floats on the top of the pond
- it acts as a solvent for ions such as nitrates ( $\text{NO}_3^-$ )
- a large quantity of energy is required to raise the temperature of water by  $1^{\circ}\text{C}$ .

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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(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]

**7**  
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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.

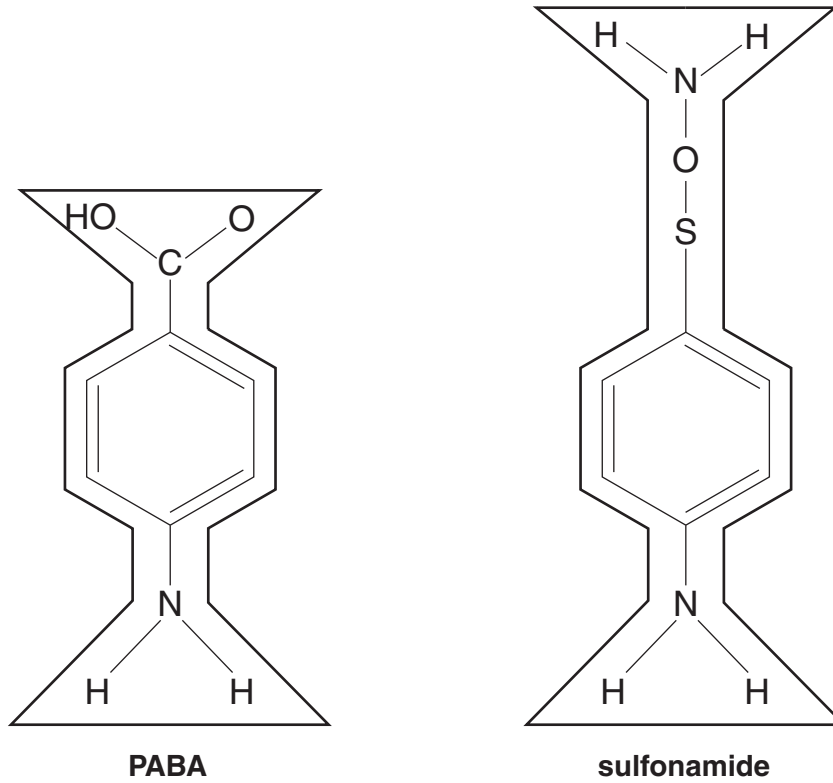
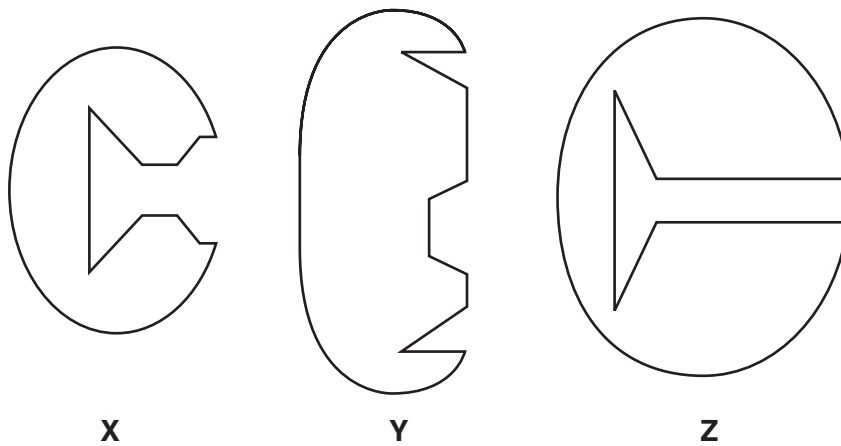


Fig. 3.1

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



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.

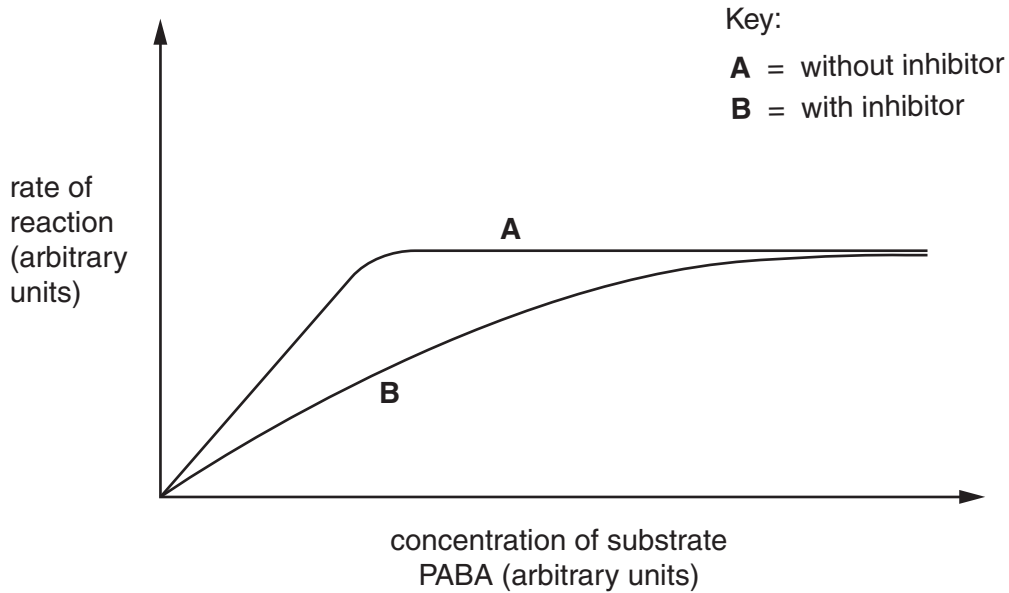


Fig. 3.2

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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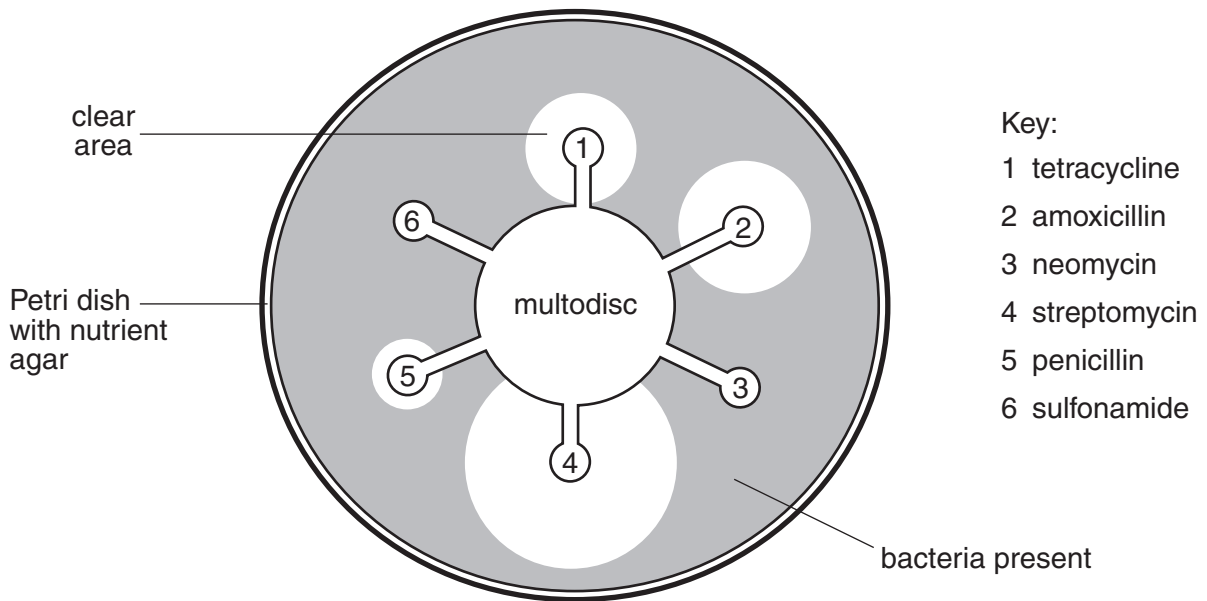
..... [2]



(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.

.....

.....

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

[Total: 20]

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

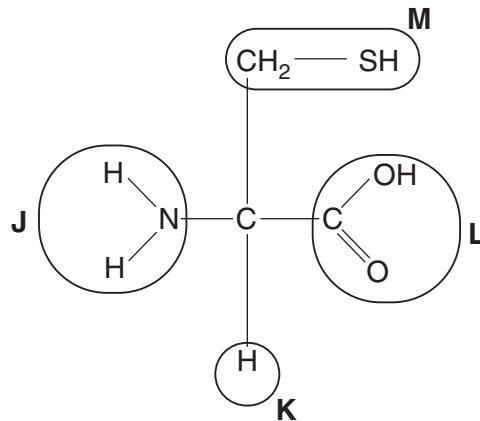


Fig. 4.1

- (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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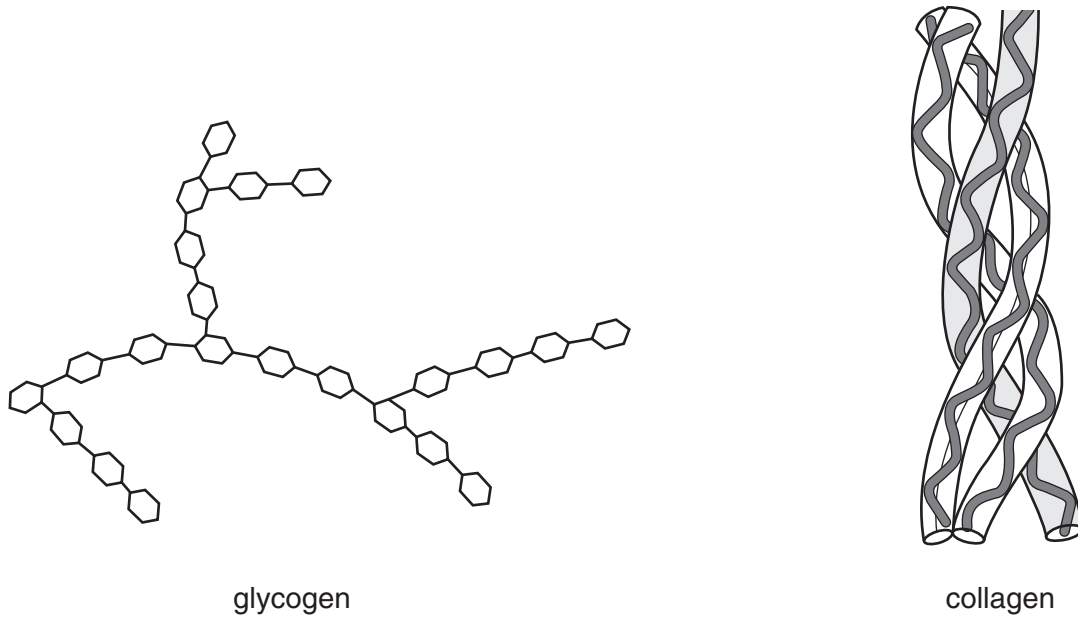
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..... [4]

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



**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.

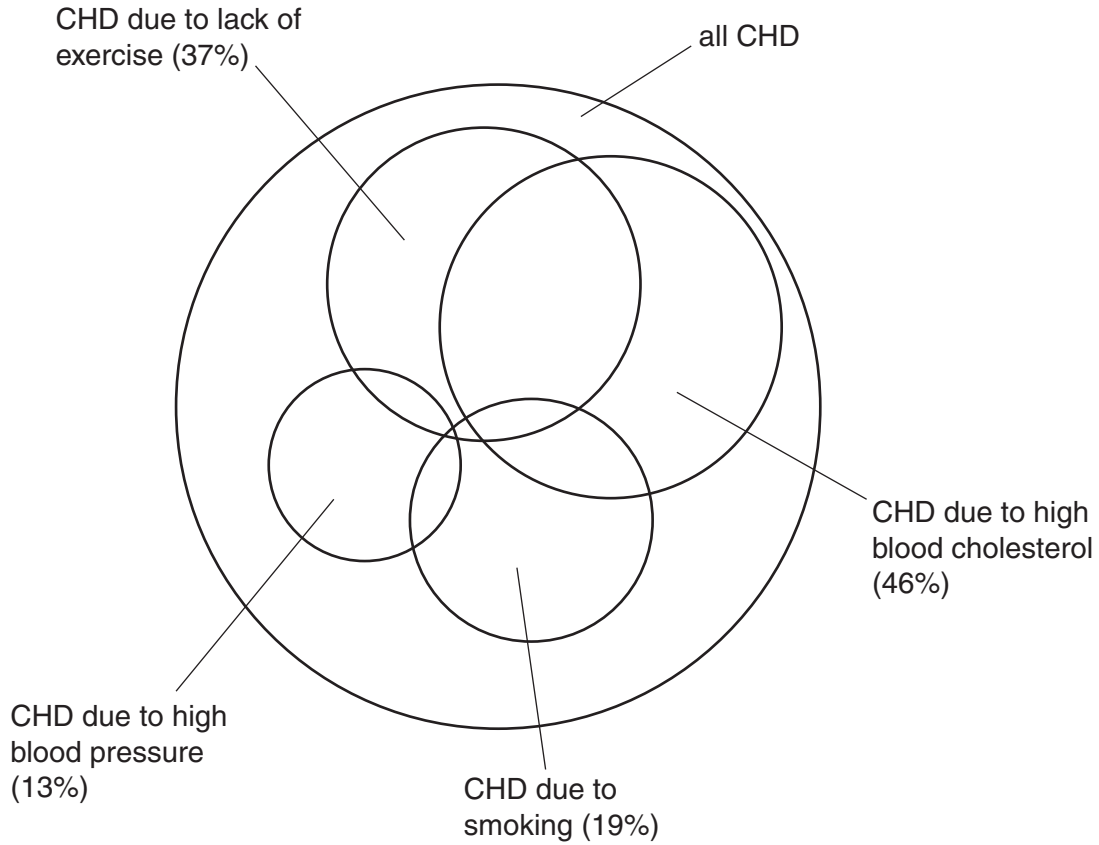


Fig. 5.1

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

Suggest why.

.....  
 ..... [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]



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]



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

.....  
.....  
..... [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* .....

.....

.....

*biodiversity* .....

.....

..... [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.

.....

..... [1]



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

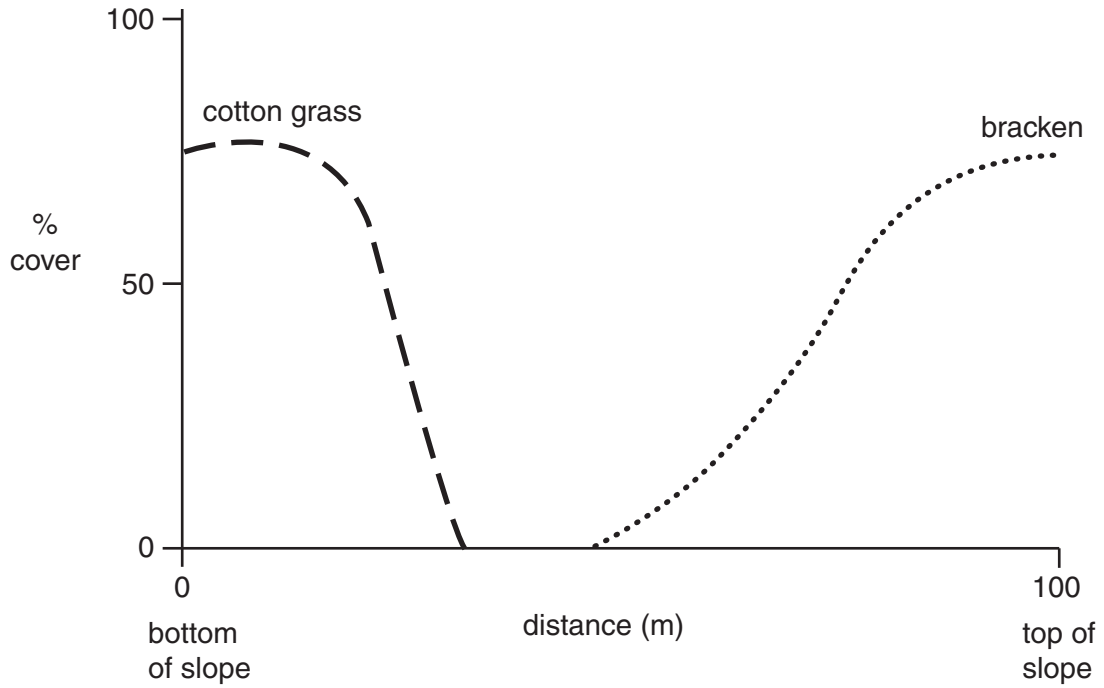


Fig. 7.2

- (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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