

1. 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.

[Total 3 marks]

2. 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.

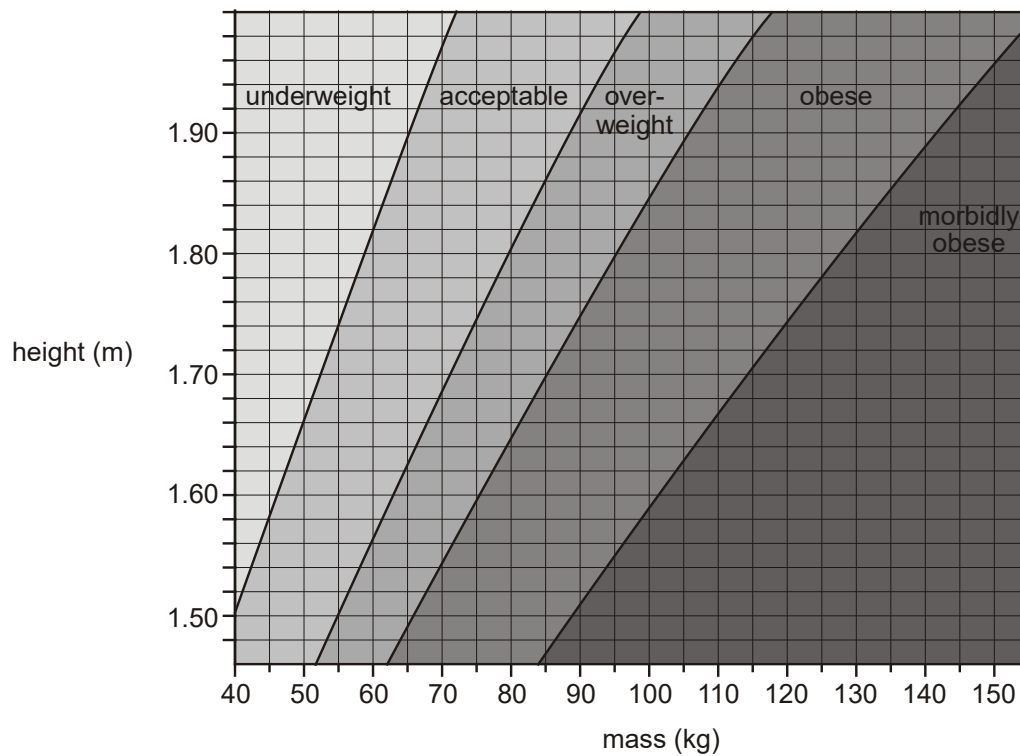
Show your working. Give your answer to **one decimal place**.

Answer =

[Total 2 marks]

3. A way of determining whether a person is underweight or overweight is to use a graph showing the relationship between height and body mass.

The figure below is an example of this type of graph.



- (i) Using the figure above, 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. The figure above does not take into account all of these factors.

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

.....

.....

.....

.....

[2]

[Total 3 marks]

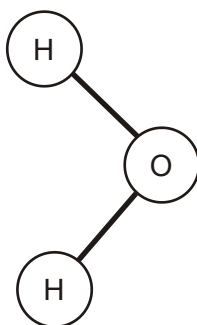
4. Name **two** diseases associated with obesity.

1

2

[Total 2 marks]

5. The figure below represents a water molecule.



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

Draw a second water molecule on the figure above.

Your drawing should show:

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

[Total 3 marks]

6. 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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[Total 8 marks]

7. Water is important in many biological reactions.

Complete the table below by writing an appropriate term next to each description.

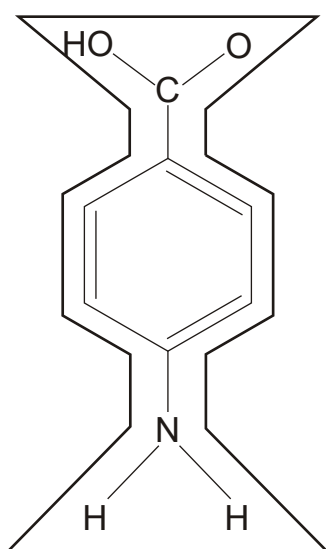
description	term
the type of reaction that occurs when water is added to break a bond in a molecule	
the phosphate group of a phospholipid that readily attracts water molecules	

[Total 2 marks]

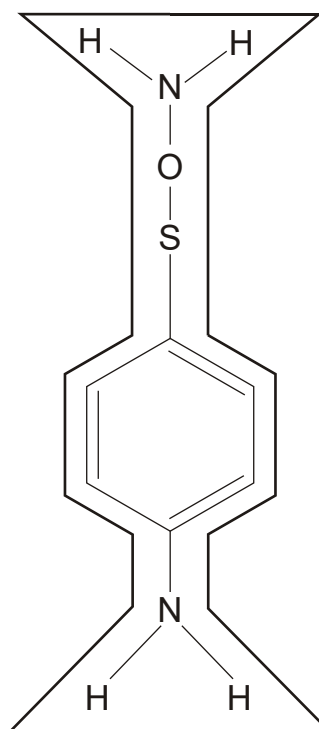
8. The enzyme DHPS is involved in the production of folic acid in bacteria.

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

The figure below shows the structure of PABA and that of sulfonamide.

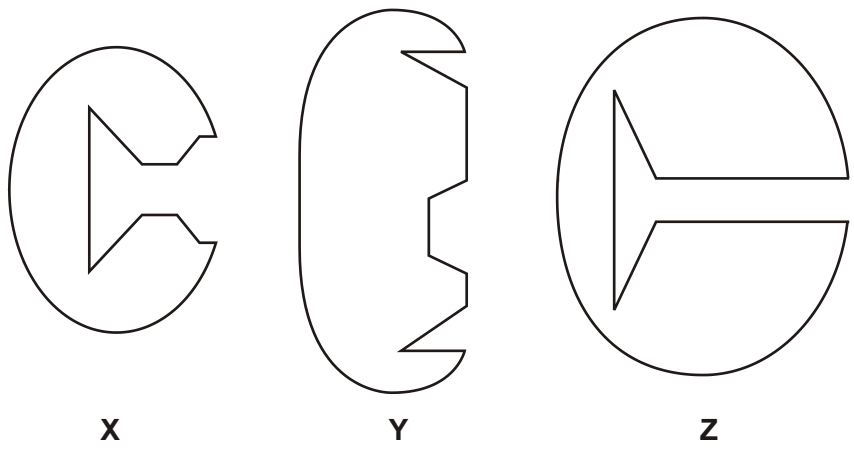


PABA



sulfonamide

(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 the figure above, explain why sulfonamide acts as a competitive inhibitor of DHPS.

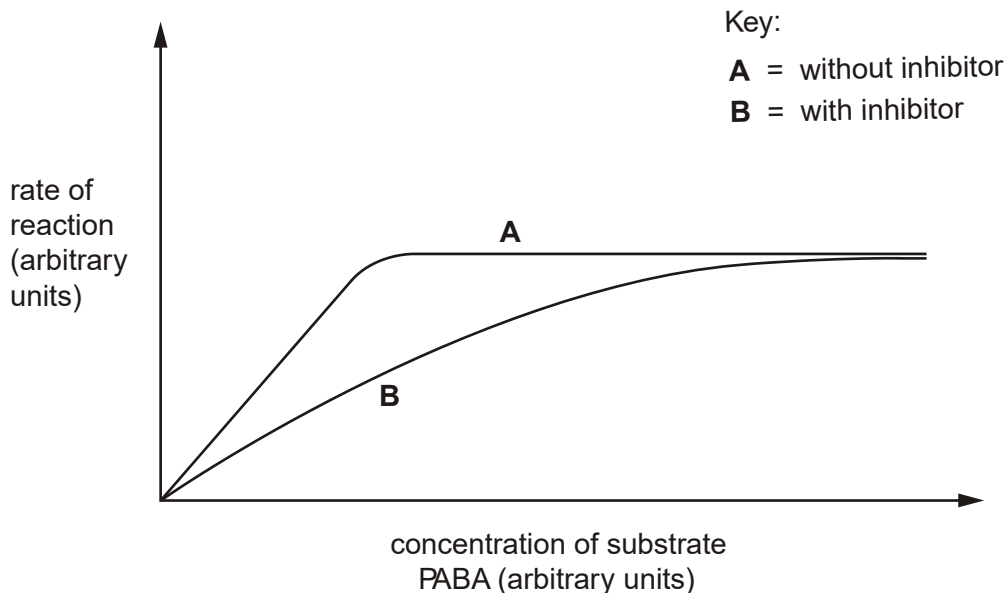
.....
.....
.....
.....
.....
.....
.....

[3]

[Total 4 marks]

9. The figure below 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.



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

(i) without inhibitor,

.....
.....
.....
.....
.....
.....

(ii) with inhibitor.

.....
.....
.....
.....
.....

[2]

[Total 5 marks]

10. Antibiotic resistance in bacteria is becoming an increasing problem.

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

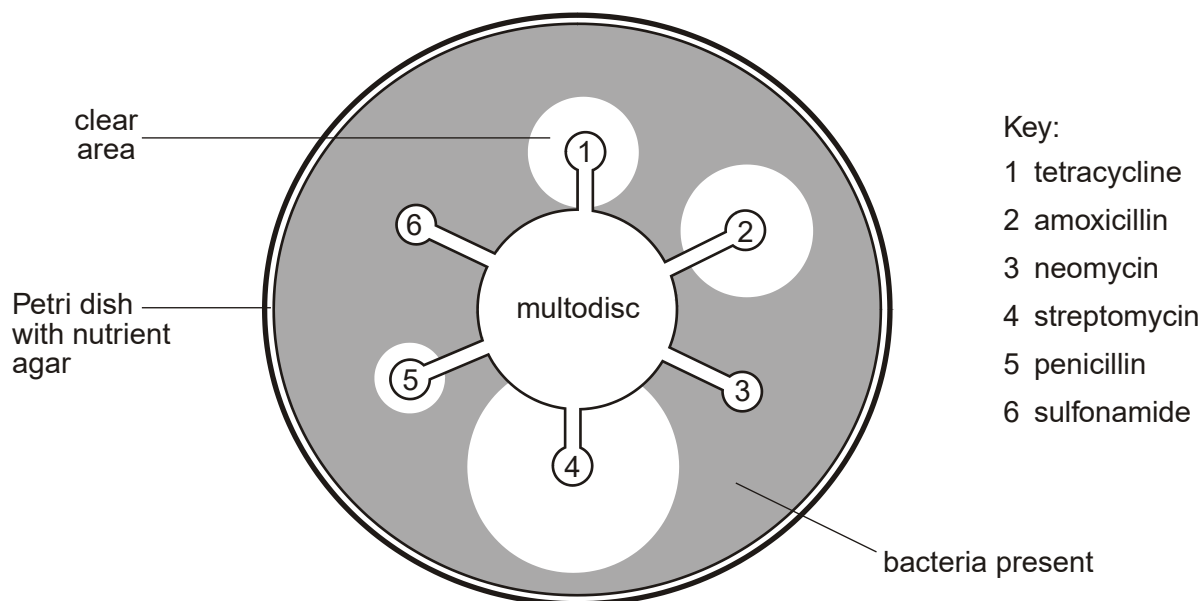
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

[Total 4 marks]

11. 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.

The figure below shows a Petri dish with the bacteria, in which is placed a multodisc containing six different antibiotics.



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

.....

.....

.....

[1]

(ii) Using the figure above, 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.

.....
.....
.....
.....
.....
.....

[3]

[Total 5 marks]

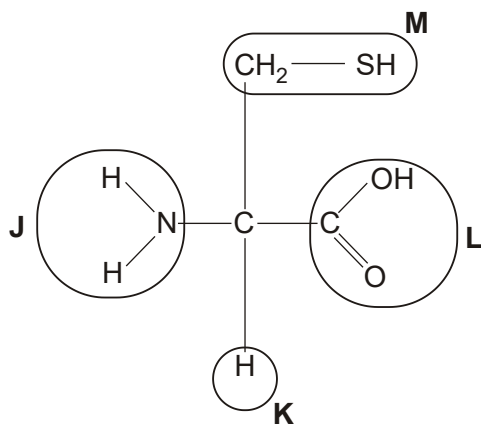
12. Drugs, such as antibiotics, are often first discovered in the natural environment.

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

.....
.....
.....
.....
.....
.....

[Total 2 marks]

13. (a) Amino acids are the basic building blocks for proteins. The figure below shows the amino acid cysteine.



- (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.

.....

.....

.....

.....

.....

.....

.....

[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.

.....

.....

.....

.....

.....

.....

.....

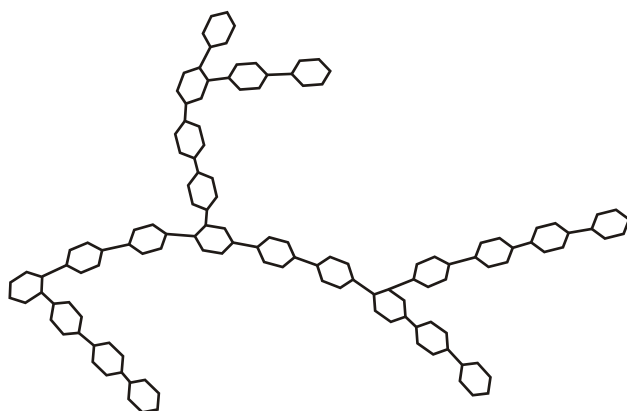
.....

.....

[4]

[Total 10 marks]

14. The figure below shows the structure of two polymers, glycogen and collagen, that are found in mammals.



glycogen



collagen

- (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

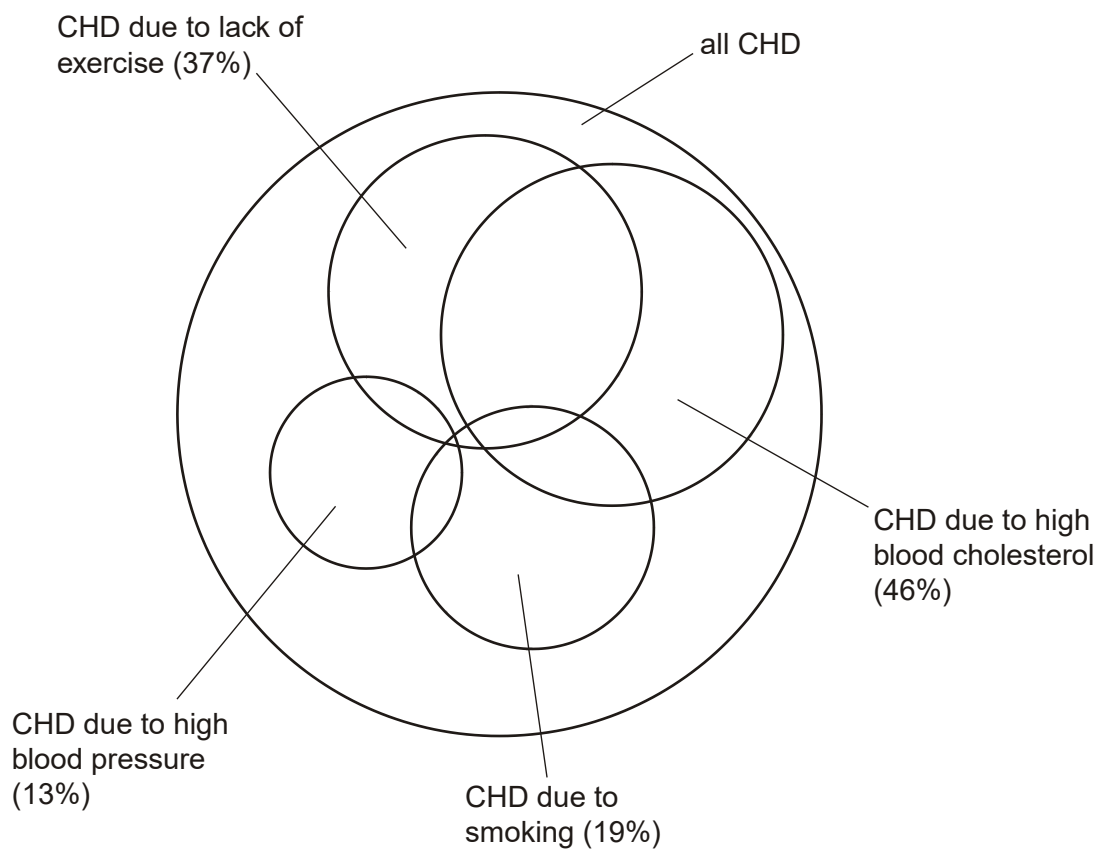
2

[2]

[Total 5 marks]

15. 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.

The figure below shows the percentage of cases of CHD in a population to which each risk factor contributed.



(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 the figure above.

1

2

[2]

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

The table below 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.

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]

[Total 7 marks]

16. 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.

.....

.....

.....

.....

.....

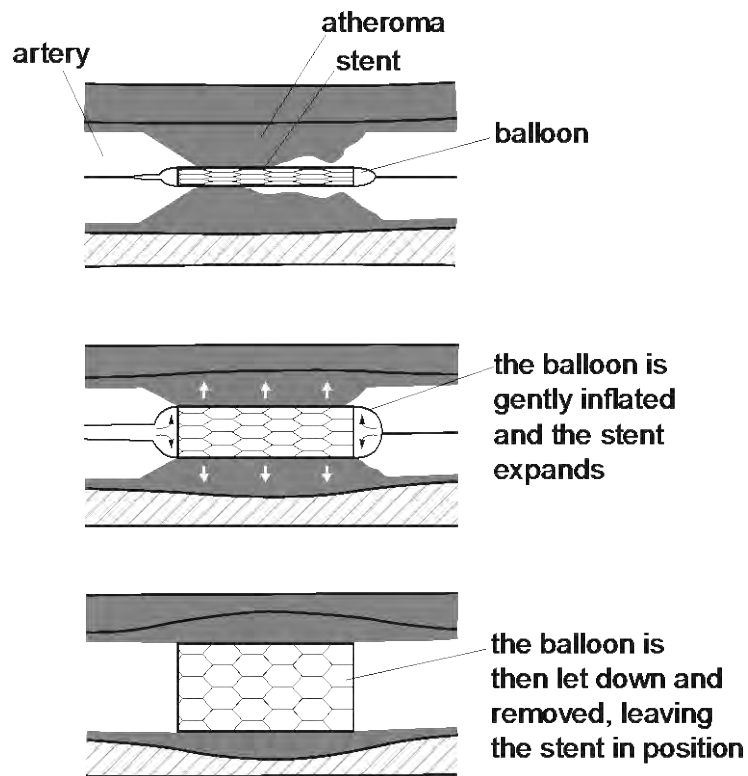
.....

[Total 2 marks]

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

The figure below 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.



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

.....

.....

.....

.....

.....

.....

.....

.....

[Total 4 marks]

18. DNA and RNA are nucleic acids.

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

.....
.....
.....
.....

[3]

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

.....
.....
.....
.....

[2]

[Total 5 marks]

19. 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.

[Total 7 marks]

20. (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.

.....

.....

.....

.....

.....

[2]

[Total 3 marks]

21. Fig. 1 below shows a photograph of a part of a heathland habitat. A study was carried out on the biodiversity of this habitat.

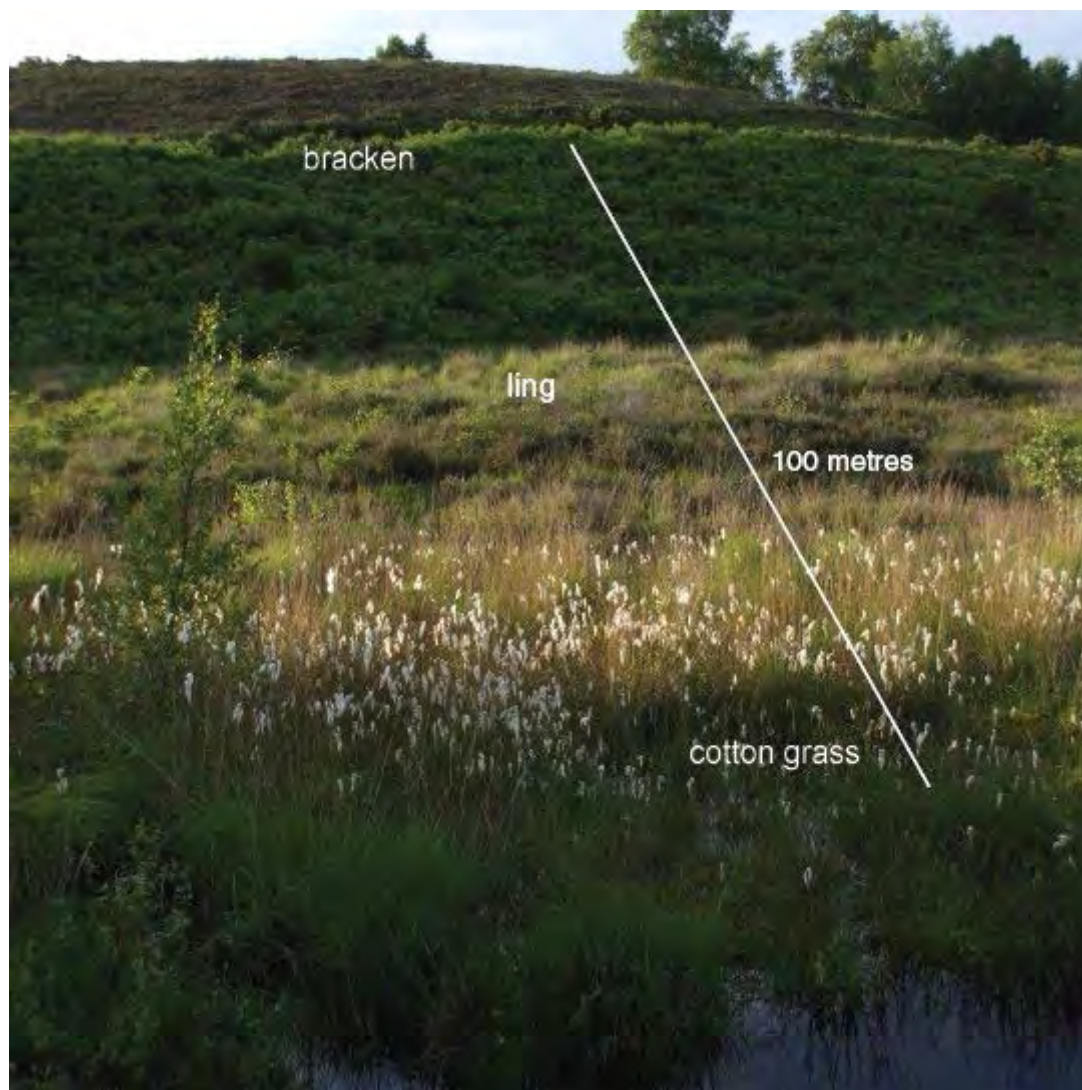


Fig. 1

(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.

.....

.....

.....

.....

.....

[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.

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.

.....

.....

Fig. 2 is a graph showing the distribution of cotton grass and bracken at different distances from the bottom of the slope.

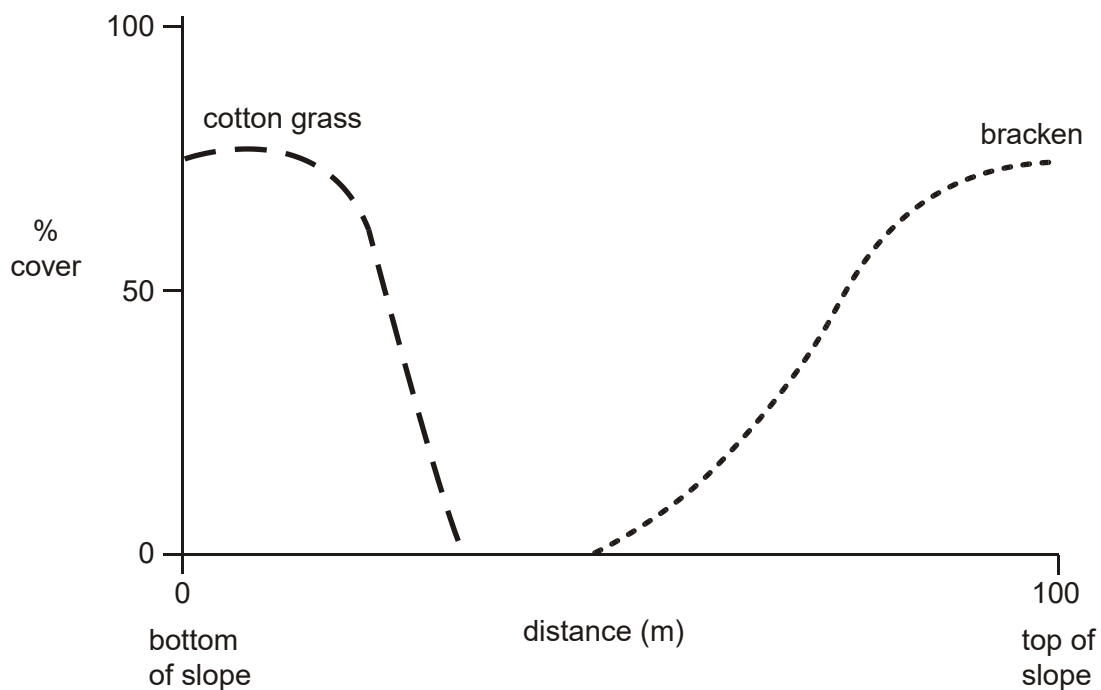


Fig. 2

(ii) Using the information given in the table above, **sketch on Fig. 2** a curve to show the distribution of **ling**.

[3]

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

.....

.....

.....

.....

.....

[2]

- (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.

.....
.....
.....
.....
.....

[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.

.....
.....
.....

[1]

[Total 14 marks]

22. 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.

anti-parallel

β -pleated sheet

covalent

double helix

hydrogen

parallel

polypeptide

ribose

sugar-phosphate

DNA is found in the nucleus. The molecule is twisted into a
 in which each of the strands are It
 has two backbones attached to one another by
 complementary bases. These bases pair in the centre of the molecule by means of
 bonds.

[Total 4 marks]

23. The table below shows the relative proportions of different DNA bases in four different organisms.

relative proportions of bases in DNA as a percentage				
organism	A	C	G	T
human	30.9	19.8	19.9	29.4
grasshopper	29.3	20.7	20.5	29.3
wheat	27.3	22.8	22.7	27.1
<i>E. coli</i>	24.7	25.7	26.0	23.6

(i) Describe the patterns shown by the data given in the table above.

.....
.....
.....
.....
.....
.....
.....
.....

[3]

(ii) Suggest how the data given in the table above might have been helpful to scientists in working out the structure of DNA.

.....
.....
.....
.....

[2]

[Total 5 marks]

24. DNA in the nucleus acts as a template for the production of RNA.

Complete the table below to show **three** ways in which the structure of DNA differs from that of RNA.

feature	DNA	RNA
number of strands		
bases present		
sugar present		

[Total 3 marks]

25. DNA codes for the structure of polypeptides.

State the role of messenger RNA (mRNA).

.....

.....

.....

.....

.....

[Total 2 marks]

- 26.** Malaria kills over one million people every year, the vast majority being under the age of ten.

Adults who have survived malaria in childhood and then continue to live in an area where malaria is found, develop a limited form of immunity.

- (a) (i) Name the parasite that causes malaria.

.....

[1]

- (ii) Name the vector for the malarial parasite.

.....

[1]

- (iii) Name a human cell in which the malarial parasite reproduces.

.....

[1]

- (b) Scientists are developing a vaccine using an attenuated (inactive) form of the malarial parasite.

The aim is to trigger an immune response without the development of the disease.

Describe the actions of the **B lymphocytes** in the immune response.



In your answer you should make clear how the steps in this part of the immune response are sequenced.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[8]

- (c) Suggest why adults who have survived malaria may lose their immunity when they leave a malarial area.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[2]

(d) State **three biological** reasons why it has not been possible to produce an effective vaccine for malaria.

.....

.....

.....

.....

.....

.....

.....

.....

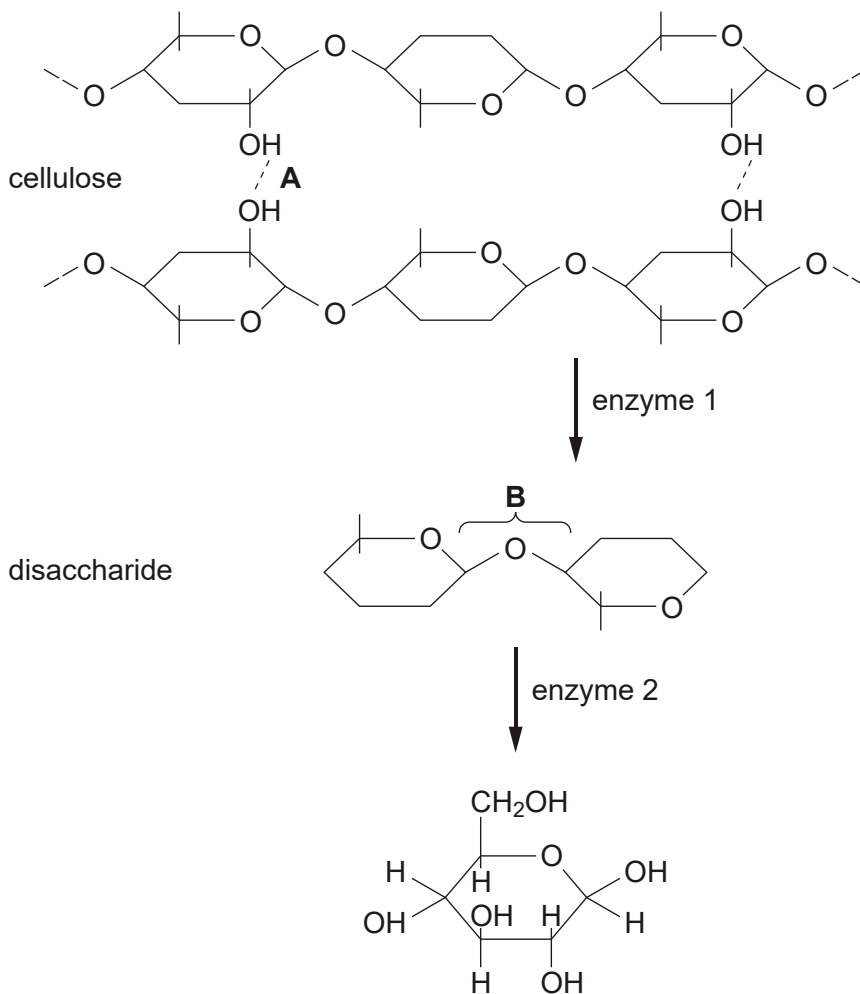
[3]

[Total 16 marks]

27. In the search for new biofuels, research has been done into the digestion of wood waste by fungi.

The cellulase enzymes produced by the fungi break cellulose into sugars. These sugars can then be converted into ethanol, a biofuel.

The figure below shows the stages in this digestion process.



- (a) (i) Name bonds **A** and **B** shown in the figure.

A

B

(ii) State how bond **B** is broken in the digestion of the disaccharide.

.....
.....

[1]

(iii) Name the sugar that is the **final** product of this digestion process.

.....

[1]

(b) Explain why **different** enzymes are involved in each stage of the digestion process.

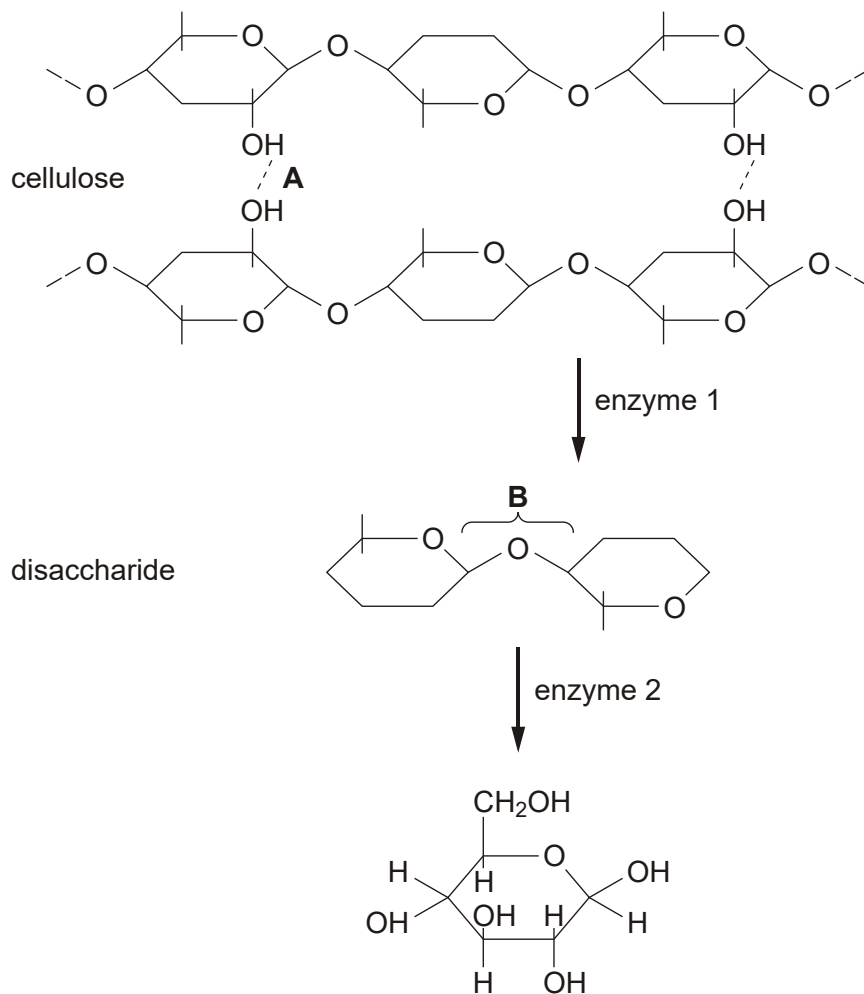
.....
.....
.....
.....
.....
.....
.....

[3]

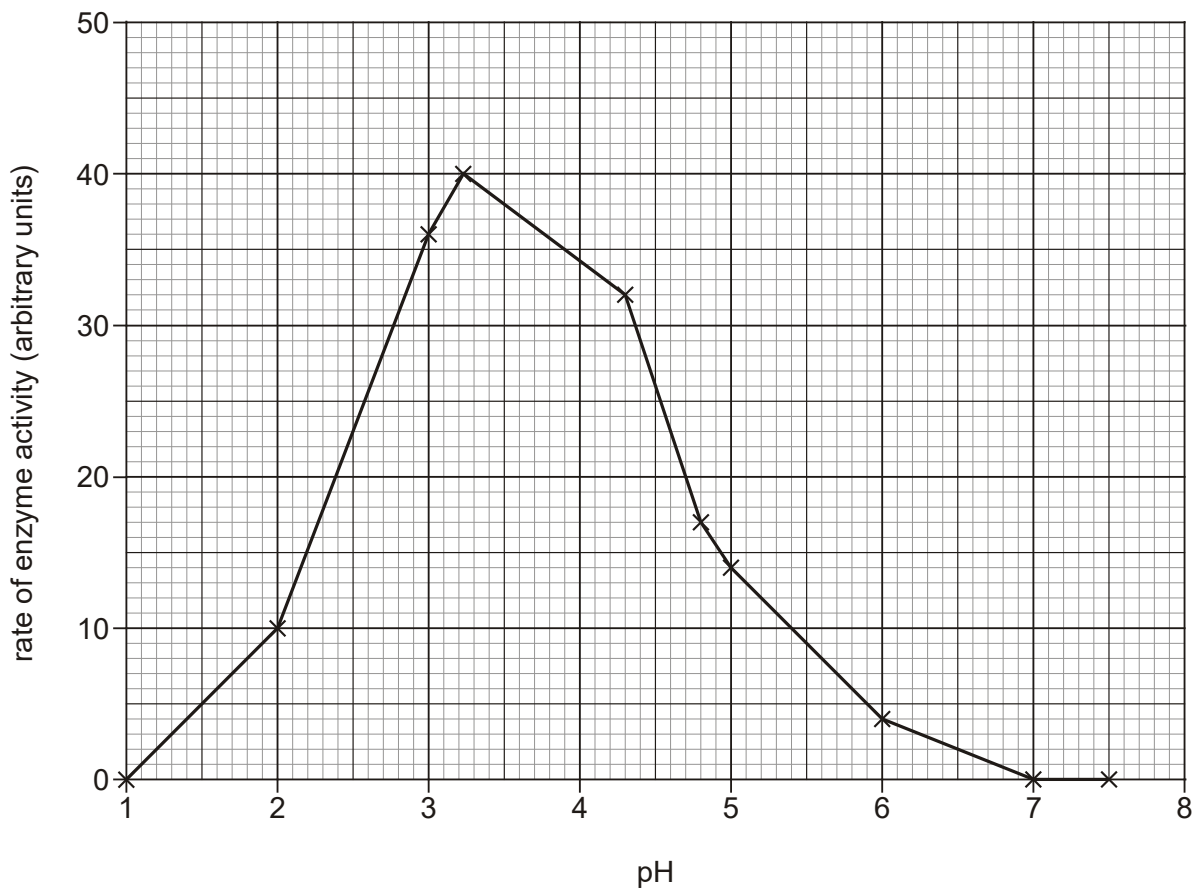
- (c) In the search for new biofuels, research has been done into the digestion of wood waste by fungi.

The cellulase enzymes produced by the fungi break cellulose into sugars. These sugars can then be converted into ethanol, a biofuel.

The figure below shows the stages in this digestion process.



The figure below shows the effect of changing pH on the rate of activity of **enzyme 2**.



(i) Explain why the activity of **enzyme 2** falls to zero at pH 7.

.....

.....

.....

.....

.....

.....

.....

(ii) State **two** factors that should have been controlled when investigating the effect of pH on the activity of **enzyme 2**.

- 1
- 2

[2]

[Total 12 marks]

28. The activity of an enzyme can be measured by testing for the concentration of its product at regular intervals.

Describe how the concentration of a reducing sugar can be measured using a colorimeter.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[Total 6 marks]

29. In India, the population of the white-backed vulture, *Gyps bengalensis*, has fallen by 97% to an estimated 4 000 vultures. This vulture is now considered to be 'critically endangered'. Reasons for the decline in numbers include:

- vultures feed on carcasses including those from farm animals.
- these farm animals may have been treated with a pain killer. This particular pain killer causes kidney failure in the vultures.
- the use of this pain killer is being phased out. However, many farmers continue to use up their stocks of the drug.
- this pain killer is not easily biodegradable and will remain in the environment for many years.

(i) Suggest what is meant by *critically endangered*.

.....

[1]

(ii) Calculate the **original** population of the white-backed vulture.

Show your working.

Answer =

[2]

[Total 3 marks]

30. In India, the population of the white-backed vulture, *Gyps bengalensis*, has fallen by 97% to an estimated 4 000 vultures. This vulture is now considered to be 'critically endangered'. Reasons for the decline in numbers include:

- vultures feed on carcasses including those from farm animals.
- these farm animals may have been treated with a pain killer. This particular pain killer causes kidney failure in the vultures.
- the use of this pain killer is being phased out. However, many farmers continue to use up their stocks of the drug.
- this pain killer is not easily biodegradable and will remain in the environment for many years.

In an effort to save the white-backed vulture, a captive breeding programme has been set up.

Three centres in India have been built, each housing up to 40 individuals. These vultures have been collected from different areas of the Indian subcontinent.

- (i) Explain why the decision was made to conserve the species in captivity (*ex situ*) rather than in the wild (*in situ*).

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Explain why the white-backed vultures in the captive breeding programme were,

- collected from several different areas
- housed in three separate centres.

.....

.....

.....

.....

.....

.....

.....

.....

.....

[3]

[Total 7 marks]

31. In India, the population of the white-backed vulture, *Gyps bengalensis*, has fallen by 97% to an estimated 4 000 vultures. This vulture is now considered to be ‘critically endangered’. Reasons for the decline in numbers include:

- vultures feed on carcasses including those from farm animals.
- these farm animals may have been treated with a pain killer. This particular pain killer causes kidney failure in the vultures.
- the use of this pain killer is being phased out. However, many farmers continue to use up their stocks of the drug.
- this pain killer is not easily biodegradable and will remain in the environment for many years.

In an effort to save the white-backed vulture, a captive breeding programme has been set up.

Three centres in India have been built, each housing up to 40 individuals. These vultures have been collected from different areas of the Indian subcontinent.

Outline **three** reasons why the conservation of the white-backed vulture is important.

1

.....

.....

2

.....

.....

3

.....

.....

[Total 3 marks]

32. In India, the population of the white-backed vulture, *Gyps bengalensis*, has fallen by 97% to an estimated 4 000 vultures. This vulture is now considered to be 'critically endangered'. Reasons for the decline in numbers include:

- vultures feed on carcasses including those from farm animals.
- these farm animals may have been treated with a pain killer. This particular pain killer causes kidney failure in the vultures.
- the use of this pain killer is being phased out. However, many farmers continue to use up their stocks of the drug.
- this pain killer is not easily biodegradable and will remain in the environment for many years.

In an effort to save the white-backed vulture, a captive breeding programme has been set up.

Three centres in India have been built, each housing up to 40 individuals. These vultures have been collected from different areas of the Indian subcontinent.

Suggest **three** measures that could be taken **in the long term** to preserve the numbers of white-backed vultures, once the captive bred individuals have been released into the wild.

.....

.....

.....

.....

.....

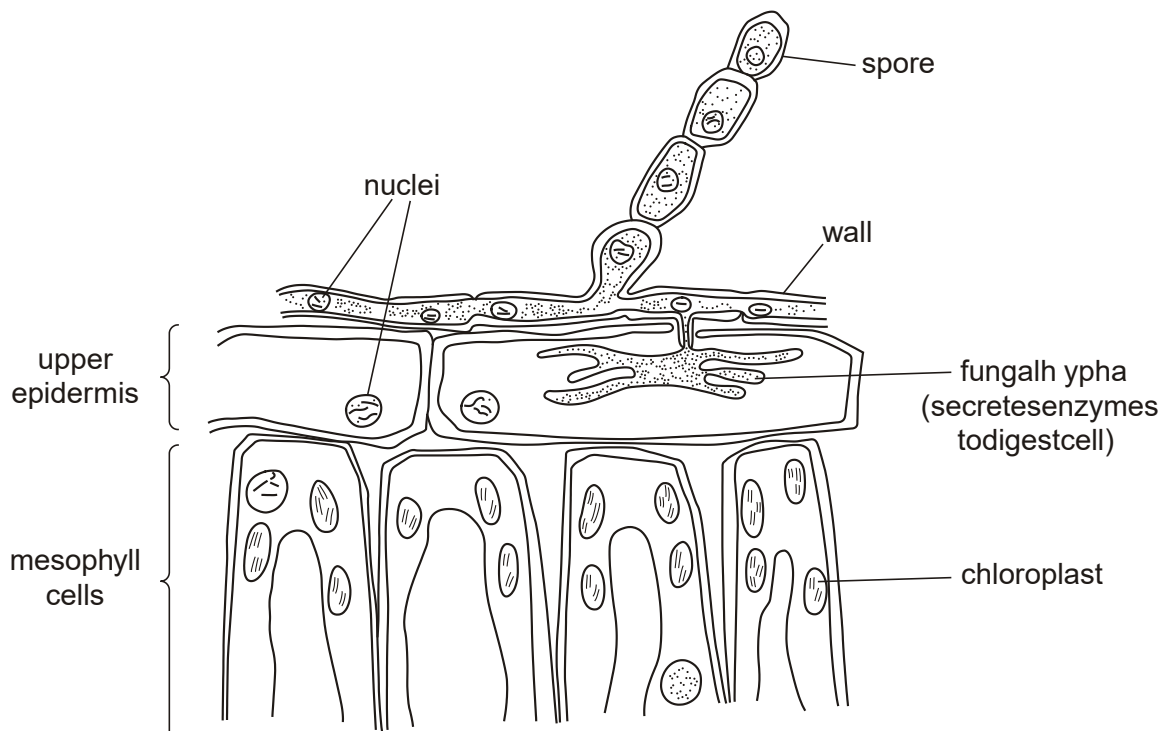
.....

.....

.....

[Total 3 marks]

33. The figure below shows a section of a leaf from a pear tree that is infected by the mildew fungus.



(i) State **one** feature, **shown in the figure above**, that excludes **both** the pear tree and mildew from the kingdom Prokaryotae.

.....

[1]

(ii) State **two** reasons why mildew should be placed in the kingdom Fungi.

.....

[2]

(iii) State **two** reasons why the pear tree should be placed in the kingdom Plantae.

.....
.....
.....
.....

[2]

(iv) Name **two** kingdoms other than Prokaryotae, Fungi and Plantae.

1

2

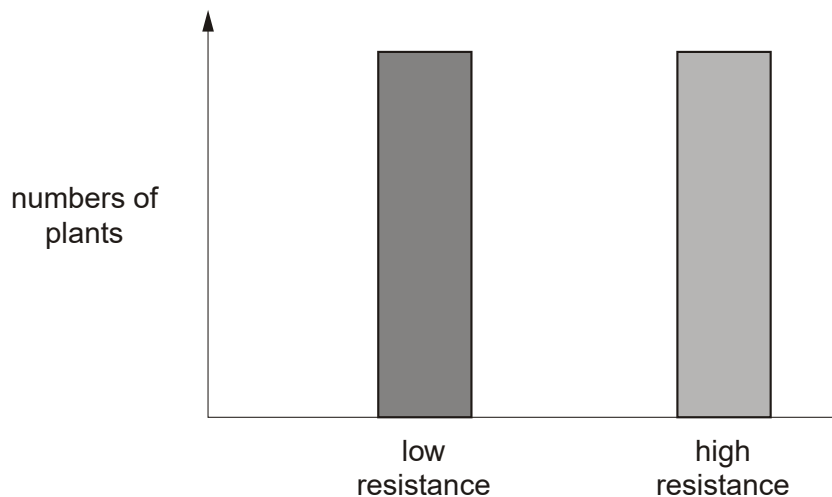
[2]

[Total 7 marks]

34. The mildew fungus also infects wheat plants, causing disease.

- Most wheat plants in the UK show little resistance to this disease.
- Some Iranian wheat plants are resistant.
- The yield from these resistant wheat plants is very low.

(i) An investigation into the resistance of the Iranian wheat plants to mildew produced the results shown in the figure below.



State the type of variation that is shown in the figure above **and** describe its characteristics.

type of variation

characteristic of this type of variation

.....

.....

.....

.....

.....

.....

.....

.....

.....

[3]

- (ii) Outline how a breeding programme could be carried out to produce wheat plants which have both high yield **and** resistance to mildew.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[3]
[Total 6 marks]

35. Over a period of time, mildew can overcome the resistance bred into the wheat.

Use the theory of natural selection to explain how the mildew fungus adapts to overcome this resistance.

.....

.....

.....

.....

.....

.....

.....

.....

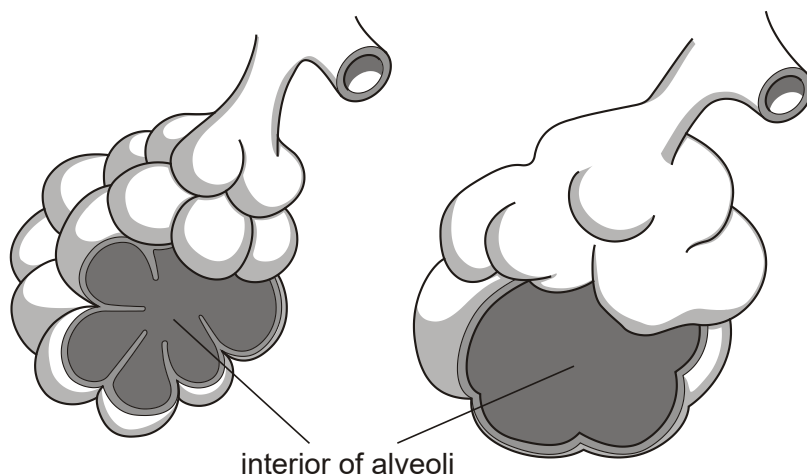
.....

.....

.....

[Total 4 marks]

36. The figure below shows a diagram of alveoli in a healthy lung and alveoli in a lung from a person with advanced emphysema.



alveoli in a healthy lung

alveoli from a person with advanced emphysema

- (i) Describe how smoking could cause changes in alveoli, such as those shown in the figure above.



In your answer you should make the links between the changes and their causes clear.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[6]

- (ii) Emphysema is a form of chronic obstructive pulmonary disease (COPD). Describe **two** signs or symptoms of emphysema.

.....

.....

.....

.....

.....

[2]

(iii) Emphysema is described as a chronic disease.

Suggest the meaning of the term *chronic*.

.....

.....

.....

[2]

[Total 10 marks]

37. An investigation was conducted into the effect of smoking on lung function. One measure of lung function is peak flow rate.

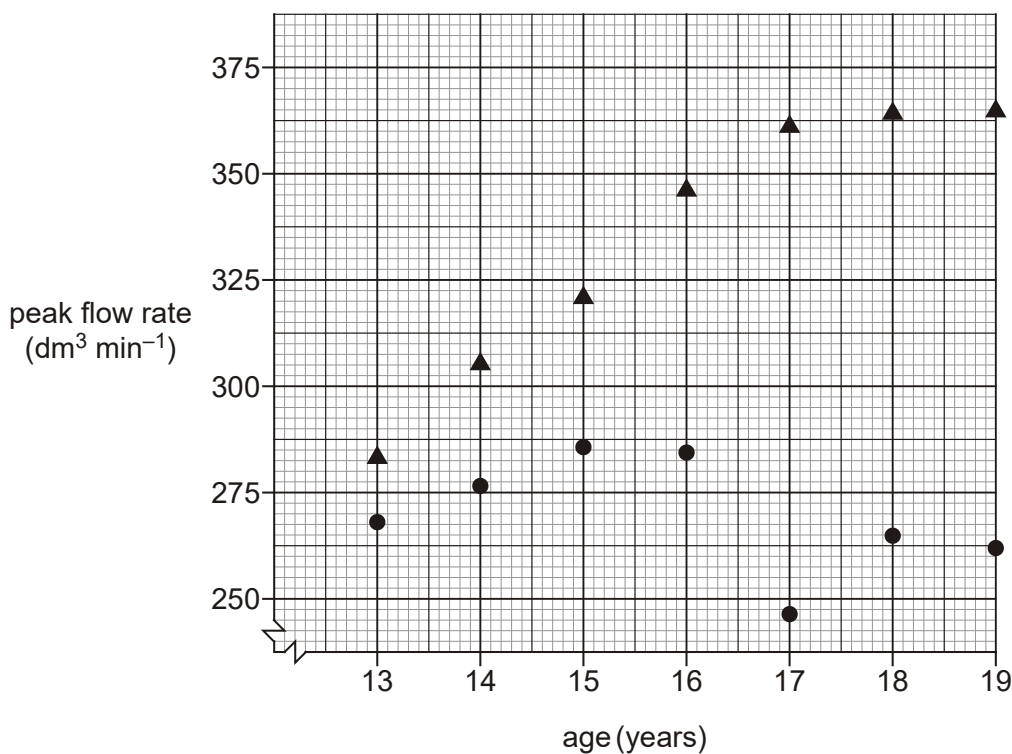
The peak flow rate is the maximum volume of air expelled from the lungs in one minute ($\text{dm}^3 \text{min}^{-1}$).

Two male volunteers, one a smoker and one a non-smoker, had their peak flow measured once a year for seven years.

Key:

▲ non smoker

● smoker



(i) **Describe** the data shown in the figure above.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

[4]

(ii) **Explain** the results obtained for the smoker.

.....
.....
.....
.....
.....
.....

[2]

(iii) Suggest **three** ways of improving the reliability of this investigation.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

[3]
[Total 9 marks]

38. Some species of Acacia tree produce gum arabic. Gum arabic is classed as a heteropolysaccharide. This means that it is made up of a number of different sugars.

Hydrolysis of gum arabic releases four different monosaccharides.

Describe what happens during the hydrolysis of a polysaccharide molecule.

.....
.....
.....
.....
.....
.....
.....

[Total 2 marks]

39. Complete the table below, comparing gum arabic with some other polysaccharides.

	gum arabic	amylase	cellulose	glycogen
branched structure	yes		no	
heteropolysaccharide	yes		no	
found in animals/plants	plants		plants	
function in organism	healing cuts			energy store

[Total 4 marks]

40. *Acacia senegal* is a species of tree which is common in the drier parts of Africa. Cattle are allowed to graze on both its leaves and the fallen seed pods. The seed pods have relatively high protein content.

(i) Describe how you would test an extract of the seed pods for protein.

.....

.....

.....

.....

.....

.....

[2]

- (ii) Describe how you could compare the **reducing sugar** content of the leaves with that of the seed pods.



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

[8]

- (iii) The **seeds** of *Acacia* species are sometimes eaten by people.

Suggest why it might be better for people living in areas where the tree grows to let their cattle feed on the trees and fallen seed pods and then obtain their nutrition from the cattle.

.....

.....

.....

.....

.....

.....

.....

.....

.....

[3]

[Total 13 marks]

41. DNA and RNA are nucleic acids.

(i) Describe the structure of a DNA **nucleotide**.

In your answer you should spell the names of the molecules correctly.

You may use the space below to draw a diagram if it will help your description.

.....

.....

.....

.....

.....

.....

[3]

(ii) Describe how the two nucleotide chains in DNA are bonded together.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

[4]

[Total 7 marks]

42. State **three** ways in which the structure of DNA differs from that of RNA.

1

.....

2

.....

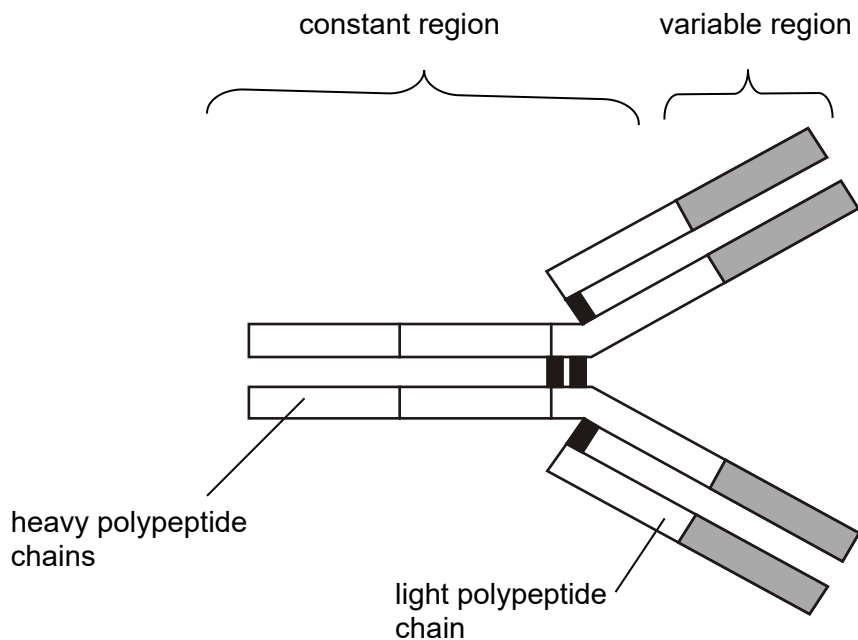
3

.....

[Total 3 marks]

43. An antibody is an example of a protein molecule, which has a specific 3-dimensional shape.

The diagram below shows the structure of an antibody molecule.



(i) Outline how the structure of an antibody molecule is related to its function.

.....

.....

.....

.....

.....

.....

.....

- (ii) Suggest why the base sequence in the genes for human antibodies is more similar to that found in a chimp than to that found in a mouse.

.....

.....

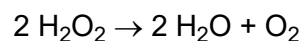
.....

[2]

[Total 5 marks]

44. The fungus, yeast, contains the enzyme catalase.

Catalase speeds up the decomposition of hydrogen peroxide, a toxic metabolic product, to oxygen and water.



A student decided to investigate the activity of catalase using the apparatus shown in Fig. 1.

The total volume of gas collected was recorded every 20 seconds.

The results are shown in Fig. 2.

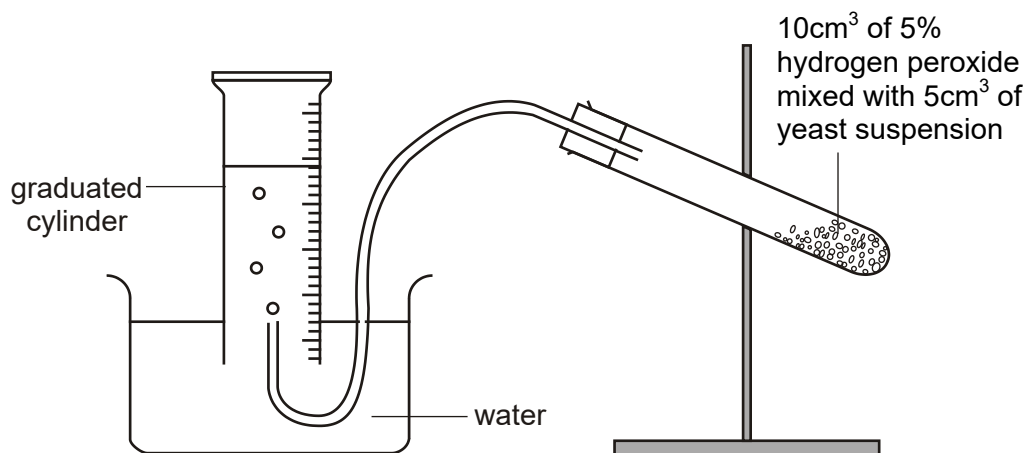


Fig. 1

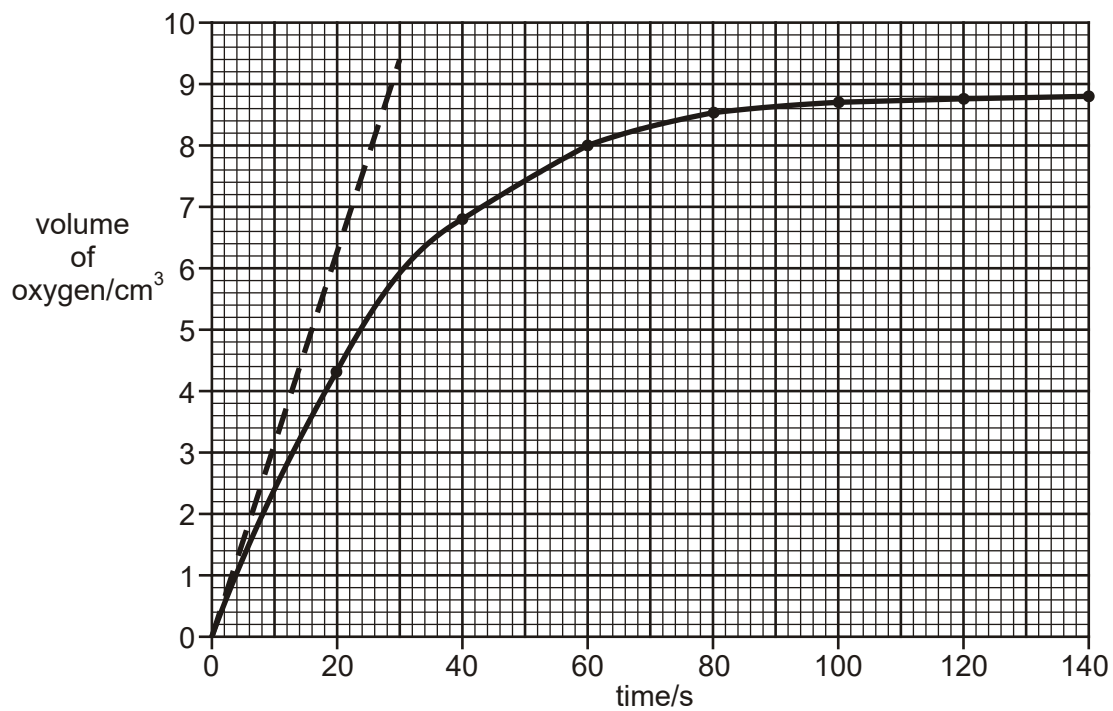


Fig. 2

The rate of decomposition can be calculated using the formula:

$$\text{rate of decomposition} = \frac{\text{volume of oxygen collected}}{\text{time taken for collection}}$$

- (a) Calculate the rate of decomposition over the first 30 seconds.

Show your working and give your answer in **cm³ min⁻¹**.

.....cm³ min⁻¹

- (b) The initial rate of decomposition is the rate measured within the first few seconds. Using the dashed line in Fig. 2, the initial rate of decomposition is calculated to be $19 \text{ cm}^3 \text{ min}^{-1}$.

Explain why the initial rate of reaction is greater than the rate you calculated in (a).

.....

.....

.....

.....

.....

.....

[3]

[Total 5 marks]

45. Fungi such as *Fusarium venenatum* are grown in huge batch cultures to manufacture protein for food products.

Explain why these cultures are often maintained at the optimum temperature for protein production and not at a temperature above the optimum.



In your answer you should make clear how the structure and activity of enzymes relates to the effects described.

[Total 8 marks]

46. A group of students carried out some fieldwork to investigate the diversity of insects in three habitats:

- a field of barley
- a field of wheat
- the vegetation under a hedge.

Their results are shown in the table below. The table also shows how they used their data to calculate Simpson's Index of Diversity (D) for each habitat.

$$D = 1 - (\sum(n/N)^2)$$

where N = the total number of insects found, and n is the number of individuals of a particular species.

	number of individuals of each species in each habitat		
species	barley field	wheat field	under hedge
a	32	4	0
b	78	0	1
c	0	126	2
d	0	5	12
e	0	0	8
f	0	0	9
g	0	25	3
h	0	10	3
i	0	0	2
j	0	0	5
k	86	56	0
l	0	0	7
species richness	3	6	10
total number of insects (N)	196	226	52
Simpson's Index of Diversity (D)		0.61	0.86

- (a) State what is meant by the term *species richness*.

.....
.....

[1]

- (b) (i) Calculate the value for Simpson's Index of Diversity (D) for the barley field.
Show your working and write your answer **in the shaded box in the table**.

[2]

- (ii) Using the data in the table, suggest why the value of Simpson's Index of Diversity (D) for the vegetation under the hedge is so much higher than that for the wheat field.

.....
.....
.....
.....

[3]

- (c) Describe how the students may have determined the numbers of individuals of each species in each habitat.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[5]

[Total 11 marks]

47. Studies of biodiversity are an integral part of an environmental impact assessment (EIA).

- (i) Discuss the role of an EIA as part of a local planning decision.

.....

.....

.....

.....

.....

.....

.....

.....

[3]

(ii) Suggest why some conservationists might object to these studies.

.....

.....

.....

.....

[2]

[Total 5 marks]

48. The leopard, *Panthera pardus*, is a large member of the cat family.

Complete the following table to show the full classification of the leopard.

Kingdom	.....
.....	Chordata
Class	Mammalia
.....	Carnivora
Family	Felidae
Genus	.....
.....	<i>pardus</i>

[Total 5 marks]

49. The leopard belongs to a kingdom in which all members are eukaryotic. Plants are also eukaryotic.

Name **two** other kingdoms that contain eukaryotic organisms.

1

2

[Total 2 marks]

50. Historically, all organisms were classified into just two kingdoms. In 1988 a five-kingdom system of classification was accepted. In 1990 a three domain system was proposed.

Discuss, with reference to the **Prokaryotes**, the reasons why classification systems are not universally accepted and why they change over time.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

[Total 4 marks]

51. (a) *Staphylococcus aureus* is a species of bacterium that is found on the skin.

(i) Describe how variation may arise within a species of bacterium such as *S. aureus*.

.....
.....
.....

[1]

(ii) Suggest why such variation alters the characteristics of the individual organism.

.....
.....
.....
.....

[2]

(b) Discuss the difficulties that variations arising in *S. aureus* may cause to the medical profession.

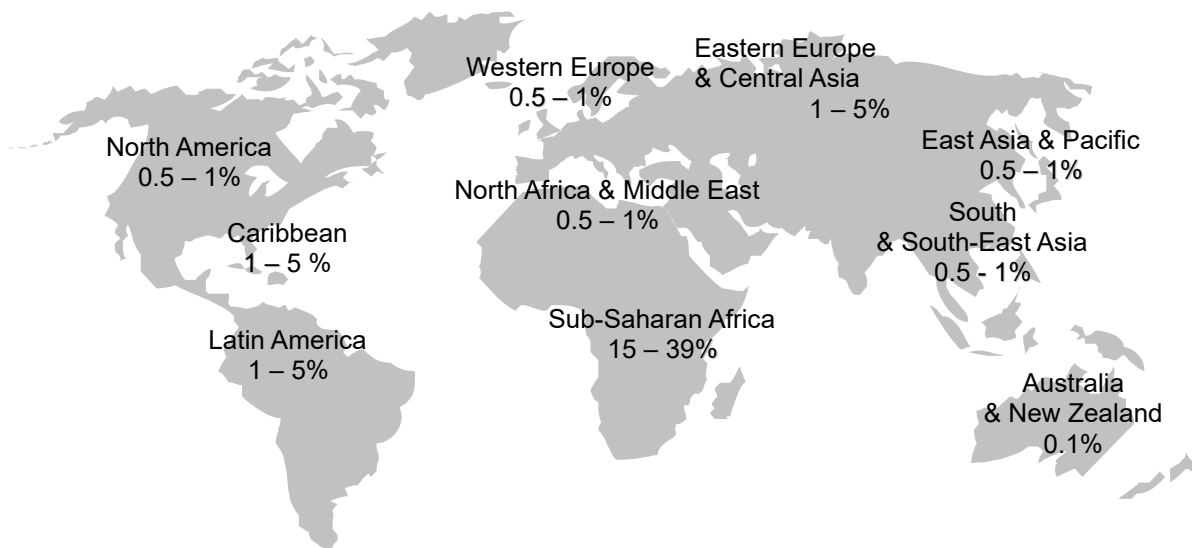
.....
.....
.....
.....
.....
.....
.....
.....

[4]

[Total 7 marks]

52. The Human Immunodeficiency Virus (HIV) is spread by exchange of body fluids between an infected person and an uninfected person. This often occurs as a result of unprotected sexual intercourse.

The diagram below shows the percentage of people infected with HIV in different parts of the world at the end of 2002.



(i) The percentage of people infected with HIV is much higher in Sub-Saharan Africa than in much of Europe.

Suggest **three** reasons why the percentages are so much higher in Sub-Saharan Africa.

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Explain why it is useful to collect information, such as that shown in the figure above.

.....

.....

.....

.....

.....

.....

.....

.....

.....

[4]

[Total 7 marks]

53. At present there is no cure for HIV / AIDS. Researchers have found that some people in Africa are not infected despite continual exposure to the disease. HIV uses a specific cell surface receptor known as the CD4 receptor to enter a human cell.

Suggest how this information and knowledge of the Human Genome might be used to help reduce the spread of HIV.

.....

.....

.....

.....

.....

.....

[Total 2 marks]

54. The black rhinoceros, *Diceros bicornis*, is an endangered species whose numbers have fallen to approximately 3000 in the past thirty years. For this reason, the species was placed on Appendix I of the Convention on International Trade in Endangered Species (CITES) agreement. Since the black rhinoceros has been placed on the appendix, numbers have stabilised, or even increased, in several countries.

(a) (i) Explain the term endangered species.

.....
.....
.....
.....

[2]

(ii) Suggest **two** reasons why the black rhinoceros is endangered.

1

.....

2

.....

[2]

(b) State two ways in which the CITES agreement is helping to save endangered species, such as the black rhinoceros.

1

.....

2

.....

[2]

[Total 6 marks]

55. Outline the potential benefits to agriculture of maintaining the biodiversity of wild animals and plants.

.....

.....

.....

.....

.....

.....

.....

.....

[Total 4 marks]

56. 'Health – Milk' and 'Energy – Boost' are flavoured milk drinks.

The manufacturers make the following claims:

'HEALTH – MILK'
Flavoured with real fruit extract.
No added sugar.

'ENERGY – BOOST'
A delicious milk drink – packed full of
energy.
Convenient, quick and easy.

The two different flavoured milk drinks and a sample of fresh milk were all tested for the presence of some biological molecules.

The methods used and the results obtained are shown in the table below.

method used	colour change observed for		
	fresh milk	'Health – Milk'	'Energy – Boost'
a few drops of iodine solution added	remains yellow	remains yellow	remains yellow
5 cm ³ biuret solution added	blue to lilac	blue to lilac	blue to lilac
5 cm ³ Benedict's reagent added and solution boiled	blue to green	blue to green to yellow	blue to green to yellow to orange
<ul style="list-style-type: none"> sample that has been tested with Benedict's reagent is filtered the filtrate (solution) is boiled with 5 cm³ dilute acid, cooled and neutralised then 5 cm³ Benedict's reagent is added and the solution is boiled 	remains blue	blue to green to yellow to orange	blue to green to yellow to orange to red

(a) Using **only** the information in the table, state the biological molecules present in

(i) fresh milk;

.....

[2]

(ii) 'Health – Milk'.

.....

[3]

(b) What **differences** between 'Health – Milk' and 'Energy – Boost' are identified by the information in the table?

.....
.....
.....
.....

[2]

(c) Explain why the claims made by the manufacturer for 'Health – Milk' could be misleading.

.....
.....
.....
.....
.....
.....

[3]

(d) Suggest why it would **not** be appropriate to test milk for lipids using the emulsion test.

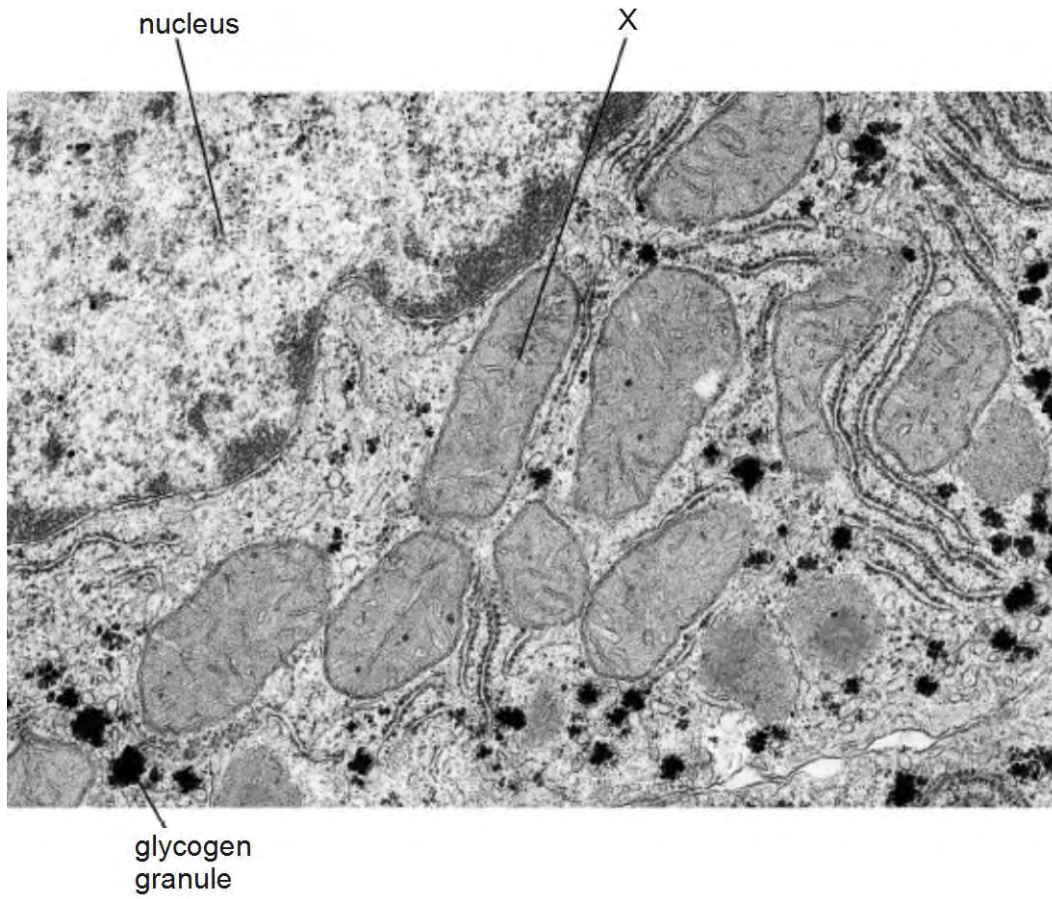
.....
.....

[1]

[Total 11 marks]

57. The diagram below is an electron micrograph of part of a cell from a human liver.

This cell is responsible for converting glucose in the body into glycogen for storage. The glycogen can be seen as granules in the cytoplasm.



(i) Describe the molecular structure of glycogen.

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Name the type of chemical reaction that takes place during the formation of glycogen.

.....

[1]

[Total 5 marks]

58. The formation of glycogen is one of many enzyme-controlled reactions carried out by liver cells in humans. The liver is a very active organ and generates a lot of heat. The temperature must not be allowed to increase too much as it will affect the rate at which glucose is converted into glycogen.

(i) Suggest the optimum temperature for these enzyme-controlled reactions.

.....

[1]

(ii) A **significant** increase in temperature above the optimum has an effect on the rate of an enzyme-controlled reaction.

Explain why this is so.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

[4]

[Total 5 marks]

- 59.
- DNA is found in the nucleus of a cell.
 - During interphase DNA replicates.
 - DNA is involved in the transcription stage of protein synthesis.

The following statements, **A** to **H**, refer to events that may take place during:

- ◆ DNA replication **only**
- ◆ transcription **only**
- ◆ **both** DNA replication **and** transcription
- ◆ **neither** DNA replication **nor** transcription.

Complete the table by marking the appropriate boxes with a tick (✓) if the event takes place or a cross (✗) if it does not take place.

		DNA replication	transcription
A	Nucleotides line up along an exposed DNA strand.		
B	The whole of the double helix 'unzips'.		
C	Uracil pairs with adenine.		
D	A tRNA triplet pairs with an exposed codon.		
E	Both DNA polynucleotide chains act as templates.		
F	Adjacent nucleotides bond, forming a sugar-phosphate backbone.		
G	The original DNA molecule is unchanged after the process.		
H	Adenine pairs with thymine.		

[Total 8 marks]

60. Over the last few years there has been much public concern over the diet of people in the UK and its effects upon their weight and health.

Body Mass Index is a calculation used by doctors to indicate whether a person is underweight or overweight.

- (a) State the medical term used to describe a person whose Body Mass Index is greater than 30.
-

[1]

The table below shows the daily intake of certain components in three diets, **A**, **B** and **C** for men in the UK.

- Diet **A** • a normal balanced diet for a typical man
- Diet **B** • a weight-reducing low fat diet
 • restricted to avoid fats
 • includes any fruit, vegetables and proteins
 • energy intake is monitored carefully
- Diet **C** • a weight-reducing low carbohydrate diet
 • restricted to avoid carbohydrates
 • excludes fruit as these contain sugars
 • includes any non-starchy vegetables, proteins and fats
 • energy intake is not counted and may exceed 10 000 kJ on some days

	Diet A normal balanced diet	Diet B weight-reducing low fat diet	Diet C weight-reducing low carbohydrate diet
energy / kJ	9720	6000	8000
fats / g	87	34	124
carbohydrates / g	275	200	20
proteins / g	88	76	165
combined minerals / g	12	12	18

(b) In any unbalanced diet it is possible that there may be a deficiency of certain nutrients.

Suggest **one** nutrient that may be deficient in diet **B** and **one** in diet **C**.

Diet **B**

Diet **C**

[2]

(c) (i) Explain which diet, **B** or **C**, is likely to cause more rapid weight loss.

.....
.....
.....
.....

[2]

(ii) State the relationship between energy intake and energy use that would allow a person to lose weight.

.....

[1]

- (d) Doctors suggested that diet **C** may not be very healthy in the long term, as it contains unlimited amounts of fats and no fruit.

Suggest what potential health problems, **other than continued weight loss**, might result in a person who kept to a low carbohydrate diet, similar to diet **C**.

.....

.....

.....

.....

.....

.....

[3]

[Total 9 marks]

- 61. Read the following passage and complete each sentence by writing the most appropriate word in the spaces provided.

Health can be defined as a state of complete, mental and social well-being. It is not merely the absence of infirmity or Many people may consider themselves healthy, even though they do not fully match the above criteria. A young woman can improve her health in a number of ways.

To improve physical well-being she should eat a balanced diet in which the majority of her energy needs come from Her diet should include only small quantities of fats and more plant oils, such as olive oil. She should exercise for at least minutes on three or more occasions per week. This exercise should be at an intensity that raises her heart rate to percent of her maximum heart rate. She should not smoke at all and should avoid passive smoking.

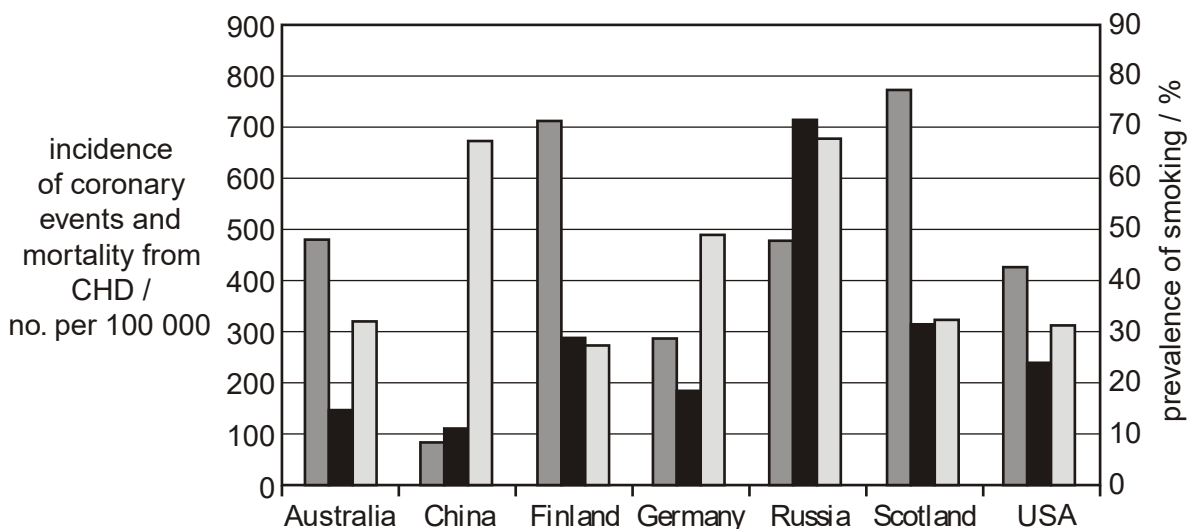
[Total 6 marks]

62. The diagram below shows the incidence of coronary events and mortality from coronary heart disease (CHD) in some countries around the world. The incidence of coronary events refers to the number of reported cases of any form of coronary illness per 100 000 of the population.

The diagram also shows the prevalence of smoking in the same countries. The prevalence of smoking is the percentage who smoke cigarettes every day.

The figures in the diagram refer to men aged from 35 to 64 during the late 1990s.

Key:
 ■ incidence of coronary events / no. of cases per 100 000
 ■ mortality from CHD / no. per 100 000
 □ prevalence of smoking / %



Source: British Heart Foundation Health Promotion Research Group www.heartstats.org

(a) The diagram above shows that the **relationship** between the incidence of coronary events and the mortality from CHD is not the same in all the countries shown.

Suggest **three** reasons why this relationship is not the same.

- 1
-
- 2
-
- 3
-

(b) Using the information in the diagram, describe the evidence to suggest that smoking is **not** the only factor involved in causing heart disease.

.....
.....
.....
.....

[2]

(c) Describe **three** steps a **government** might take to try to reduce the mortality from CHD.

1

.....

2

.....

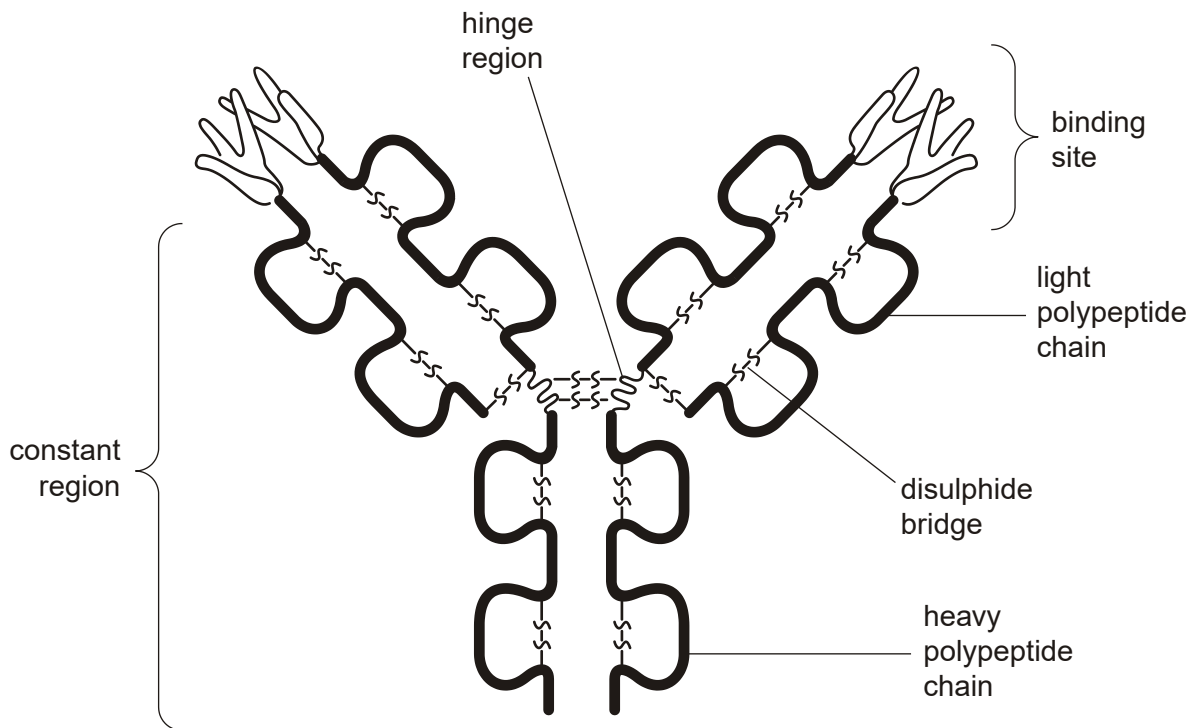
3

.....

[3]

[Total 8 marks]

63. Below is a diagram showing the structure of a typical antibody.



(a) Name the type of cell that produces antibodies.

.....

[1]

(b) (i) State **one** function for each of the component parts listed below.

binding site

.....

disulphide bridge

.....

constant region

.....

hinge region

.....

[4]

- (ii) Explain why the part of the antibody molecule incorporating the binding site is often called the variable region.

.....

.....

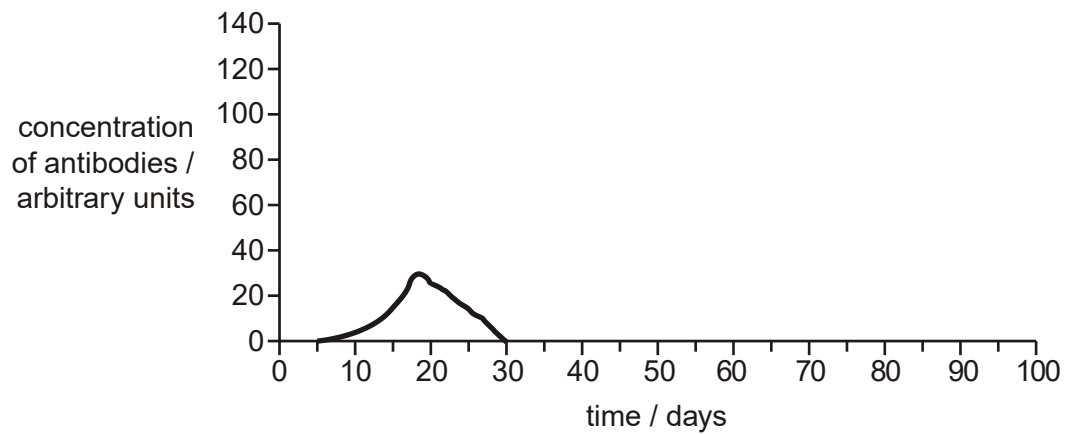
.....

.....

[2]

[Total 7 marks]

64. The figure below shows the concentration of antibodies in the blood following a first infection by a pathogen on day 0.



- (i) Explain why there is a delay between the **first** infection by the pathogen and the appearance of antibodies in the blood.

.....
.....
.....
.....

[2]

- (ii) On the figure above, draw a curve to show the expected concentration of antibodies in the blood following a **second** infection of the **same pathogen** at day 30.

[2]

[Total 4 marks]

65. Antibiotics can be used to artificially prevent bacterial infections. However, resistance to antibiotics is common among bacteria. For example, the so-called ‘superbug’ MRSA (methicillin-resistant *Staphylococcus aureus*) is resistant to many antibiotics.

- (i) State the way in which a bacterium develops resistance to an antibiotic.

.....

[1]

- (ii) Suggest **two** measures, **apart from use of antibiotics**, that could be taken in a hospital to combat possible infection with MRSA.

1

.....

2

.....

[2]

[Total 3 marks]

66. The figure below shows some deadwood that has been colonised by fungi.



(i) List **three** features of organisms belonging to the Kingdom Fungi.

- 1
- 2
- 3

[3]

(ii) State **two** features that fungi have in common with plants.

- 1
-
- 2
-

[2]

[Total 5 marks]

67. Malaria is caused by the parasite *Plasmodium* which is a single-celled protocist. At one stage in the life cycle the parasites reproduce asexually within human red blood cells.

(i) Describe how *Plasmodium* reproduces asexually.

-
-
-
-

[2]

(ii) State **two** advantages of asexual reproduction to a parasite such as *Plasmodium*.

1

.....

2

.....

[2]

[Total 4 marks]

68. In order to reproduce asexually, *Plasmodium* needs to obtain amino acids from red blood cells of its host.

Suggest how *Plasmodium* obtains amino acids from haemoglobin within red blood cells.

.....

.....

.....

.....

.....

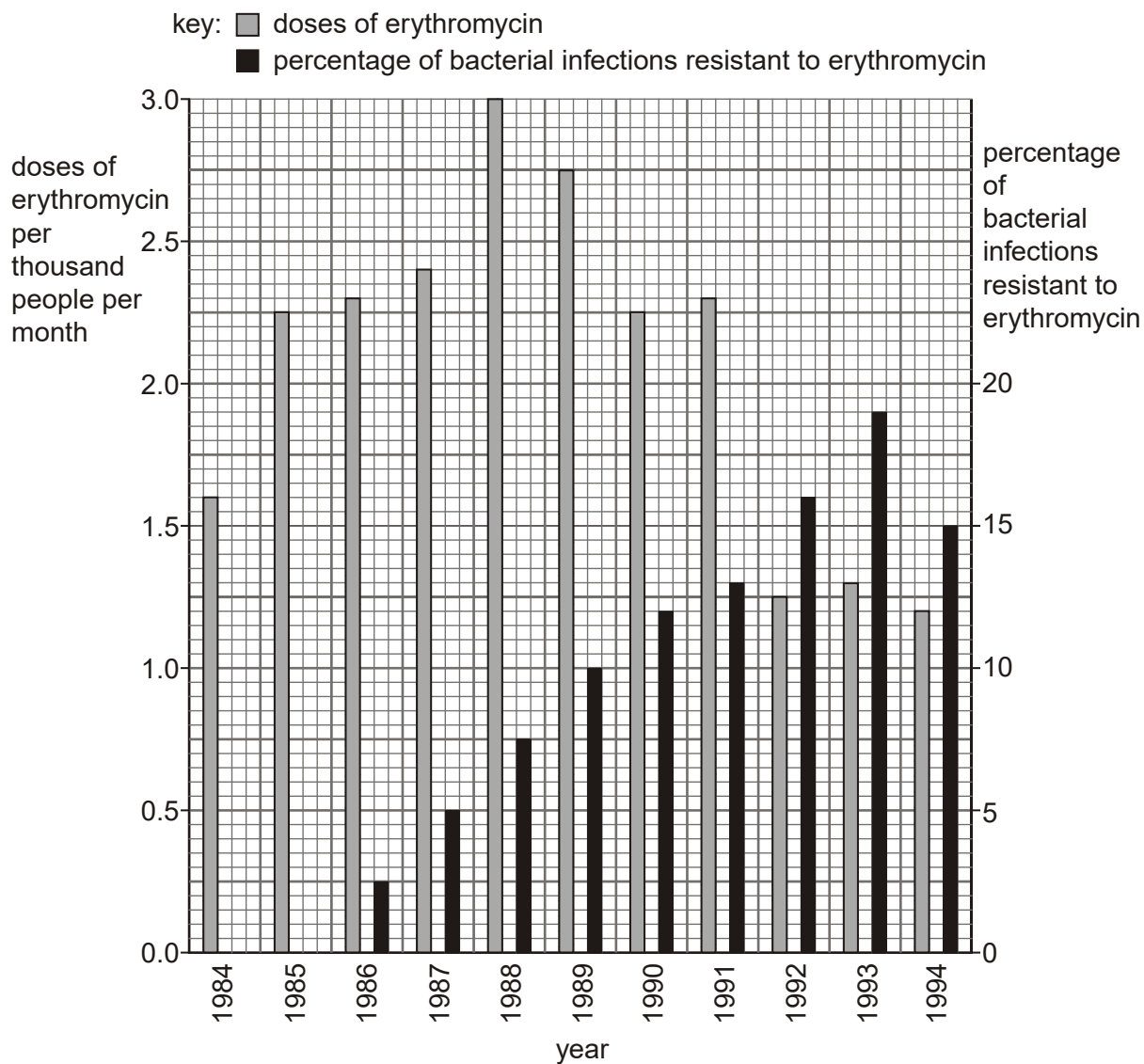
.....

[Total 3 marks]

69. In Finland, a national campaign in 1988 led to a reduction in the use of the antibiotic erythromycin.

The figure below shows the number of doses of erythromycin used per thousand people per month over the eleven year period 1984–94.

The percentage of infections each year caused by the bacterium *Streptococcus pyogenes* that were resistant to erythromycin is also shown.



(i) With reference to the information in the figure, explain the changes in the percentage of infections of *S. pyogenes* that are resistant to erythromycin.

.....

.....

.....

.....

.....

.....

.....

.....

[4]

(ii) Describe **two** ways in which resistance to erythromycin may arise in a population of *S. pyogenes*.

1

.....

.....

2

.....

.....

[4]

[Total 8 marks]

70. The table below shows data from research investigating the presence of pesticide (insecticide and herbicide) residues in drinking water in the UK from 1995 to 1998.

pesticide		number of samples analysed over 4 years	% of samples over safe limit for drinking
insecticide	lindane	2227	0.7
	DDT	1057	0.2
herbicide	mecoprop	2281	27.9
	atrazine	333	10.2

Data from Guide to a Green Planet, edited by Jules Pretty, pp.71–75, University of Essex, 2002

(a) DDT was banned from use in the UK in 1986.

Suggest why DDT was detected in drinking water more than ten years following the ban.

.....

.....

.....

.....

[2]

(b) The table above shows that a greater percentage of samples analysed for herbicide residues were over the safe limit than those analysed for insecticide residues.

Suggest why farmers used larger quantities of herbicides than insecticides.

.....

.....

.....

.....

.....

[3]

[Total 5 marks]

71. Aphids are pest species which farmers control using insecticides. It is important that farmers use the correct dose of the active ingredient in an insecticide on their crops to ensure effective control. The following table shows doses that a farmer would apply to a crop of barley to control aphids.

active ingredient	dose / $\text{cm}^3 \text{ ha}^{-1}$
deltamethrin	250
dimethoate	845
tau-fluvalinate	150
β -cyhalothrin and pirimicarb	1000
chlorpyrifos	700

Data from Guide to a Green Planet, edited by Jules Pretty, pp.71–75,
University of Essex, 2002

Using the table state which active ingredient is the most toxic to aphids **and** explain your answer.

.....

.....

.....

.....

[Total: 2 marks]

72. The Millennium Seed Bank Project (MSBP) is a global conservation programme conceived, developed and managed by the Seed Conservation Department at the Royal Botanic Gardens, Kew. The aims of the project are to collect and conserve 10% of the world's seed-bearing plants by 2010.

The project aims to make seeds available for research and species re-introduction into the wild. Scientists working in seed banks have to maintain the viability and genetic variability of the seeds they store. Samples of seeds stored are germinated to assess their variability.

Describe **how** scientists working in seed banks maintain the viability and genetic variability of seeds.

viability

.....

.....

genetic variability

.....

.....

[Total 3 marks]

73. In this question, one mark is available for the quality of spelling, punctuation and grammar.

Zoos and botanic gardens, such as Kew Gardens, are involved in many conservation projects throughout the world.

Outline the problems experienced by zoos and botanic gardens in managing such projects **and** explain why it is important for such projects to be successful.

[7]

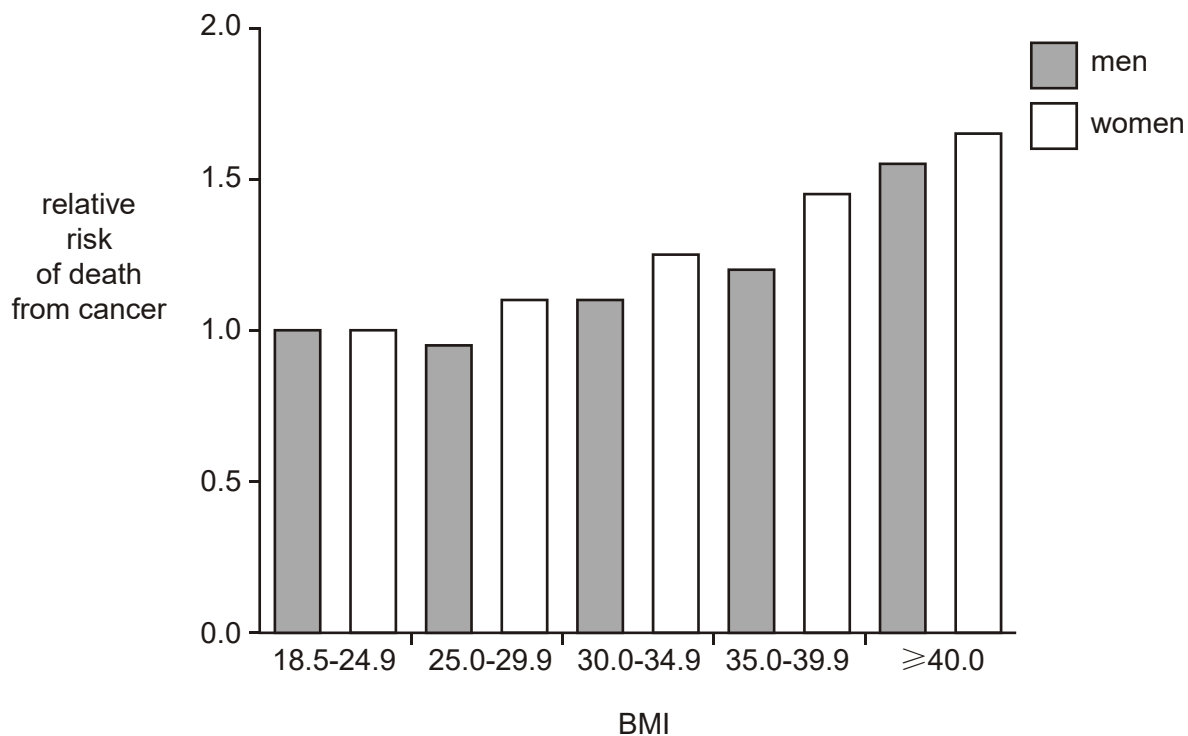
Quality of Written Communication [1]

[Total 8 marks]

74. The effect of diet on cancer mortality is partly due to its effect on obesity. Obesity is defined as having a Body Mass Index (BMI) over 24.9. BMI is calculated by the following formula.

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

The figure below shows the effect of BMI on the relative risk of dying from cancer. Non-obese people with a BMI of 18.5–24.9 are assigned a baseline risk of 1.



© National Obesity Forum, Reproduced by kind permission of the National Obesity Forum

- (i) Calculate the BMI of a woman 1.7 m tall with a mass of 105 kg.

Answer =

(ii) Use the figure above to explain the likelihood of this woman dying from cancer.

.....

.....

.....

.....

[2]

[Total 4 marks]

75. The table below shows six statements that apply to biochemical tests.

Complete the table to show which of these statements apply to the biochemical tests carried out on the substances listed.

Fill in each box using a tick (✓) to show that the statement applies or a cross (✗) if it does not. The first row has been completed for you.

substance	statement					
	use heat	use biuret reagent	use Benedict's reagent	boil with a dilute acid	a positive result is a blue-black colour	a positive result is an emulsion
lipid	✗	✗	✗	✗	✗	✓
protein						
starch						
reducing sugar						
non-reducing sugar						

[Total 4 marks]

76. A sucrose molecule is a carbohydrate molecule made by joining a glucose unit to a fructose unit.

(i) Name the bond that joins the units in a molecule of sucrose.

.....

[1]

(ii) Name the type of reaction that **breaks** this bond.

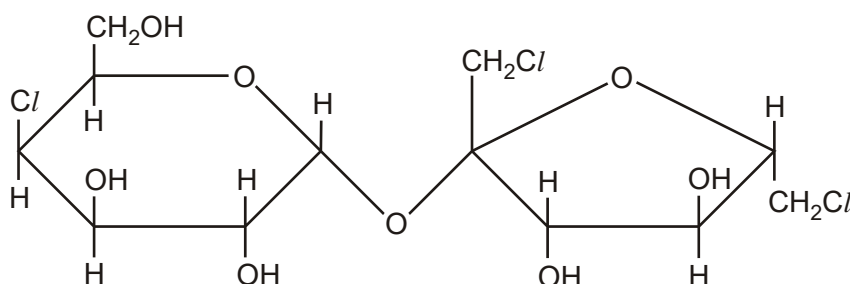
.....

[1]

[Total 2 marks]

77. Sucralose is a chemical that is similar in structure to sucrose. It has been made from sucrose by replacing three of the OH (hydroxyl) groups with Cl (chlorine) atoms.

The diagram below shows a molecule of sucralose.



The following claim is made for sucralose:

Sucralose has the same sweet taste as sucrose.

It cannot be digested by enzyme action in the human body and so it does not lead to weight increase.

Using the information in the diagram to help you, suggest why sucralose cannot be digested in the body.

.....

.....

.....

.....

.....

.....

.....

.....

[Total 4 marks]

78. The table below shows a number of categories of disease, a definition of each category and one example of a disease that fits into each category.

Complete the table.

category	definition of disease category	one example
deficiency	diseases caused by poor diet	scurvy
.....	diseases caused by a genetic fault passed from the parents	cystic fibrosis
degenerative	..... ..... .....	Huntington's disease
infectious	diseases that are transmitted by a pathogenic organism which invades the body	.....
.....	diseases caused by changes to the mind	schizophrenia
physical	..... .....	asthma

[Total 5 marks]

79. Epidemiology is the study of patterns of disease and the factors that affect their occurrence and spread.

State **three** ways in which members of the medical profession can use information about how diseases spread.

1

.....

2

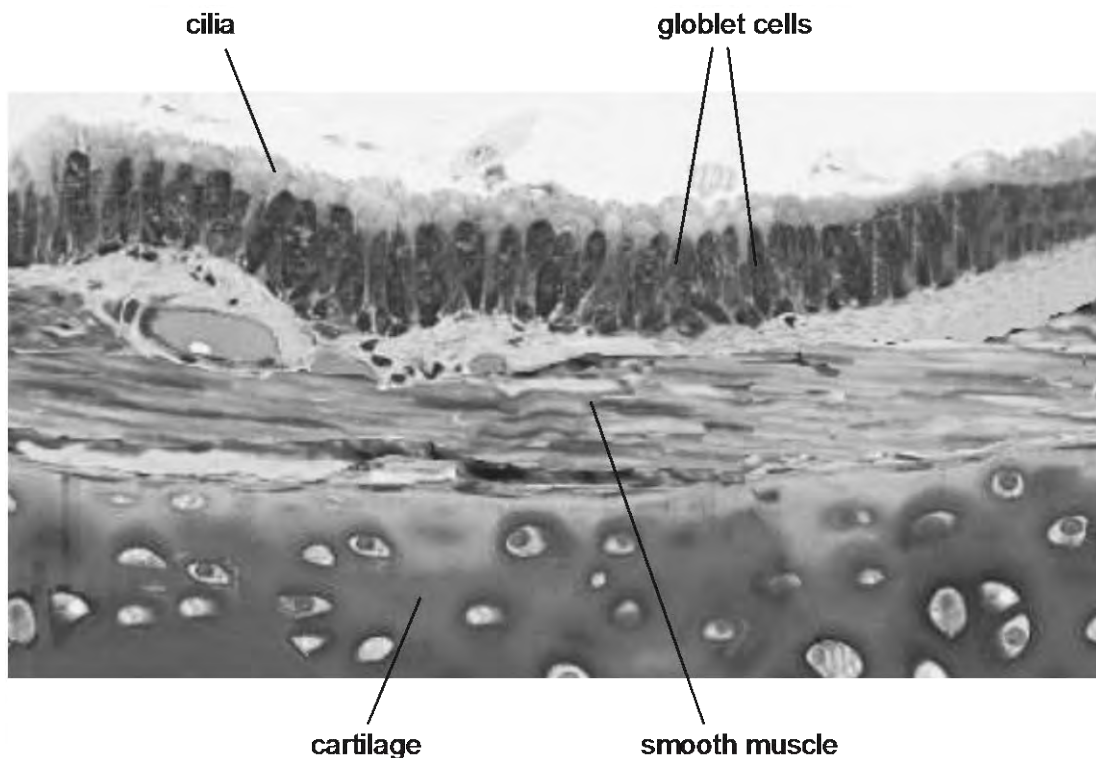
.....

3

.....

[Total 3 marks]

80. The different parts of the gaseous exchange system, such as the bronchi, show structural adaptations to their functions. The diagram below shows a section through the wall of a bronchus as seen with a light microscope.



(a) (i) State **one** function for each of the following components of the bronchus wall.

goblet cell

.....

cartilage

.....

[2]

(ii) State **two** ways in which the **structure** of the wall of the bronchus would be different in a long-term smoker.

1

.....

2

.....

[2]

(b) Gaseous exchange occurs across the walls of the alveoli.

Explain why the walls of the alveoli contain elastic fibres.

.....

.....

.....

.....

[2]

(c) One feature of the disease emphysema is that the alveoli lose their elasticity.

Explain the effects of this loss of elasticity on the gaseous exchange system of a person with emphysema.

.....

.....

.....

.....

.....

.....

.....

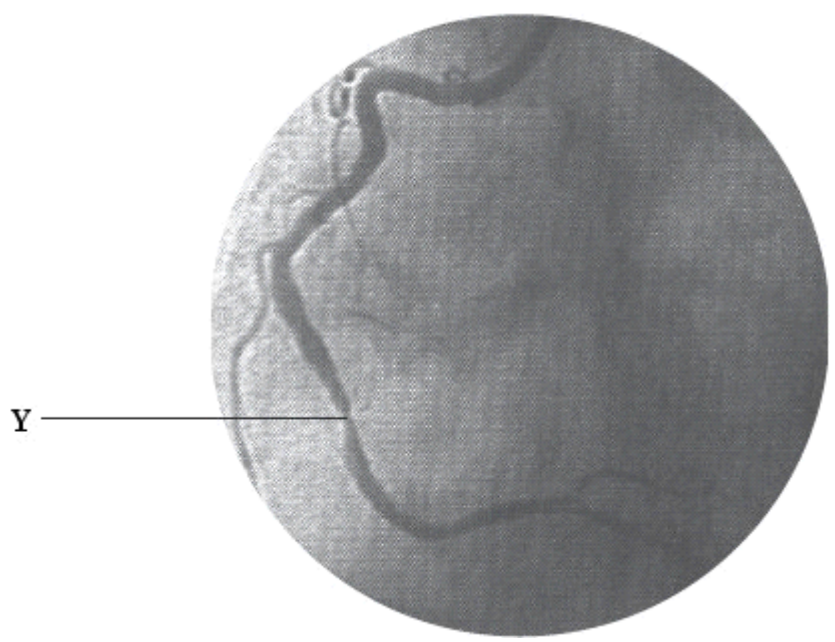
.....

.....

[4]

[Total 10 marks]

81. The diagram below shows an artery lying on the surface of living heart muscle as seen by an instrument called an endoscope. The lumen of the artery has become narrowed at the point labelled Y.



The Forum on Ischaemic Heart Disease.
Reproduced by kind permission of Dr Graham Jackson,
Cardiology Unit, Guy's and St Thomas' Hospital.

(i) Name the artery shown in the diagram.

.....

[1]

(ii) Explain how the lumen of the artery has become narrowed at point Y.

.....
.....
.....
.....

[2]

[Total 3 marks]

82. (i) Suggest how doctors might treat a patient with narrowing of the arteries that supply the heart muscle.

.....
.....
.....
.....

[2]

(ii) Suggest **two** pieces of advice that a doctor might give to such a patient to try to reduce the likelihood of further narrowing of the arteries.

1

.....

2

.....

[2]

[Total 4 marks]

83. (a) Milk contains a number of important nutrients including:

- proteins which contain amino acids
- fats which contain fatty acids
- minerals.

Name **two other** groups of nutrients found in a balanced diet.

1

2

[2]

(b) Some amino acids are known as essential amino acids.

(i) State what is meant by the term *essential amino acids*.

.....
.....

[1]

(ii) Outline the functions of essential amino acids in the body.

.....
.....
.....
.....

[2]

(c) The photograph below shows a child with kwashiorkor, a form of protein energy malnutrition.



Reproduced by kind permission of Tom D Thacher,
MD, www.thachers.org

(i) Describe the symptoms of kwashiorkor.

.....
.....
.....
.....
.....
.....

[3]

(ii) Explain why the onset of this disease often occurs between the ages of six months and eighteen months.

.....
.....
.....
.....

[2]

[Total 10 marks]

84. The table below shows:

- the percentage of people with HIV/AIDS in different regions of the world at the end of 2002
- the number of new infections with HIV between 1999 and 2002 expressed as a percentage of those with HIV/AIDS at the end of 2002.

region	percentage of people with HIV/AIDS at the end of 2002	number of new infections between 1999 and 2002 as % of those with HIV/AIDS at the end of 2002
East Asia and Pacific	1	76
Eastern Europe and Central Asia	1 – 5	196
North Africa and Middle East	1	74
North America	1	16
Sub-Saharan Africa	15 – 39	52
Western Europe	1	15

It has been suggested that HIV/AIDS is a greater problem in less economically developed regions than in more economically developed regions.

Describe the evidence in the table that supports this suggestion.

.....

.....

.....

.....

.....

.....

[Total 2 marks]

85. In this question, one mark is available for the quality of spelling, punctuation and grammar.

Explain why it is difficult to prevent the spread of HIV/AIDS **and** explain why the increase in the number of cases is so much higher in some parts of the world than in others.

[7]

Quality of Written Communication [1]

[Total 8 marks]

86. (a) Complete the following passage.

In October 2004, scientists announced successful trials of a malaria vaccine. The vaccine was developed from proteins taken from the parasite, *falciparum*. When the proteins enter the body they act as which are recognised as foreign by the immune system. These foreign proteins activate lymphocytes called T cells which then divide to increase in numbers. Some of these newly cloned cells become cells which attack infected cells in the liver. Others become cells which release a hormone-like messenger molecule called a These molecules activate B cells to divide and produce plasma cells. The B cells also produce cells that stay in the body for a number of years. The result is an immune system prepared to make a strong attack on the parasite when it enters the body.

[6]

- (b) Name the molecules, released by plasma cells, that attack the parasite when it enters the body.

.....

[1]

(c) Suggest why it has been difficult to produce a malaria vaccine.

.....
.....
.....
.....
.....
.....
.....

[3]
[Total 10 marks]

87. (a) The malarial parasite, *Plasmodium*, and its vector, the mosquito, are both eukaryotes.

The treatment and control of malaria is difficult because *Plasmodium* rapidly develops resistance to most anti-malarial drugs as do mosquitoes to insecticides. Also, vaccine production has proved to be very difficult. The B-cell responses induced by experimental vaccines are not yet very effective.

Explain

(i) the genetic basis of resistance in eukaryotes;

.....
.....
.....
.....
.....
.....
.....
.....
.....

[5]

(ii) why producing an effective vaccine against *Plasmodium* has proved to be so difficult.

.....
.....
.....
.....
.....
.....

[3]

(b) A gene has been identified in several species of *Plasmodium* which codes for a small transmembrane protein.

A mutant form of *P. berghei* exists in which this protein is **not** produced. *P. berghei* infects mice. The mutants:

- develop normally in a mosquito and infect the salivary glands in numbers comparable to wild type parasites
- infect mouse liver cells but do not multiply
- do not infect red blood cells.

(i) Describe **one** mutation of this gene that could have occurred in *P. berghei* so that the encoded protein is **not** produced.

.....
.....
.....

[2]

(ii) Suggest **one** reason why mutant *P. berghei* **do not** infect red blood cells.

.....
.....
.....
.....

[2]

- (c) It has been suggested that *Plasmodium* with this mutation could be used as a 'whole organism' vaccine against malaria.

Mice were inoculated with different numbers of mutant *Plasmodium* and then given one or two 'booster' inoculations. Their protection against infection by wild-type *Plasmodium* was compared with that of mice that had not been inoculated. The results of the investigation are shown in the table below.

number of mutant <i>Plasmodium</i>			percentage of mice resistant to infection by wild-type <i>Plasmodium</i>
in initial inoculation	in first booster inoculation	in second booster inoculation	
50 000	25 000	25 000	100
10 000	10 000	10 000	100
10 000	10 000	0	70
0	0	0	0

With reference to the information in the table and in (b), comment on the use of this mutant *Plasmodium* as a 'whole organism' vaccine.

.....

.....

.....

.....

.....

[3]

[Total: 15 marks]

88. Musk deer occur throughout forested mountain habitats in Asia and eastern Russia. They live in small groups, normally three individuals in a group, and are primarily active at night.

The deer are hunted illegally for traditional medicine and also threatened by habitat destruction. Populations of musk deer in China and Mongolia are listed in Appendix II of the Convention for International Trade in Endangered Species (CITES).

Explain what is meant by the term *endangered species*.

.....

.....

.....

.....

[Total 2 marks]

89. In this question, one mark is available for the quality of the use and organisation of scientific terms.

Musk deer populations in isolated habitats could be conserved by a programme of captive breeding. Zoos, such as London Zoo and Jersey Zoo, are involved in captive breeding of many endangered species.

Describe how a captive breeding programme for musk deer would be set up **and** discuss the problems associated with the reintroduction of the captively bred deer back into the wild.

[7]

Quality of Written Communication [1]

[Total 8 marks]

90. Hedgerows are important in farming as they act as sites of refuge for beneficial insects, provide protection for the crop from adverse weather conditions and act as wildlife corridors.

Farmers are advised to leave strips of land between hedgerows and the crops in the fields to encourage biodiversity.

Describe how you would investigate whether leaving strips of land around fields encourages **plant** biodiversity.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[Total 5 marks]

91. When hedgerows are destroyed there is a loss of biodiversity.

Suggest why this loss of biodiversity is of concern.

.....
.....
.....
.....
.....
.....

[Total: 3 marks]

92. The Royal Society for the Protection of Birds (RSPB) and the British Trust for Ornithology (BTO) carried out research into the declining populations of farmland bird species. In a study carried out from 1970 to 1998 they found that farmland bird species had decreased by up to 68% across rural areas of the UK.

- (i) Changes in farming practices, such as the increased use of pesticides, are highlighted by the RSPB and BTO as possible causes of this decline in bird species.

Suggest how the increased use of pesticides could have caused this decline.

.....
.....
.....
.....
.....
.....

[3]

- (ii) An increase in the number of predators, such as magpies and sparrowhawks, has also been suggested as a possible cause for the decline in the populations of farmland bird species.

Suggest why this may **not** be the cause.

.....

.....

.....

.....

[2]

[Total 5 marks]

93. In this question, one mark is available for the quality of spelling, punctuation and grammar.

The immense biodiversity of the oceans includes:

- corals that host symbiotic algae which die if the sea temperature rises by 1°C;
- animals like polar bears that use floating ice as a base for sea fishing expeditions;
- sessile animals like mussels that feed by filtering food particles from the water and reproduce by releasing gametes into the water;
- reef-building animals like corals that form hard calcium carbonate skeletons by extracting mineral ions such as Ca^{2+} from the water;
- seaweeds of different colours which occur in shallow water;
- animals like fish that hunt prey using well-developed visual skills;
- large animals such as the blue whale;
- physically delicate organisms like jellyfish that lose their shape in air.

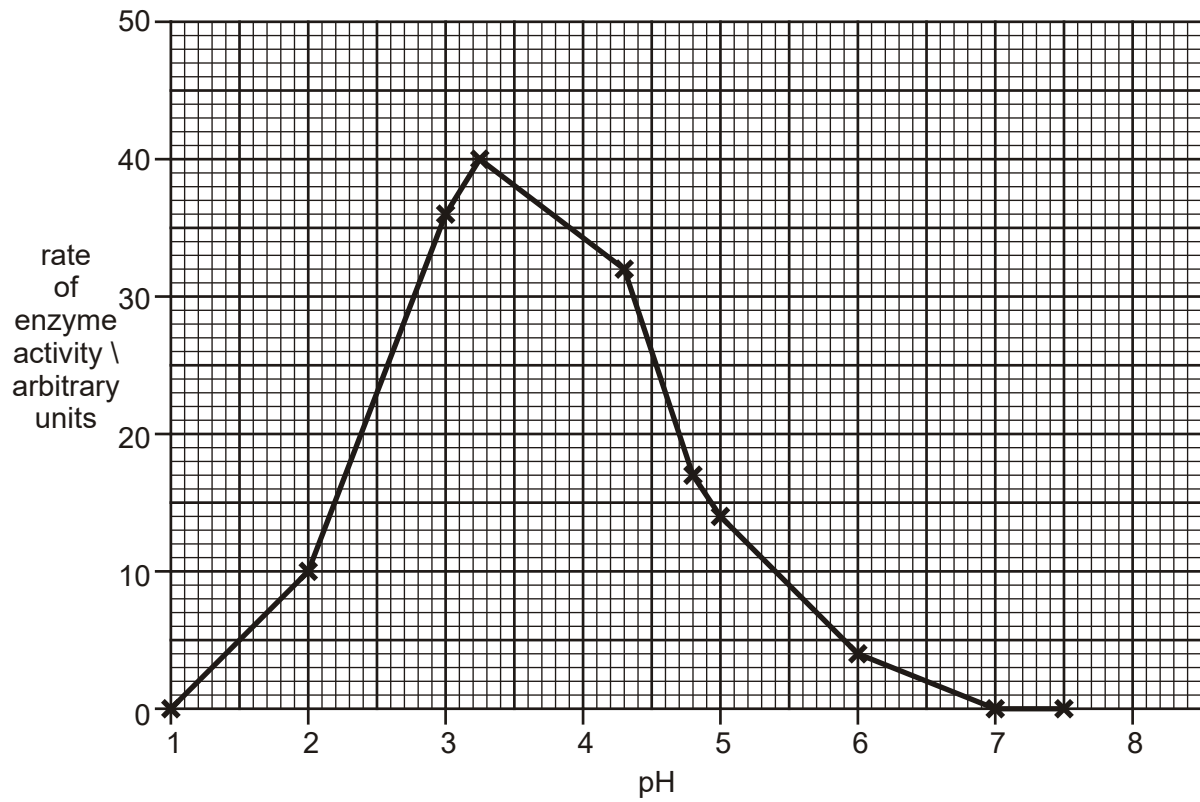
Using examples from the list above, describe **and** explain how the **properties** of water make it a suitable environment for these organisms.

[7]

Quality of Written Communication [1]

[Total 8 marks]

94. Two students carried out an investigation into the effect of pH on the activity of a lysosomal enzyme. Student **A** drew the graph shown in the diagram below.



(i) A teacher asked two students to state the optimum pH for this enzyme. Student **A** gave the answer 'pH 3.25' but student **B** gave the answer 'somewhere between pH 3.0 and pH 4.3'. The teacher said that student **B** had given the better answer.

Explain why student **B**'s answer was better.

.....

.....

.....

.....

- (ii) Explain why this enzyme is not active at pH 7.

.....

.....

.....

.....

[2]

[Total 4 marks]

- 95.** In this question, one mark is available for the quality of spelling, punctuation and grammar.

Explain the effects of enzyme concentration, substrate concentration **and** competitive inhibitors on the rate of an enzyme-controlled reaction.

[9]

Quality of Written Communication [1]

[Total 10 marks]

- 96.** Read the following passage and then answer the questions that follow.

Human Factor VIII is a glycoprotein found in blood plasma. It is involved in blood clotting.

- 5 This glycoprotein contains 2332 amino acids linked into a single chain. This chain is folded and coiled into a secondary structure and then further folded. The chain forms six individual regions, each with its own function.

An artificial source of Factor VIII, created using genetic engineering, is now used to treat patients with haemophilia, a medical condition in which the blood clots more slowly than normal. The Factor VIII gene is first removed from the genome of human cells. It is then inserted into the genome of hamster cells.

- 10 Cancer cells or cells taken from an ovary are usually used to produce Factor VIII as these grow very well in industrial tanks. The Factor VIII that is produced is then removed from the tanks and purified before use in treating patients.

- (a) State what is meant by the term *glycoprotein* (line 1).

.....
.....

[1]

- (b) The secondary structure of a protein is identified by its shape.

- (i) Name a shape formed by **coiling** of the primary structure.

.....

[1]

- (ii) Name a shape formed by **folding** of the primary structure.

.....

[1]

- (c) State the name given to the level of structure formed by **further folding** of the secondary structure (line 4).

.....

[1]

[Total 4 marks]

97. Complete the following passage by using the most suitable word(s) in each of the blank spaces.

Water is essential for life. It makes up a high proportion of the cytoplasm in a cell. Many different compounds can dissolve in it and it is therefore described as an excellent

Water remains in the state over a wide range of environmental temperatures. As it cools below 4 °C it becomes less than warmer water. Ice floats on water, forming a layer that the water beneath with the result that large bodies of water rarely freeze entirely.

The bonds that form between water molecules are responsible for its high, which allows small insects such as pond skaters to move on its surface without sinking.

[Total 6 marks]

98. The Human Immunodeficiency Virus (HIV) is spread by exchange of body fluids between an infected person and an uninfected person. This often occurs as a result of unprotected sexual intercourse. HIV / AIDS is categorised as an infectious disease.

Listed below are three other categories of disease.

- (a) State one example of a disease that fits into each category.

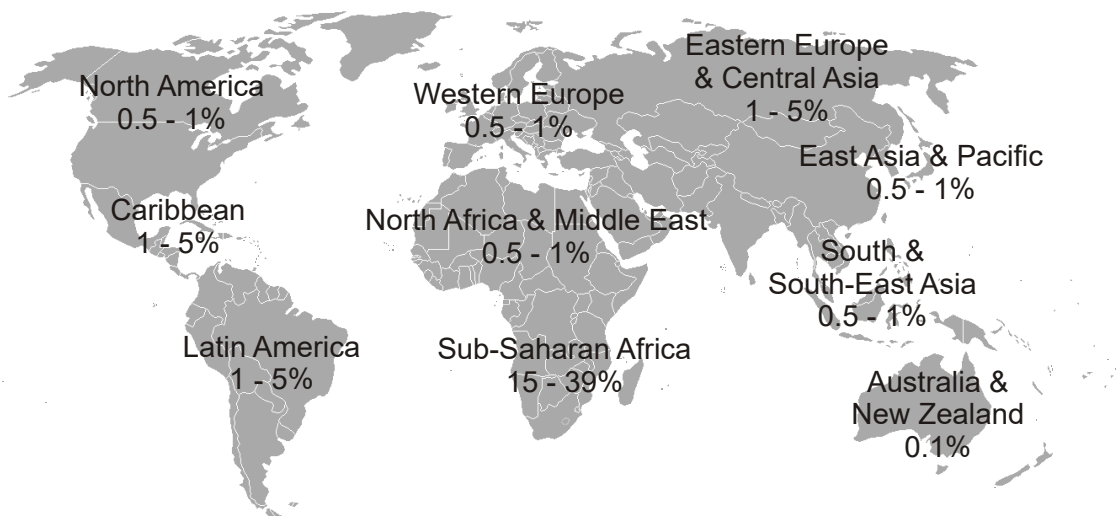
mental disease

self-inflicted disease

inherited disease

[3]

The diagram below shows the percentage of people infected with HIV in different parts of the world at the end of 2002.



data from UNAIDS

- (b) (i) Explain why it is useful to collect information, such as that shown in the diagram.

.....

.....

.....

.....

.....

.....

.....

- (ii) The percentage of people infected with HIV is much higher in Sub-Saharan Africa than in much of Europe.

Suggest why the percentages are so much higher in Sub-Saharan Africa.

.....
.....
.....
.....

[2]

- (c) At present there is no cure for HIV/AIDs. Efforts to reduce the spread of HIV infection are centred on reducing the chances of a person carrying HIV passing it on to others.

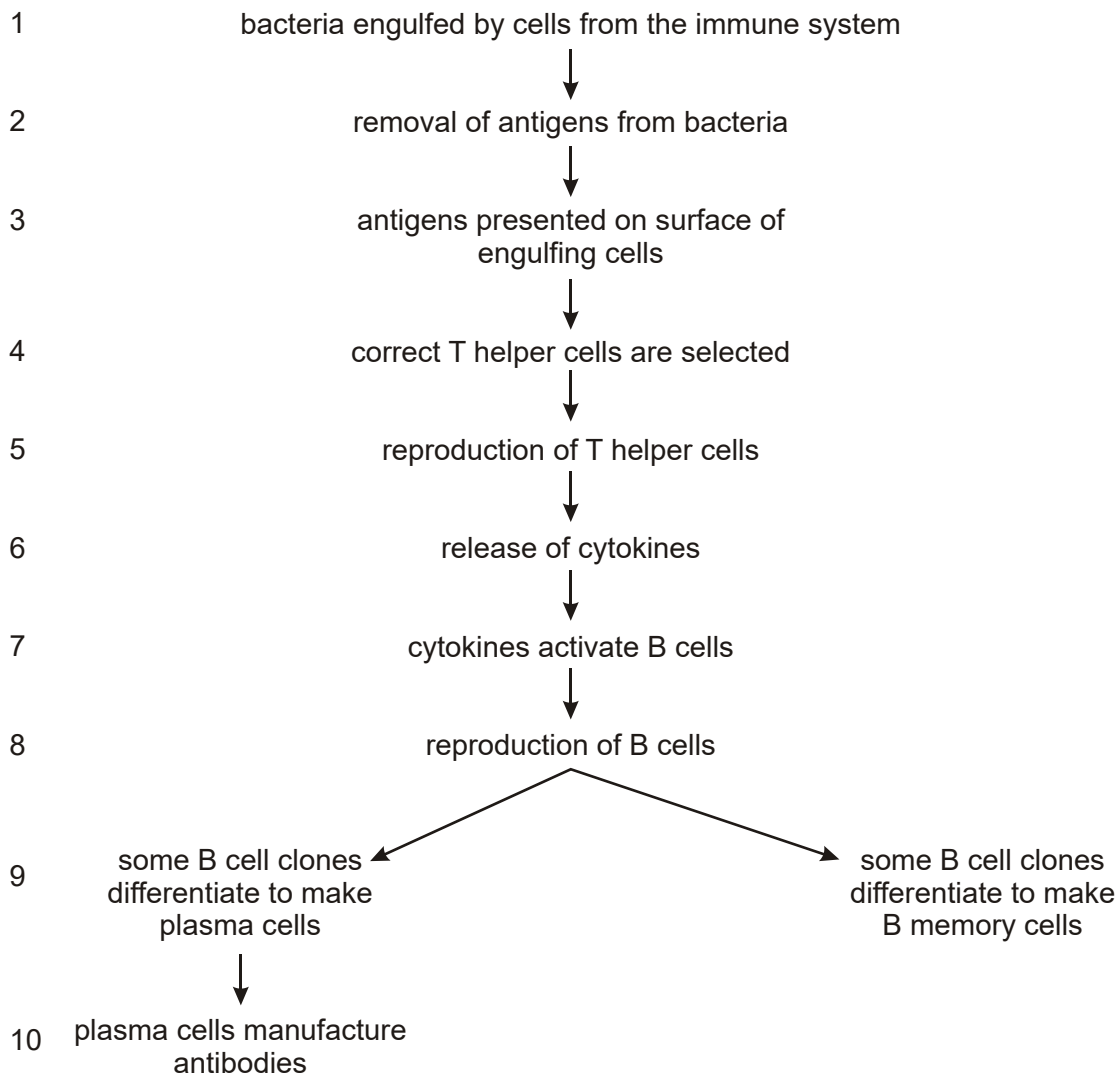
Suggest how information gained from the Human Genome Project might be used to help reduce the spread of HIV.

.....
.....
.....
.....
.....

[2]

[Total 10 marks]

99. The diagram below shows stages in the immune response to invading bacteria.



(i) Name the type of cell that engulfs the bacteria in stage 1.

.....

[1]

(ii) Suggest how the antigens are removed from the bacteria in stage 2.

.....
.....
.....
.....

[2]

(iii) Explain how the correct T helper cells are selected in stage 4.

.....
.....
.....
.....

[2]

(iv) Name the type of cell division used for reproduction of the T helper cells in stage 5.

.....

[1]

(v) Explain the importance of B memory cells in immunity.

.....
.....
.....
.....
.....
.....
.....
.....

[4]

[Total 10 marks]

100. Describe how antibodies act on invading pathogens, such as bacteria or viruses.

.....

.....

.....

.....

.....

[Total 2 marks]

101. Both Fig. 1 and Fig. 2 are photographs of lung tissue taken through a light microscope at the same magnification.

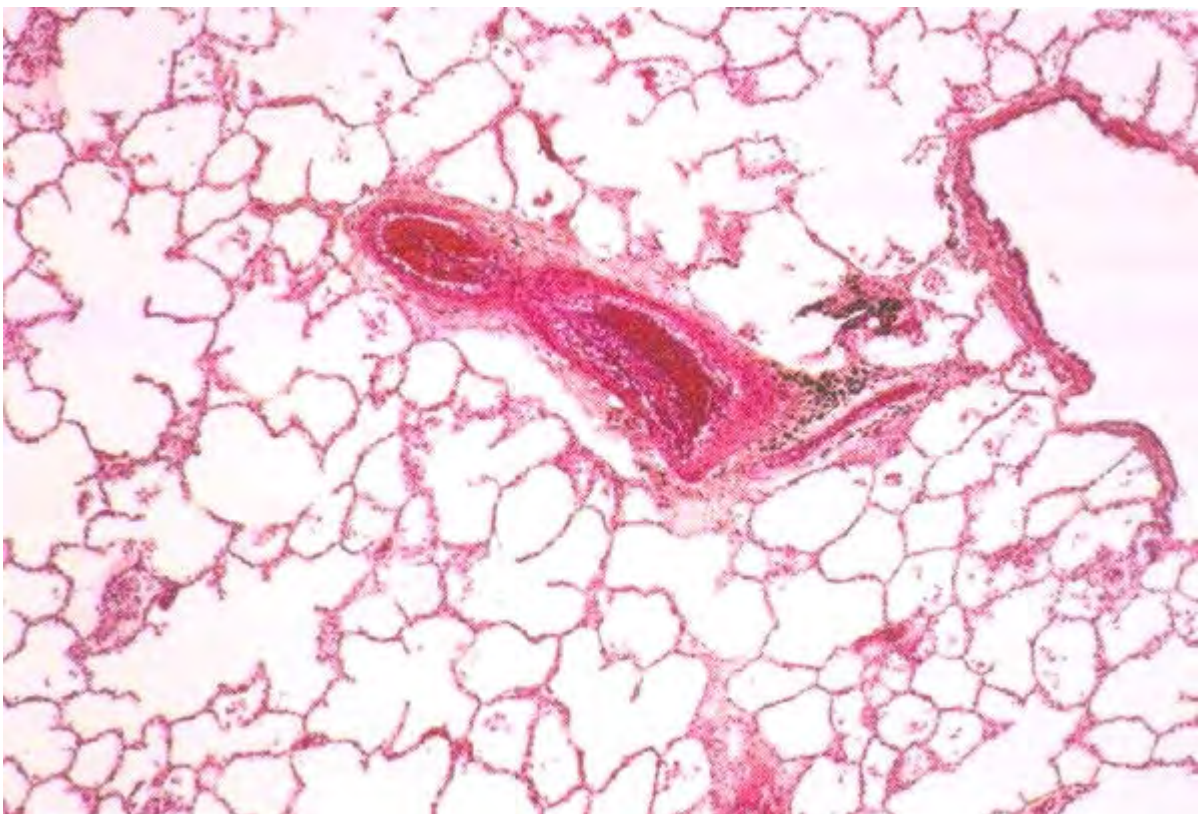
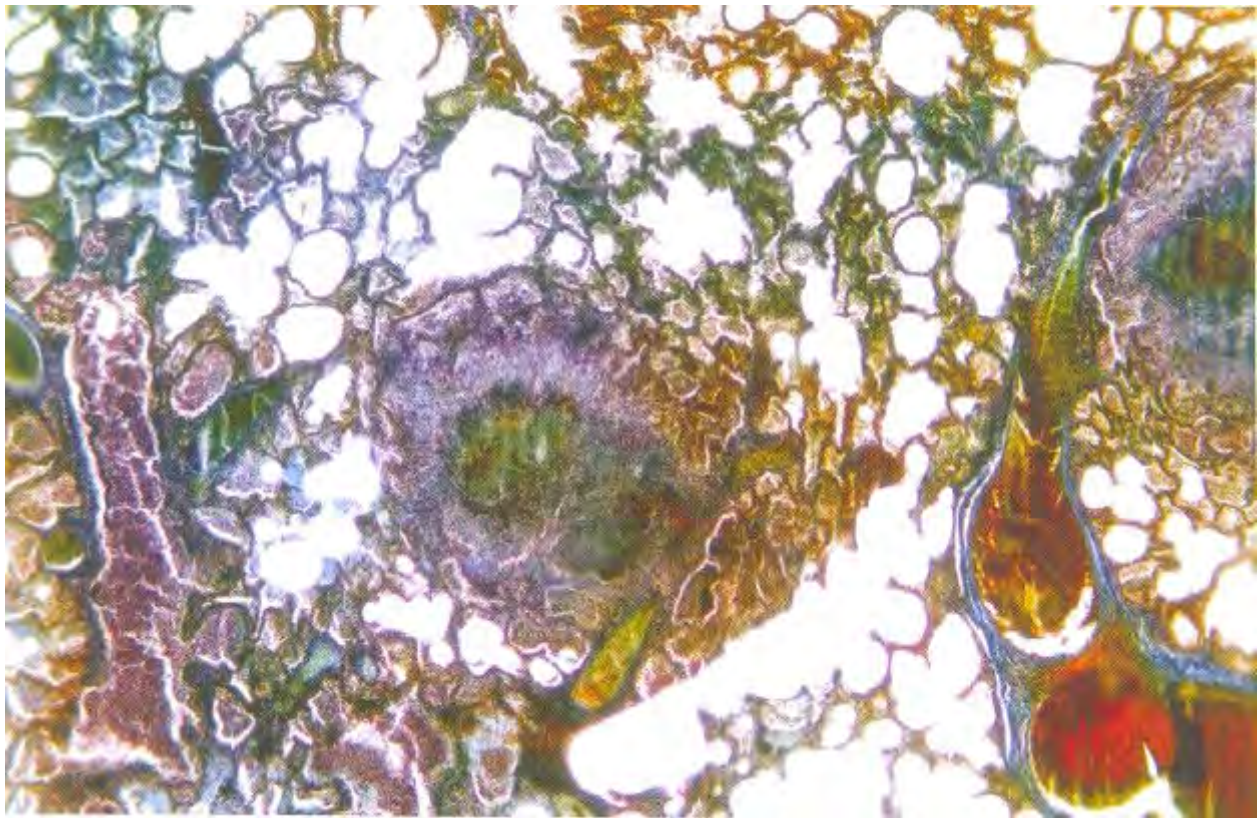


Fig. 1



John Burbridge / Science Photo Library

Fig. 2

Fig. 1 shows healthy lung tissue.

Fig. 2 shows lung tissue damaged by tuberculosis.

- (a) Name the organism that causes tuberculosis.

.....

[1]

- (b) Suggest how damage to lung tissue in tuberculosis, as seen in Fig. 2, is likely to affect a person with this disease.

.....
.....
.....
.....
.....

[2]

(c) Outline the reasons why tuberculosis has not been eradicated.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[5]

[Total 8 marks]

102. (a) Name **two** diseases that may be caused by many years of cigarette smoking.

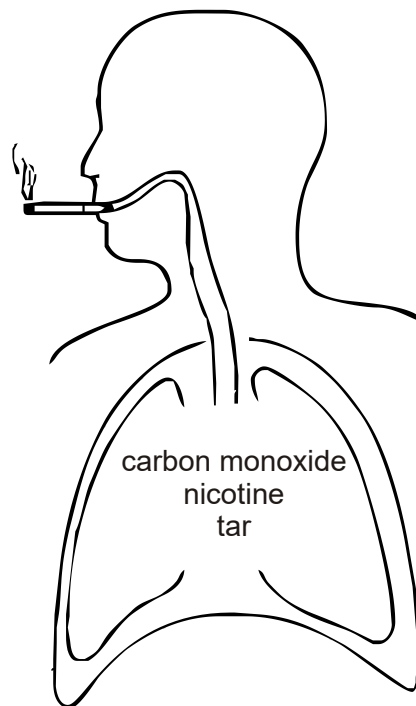
1

2

[2]

- (b) In this question, one mark is available for the quality of use and organisation of scientific terms.

The diagram below shows three components inhaled as a result of smoking a cigarette.



Describe the effects of these three components of cigarette smoke on the body.

[8]

Quality of Written Communication [1]

[Total 11 marks]

103. The tiger, *Panthera tigris*, is the largest and most distinctive cat in the world.

Complete the following table to show the classification of the tiger.

kingdom	.....
.....	chordata
.....	mammalia
order	carnivora
family	felidae
genus	.....
.....	<i>Panthera tigris</i>

[Total 5 marks]

104. Haemolytic disease of the newborn can occur if red blood cells are broken down too rapidly.

This is caused by antibodies, produced by the mother, crossing the placenta into the fetal circulation.

Suggest how antibodies cause the breakdown of red blood cells in haemolytic disease of the newborn.

.....

.....

.....

.....

.....

.....

[Total 2 marks]

105. Seed banks maintain the genetic diversity of plant populations.

State **two** methods used to preserve seeds in seed banks.

1

2

[Total 2 marks]

106. When Darwin first came to the Galapagos there were some 3000 tortoises which had been reduced to 14 by 1965. Since then each type of tortoise has been kept on its own island as part of a captive breeding programme. The Espanola Tortoise was successfully bred so that there are now about 1000 of them on Santa Cruz Island. Conservationists are now planning to release them into the wild on another island to increase the population there.

(a) Suggest **two** reasons why the population decreased before 1965.

- 1
-
- 2
-

[2]

Captive breeding programmes are not always as successful as the one described above.

(b) Explain why many species **do not** breed successfully in captivity.

-
-
-
-
-
-

[3]

(c) State **two** problems encountered when releasing captive bred individuals into the wild.

- 1
-
- 2
-

[2]

- (d) A further study of 134 individuals was carried out on the tortoise population. It was found that the population had a very low genetic diversity. This was caused by an introduced male tortoise from the San Diego Zoo who fathered nearly 80 of the individuals sampled.

Suggest how a low genetic diversity may be damaging to the population.

.....

.....

.....

.....

.....

.....

[3]

[Total 10 marks]

- 107. Cholesterol is a lipid which forms part of the structure of membranes of animal cells. It is absorbed from food and can also be synthesised by liver cells.

Cholesterol is transported by the blood with the help of specific transport proteins to which cholesterol molecules become reversibly attached. These complexes of lipid and protein are known as lipoproteins. There are three different types of lipoprotein transporting cholesterol in the blood. The concentration of cholesterol in blood can be measured, either as the total cholesterol, or as the amount carried by each of the different types of lipoprotein.

Explain why cholesterol must be carried in the blood by proteins while glucose does **not** need any transport protein.

.....

.....

.....

.....

[Total 2 marks]




- 108.** Researchers and medical practitioners calculate the ratio of the total blood cholesterol concentration (**TC**) to the concentration of cholesterol carried by one type of lipoprotein, called high density lipoprotein (**HDL**). This ratio is called the **TC : HDL ratio**.

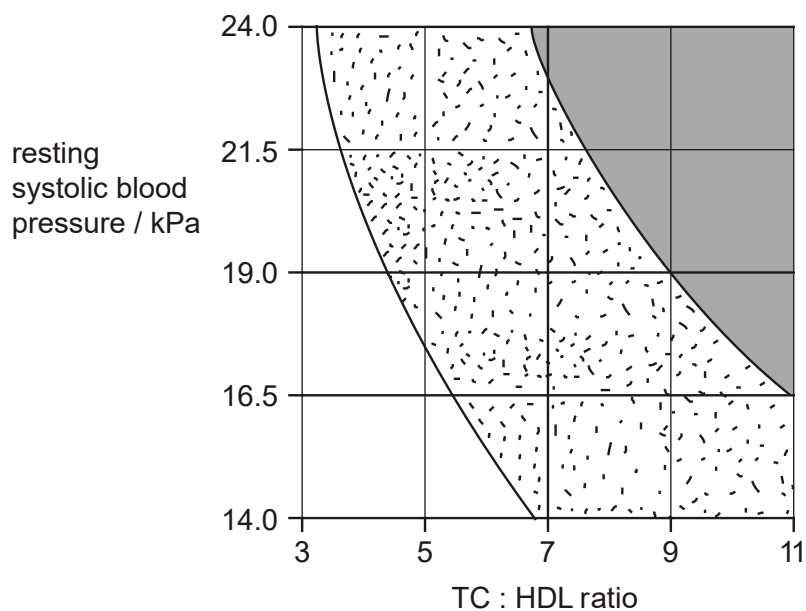
The TC : HDL ratio and the resting systolic blood pressure are both factors which are associated with the risk of having coronary heart disease (CHD).

Systolic pressure is the pressure in the major distributing arteries when the left ventricle contracts.

The way in which both the TC : HDL ratio and the resting systolic blood pressure are associated with the risk of CHD, is shown in the figure below.

key

-  less than 15% probability of developing coronary heart disease in the next ten years
-  15% to 30% probability of developing coronary heart disease in the next ten years
-  more than 30% probability of developing coronary heart disease in the next ten years



Using **only** the information above, describe the influence of the TC : HDL ratio and the resting systolic blood pressure on the risk of developing CHD.

.....

.....

.....

.....

.....

.....

.....

[Total 3 marks]

- 109.** The table below shows information about tests that identify three different types of biological molecule.

Complete the table to show the names of the types of molecule that are tested, the reagents used and the results obtained.

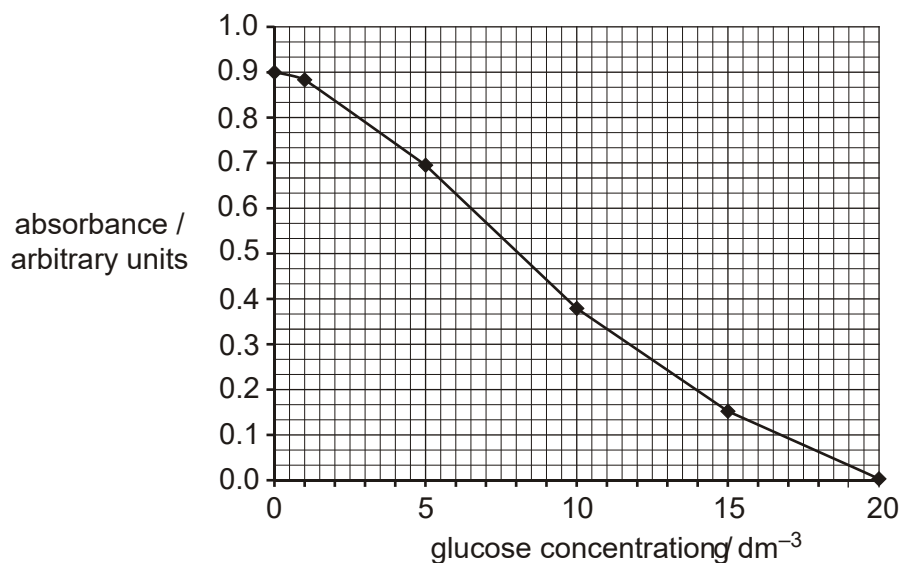
type of molecule tested	reagents used	positive result	negative result
protein	..... ..... .....	..... .....	blue solution
.....	alcohol and water	white emulsion	clear liquid
starch	..... .....	.....	yellow solution

[Total 5 marks]

110. A student followed a procedure to find the concentration of reducing sugars in a fruit juice. The first part of the method used was as follows:

- A range of glucose solutions of different concentrations was made up, starting with a 20 g dm^{-3} glucose solution.
- Each solution was boiled with excess Benedict's solution.
- When there was no further change in colour, the liquid was cooled and filtered.
- The absorbance of the liquid was measured with a colorimeter. (A colorimeter measures the amount of light that is absorbed by a coloured solution.)

The student's results are shown in the diagram below.



- (i) State **two** precautions that the student should have taken during the procedure to ensure that the results give a valid comparison between the different glucose solutions.

1

.....

2

.....

- (ii) In the second part of the method, the student tested the fruit juice. The absorbance reading obtained was 0.60 arbitrary units.

Use the diagram above to determine the reducing sugar concentration of the fruit juice.

..... g dm⁻³

[1]

- (iii) This procedure does **not** test for non-reducing sugars, such as sucrose.

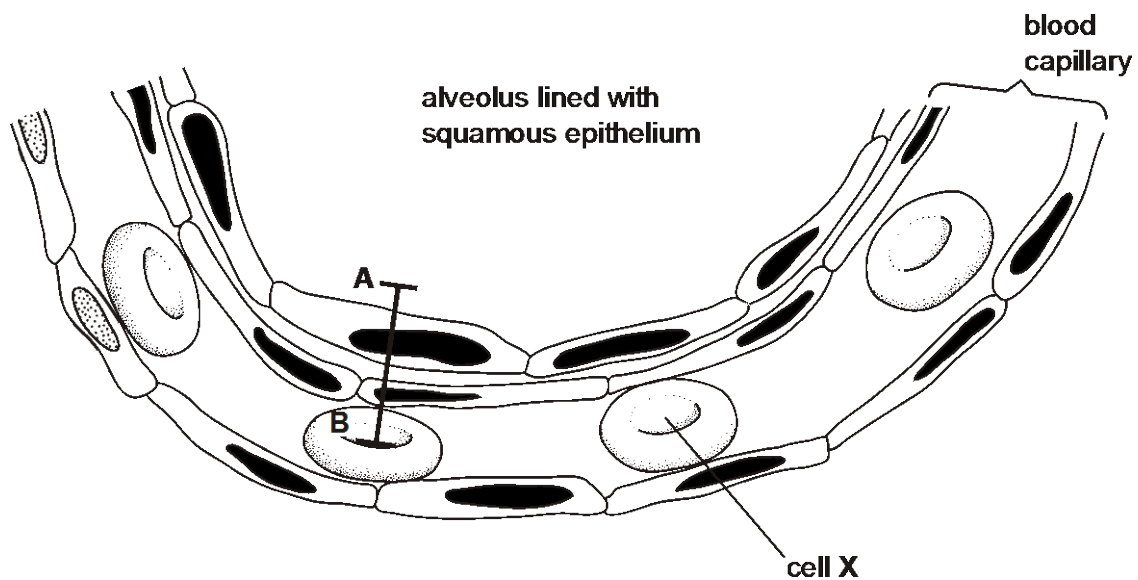
How should the procedure be altered to determine the concentration of **non-reducing sugar** in the fruit juice?

.....
.....
.....
.....
.....
.....

[2]

[Total 5 marks]

111. The diagram below is a drawing of an alveolus together with an associated blood capillary.



Oxygen diffuses from the alveolus into cell X. Cell X carries oxygen around the body in the blood stream.

- (i) **Name** the compound inside cell X that combines with oxygen.

.....

[1]

- (ii) **Name** the metal ion required for the formation of the compound in (i).

.....

[1]

[Total 2 marks]

112. An experiment was carried out in which the enzyme lipase was used to hydrolyse a triglyceride. The pH of the reaction mixture was recorded at regular intervals during the experiment. The results are shown in the table.

time / min	pH
0	7.0
2	6.2
4	5.6
6	5.1
8	4.7
10	4.6
12	4.6
14	4.6

- (i) State what is meant by the term *hydrolysis*.

.....
.....

[1]

- (ii) Explain why the pH falls during the reaction.

.....
.....
.....

[2]

- (iii) After 14 minutes, the mixture was analysed and unreacted triglyceride was found to be present. No inhibitor was added to the reaction mixture.

Explain why the reaction had stopped after 10 minutes.

.....
.....
.....
.....
.....

[2]

[Total 5 marks]

- 113. Explain how a **non-competitive** inhibitor affects the rate of an enzyme-catalysed reaction.

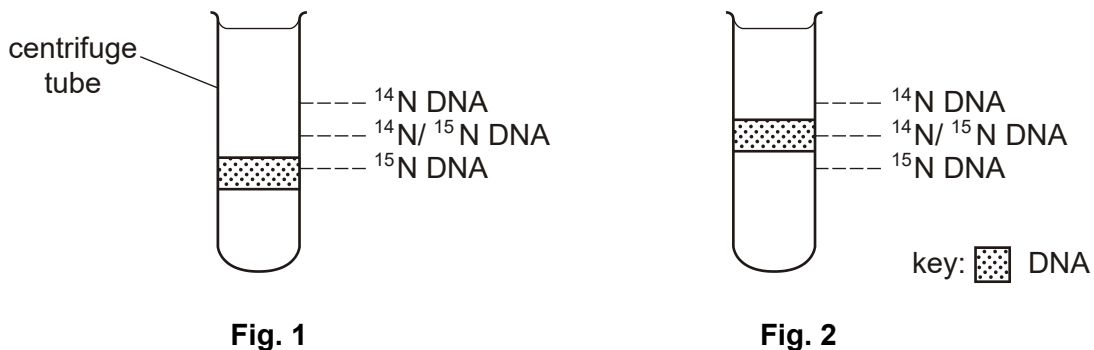
.....
.....
.....
.....
.....
.....

[Total 3 marks]

114. During research into the mechanism of DNA replication, bacteria were grown on a medium containing nitrogen isotopes. The nitrogen isotopes used were 'heavy' nitrogen, ^{15}N , and 'light' nitrogen, ^{14}N . After growth, the bacterial DNA was isolated from the cells and spun in a centrifuge. The DNA settled in the centrifuge tube at a position that corresponded to its density, indicating the proportion of the different types of DNA present in the sample.

Bacteria were grown for many generations in a medium containing only the 'heavy' isotope of nitrogen, ^{15}N . This resulted in all the DNA molecules containing only ^{15}N . The result after centrifugation is shown in Fig. 1.

These bacteria were then grown in a medium containing only 'light' nitrogen, ^{14}N . After allowing time for the DNA to replicate once, the DNA was analysed as before. The result is shown in Fig. 2.



(a) Explain how this information supports the semi-conservative hypothesis of DNA replication.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

The bacteria were allowed to continue to grow in the 'light' nitrogen, ^{14}N , until the DNA had replicated once more. The DNA was analysed as before and the result is shown in Fig. 3.

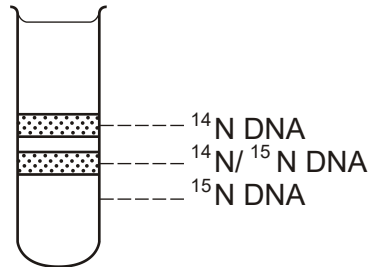


Fig. 3

Fig. 4 shows simple diagrams of DNA molecules, indicating the nitrogen content of each.

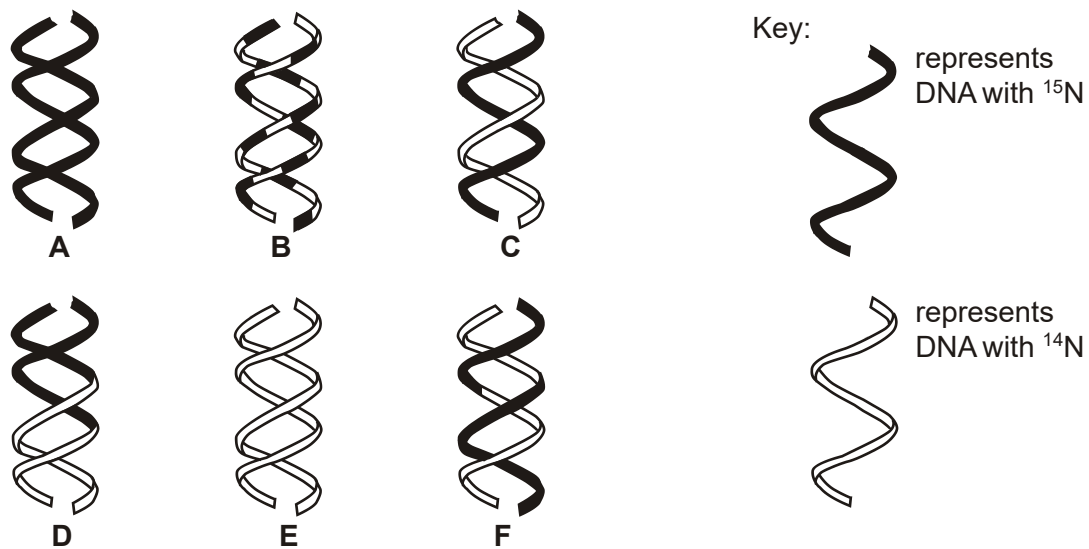


Fig. 4

(b) Select the letter or letters from Fig. 4 representing the bacterial DNA in Fig. 1, Fig. 2 and Fig. 3.

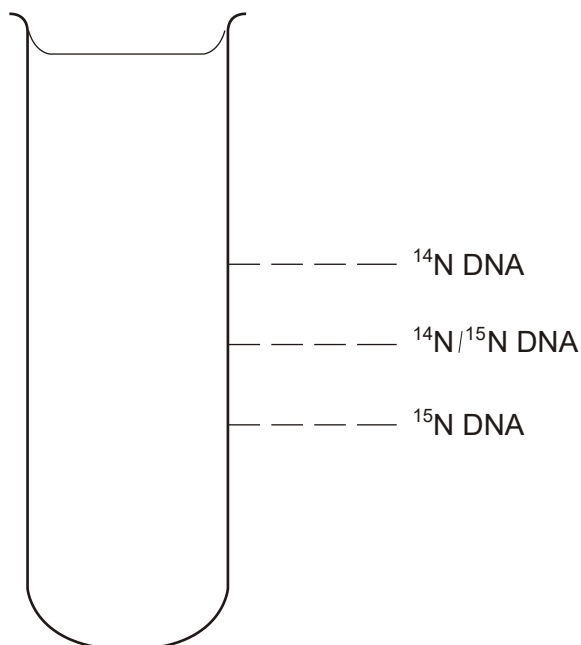
Fig. 1

Fig. 2

Fig. 3

- (c) The bacteria were allowed to continue to grow in the 'light' nitrogen, ^{14}N , until the DNA had replicated once more. The DNA molecules were analysed as before.

Complete the diagram to indicate the expected results showing the composition of these DNA molecules.



[2]

[Total 9 marks]

115. Smoking is considered to be a disease. In 2004, in the UK, the Wanless Report recommended a change in emphasis in the way that the National Health Service tackles certain diseases, such as smoking and obesity.

- (a) Name **one** category of disease which includes smoking and obesity.

.....

[1]

- (b) Both these diseases increase the risk of developing coronary heart disease (CHD). CHD is known as a multifactorial disease.

Suggest what is meant by the term *multifactorial disease*.

.....

.....

[1]

(c) Explain how cigarette smoke can increase the risk of developing CHD.

.....
.....
.....
.....
.....
.....

[3]

(d) Suggest reasons why the incidence of CHD is **not** the same in all parts of the world.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

[4]

- (e) The Wanless Report recommended greater emphasis on prevention rather than cure.

With reference to CHD, suggest what benefits this change in approach may bring.

.....

.....

.....

.....

.....

.....

[3]

[Total 12 marks]

116. A number of definitions are listed in the table below.

In the right hand column, write a term that **best** matches the definition in the left hand column. The first one has been done for you.

The type of B cell which secretes antibodies.	<i>plasma cell</i>
The term which refers to any organism that causes infectious disease.	
Diseases which cause a progressive deterioration of part of the body.	
The type of exercise that uses the heart and lungs to provide oxygen for respiration in muscles.	
The volume of air breathed in or out during a single breath.	
A term used to describe a disease that spreads across continents.	

[Total 5 marks]

117. During an immune response, phagocytic cells are attracted to the site of infection.

Describe the action of these phagocytic cells at the site of infection.

.....

.....

.....

.....

.....

.....

.....

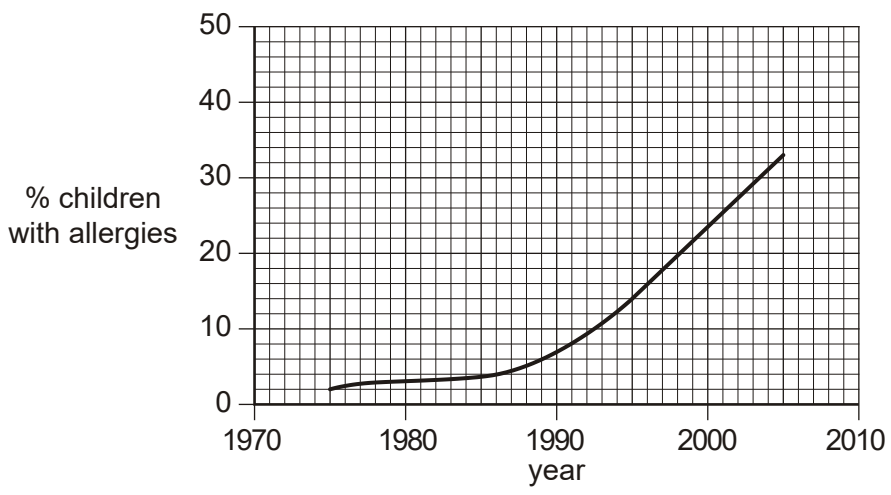
.....

.....

[Total 4 marks]

118. Sometimes the immune system overreacts and responds to otherwise harmless substances. This occurs in allergic reactions.

The diagram below shows the increase in the percentage of children with allergies. The figures were collected between 1975 and 2005 in the UK.



- (i) Suggest **one** reason for the increase shown in the diagram.

.....

[1]

- (ii) Use the information in the diagram to estimate the percentage of children who are likely to have an allergy in 2010. Assume the rate of increase remains constant.

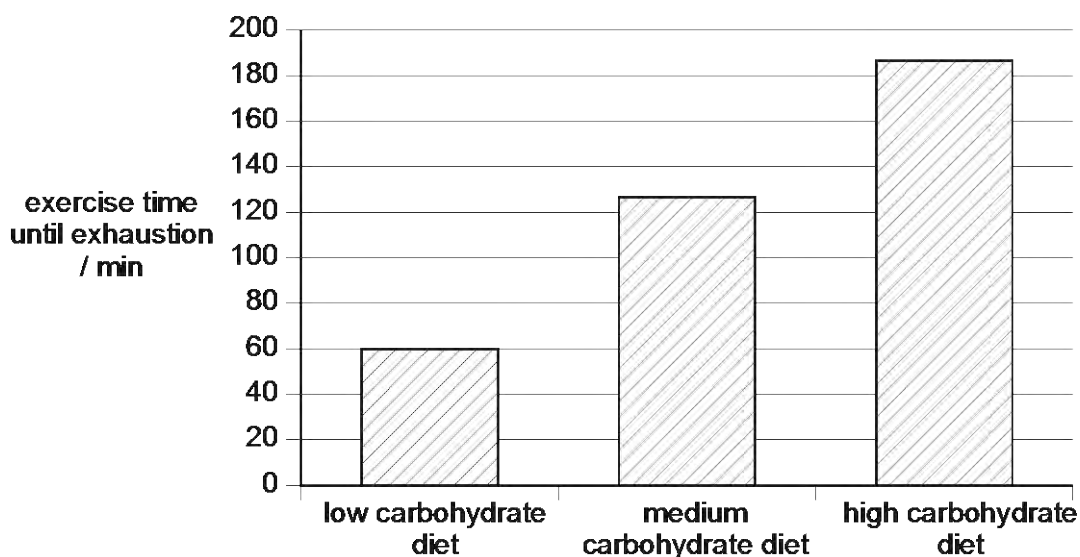
.....

[1]

[Total 2 marks]

- 119.** An investigation was carried out to determine the effects of increasing carbohydrate levels in the diet. Consuming extra carbohydrate is a technique called carbohydrate loading. It is often used by endurance athletes, such as long distance cyclists.

The diagram below shows the effect that different amounts of carbohydrate have on the length of time an athlete can continue exercising until exhausted.



Clyde Williams (1999) 'Does carbo-loading work?'
Biological Sciences Review vol. 12 No. 2

Using the evidence in the diagram, describe the effect of carbohydrate loading on an athlete's performance.

.....

.....

.....

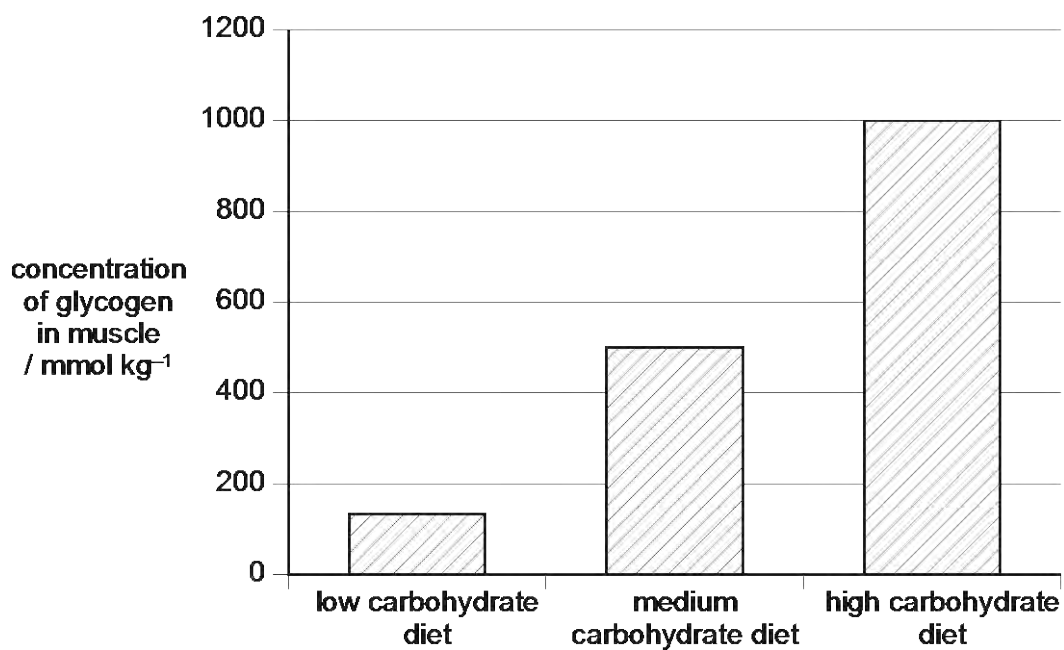
.....

.....

.....

[Total 3 marks]

120. The diagram below shows the effect that different amounts of carbohydrate have on the concentration of glycogen stored in the muscles.



Clyde Williams (1999) 'Does carbo-loading work?'
Biological Sciences Review vol. 12 No. 2

Explain why a high concentration of glycogen in the muscles improves an athlete's performance in an endurance event.

.....
.....
.....
.....
.....

[Total 2 marks]

121. (i) Name the virus that leads to AIDS.

.....

[1]

(ii) The virus infects and kills T helper cells in the immune system.

State **three** ways in which the lack of T helper cells will affect the functioning of the immune system.

1
.....
2
.....
3
.....

[3]

(iii) State **three** ways in which this virus can be transmitted from person to person.

1

.....

2

.....

3

.....

[3]

[Total 7 marks]

122. The Millennium Seed Bank Project is an international plant conservation project. Its aim is to prevent the extinction of about 24 000 plant species.

Suggest **two** benefits of preventing extinction of plant species.

1

.....

2

.....

[Total 2 marks]

123. Papaya fruit are an important commercial crop in many tropical countries. The wild relatives of *C. papaya* are found in tropical South America.

(i) Explain the **importance** of keeping seeds of the wild relatives of commercial crop plants, such as papaya, in a seed bank.

.....
.....
.....
.....
.....
.....

[3]

(ii) Outline the main steps by which disease resistance could be selectively bred into commercially grown papaya.

.....
.....
.....
.....
.....
.....

[3]

[Total 6 marks]

124. The black rhinoceros, *Diceros bicornis*, is an endangered species whose numbers have fallen to approximately 3000 in the past thirty years. For this reason, the species was placed on Appendix I of the Convention on International Trade in Endangered Species (CITES) agreement. Since the black rhinoceros has been placed on the appendix, numbers have stabilised, or even increased, in several countries.

(i) Explain the term *endangered species*.

.....
.....
.....
.....

[2]

(ii) Suggest **two** reasons why the black rhinoceros is endangered.

1

.....

2

.....

[2]

[Total 4 marks]

125. The clearing of tropical forests across the Earth has been occurring on a large scale basis for many centuries. This process, known as deforestation, involves the cutting down, burning and damaging of forests. The loss of tropical rain forest is more profound than merely destruction of beautiful areas. If the current rate of deforestation continues, the world's rain forests will vanish within 100 years, causing unknown effects on global climate and eliminating the majority of plant and animal species on the planet.

State **three** reasons for the decline in rain forest.

1

2

3

[Total 3 marks]

126. Over half of the species of plants and animals comprising the biodiversity of the Earth are thought to exist in tropical rain forests.

What are the economic and ethical reasons for maintaining biodiversity?

economic reasons

.....
.....
.....
.....
.....

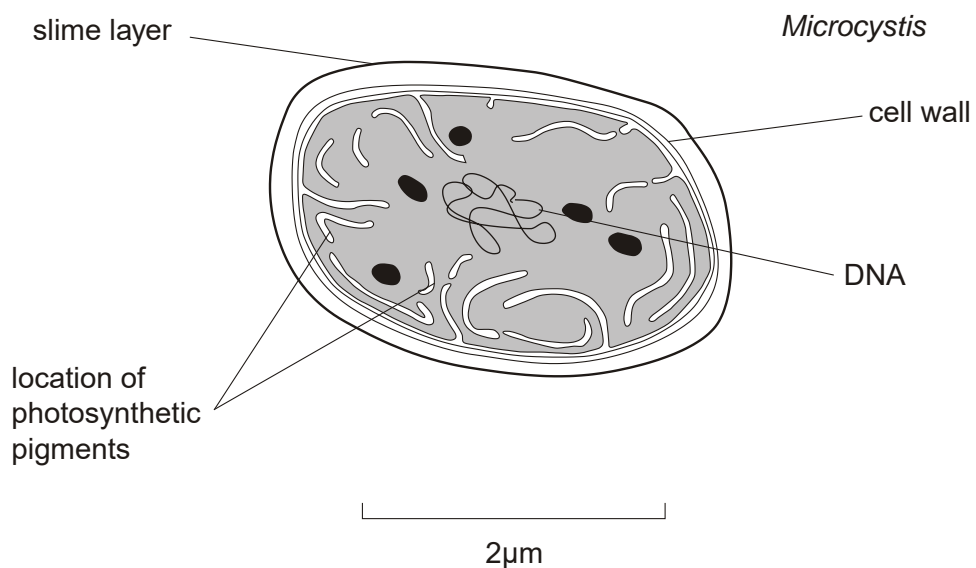
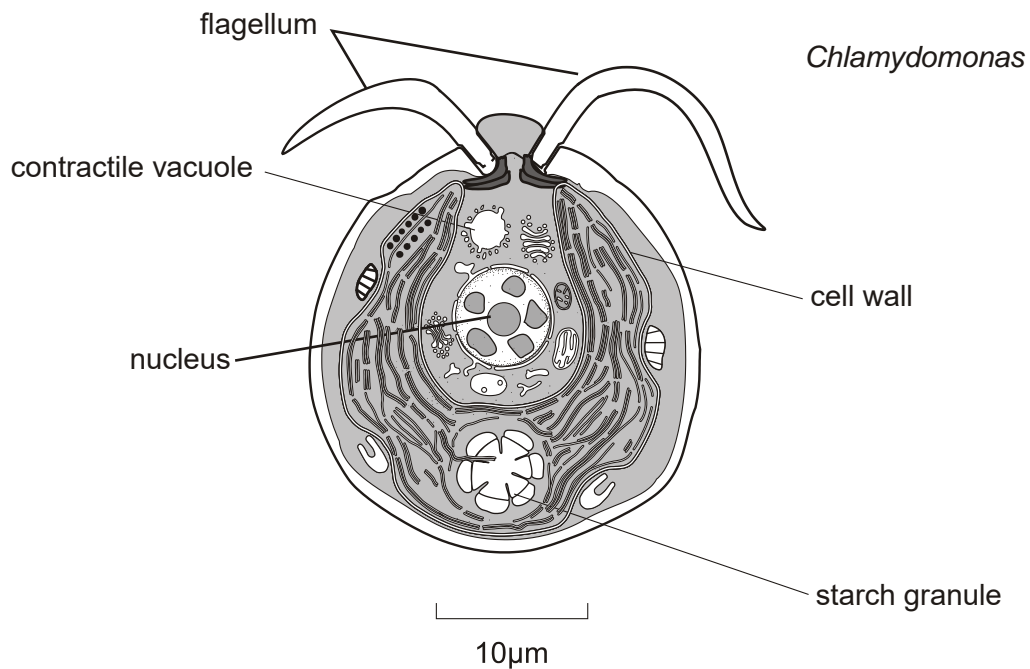
ethical reasons

.....
.....
.....
.....
.....

[Total 5 marks]

127. In this question, one mark is available for the quality of spelling, punctuation and grammar.

The figure below shows a green alga, *Chlamydomonas*, and a cyanobacterium, *Microcystis*.



Green algae and cyanobacteria (blue-green bacteria) were once classified in the Kingdom Plantae. As more information became available, taxonomists re-classified these organisms into separate kingdoms. The green algae are now in the Kingdom Protocista. Although cyanobacteria and green algae share certain structural and functional features, they are placed in different kingdoms.

Suggest why the green algae and cyanobacteria were originally considered to be plants **and** explain why taxonomists decided to re-classify them into **separate** kingdoms.

Use the information given in the figure above and the box to help you. You may annotate the figure if you wish.

[7]

Quality of Written Communication [1]

[Total 8 marks]

- 128.** Cholesterol molecules are transported in the blood as lipoproteins. Some lipoproteins are high density lipoproteins (HDLs) and others are low density lipoproteins (LDLs).

The liver regulates the blood cholesterol concentration.

A high blood cholesterol concentration indicates that a person's health may be at risk.

Cholesterol also has many beneficial functions in the body.

Outline the functions of cholesterol in the body.

.....

.....

.....

.....

.....

.....

[Total 3 marks]

129. Suggest why the people were required **not** to eat before the blood test.

.....

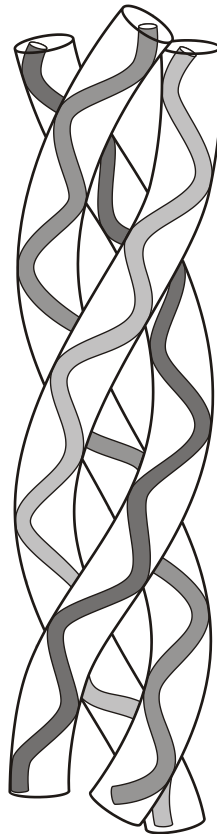
.....

.....

.....

[Total 2 marks]

130. The diagram below represents part of a collagen molecule.



- (i) Collagen is a protein made of three chains of amino acids, twisted together like a rope. State the name given to a chain of amino acids.

.....

[1]

- (ii) Name the amino acid that forms a high proportion of the collagen molecule.

.....

[1]

- (iii) Collagen has tremendous strength, having about one quarter of the tensile strength of mild steel.
Using information given in the diagram to help you, explain how the structure of collagen contributes to its strength.

.....

[2]

[Total 4 marks]

131. Complete the following passage by inserting the most appropriate terms in the spaces provided.

Cellulose and collagen are both fibrous molecules. Cellulose, a carbohydrate, is the main component of the in plants.

Cellulose is made of chains of many glucose molecules which are joined by 1,4 bonds. Each glucose molecule is rotated° relative to its neighbour, resulting in a chain. Adjacent chains are held to one another by bonds.

[Total 6 marks]

132. Deoxyribonucleic acid (DNA) is a polynucleotide.

- (i) State how many different types of nucleotide are found in DNA.

.....

[1]

- (ii) Name the components of **one** of these nucleotides.

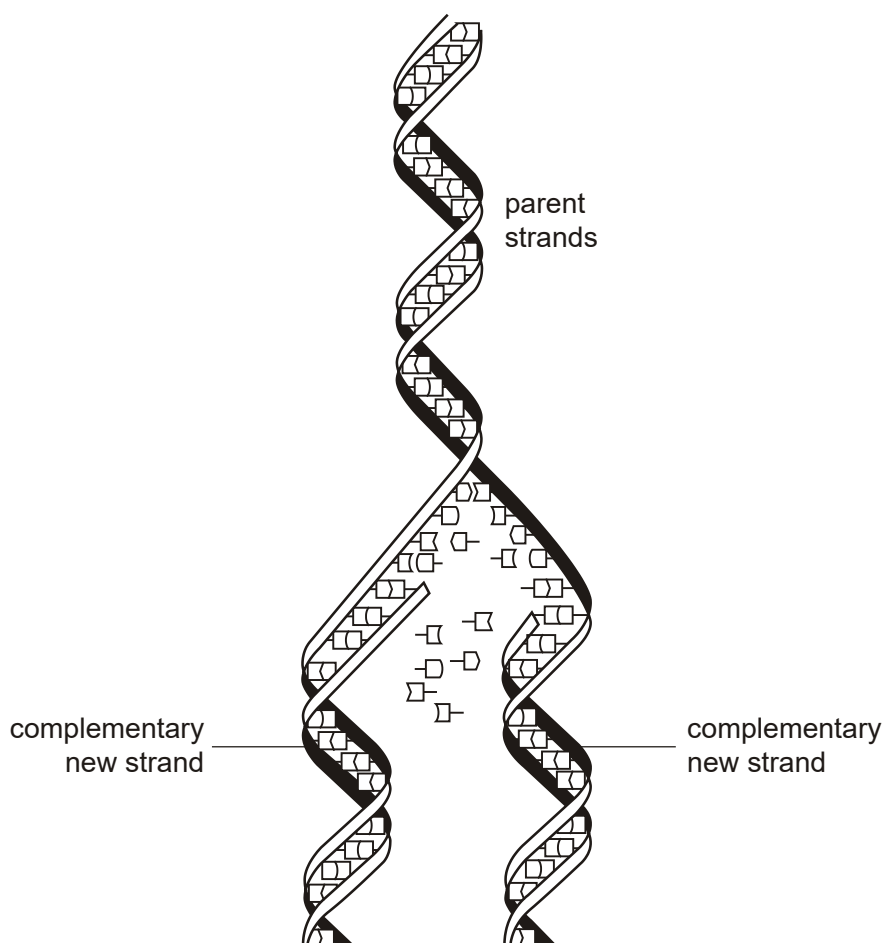
.....

.....

[3]

[Total 4 marks]

133. DNA replication is described as semi-conservative. Below is a diagram showing the replication of a DNA molecule.



Explain what is meant by the term *semi-conservative replication*.

.....

.....

.....

.....

[Total 3 marks]

- 134.** Radiation is one factor that can increase the chance of developing lung cancer. Radon, a naturally occurring radioactive gas, is found in all rocks and soils. On average, radon contributes about 50% of the total radiation dose received by people. Different areas of the UK have different levels of radon because of their rock and soil types. Radon seeps out of soils and rocks into the air and may build up in enclosed spaces such as buildings. Air containing an average concentration of 20 units of radon is considered to be a typical figure. Air containing an average concentration of 200 units has been defined as a Threshold Level at which radon is considered to be a significant risk. Research has linked exposure to radon with an increased risk of lung cancer. Smoking also increases the risk of lung cancer. Some typical figures are shown in the table below.

radon level / arbitrary units	estimated risk of developing lung cancer / %	
	no exposure to cigarette smoke	smoker (15 cigarettes per day)
0	0.1	1.0
20	0.1	1.0
200	1.0	10.0

Using the data in the table,

- (i) calculate by how much smoking increases the risk of developing lung cancer;

.....

.....

[1]

(ii) comment on the risks of radon and smoking on the development of lung cancer.

.....

.....

.....

.....

.....

.....

[2]

[Total 3 marks]

135. Cyclo-oxidase (COX) is one of the enzymes needed in the formation of prostaglandins, compounds that are involved in causing fever, pain and inflammation. COX catalyses the conversion of arachidonate to prostaglandinH₂, as shown in Fig. 1.

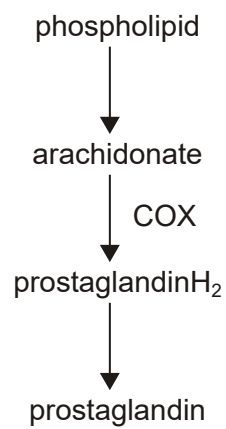


Fig. 1

The COX enzyme is found attached to the inner surface of the endoplasmic reticulum membrane. This is shown in Fig. 2.

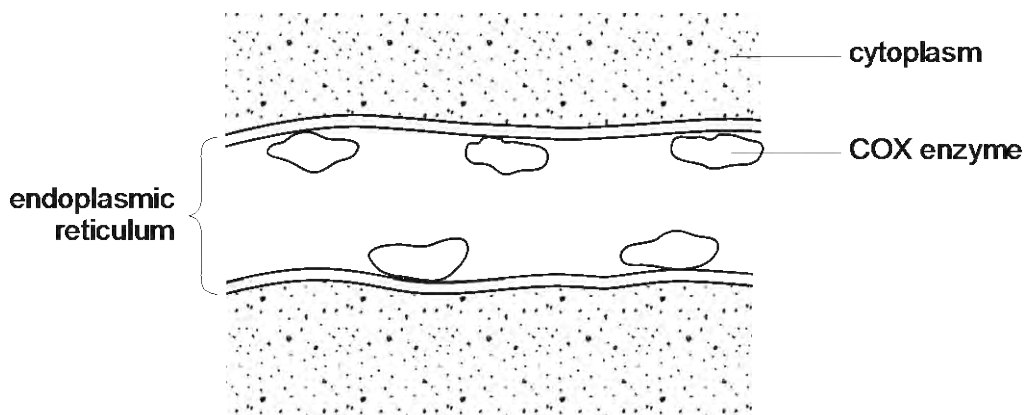


Fig. 2

- (a) Using the information given above, suggest why the COX enzyme is found attached to the inner surface of the endoplasmic reticulum.

.....

.....

.....

.....

.....

(b) Arachidonate reaches the active site of COX through a hydrophobic channel in the surface of the enzyme.

Ibuprofen and aspirin are drugs that inhibit the action of the COX enzyme.

- Ibuprofen enters and occupies the hydrophobic channel in the surface of the enzyme.
- Aspirin reacts with one of the R groups close to the active site of the enzyme.

Suggest how each drug inhibits the action of the COX enzyme.

ibuprofen

.....
.....
.....
.....

aspirin

.....
.....
.....
.....

(c) Describe the effect of **low** temperature, such as 5 °C, on enzyme action.

.....

.....

.....

.....

.....

.....

.....

.....

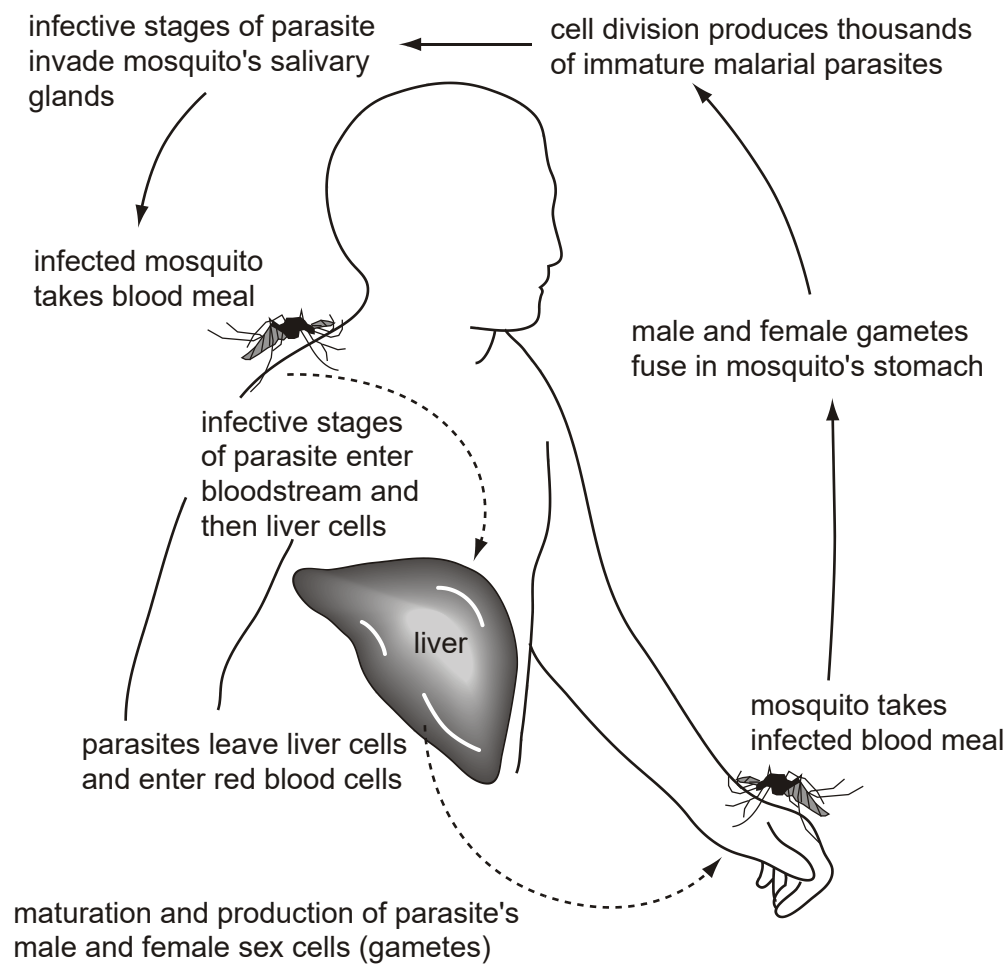
.....

.....

[4]

[Total 10 marks]

136. The diagram below shows the transmission cycle of the single-celled organism that causes malaria.



Adapted from Fosbery, R. Human Health and Disease, CUP 1997

- (a) Use your knowledge and the information shown in the diagram above to complete the passage below.

Malaria is caused by a single-celled organism called The organism is transmitted from one person to another by female mosquitoes. A mosquito takes up the gametes of the malarial parasite when it feeds on the blood of an person. Fertilisation occurs in the mosquito's stomach and the immature parasites reproduce. Infective stages of the parasite migrate to the mosquito's salivary glands. A new person becomes infected when the mosquito takes another meal of The parasites enter the liver of the new victim where further reproduction takes place before migrating to the red blood cells. When an organism, such as the mosquito, is involved in transmission it is called a The malarial parasite can also be transmitted by

[6]

- (b) Describe **two** ways in which the transmission cycle of malaria can be disrupted.

1

.....

2

.....

[2]

[Total 8 marks]

137. Outline how substances such as benzpyrene affect the cells in the lungs.

.....
.....
.....
.....
.....
.....

[Total 3 marks]

138. State **two** symptoms which could alert someone to the possibility that they may have lung cancer.

symptom 1
.....
symptom 2
.....

[Total 2 marks]

139. Severe Acute Respiratory Syndrome (SARS) is a severe form of viral pneumonia. The disease was first described in China in November 2002. Within six weeks, 29 countries were affected. The number of cases in China was considered to be of epidemic proportions. The World Health Organisation called SARS ‘the first worldwide epidemic of the twenty-first century’.

Vaccination can provide protection against many diseases by inducing artificial active immunity.

(i) What is meant by the word **artificial** in the term *artificial active immunity*?
.....
.....

[1]

(ii) Describe how an effective vaccine can produce **active immunity** to a disease.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[4]

(iii) In 2003, scientists started working to produce a vaccine for SARS.

Explain how vaccination may be used as part of an eradication programme for diseases such as SARS.

.....

.....

.....

.....

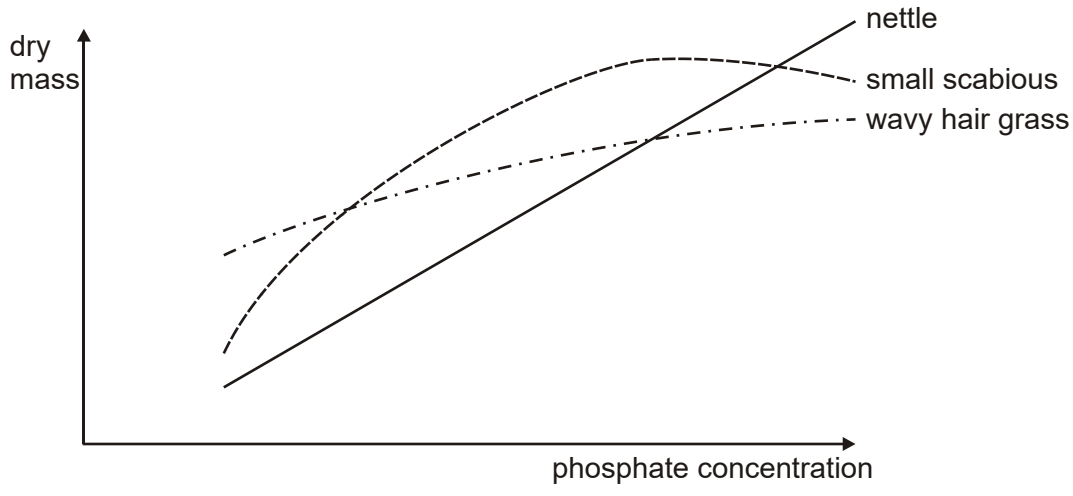
.....

.....

[3]

[Total 8 marks]

140. The figure below shows the effect of increasing phosphate concentration on the growth of three plant species, which commonly grow as weeds amongst crops in the UK.



Adapted from an article by I.H.Rorison in *New Phytologist* / 1968 / Volume 67 / Issue 4 / Figure 2b (p.917)

Describe the effects of increasing phosphate concentration on the growth of these three plant species.

.....

.....

.....

.....

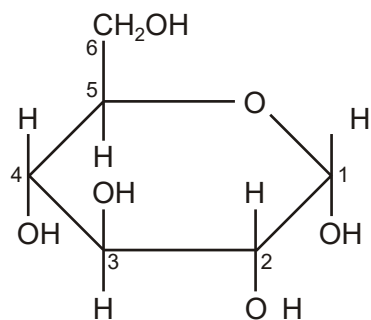
.....

[Total 4 marks]

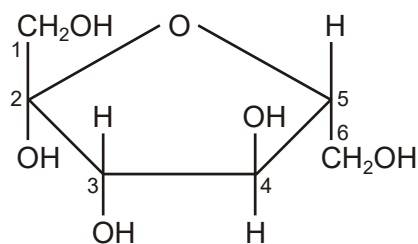
141. Glucose:

- is a carbohydrate
- is a hexose (six-carbon sugar)
- has the formula $C_6H_{12}O_6$
- has a six-membered ring structure.

The diagram below shows the molecular structures of two monosaccharide sugars, glucose and fructose.



glucose



fructose

State **one way, visible in the diagram above**, in which the structure of fructose is:
similar to glucose;

.....
.....

different from glucose.

.....
.....

[Total 2 marks]

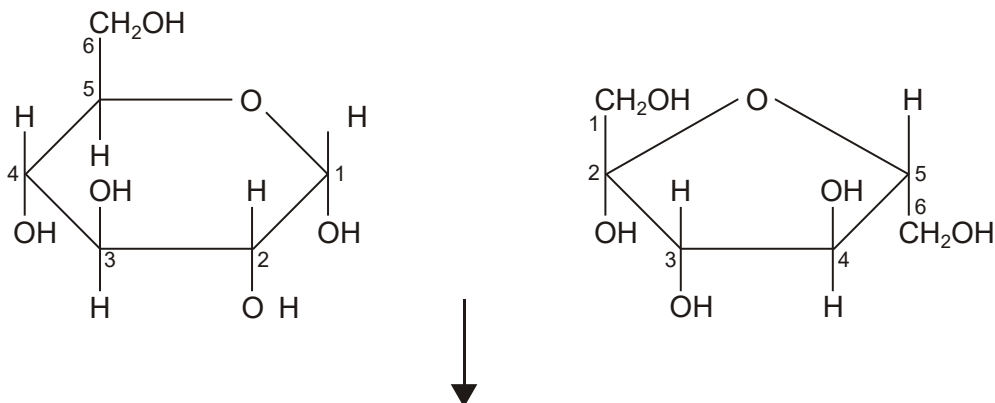
142. Maltose and sucrose are disaccharide sugars in which a bond joins two monosaccharide molecules. Sucrose is formed by the formation of a bond between carbon 1 of a glucose molecule and carbon 2 of a fructose molecule.

- (i) Name the bond that joins the two molecules to form a disaccharide.

.....

[1]

- (ii) Complete the diagram below to show what happens when the glucose and fructose molecules join together.



[2]

[Total 3 marks]

143. (i) Describe the test that is used to indicate the presence of a reducing sugar, such as glucose, and state the observation that would be made if glucose was present.

description of test

.....

.....

.....

.....

observation if glucose is present

.....

.....

[3]

- (ii) No change is observed if sucrose, a non-reducing sugar, is tested for in this way. The bond between the glucose and fructose units must first be broken. The test for a reducing sugar can then be carried out.

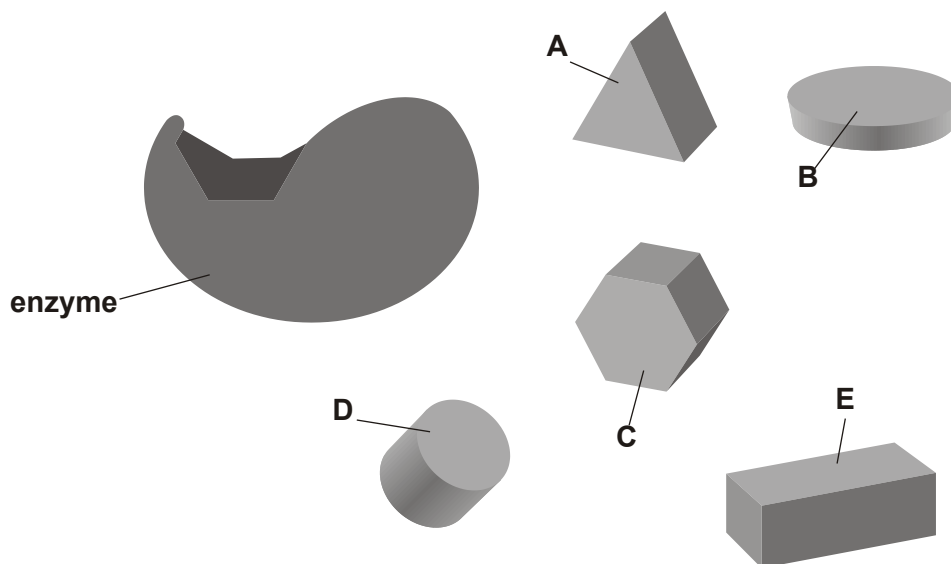
Describe how this bond can be broken chemically before carrying out the test for a reducing sugar.

.....

[1]

[Total 4 marks]

144. The diagram below represents an enzyme and a number of other molecules.



- (a) Label on the diagram the active site of the enzyme.

[1]

- (b) Write the letter of the molecule that is most likely to be the substrate for this enzyme.

.....

[1]

- (c) Use the information in the diagram to explain **enzyme specificity**.

.....

.....

.....

.....

.....

.....

[3]

- (d) One hypothesis of the mechanism of enzyme action is the 'lock and key' hypothesis. Another hypothesis, the 'induced fit' hypothesis, involves the enzyme changing shape slightly to allow the substrate to fit perfectly. The substrate also changes shape slightly.

Suggest how the **substrate** changing shape slightly will assist enzyme action.

.....

.....

[1]

[Total 6 marks]

- 145.** The smoke produced by burning tobacco leaves contains over 4000 different chemical compounds. Whilst some of these compounds may be harmless, others are addictive or may cause an increased risk of certain diseases.

- (a) Name **one** compound in tobacco smoke that is addictive.

.....

[1]

(b) Name **two** other harmful substances found in tobacco smoke. For each substance describe briefly the nature of the damage caused to the gaseous exchange system.

substance 1

.....

.....

.....

.....

substance 2

.....

.....

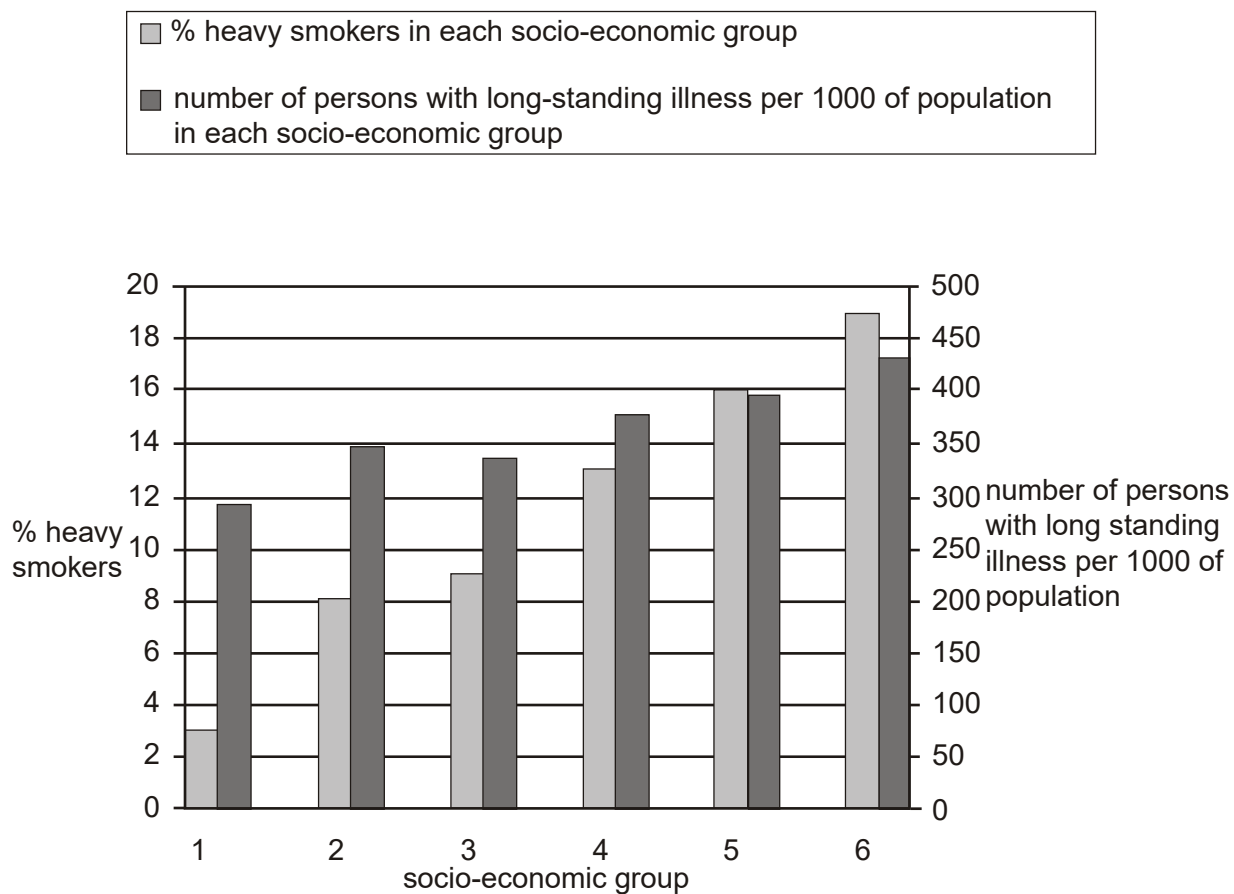
.....

.....

[5]

[Total 6 marks]

146. The diagram below shows the results of a study into the effects of smoking patterns in different socio-economic groups in the UK.



The socio-economic groups shown in the diagram are:

- 1 professional, e.g. doctors, teachers
- 2 semi-professional, e.g. employers, managers
- 3 skilled non-manual, e.g. computer technicians
- 4 skilled manual, e.g. plumbers, bricklayers
- 5 semi-skilled manual, e.g. painters, decorators
- 6 unskilled manual, e.g. labourers, delivery drivers

(i) With reference to the diagram above, describe the relationship between socio-economic group and the percentage of heavy smokers.

.....
.....
.....
.....

[2]

(ii) It has been suggested that the proportion of people suffering with long-term illness in each socio-economic group is directly linked to the percentage of heavy smokers in each group.

What evidence is there for or against this view?

.....
.....
.....
.....
.....
.....

[2]

(iii) Suggest **two** other factors that may contribute to the higher rates of long-term illness found in the groups of manual workers as compared to non-manual workers.

1

.....

2

.....

[2]

[Total 6 marks]

147. Body mass index (BMI) can be used to place people into categories according to their mass. BMI is calculated by the equation:

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

- (a) People with a BMI of greater than 30 are classed as obese. State **two** causes of obesity.

1

.....

2

.....

[2]

As part of a long-term survey into the health of the nation, a random sample of the English population was selected every five years. The BMI of each member of the sample was calculated and the percentage of people fitting into each mass category was recorded. The results are shown in the table below.

BMI category	year				
	1980	1985	1990	1995	2000
underweight	12	8	6	6	5
acceptable	53	51	46	41	36
overweight	28	32	34	36	39
obese	7	9	14	17	20

(b) Describe the trends shown in the table above.

.....

.....

.....

.....

.....

.....

.....

.....

.....

[4]

[Total 6 marks]

148. In this question, one mark is available for the quality of the use and organisation of scientific terms.

Obesity is one of the risk factors that increases the chance of coronary heart disease (CHD).

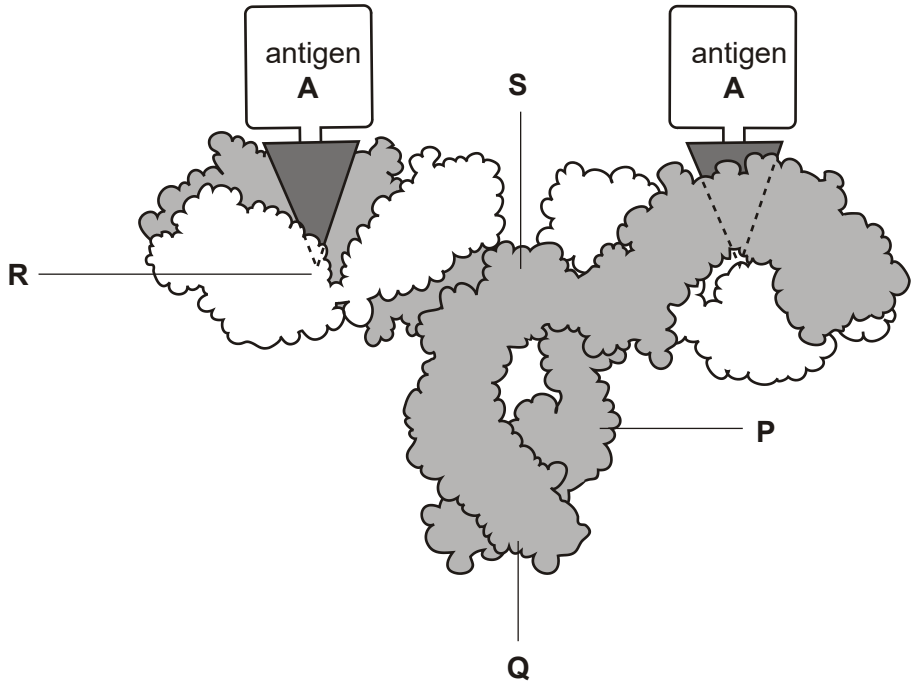
Explain how poor diet and obesity can affect the health of the heart.

[7]

Quality of Written Communication [1]

[Total 8 marks]

149. The diagram below is a representation of the three-dimensional structure of an antibody molecule. The shaded sections represent the heavy polypeptide chains. The diagram shows two antigen molecules attached to the antibody.



Anne White Biological Science Review 1993

(i) Select the letter **P**, **Q**, **R** or **S**, which identifies the position of a variable region of the antibody shown in the diagram above.

.....

[1]

(ii) Explain why this antibody will bind **only** to antigen **A**.

.....

[2]

[Total 3 marks]

150. MMR vaccine is a triple vaccine that contains antigenic material from measles, mumps and rubella. It gives 90% of all children who are vaccinated protection against measles. In the UK, the highest percentage of children in any year group that has been given the MMR vaccine is 92%.

- (i) Calculate the percentage of children who were left **unprotected** against measles in the year that a 92% vaccination rate was achieved. Show your working.

Answer =%

[2]

- (ii) Measles has proved to be difficult to eradicate from any country and vaccination programmes have been less successful than with smallpox.

Suggest **two** reasons why measles has been more difficult to eradicate than smallpox.

1

.....

2

.....

[2]

[Total 4 marks]

151. Preserving the diversity of life on Earth has come to be an accepted goal for many people.

However, this goal can sometimes come into conflict with other goals, such as economic development.

In 1980, the International Union for the Conservation of Nature and Natural Resources (IUCN) proposed a statement to form the basis for conserving biodiversity. One of the points included in the statement is:

“All species have an inherent right to exist. The ecological processes that support the integrity of the biosphere and its diverse species and habitats are to be maintained.”

Within the UK, many initiatives have been set up to help maintain biodiversity. One is the Dartmoor Biodiversity Project, part of which is the Habitat Action Plan for moorland, which covers almost 50% of the National Park.

This Action Plan specifies many objectives, all of which aim to maintain the range of habitats on Dartmoor and ensure that all native plants and animals continue to breed successfully and maintain healthy populations.

(a) State what is meant by the term *biodiversity*.

.....

.....

.....

.....

[2]

(b) In this question, one mark is available for the quality of spelling, punctuation and grammar.

Outline the **ecological**, **economic** and **ethical** reasons behind initiatives such as the Dartmoor Biodiversity Project and other similar projects around the world.

(Allow one line page)

[8]

Quality of Written Communication [1]

(c) State **four** activities of conservation organisations, such as the Royal Society for the Protection of Birds, which contribute to the maintenance of biodiversity.

- 1
- 2
- 3
- 4

[4]

[Total 15 marks]

152. *‘Scientists have discovered that certain microorganisms can survive in the Antarctic, completely surrounded by ice.’*

Suggest how this discovery was useful in the development of certain biological washing powders.

.....
.....
.....
.....

[Total 2 marks]

153. In this question, one mark is available for the quality of written communication.

Some of the properties of water are listed below.

- boils at 100 °C
- freezes at 0 °C
- water below 4 °C is less dense than water above 4 °C
- excellent solvent
- much energy is required to raise the temperature of water
- much energy is required to change water into water vapour
- high surface tension and cohesion

Describe **and** explain the roles of water in living organisms **and** as an environment for living organisms.

You will gain credit for using information about the properties of water.

(Allow one and a half lined pages).

[9]

Quality of Written Communication [1]

[Total 10 marks]

154. DNA and RNA are nucleic acids.

State **two** ways in which the structure of DNA differs from that of RNA.

1

2

[Total 2 marks]

155. The DNA molecule is made of two chains of nucleotides, wound into a double helix.

(i) Describe the structure of a **DNA nucleotide**.

You may use the space below to draw a diagram if it will help your description.

.....
.....
.....
.....
.....
.....
.....
.....
.....

[3]

(ii) Describe how the two nucleotide chains in DNA are bonded together.

.....
.....
.....
.....
.....
.....

[3]

[Total 6 marks]

156. An enzyme, such as amylase, has a specific 3-dimensional shape.

Explain how DNA structure determines the specific shape of enzymes.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[Total 4 marks]

157. Read the following passage carefully, then answer the questions below.

Rhizobium is a bacterium that is closely associated with the roots of certain plants known as legumes. These plants produce chemicals to attract the bacteria and extra root hairs are produced. The bacteria attach to the surface of the root hairs. Chemical links are formed between a complex
5 polysaccharide on the bacterial surface and lectin, a protein, formed by the plants. The bacteria penetrate the cell walls of the root hairs and enter the cells. The presence of the bacteria stimulates the cells of the root to divide, forming swellings known as nodules.

The bacteria produce an enzyme, nitrogenase, that is the catalyst for the
10 conversion of nitrogen gas to ammonia. The bacteria use carbon compounds manufactured by the plant to respire, making energy available for this conversion. The ammonia is then used to form amino acids. Nitrogenase only functions in low oxygen concentrations. The root cells produce a pigment, leghaemoglobin, that is very similar to haemoglobin. Leghaemoglobin absorbs
15 oxygen, leaving low concentrations in the nodules.

- (i) *Rhizobium* is a prokaryotic organism.

State **one** characteristic that is typical of prokaryotes, but not of eukaryotes.

.....
.....

[1]

- (ii) Lectin (line 5) and polysaccharides are compounds that are formed from small molecules joined together by chemical bonds.

Explain how the small molecules are joined together to form these compounds.

.....
.....
.....
.....

[3]

- (iii) Leghaemoglobin contains the same metal element as haemoglobin.

Name this metal element.

.....

[1]

- (iv) State the names of **two** proteins, **other than lectin**, mentioned in the passage.

1

2

[2]

- (v) Name the process that occurs in *Rhizobium* to convert nitrogen gas into ammonia.

.....

[1]

(vi) It has been suggested that oxygen is an inhibitor of nitrogenase.

Explain **one** way in which oxygen could act as an inhibitor.

.....
.....
.....
.....

[2]

[Total 10 marks]

158. Fats in the diet provide the two essential fatty acids, linoleic acid and linolenic acid.

(a) Give **one** reason why these two fatty acids must be present in the diet.

.....
.....

[1]

A 25 year old woman is concerned that she may be eating too much saturated fat.

She discovers that there are Dietary Reference Values (DRVs) for fats. These include:

- total fat in the diet should not be greater than 35% of the total energy intake per day
- of this no more than 10% should be saturated fat.

She calculates that her total energy intake should be 8 830 kJ per day.

Each gram of fat provides 37 kJ.

- (b) Calculate the maximum mass of fat in grams that the woman could consume if she is not to exceed the DRV for **total fat** in the diet.

Show your working and express your answer to the nearest whole number.

Answer g

[2]

- (c) Explain the reasons for limiting the quantity of fat in the diet.

.....
.....
.....
.....
.....
.....
.....
.....
.....

[4]

The woman decided to find out whether it is healthier to eat meat or fish. She compared the composition of mackerel (fish) and stewing steak (meat).

Some of the information that she found is summarised in the table below.

nutrient	mass per 100g	
	mackerel (fish)	stewing steak (meat)
protein/g	18.7	30.9
vitamin A/ μg	45.0	0.0
vitamin D/ μg	25.0	0.0
calcium/mg	11.0	15.0
iron/mg	0.8	3.0

Data from *'Food Tables and Labelling'*, pp.32 and 33; 56 and 57, by A. E. Bender and D. A. Bender.
Published by Oxford University Press, 1999 (ISBN 0 19 832815 X).

- (d) Explain, using the data in the table, the **advantages** and **disadvantages** for the health of the young woman of including mackerel in her diet instead of stewing steak.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[4]

[Total 11 marks]

159. Most children have antibodies to measles in their bloodstream at birth, giving them a natural immunity. The concentration of these antibodies decreases quite quickly after birth. Between the ages of about 6 to 12 months the concentration is low enough to make children susceptible to measles.

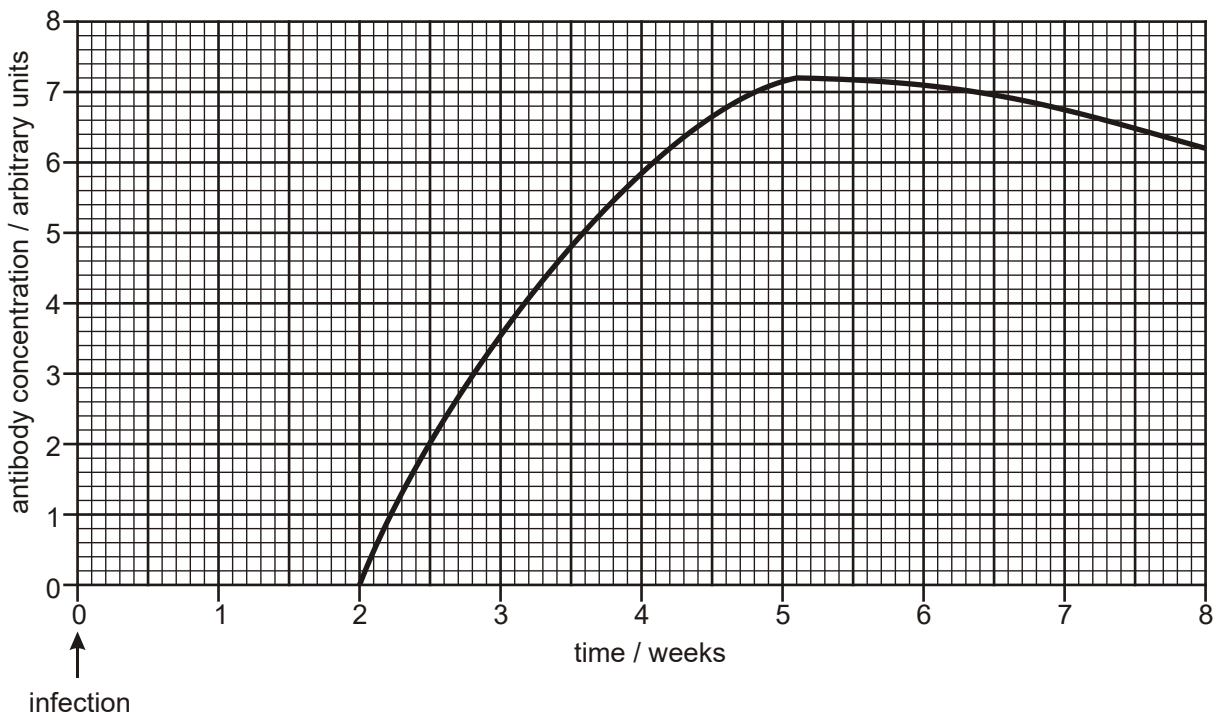
(a) (i) State the term given to the type of natural immunity described above.

[1]

(ii) State how antibodies to measles come to be present in children **at birth**.

[1]

A two year old child, who had **not** been vaccinated against measles, became infected with the disease. The concentration of antibodies specific to measles was measured in samples of blood taken at intervals of time for the following ten years. The results for the first eight weeks of this study are shown in the graph below.



(b) State the name of the type of cell that produces antibodies.

.....

[1]

(c) Explain why there is a delay between the time of infection and the first appearance of antibodies in the blood.

.....
.....
.....
.....
.....
.....

[3]

(d) This child is unlikely to develop the symptoms of measles if exposed to the pathogen again.

Explain why.

.....
.....
.....
.....
.....

[2]

- (e) Some children fail to respond to the measles vaccine when it is given too early, for example at or before 6 months of age.

Suggest why this is the case.

.....

.....

.....

.....

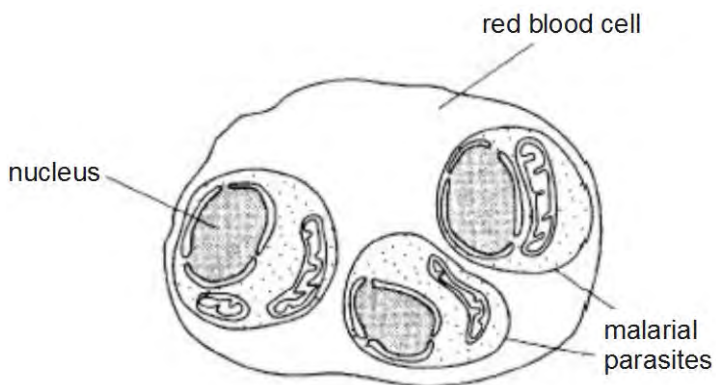
.....

[2]

[Total 10 marks]

- 160. People in many countries, especially in Africa and South-East Asia, are at high risk of acquiring malaria.

Blood collected from a person known to have malaria was examined in an electron microscope. The diagram below shows a drawing made from an electron micrograph of a red blood cell infected by malarial parasites.



- (a) State the name of the organism that causes malaria.

.....

[1]

(b) Explain how an infected person is likely to have acquired malaria.

.....
.....
.....
.....
.....

[3]

(c) In this question, one mark is available for the quality of written communication.

Outline the problems that are associated with controlling the spread of malaria.

(Allow one and a half lined pages).

[8]

Quality of Written Communication [1]

[Total 13 marks]

161. The table below shows the death rates from coronary heart disease (CHD) of men and women between the ages of 35 and 74 for some European countries. It also shows the prevalence of cigarette smoking among men and women of all ages in those countries. The prevalence of smoking is the percentage of men and women who smoke cigarettes every day.

	deaths from CHD/ deaths per 100 000		prevalence of smoking/%	
	men	women	men	women
non-Mediterranean countries				
Latvia	321	107	54	24
Russian Federation	459	153	70	27
United Kingdom	121	40	37	35
Finland	134	45	32	24
Czech Republic	210	70	37	25
Hungary	243	81	46	34
Mediterranean countries				
Greece	200	29	64	40
Italy	116	39	33	19
Spain	91	30	36	31
France	85	21	37	27

- (a) Suggest one reason why health authorities are especially concerned about the death rates from CHD for people in the 35 to 74 age group.

.....

.....

.....

- (b) Using only the information given in the table, explain whether or not the following hypotheses are supported by the data.

You should quote data from the table in support of your answers.

- (i) Mediterranean countries have lower death rates from CHD than non-Mediterranean countries.

supported or not supported

explanation

.....

.....

.....

.....

- (ii) Men are more at risk of CHD than women.

supported or not supported

explanation

.....

.....

.....

.....

(iii) Death rates from CHD are highest in countries with the highest prevalence of smoking.

supported or not supported

explanation

.....

.....

.....

.....

[5]

[Total 6 marks]

162. A 50 year old man who regards himself as 'in good health' was asked by an insurance company to answer a series of questions about his health.

Here are some of his answers to the questions:

- smoke 20 cigarettes a day
- drink at least 8 pints of beer a week - most on Saturday evenings
- play football in the park on Sundays
- drive to work
- spend most evenings at home watching television
- rarely eat fresh fruit and vegetables
- father died of a heart attack at age 45.

Use the answers above to explain the statement 'health is more than simply the absence of disease'.

.....

.....

.....

.....

.....

.....

.....

.....

.....

[Total 3 marks]

163. State the word or phrase that best describes a region on the surface of an enzyme molecule where a substrate can bind.

.....

[Total 1 mark]

164. State the word or phrase that best describes the energy that must be provided for a chemical reaction to take place.

.....

[Total 1 mark]

165. State the word or phrase that best describes a length of DNA that codes for a particular polypeptide.

.....

[Total 1 mark]

166. A student was carrying out tests to determine which biological molecules were present in a food sample.

(a) (i) Describe a test that the student could carry out to discover whether this sample contained a lipid.

.....
.....
.....
.....

[2]

(ii) State what would be seen if a lipid was present.

.....

[1]

(b) Describe how the **structure** of a phospholipid differs from that of a triglyceride.
You may use the space below for a diagram to help your answer.

.....
.....
.....
.....
.....

[3]

(c) (i) Describe a test that the student could carry out to discover whether the food sample contained protein.

.....
.....
.....

[1]

(ii) State what would be seen if protein was present.

.....

[1]

[Total 8 marks]

167. Explain what is meant by the primary and secondary structure of a protein.

primary structure

.....
.....

secondary structure

.....
.....
.....
.....
.....

[Total 5 marks]

168. An important enzyme that is used in respiration is succinate dehydrogenase. Its substrate is succinate, which is converted into fumarate. Malonate acts as a **competitive** inhibitor, but does **not** bind permanently to the enzyme.

(a) Describe how malonate inhibits the enzyme. You may use the space below for a diagram to help your answer.

.....
.....
.....

[3]

(b) Explain what would happen to the reaction if the concentration of succinate was increased relative to the concentration of malonate.

.....
.....
.....
.....
.....
.....

[3]

[Total 6 marks]

169. The following passage is taken from a medical encyclopaedia.

“Smokers may develop two serious conditions. Firstly they may experience breathlessness, wheezing and a cough which develops as sputum is produced. As the smoker ages, the condition may become permanent and disable the smoker. This can be associated with the second condition. Symptoms may include a barrel-shaped chest, an oxygen deficiency that limits the possibility of exercise and a blueness of the skin. If the condition advances, oxygen may need to be supplied through a mask.” -

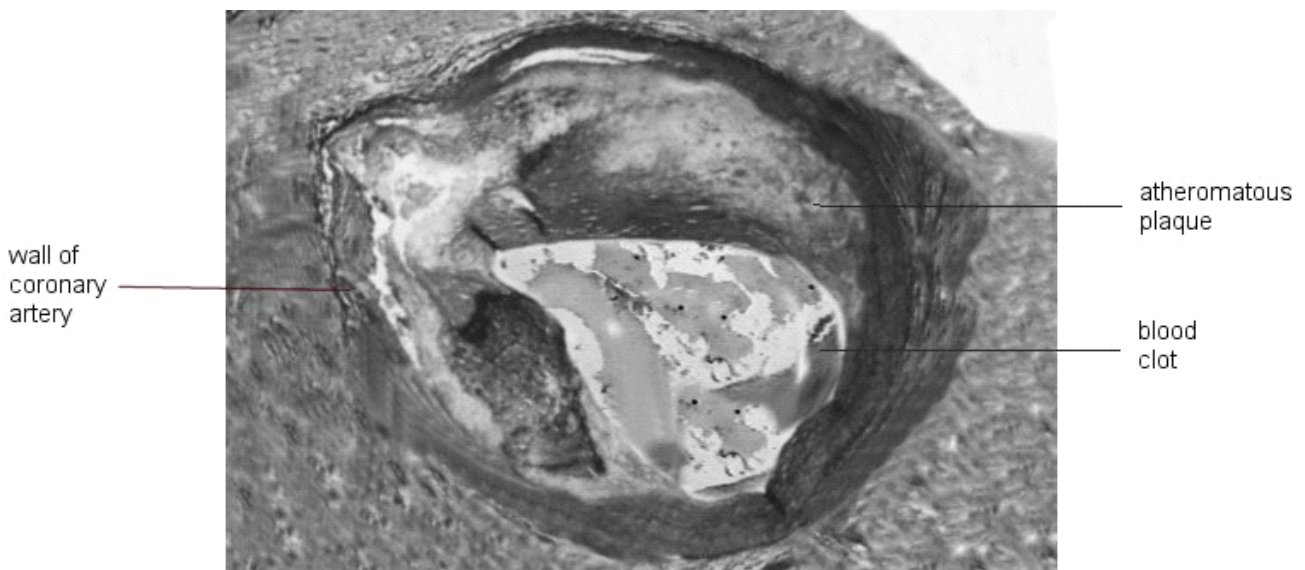
Name the **two** medical conditions described in the passage.

1

2

[Total 2 marks]

170. (a) The diagram below shows a cross section of a coronary artery from a patient who had a heart attack.



Describe how **changes** in the walls of coronary arteries make it likely that a blood clot will develop.

.....
.....
.....
.....
.....

[3]

(b) Outline how nicotine and carbon monoxide in cigarette smoke may increase the risks of atherosclerosis and blood clotting.

.....
.....
.....
.....
.....
.....

[3]

[Total 6 marks]

171. Fig. 1 is a diagram that shows the origin and maturation of lymphocytes.

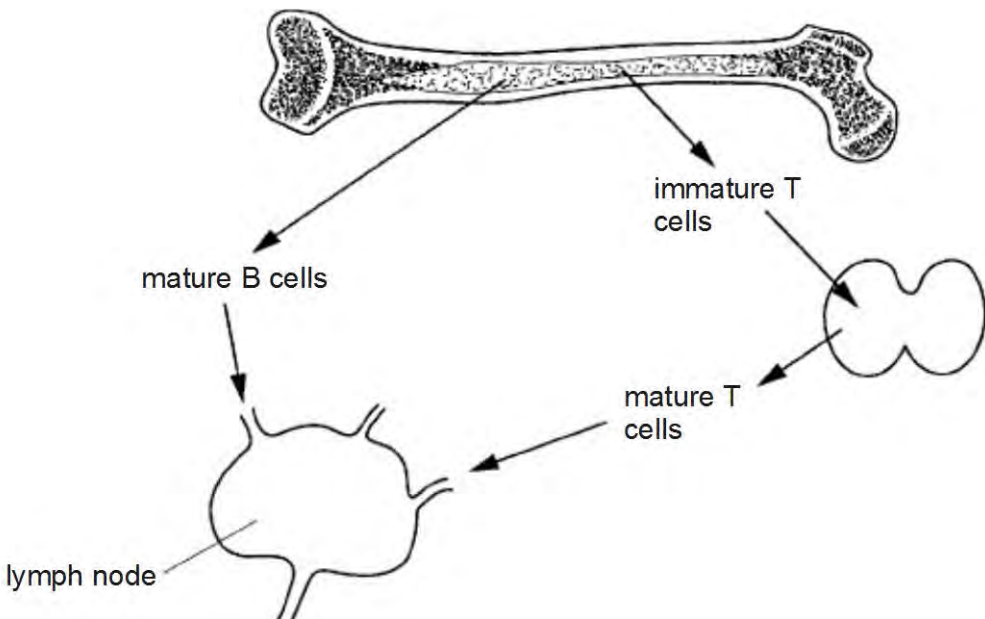


Fig. 1

Fig. 2 shows the changes that occur to B and T lymphocytes during an infection by a pathogen, such as a virus.

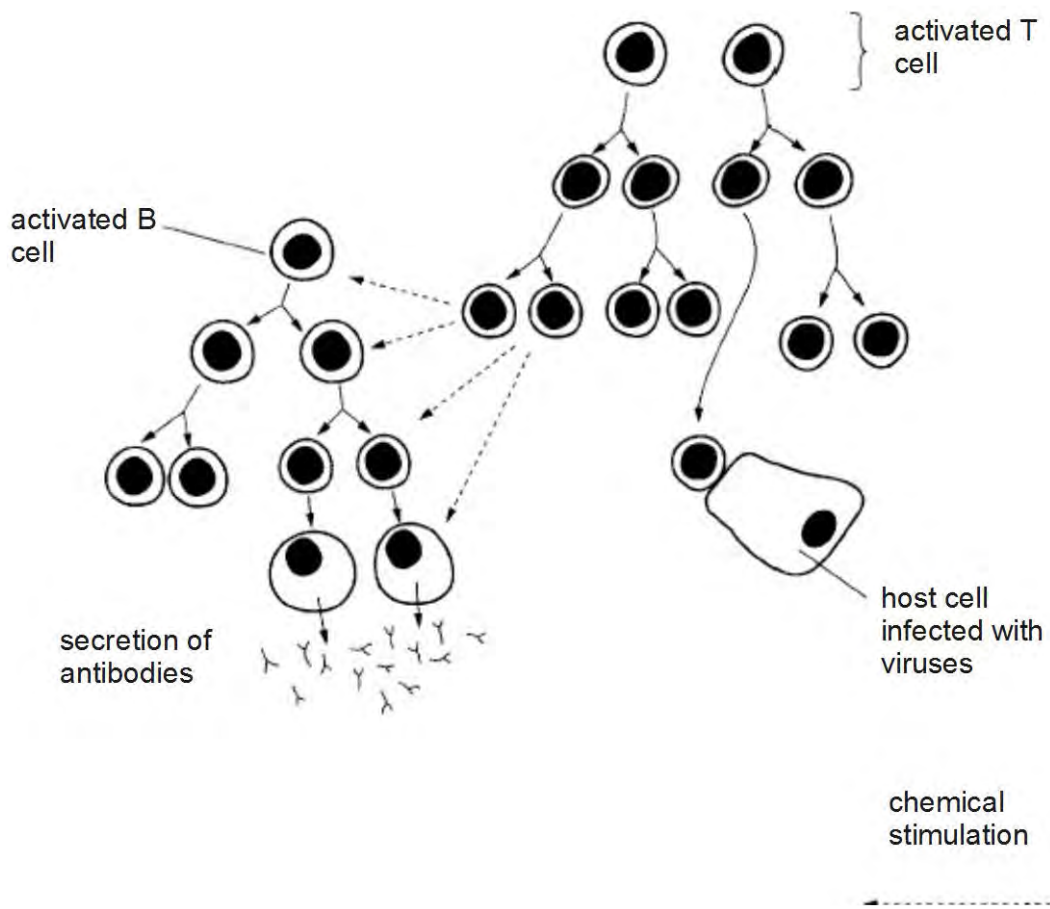


Fig. 2

Complete the following passage using the most appropriate terms.

The cells of the immune system originate from
 where stem cells divide by mitosis to produce cells that differentiate into lymphocytes
 and

Immature T lymphocytes migrate to the gland where they mature.

Mature B lymphocytes and mature T lymphocytes circulate and enter lymph nodes.

During an immune response some B lymphocytes differentiate into
 and secrete

[Total 5 marks]

172. Fig. 1 is a diagram that shows the origin and maturation of lymphocytes.

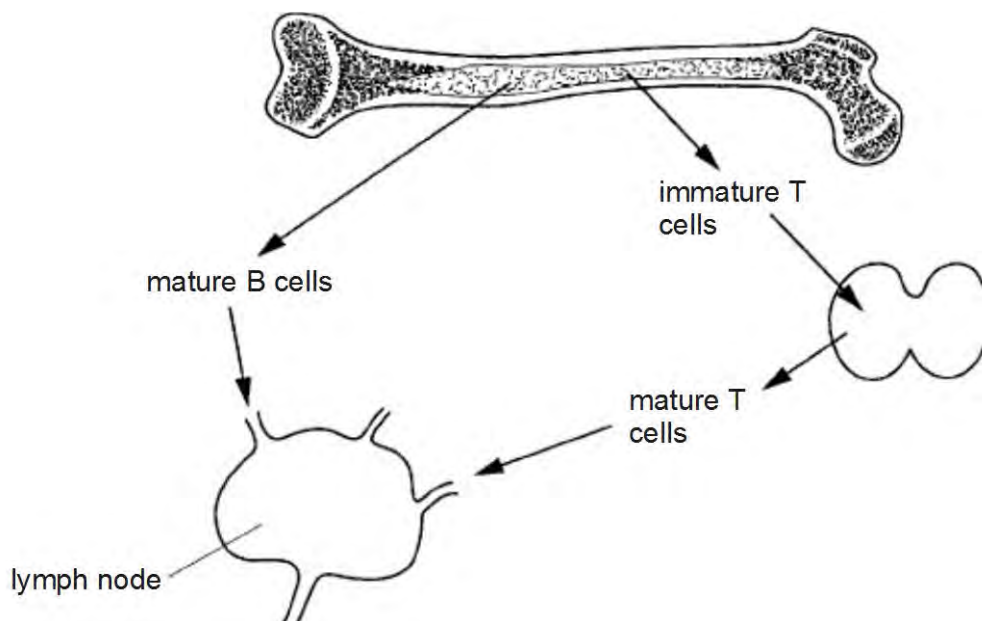


Fig. 1

Fig. 2 shows the changes that occur to B and T lymphocytes during an infection by a pathogen, such as a virus.

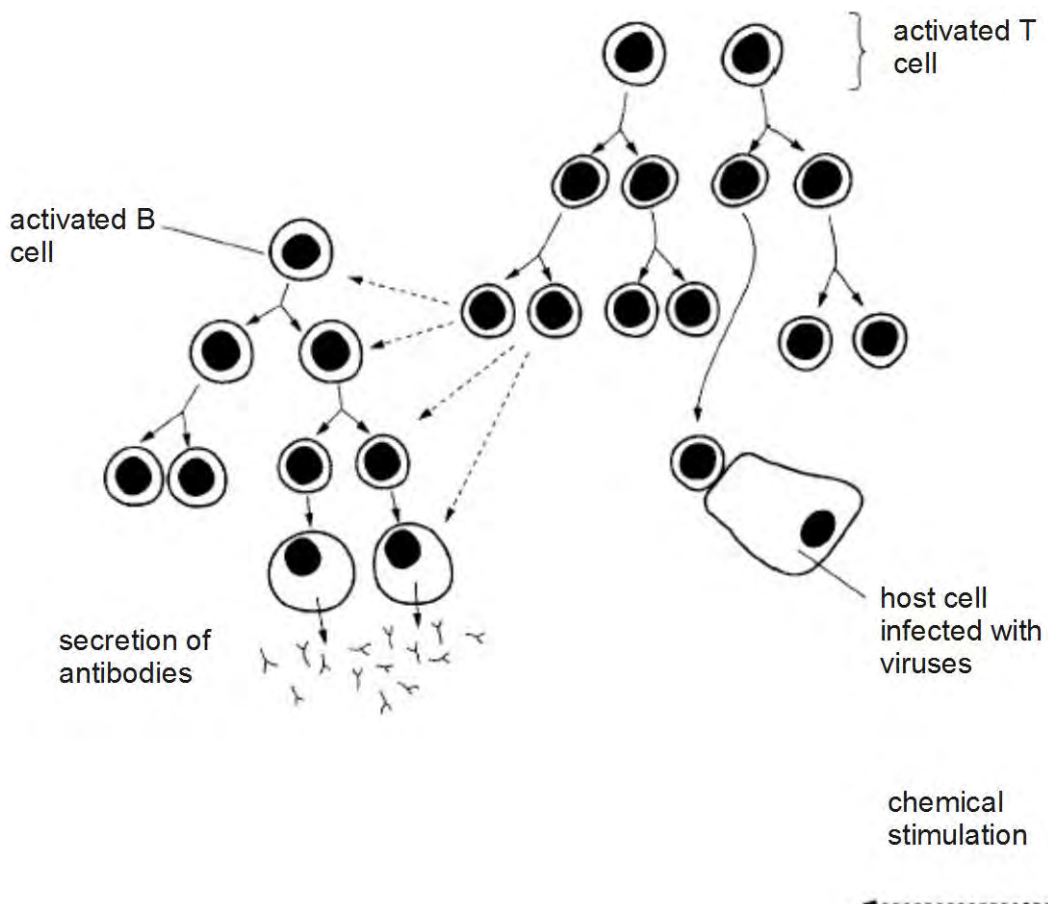


Fig. 2

In this question, one mark is available for the quality of written communication.

Describe the changes that occur to **T lymphocytes** during an immune response. Explain the roles of **T lymphocytes** in fighting an infection by a pathogen, such as a virus.

You may use information from Fig. 2 in your answer.

(Allow one and a half lined pages).

[7]

Quality of Written Communication [1]

[Total 8 marks]

173. HIV is transmitted in a variety of ways.

In the UK, most of the HIV infections reported to the Communicable Disease Surveillance Centre (CDSC) have occurred as a result of sex between men.

Describe **three** ways in which HIV is transmitted, **other than during sexual activity**.

1

.....

2

.....

3

.....

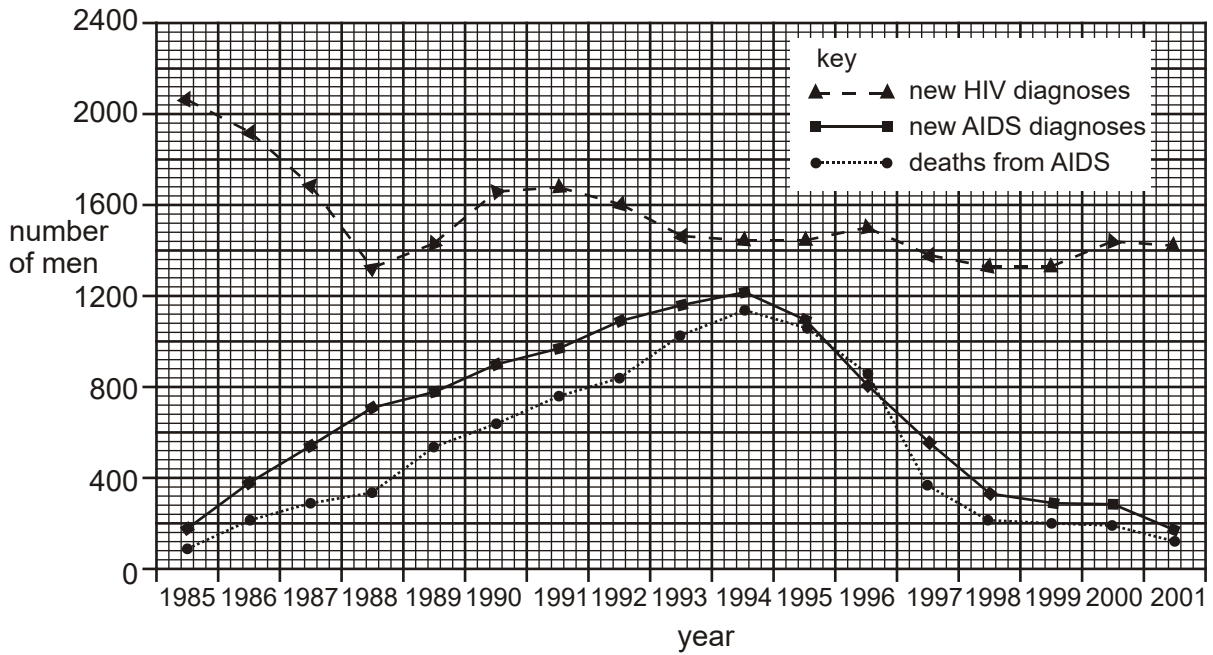
[Total 3 marks]

174. HIV is transmitted in a variety of ways.

In the UK, most of the HIV infections reported to the Communicable Disease Surveillance Centre (CDSC) have occurred as a result of sex between men.

The CDSC collects statistics on HIV/AIDS and estimates the total number of people who are infected with HIV. This increases in the UK each year and in 2002, the CDSC estimated the number to be about 33 500. It also estimated that 30% of these people were not diagnosed.

The graph below shows the numbers of new HIV and AIDS diagnoses and deaths in those infected through sex between men in the UK between 1985 and 2001.



(i) Using the data in the graph, describe the changes that have occurred in the numbers of men diagnosed with HIV between 1985 and 2001.

.....

.....

.....

.....

.....

(ii) Explain the **decrease** in number of men who have been diagnosed with AIDS and who have died from HIV/AIDS since 1994.

.....

.....

.....

.....

.....

(iii) Using the data in the graph, explain why the number of people infected with HIV in the male homosexual population in the UK is increasing.

.....

.....

.....

.....

.....

[Total 6 marks]