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AS Level Biology A

H020/02 Depth in biology

Tuesday 6 June 2017 – Afternoon

Time allowed: 1 hour 30 minutes

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

First name	
Last name	
Centre number	Candidate number

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

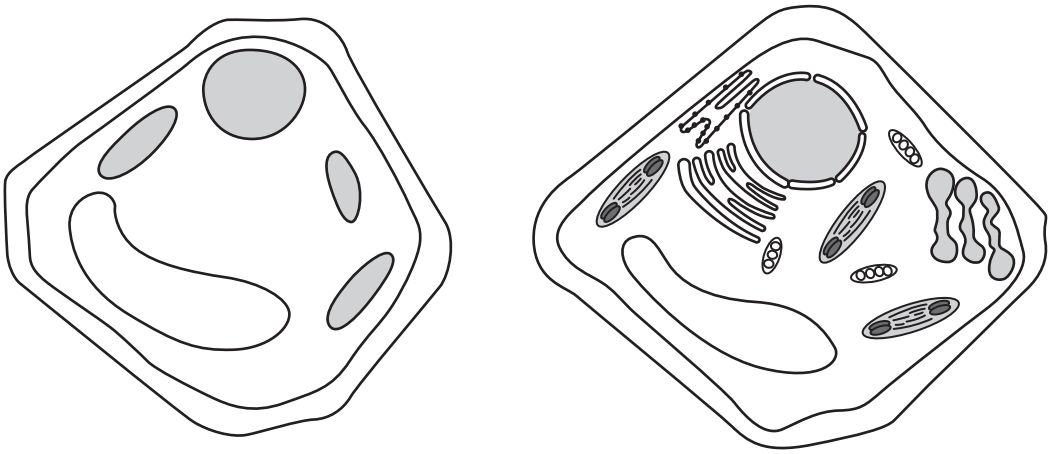
INFORMATION
- The total mark for this paper is **70**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **20** pages.

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Answer **all** the questions.

1 Fig. 1.1 shows a student's diagrams of two plant cells. Each cell was observed using a different type of microscope. The cells are not drawn to scale.

(a)



Cell A **Cell B**

Fig. 1.1

(i) **Cell B** in Fig. 1.1 was observed using an electron microscope.

Give one piece of evidence from Fig. 1.1 that supports this.

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

(ii) Give one way that an image produced by a laser scanning confocal microscope differs from that produced by an electron microscope.

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

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(b) Meiosis is a type of nuclear division.

Fig. 1.2 shows a photomicrograph of plant cells undergoing meiosis.

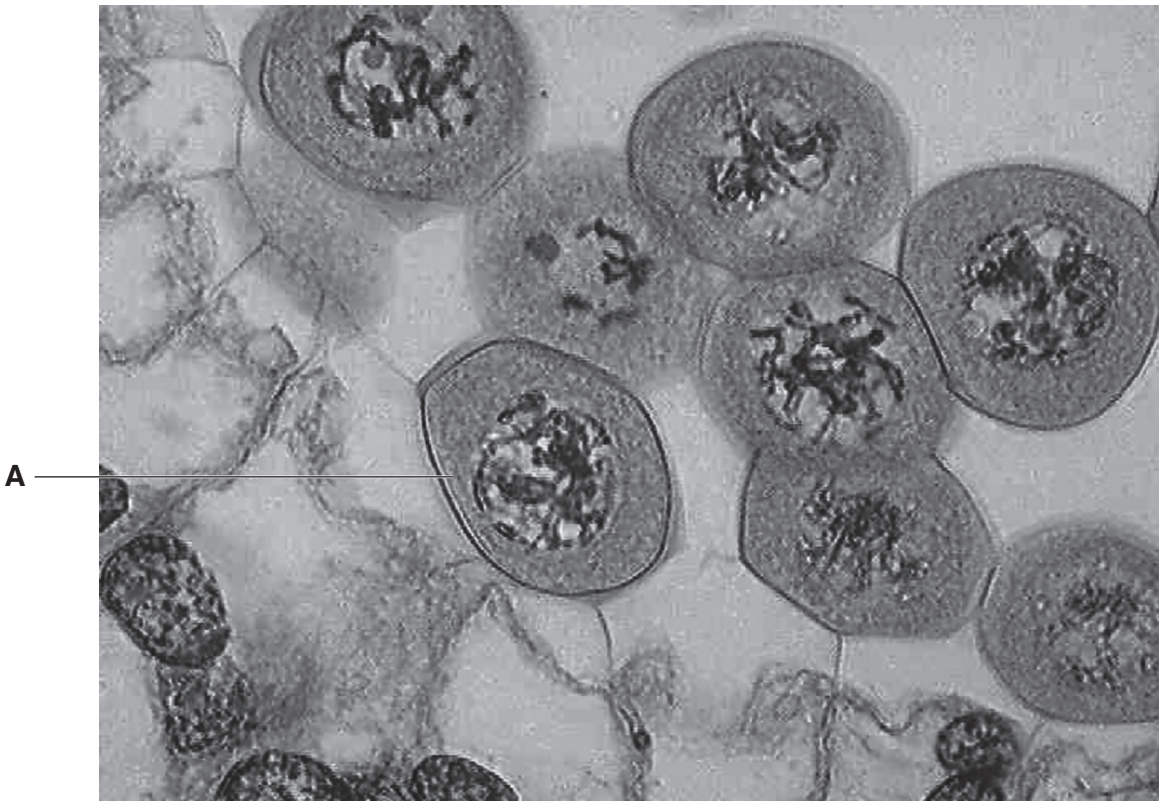


Fig. 1.2

(i) Identify the stage of meiosis 1 shown in the cell labelled **A**.

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

(ii) Based only on your observations of Fig. 1.2, state **two** reasons for your answer in **(b)(i)**.

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

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(iii) Another stage of meiosis is metaphase 1.

Explain how the organisation of homologous chromosomes during metaphase 1 increases genetic variation.

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

(c) The use of stem cells is being evaluated for the treatment of certain human diseases.

Name **two** potential sources of human stem cells and for **one** source, describe an ethical issue associated with the use of stem cells.

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

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2 **(a)** A group of students wanted to observe the position of xylem vessels in the leaf stalks (petioles) of celery.

Describe a procedure they could use to do this.

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

(b) Water Starwort is a hydrophyte belonging to the genus *Callitriche*. It is an aquatic plant which has its stems fully submerged in water.

Cholla is a cactus belonging to the genus *Cylindropuntia*. It can grow over 4 metres tall.

In the space provided below, give **one** way in which you would expect the walls of the xylem vessels in the stems of Water Starwort and the walls of xylem vessels in the stems of Cholla, to differ from those of a herbaceous dicotyledonous plant growing in a deciduous woodland.

Water Starwort

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Cholla

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[2]

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(c) Xylem and phloem are two vascular tissues found in plants.

State **one** similarity and **two** differences between the structure of xylem and phloem.

Similarity 1

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Difference 1

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Difference 2

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[3]

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3 Bony fish and insects have different gas exchange systems. Both can be observed by dissection.

(a) Describe how you would carry out the dissection to display maximum detail of either gas exchange system.

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

(b) Insects, such as beetles, obtain oxygen by drawing air in through holes in their exoskeleton, called spiracles. Pairs of spiracles on each abdominal segment connect to air tubes that take the air deep into the tissues of the insect for gas exchange.

Diving beetles live in ponds. They carry an air bubble under their wing when they swim underwater. The bubble supplies air to the spiracles. When the bubble has been used up, the beetle comes to the surface to collect a new bubble.

A student carried out an investigation into the effect of temperature on three diving beetles.

- Three beetles (A, B and C) from the same species were used in the investigation.
- They were placed in thermostatically controlled water baths at 10 °C, 20 °C and 30 °C respectively.
- They were observed for one hour.
- The number of times the beetle surfaced to renew its air bubble was recorded.
- Mean values for each temperature were calculated and recorded to the nearest whole number.
- The results are shown in Table 3.

Temperature (°C)	**Number of times beetle resurfaced in one hour**			
	Beetle A	**Beetle B**	**Beetle C**	**Mean**
10	10	12	8	10
20	18	22	18	20
30	44	48	38	43

Table 3

The student made an error in their working.

(i) Put a ring around the error in **Table 3** and write the correct answer next to it. Use the space below to show your working.

[2]

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(ii) Fig. 3 shows a diagram of part of the gas exchange system of an insect.

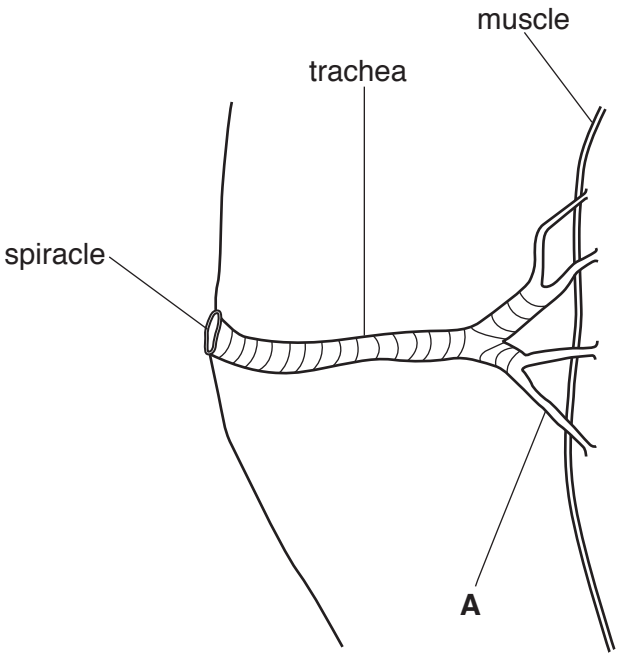


Fig. 3

Name the structure labelled **A**.

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

(iii) Describe how the trachea of a mammal is different from the trachea shown in Fig. 3.

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

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(c)* Alveoli are located in the lungs of mammals.

Explain how **alveoli** are adapted for efficient gas exchange.

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..... **[6]**

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4 Lymphocytes form an important part of the specific immune system in humans. They can be classified into B lymphocytes and T lymphocytes.

(a) For each of the statements in the table below, use **ticks or crosses** to identify whether the statement belongs to B lymphocytes, or to T lymphocytes, or to both B and T lymphocytes.

The first one has been done for you.

Statement	B lymphocytes	T lymphocytes
Matured in bone marrow	✓	✗
Form part of immune response		
Differentiate into memory cells		
Produce chemicals that can cause lysis of infected cells		
Form plasma cell clones		

[4]

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(b) Fig. 4 shows the concentration of antibodies in a patient's bloodstream following an influenza (flu) vaccination, and then a subsequent infection with the influenza virus.

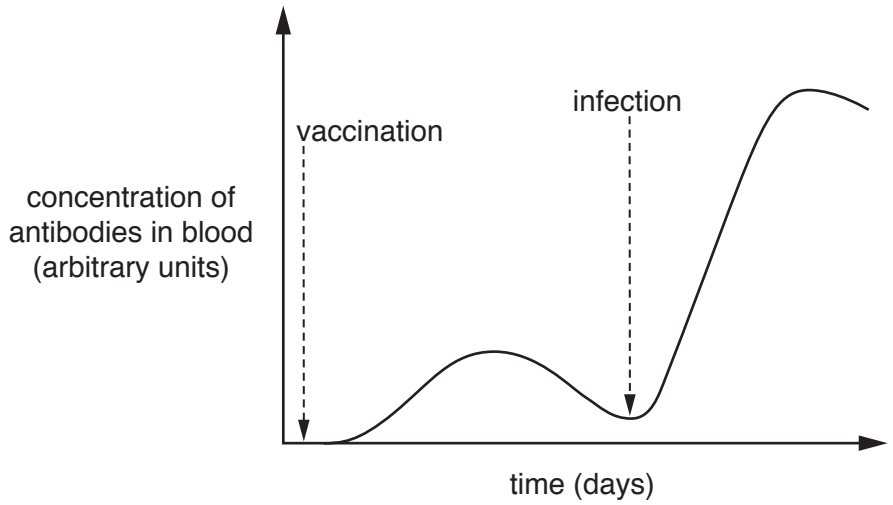


Fig. 4

Describe where the primary and secondary immune responses are taking place on Fig. 4 and explain the differences between the two processes.

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

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(c)* In West Africa during 2015 there was a serious outbreak of the viral disease Ebola which spread by contact with infected bodily fluids.

- At the start of the outbreak there was a severe lack of trained health workers in the affected areas and much of the nursing was carried out in the family home or at local clinics.
- Many residents lived in close proximity to one another and sanitation was often of a poor standard.
- In times of illness it was common for people to travel to stay with close relatives, often in nearby villages or towns.
- As the outbreak spread, some residents left their villages to flee from the disease.
- Local mourning and burial practices involved gathering at the family house to pay respects to the deceased. Prior to burial the deceased was usually bathed by close family members.

A number of common factors affect the spread of communicable diseases in humans and some of them are relevant to the spread of Ebola. From the information above, discuss these factors and suggest what actions could have been put in place to address them.

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..... **[6]**

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5 A study was carried out on butterflies in two different habitats in the north of England. The two habitats were farmland and mixed deciduous woodland.

- Surveys were completed in 1992 and then at four year intervals.
- Data were collected from butterfly transect sites in both habitats. Using this data, the total butterfly population in each habitat was estimated.
- In 2012, the general populations of butterflies in these two habitats reached historical lows as a result of the prolonged cold and wet weather.
- Between 1992 and 2012 the woodland had become overgrown due to lack of active management. In particular the number of open spaces in the woodland had decreased.

(a) The data in Fig. 5 shows the total butterfly populations per square kilometre in both habitats between the years 1992 to 2012.

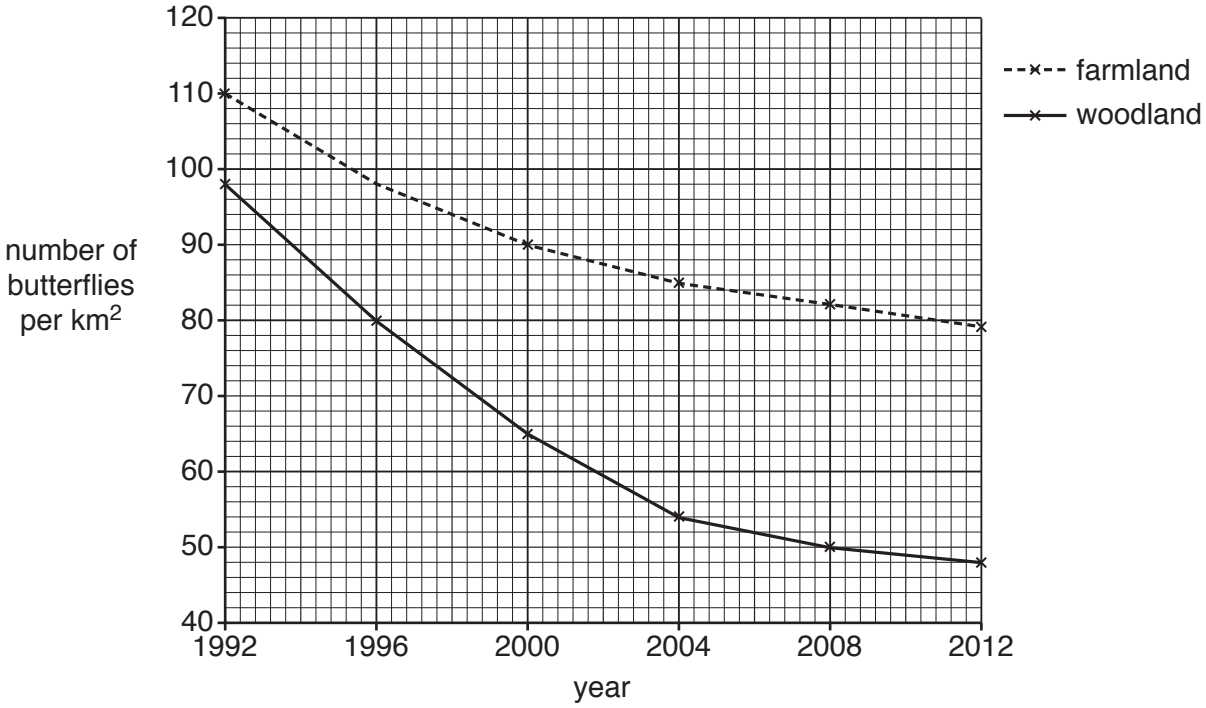


Fig. 5

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(i) Calculate the total percentage decrease in the number of butterflies on farmland between 1992 and 2012.

Show your working. Give your answer to the nearest whole number.

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

(ii) Using the data given in **Fig. 5**, compare the changes in the number of butterflies on farmland and on woodland between 1992 and 2012.

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

(iii) Both habitats experienced the same weather conditions.

Suggest a reason for the **difference** in the rates of decline in butterfly numbers in woodland and farmland.

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

(iv) A student made the following statement:

'These data show that the change in butterfly numbers was caused by changes in weather conditions in England.'

Comment on the validity of this statement.

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

(v) State **one** variable that scientists should control when carrying out surveys such as this.

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

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(b) Butterfly species in severe decline on farmland include gatekeeper, large skipper, small copper, wall brown, small tortoiseshell and white-letter hairstreak.

Butterfly species in severe decline in woodland include brown argus, common blue, gatekeeper, holly blue, marbled white, meadow brown, peacock, small copper, small heath, small tortoiseshell and wall brown.

State which habitat you would expect to have greater species richness and give **two** reasons for your answer.

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

(c) Female silver-washed fritillary butterflies, *Argynnis paphia*, are usually an orange-brown colour. However, a deep olive-green colour can be seen in some females, largely in the south of England.

(i) What is the term given to this type of biodiversity?

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

(ii) Give one possible benefit to the species of this type of biodiversity.

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

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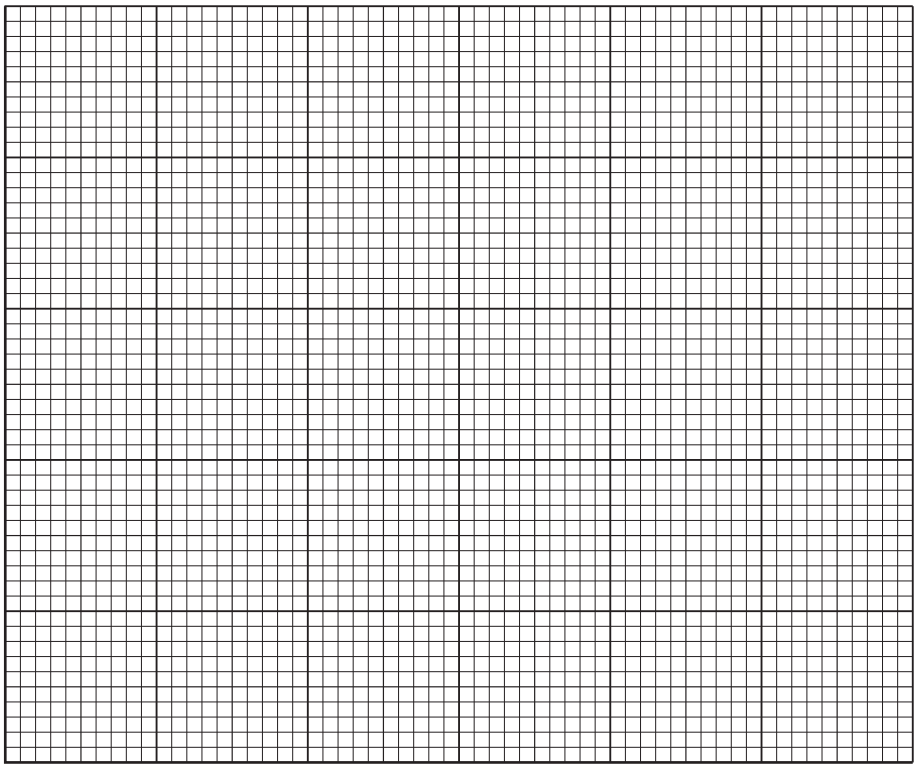
6 A group of students decided to investigate the glucose content of three types of fruit juice. They carried out the Benedict's test on known concentrations of glucose solutions and used these to calibrate a colorimeter.

The results of their calibration are shown in Table 6.

glucose concentration (mmol dm^{-3})	% absorbance			
	Trial 1	Trial 2	Trial 3	Mean
1.0	67	68	65	67
2.0	54	52	55	54
3.0	47	46	48	47
4.0	41	41	40	41
5.0	27	25	25	26
6.0	16	16	17	16

Table 6

(a) (i) Plot a graph of the mean % absorbance at each glucose concentration.



[3]

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(ii) The students were provided with three different fruit juices labelled A, B and C. The Benedict's test was carried out on each fruit juice and samples were prepared for the colorimeter.

Explain how the students would use the calibration curve to estimate the glucose concentration of the fruit juices.

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

(b) The students wrote the following hypothesis:

'The higher the concentration of glucose in the fruit juice, the sweeter it will be.'

(i) Describe how you would carry out a controlled experiment to test this hypothesis **without** using a colorimeter.

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

(ii) Suggest one reason why the results for this experiment might **not** support the students' hypothesis.

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

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(c) Glucose and cholesterol are both molecules transported in the bloodstream that may need monitoring in people with different medical conditions.

Fig. 6 represents the structure of a cholesterol molecule.

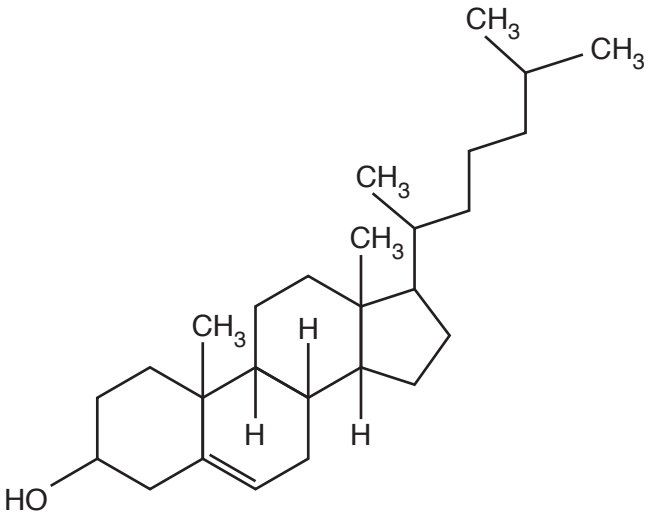


Fig. 6

(i) State **two** ways in which the molecular structure of cholesterol is similar to the molecular structure of glucose.

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

(ii) Glucose is an important biological molecule required by cells for cellular respiration.

State the physical property of glucose that allows it to be easily transported in the bloodstream.

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

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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