OCR
Oxford Cambridge and RSA

Thursday 23 May 2024 – Morning

AS Level Biology A

H020/02 Depth in biology

Time allowed: 1 hour 30 minutes

You can use:
- a scientific or graphical calculator
- a ruler (cm/mm)

H020/02

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **70**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*****).
- This document has **24** pages.

ADVICE
- Read each question carefully before you start your answer.

1

(a) Students used a transect line to sample species of wildflowers in a field.

(i) Name the type of sampling method used in a transect line.

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

(ii) This table shows their findings.

Species	**Number of organisms (*n*)**	***n*/*N***	$(n/N)^2$
Foxglove	3	0.13	0.02
Meadow buttercup	7		
Oxeye daisy	9		
Yellow rattle	4		
	N =		$\sum(n/N)^2$ =
			$1 - \sum(n/N)^2$ =

Calculate the Simpson's Index of Diversity for the field using the data in the above table.

Use the formula: $D = 1 - \left(\sum\left(\frac{n}{N}\right)^2\right)$

Give your answer to **2** significant figures.

Simpson's Index of Diversity = ... **[3]**

(iii) State what can be concluded about the diversity of the field from your answer in **(a)(ii)**.

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

(b) The students then used a sweep net to sample animals in two different parts of a river.

They did this by holding the sweep net in the water and at the same time kicking the riverbed downstream.

Suggest how they could improve their sampling method to obtain more valid results.

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

(c) Black oak trees are an example of a keystone species within an oak woodland ecosystem in England.

Suggest what would happen to the ecosystem if the black oak trees died out.

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

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2

(a) Zombie-ant fungus is a pathogen that causes a disease in ants.

Fig. 2.1 shows an ant infected by the zombie-ant fungus.

Fig. 2.1

This fungus affects the behaviour of an ant in these ways:

- An infected ant will climb to a high point in a tree, bite into a branch or leaf and then remain there until it dies.
- The fungus feeds on the dead ant and produces a stalk from the ant's head.
- The stalk then breaks open, releasing fungal spores.

(i) Suggest **two** ways in which the ant's behaviour helps to increase the spread of the zombie-ant fungus.

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[2]

(ii)* Scientists carried out a study in 2017 in Taiwan to see if various climatic factors affected the numbers of zombie-ant fungus infections

Fig. 2.2 and **Fig. 2.3** show the findings of this study.

Fig. 2.2

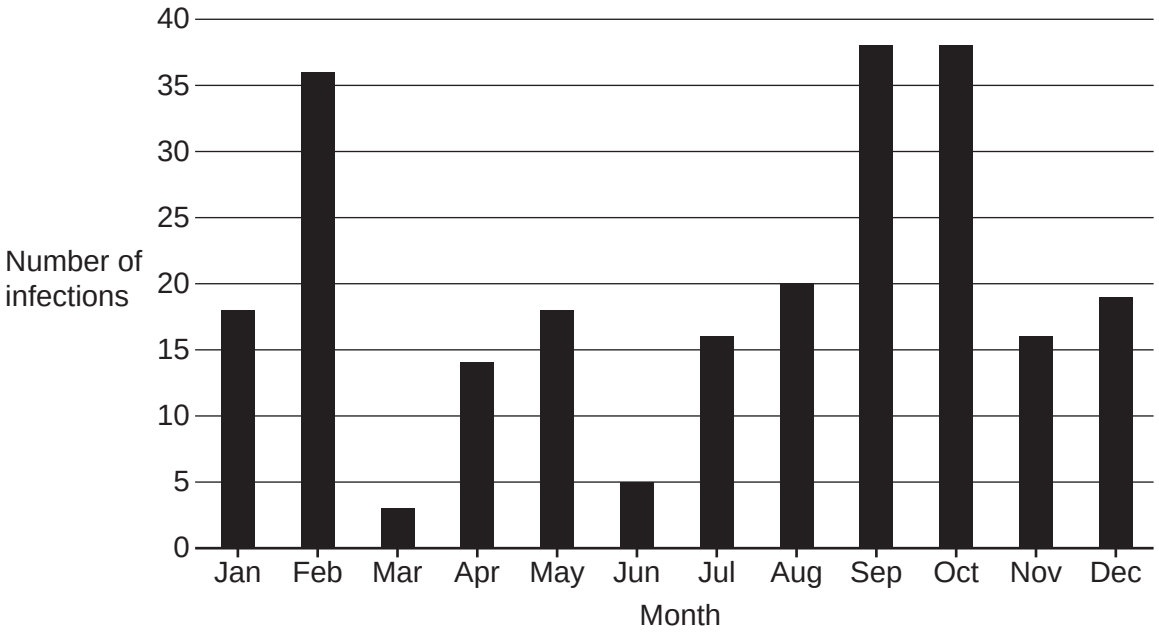
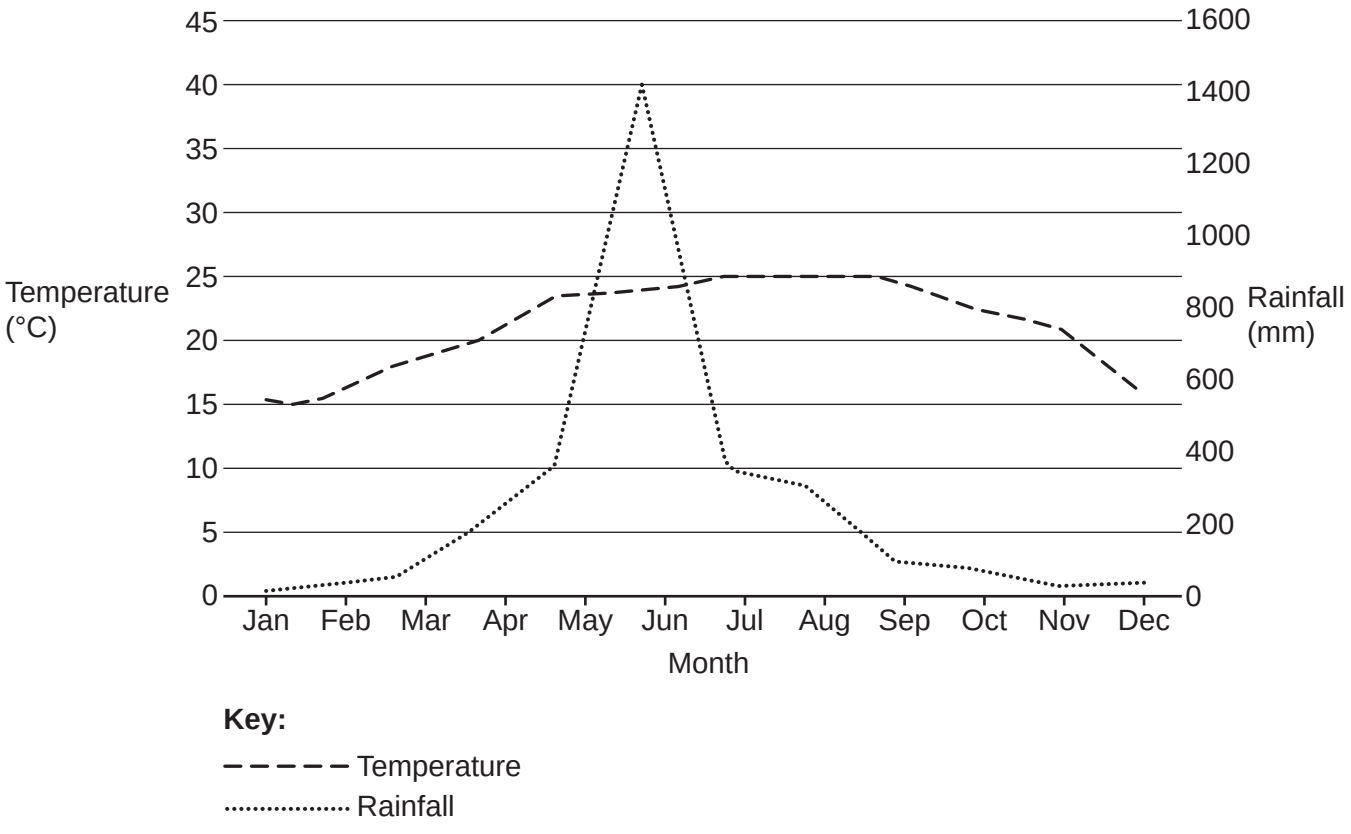


Fig. 2.3



7

A student looked at the data in **Fig. 2.2** and **Fig. 2.3** and concluded:

'Zombie-ant fungus infections increase after heavy rainfall but are not affected by temperature.'

Discuss whether the data supports the student's conclusion.

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Extra answer space if required.

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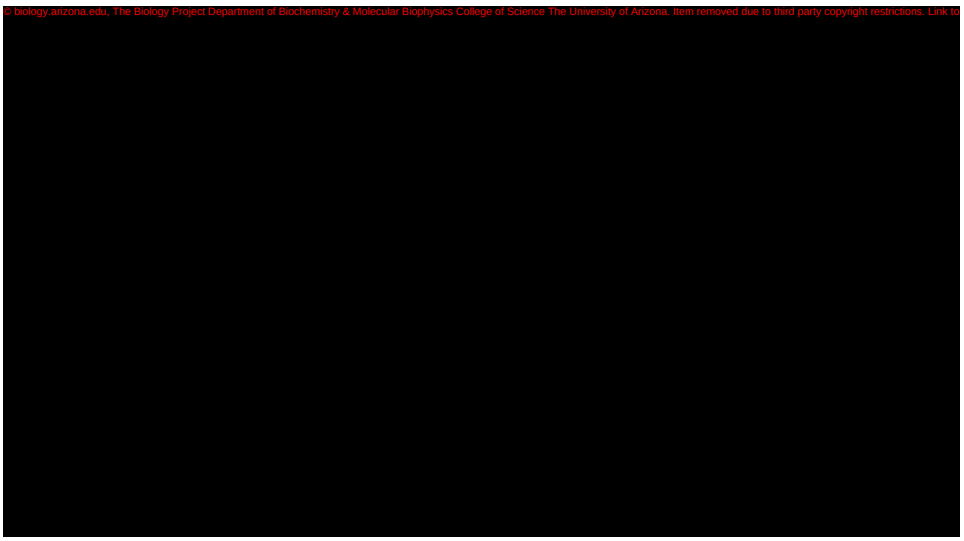
(b) Complete the table with the type of pathogen that causes the communicable disease.

Communicable Disease	Type of Pathogen
Influenza	
Malaria	
Black sigatoka in bananas	

[3]

3

(a) The graph shows the rate of uptake of particles across a membrane by two different methods of diffusion.



State which method shows facilitated diffusion. Explain the reasons for your answer.

Method .....

Explanation .....

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[3]

(b) Temperature and concentration are two factors that affect the rate of diffusion.

State **one other** factor that affects the rate of diffusion.

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

(c) Students used a model cell to investigate the effect of temperature on the rate of diffusion across membranes

They were provided with:

- a calibrated colorimeter
- a calibration curve
- Benedict's solution and all the apparatus required to carry out a Benedict's test
- glucose solution
- dialysis tubing.

(i) Name **two** more pieces of apparatus they would need to make sure this is a controlled investigation.

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2 .....

[2]

(ii) Outline the method that the students would use to carry out an investigation into the effect of **temperature** on the diffusion rate in their model cells

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

(d) The table below shows some results from a model cell investigation.

Temperature (°C)	Concentration of glucose found outside the dialysis tubing after two minutes (mol dm^{-3})
10	1.5
20	3.6
30	4.7
40	5.8

Explain these results in terms of the effect of temperature on the rate of diffusion.

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

4

(a) An aneurysm is a bulge in a blood vessel caused by a weakness in the wall of the blood vessel.

If an aneurysm bursts it can be very serious or even fatal.

(i) Scientists can measure the size of an aneurysm. An investigation measured the ratio of collagen to elastin in the blood vessel wall in five patients with an aneurysm.

The table shows some of their findings.

Patient	Size of aneurysm (cm)	Ratio of collagen to elastin
A	0.00	2 : 1
B	0.03	3 : 1
C	0.50	4 : 1
D	1.10	7 : 1
E	2.20	8 : 1

Based only on the data in the table, suggest a hypothesis on the formation of aneurysms

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

(ii) Students looked at data on aneurysms in different groups of people of the same age.

The table shows their findings

Group	**Observed frequency of people with aneurysms (*O*)**	**Expected frequency of people with aneurysms (*E*)**
Females	566	600
Males	377	343

Calculate chi squared for this data.

Use the formula: $\chi^2 = \sum \frac{(O - E)^2}{E}$

Give your answer to **4** significant figures

χ^2 = ... **[3]**

(iii) The table shows part of a statistical table for the chi squared test.

	Probability (%)			
	10	5	1	0.5
df				
1	2.706	3.841	6.635	7.879
2	4.605	5.991	9.210	10.60
3	6.251	7.815	11.34	12.84
4	7.779	9.488	13.28	14.86

Using the table above and your answer to **(ii)**, state what conclusion the student would make with 95% confidence?

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(b)

(i) Explain the role of valves in veins

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(ii) The smooth muscle content in some arteriole walls is more than double the smooth muscle content in the walls of some arteries

Explain how arterioles are better adapted than arteries to allow the blood to flow into an individual organ.

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

(c)* Heart action in a mammalian heart starts at the sino-atrial node (SAN).

Describe how heart action is initiated and coordinated by the SAN **and** explain why the muscle in the walls of the atria does not contract at the same time as the muscle in the walls of the ventricles

Details of hormonal and nervous control are **not** required.

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Extra answer space if required.

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5

(a)

(i) Some students collect a sample of pond water to observe under a light microscope.

They pour some of the pond water onto a microscope slide.

Describe how they could improve their technique in preparing the microscope slide for examination under a light microscope.

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(ii) Explain how the students would use the different objective lenses of a light microscope to focus and observe the pond water sample at high power magnification.

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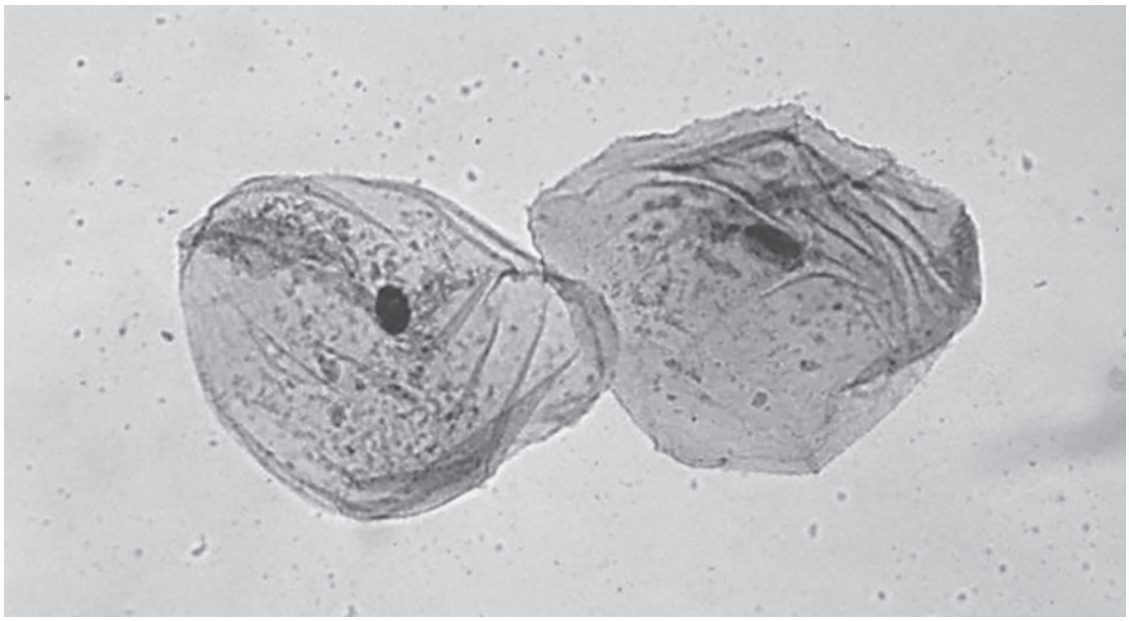
(b) **Fig. 5.1** shows a photomicrograph of human cheek cells observed by the students under a light microscope.

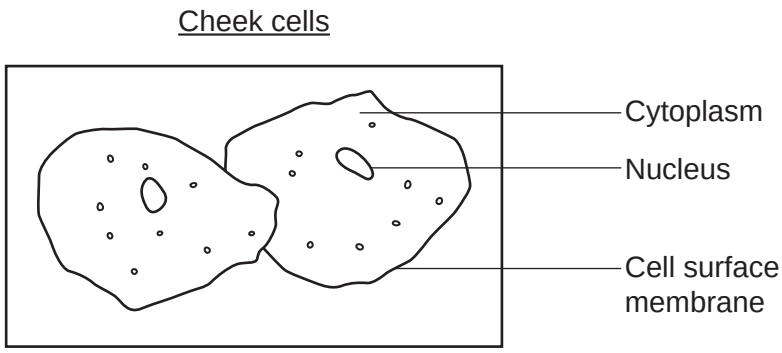
Fig. 5.1



Magnification ×400

Fig. 5.2 shows a drawing made by a student of the cells from this photomicrograph.

Fig. 5.2



Magnification ×400

A student said **Fig. 5.2** was a correct biological drawing.

Identify **two** pieces of evidence from **Fig. 5.1** and **Fig. 5.2** that support the student's comment.

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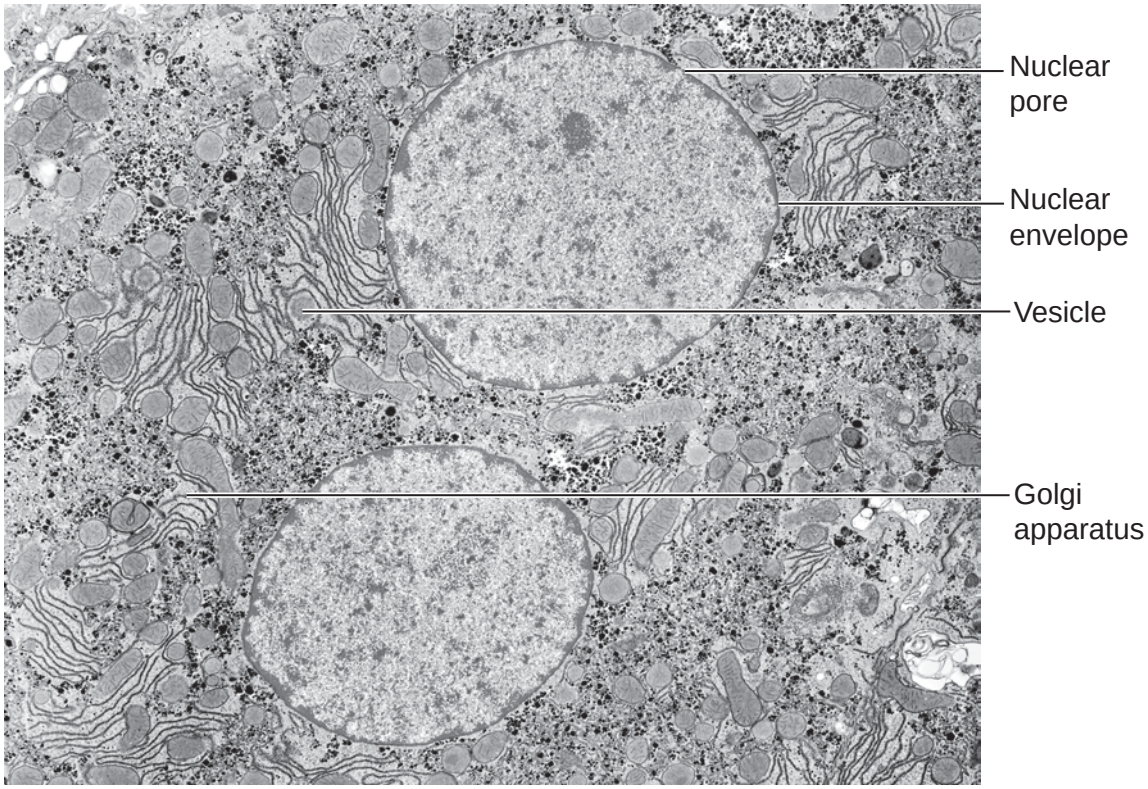
[2]

(c)

(i) **Fig. 5.3** shows a photomicrograph of a liver cell taken from a transmission electron microscope (TEM).

Fig. 5.3



Magnification ×100 000

Identify **two** pieces of evidence that indicate that the image in **Fig. 5.3** was taken using a TEM.

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[2]

(ii) Describe how the rough endoplasmic reticulum and the Golgi apparatus are involved in the production of a secretory vesicle that contains protein.

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(iii) The secretory vesicles remove proteins from the cell by a process called exocytosis.

Explain why exocytosis is described as an active process.

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(d) Outline the importance of the cytoskeleton.

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6

(a)

(i) The general structure of an amino acid molecule has one R group and two other groups.

Name the **two** other groups in an amino acid molecule.

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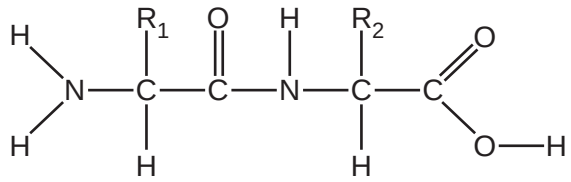
[2]

(ii) Below is a diagram of a dipeptide.



Draw a circle around the peptide bond. Answer on the diagram. **[1]**

(iii) Name the type of reaction involved in breaking the peptide bond.

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

(b) Which statements about biological molecules are true and which are false?

Tick (✓) **one** box in each row.

Statement	**True**	**False**
Breaking one ester bond in a triglyceride produces glycerol and three fatty acids.		
Ribose is a hexose monosaccharide.		
In an alpha glucose molecule, the hydroxyl (OH) group is positioned below carbon 1.		

[2]

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.