OCR
Oxford Cambridge and RSA

Monday 11 October 2021 – Morning

AS Level Biology B (Advancing Biology)

H022/01 Foundations of biology

Time allowed: 1 hour 30 minutes

You must have:
- the Insert (ns de th s document)

You can use:
- a sc ent f c or graph ca ca cu ator
- a ru er (cm/mm)

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 **[ ]**.
- This document has **28** pages.

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

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SECTION A

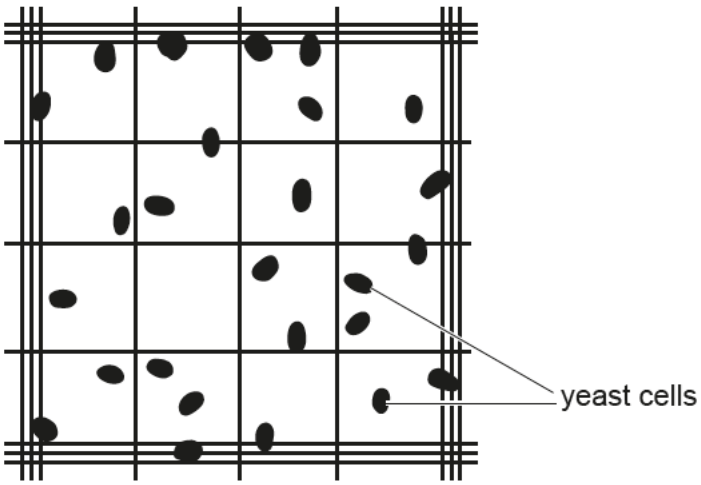
You should spend a maximum of 25 minutes on this section.

Write your answer for each question in the box provided.

Answer **all** the questions.

1 A student used a haemocytometer to count the number of yeast cells in a diluted sample.

The North-West counting rule was applied by the student when counting the cells in one triple lined grid of the haemocytometer.



Which of the options, **A** to **D**, is the number of cells counted by the student in this grid?

A 20

B 21

C 22

D 26

Your answer ☐

[1]

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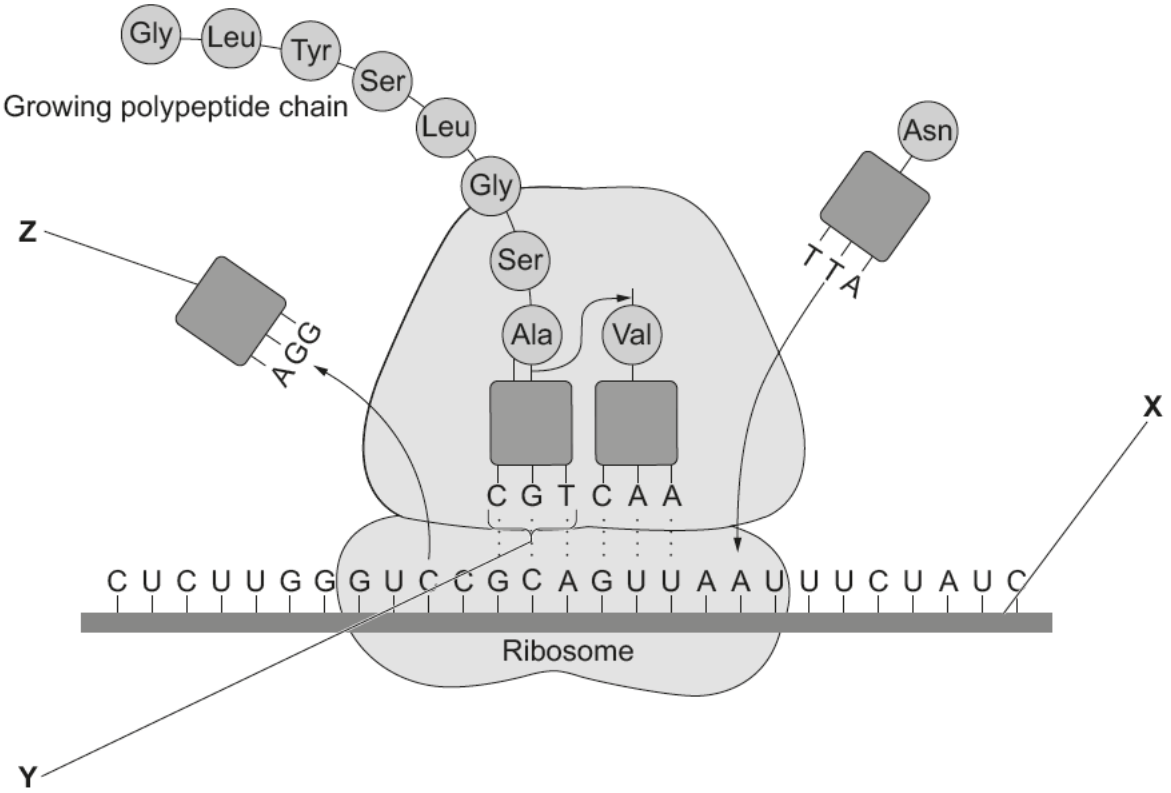
2 The diagram shows the process of translation that occurs during protein synthesis.



Which of the rows, **A** to **D**, correctly identifies **X**, **Y** and **Z** in the diagram?

	X	Y	Z
A	mRNA	codon	tRNA
B	DNA	anticodon	tRNA
C	mRNA	anticodon	tRNA
D	DNA	anticodon	mRNA

Your answer ☐

[1]

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3 Tyrosine is an amino acid that can be coded for by two different DNA codons.

Which of the options, **A** to **D**, is a feature of the genetic code that explains why there can be two different DNA codons for tyrosine?

A it is a triplet code

B it is degenerate

C it is universal

D it is non-overlapping

Your answer ☐

[1]

4 Which of the options, **A** to **D**, are components found in a strand of ribonucleic acid (RNA)?

A deoxyribose, uracil, phosphate

B ribose, adenine, phosphate

C ribose, thymine, phosphate

D ribose, uracil, ATP

Your answer ☐

[1]

5 A clinical trial was being used to test a new drug.

- 40 people applied to take part in the trial.
- 30 of these people were randomly selected to receive either the new drug or a placebo.
- A placebo was given to 12 of these randomly selected people.

Which of the options, **A** to **D**, is the chance that a person who applied to take part in this trial received the new drug?

A 0.75

B 0.30

C 0.40

D 0.45

Your answer ☐

[1]

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6 Which of the features, **A** to **D**, about the developing fetus can **not** be provided by an ultrasound scan?

A number of chromosomes in fetal cells

B position of the placenta

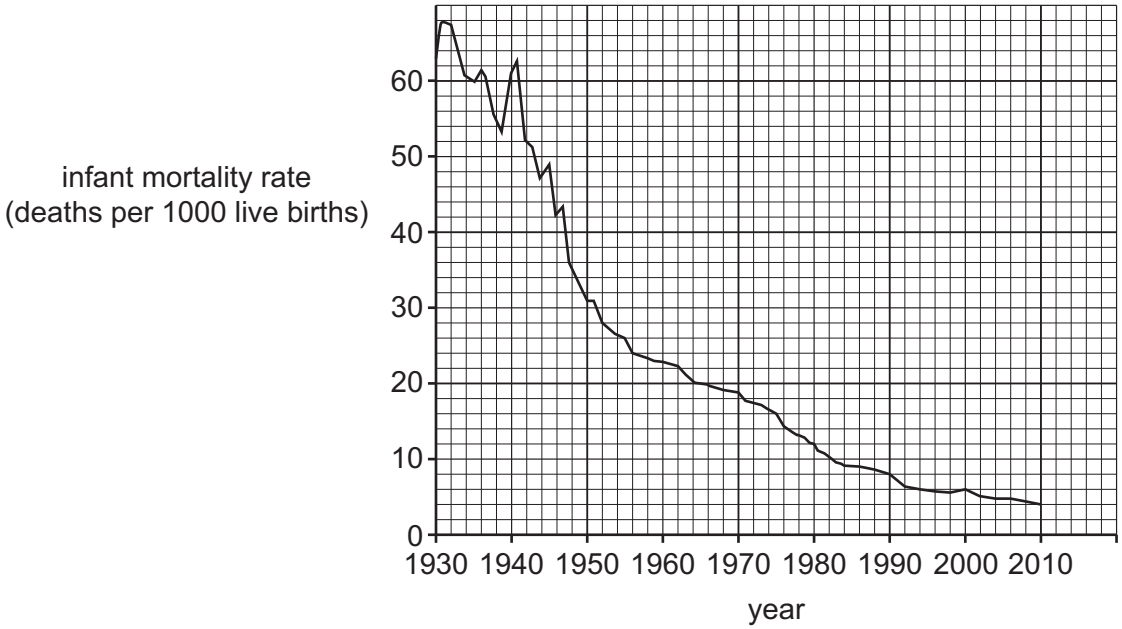
C number of fetuses in the uterus

D blood flow through the umbilical cord

Your answer ☐

[1]

7 The graph below shows the infant mortality rate in the UK from 1930 to 2010.



Which of the options, **A** to **D**, is the correctly calculated percentage decrease in infant mortality rates between 1950 and 2000?

A 80.6%

B 90.5%

C 416.7%

D 950.0%

Your answer ☐

[1]

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8 Rubella is a viral disease that was eliminated from the UK population in 2015. Medical practitioners must report suspected cases to local authorities.

Which of the statements, **A** to **D**, about rubella is true?

A It is endemic in the UK population.

B It can be treated with antibiotics.

C It is a non-communicable disease.

D It is a notifiable disease.

Your answer ☐

[1]

9 Clonal expansion occurs during the specific immune response.

Which of the statements, **A** to **D**, is a description of clonal expansion?

A B lymphocytes differentiate into plasma cells.

B B lymphocytes differentiate into memory cells.

C B lymphocytes divide by mitosis.

D B lymphocytes produce large quantities of antibodies.

Your answer ☐

[1]

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10 The diagram shows possible pathways in which water can travel between the cells of a plant.

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Which of the pathways, **A** to **D**, shows the apoplast pathway?

Your answer ☐

[1]

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11 The hierarchical classification from domain to species of the castor oil plant, *Ricinus communis*, is shown below.

Eukaryota
Plantae
Magnoliophyta
Magnoliopsida
Malpighiales
Euphorbiaceae
Ricinus
communis

Which of the options, **A** to **D**, is the **family** taxon for the castor oil plant?

A Euphorbiaceae

B Malpighiales

C Magnoliophyta

D Magnoliopsida

Your answer ☐

[1]

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12 The DNA codon sequence from five different species is shown in the table below.

Species	DNA codon sequence
P	TTC-ATT-AGT-TGG-CCC-GCC-GTC
Q	TTC-GTC-AGT-TGG-CCC-ATT-GTC
R	TTC-ATT-AGT-TGG-CCC-GCC-CCC
S	TTC-ATT-AAA-TGG-CCC-ATT-CCC
T	TTC-GTC-AAA-TGG-CCC-GCC-GTC

From this evidence, which of the options, **A** to **D**, shows the most closely related species?

A **P** and **R**

B **P** and **S**

C **Q** and **R**

D **Q** and **T**

Your answer ☐

[1]

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13 The Mantoux test is used to test for Tuberculosis (TB).

Which of the statements, **A** to **D**, about the Mantoux test is true?

A People who have a strong positive reaction to the test will not need a TB vaccination.

B People who have a strong positive reaction to the test will have produced antigens against the TB bacterium.

C People who do not have a reaction to the test will have produced antibodies against the TB bacterium.

D People who do not have a reaction to the test will be immune to the TB bacterium.

Your answer ☐

[1]

14 Scientists have calculated that, during apoptosis, destruction of cell contents can occur at a rate of 30 μm per minute.

Which of the options, **A** to **D**, is the estimated time taken for a 0.15 mm long cell to be destroyed during apoptosis?

A 3 s

B 30 s

C 300 s

D 3000 s

Your answer ☐

[1]

15 Which of the plant structures, **A** to **D**, has intercellular spaces to allow for the process of gas exchange?

A sieve tubes

B lenticels

C root hairs

D xylem vessels

Your answer ☐

[1]

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16 After donation, blood is processed into different products.
The table shows a description of some blood products and possible uses.

Which of the rows, **A** to **D**, is correct?

	Blood product	Description	Use
A	Packed red cells	Erythrocytes in solution	To replace clotting factors after transfusion
B	Leuco-depleted blood	Whole blood with red blood cells removed	For patients with bone marrow failure
C	Fresh frozen plasma	Consists of whole blood	To replace clotting factors after transfusion
D	Platelets	Thrombocytes in solution	For patients with bone marrow failure

Your answer ☐

[1]

17 Which of the options, **A** to **D**, is part of the emergency treatment for a person suffering a suspected heart attack?

A expired air resuscitation (EAR)

B laying the person down in the recovery position

C sitting the person down against a wall with knees raised

D use of a defibrillator

Your answer ☐

[1]

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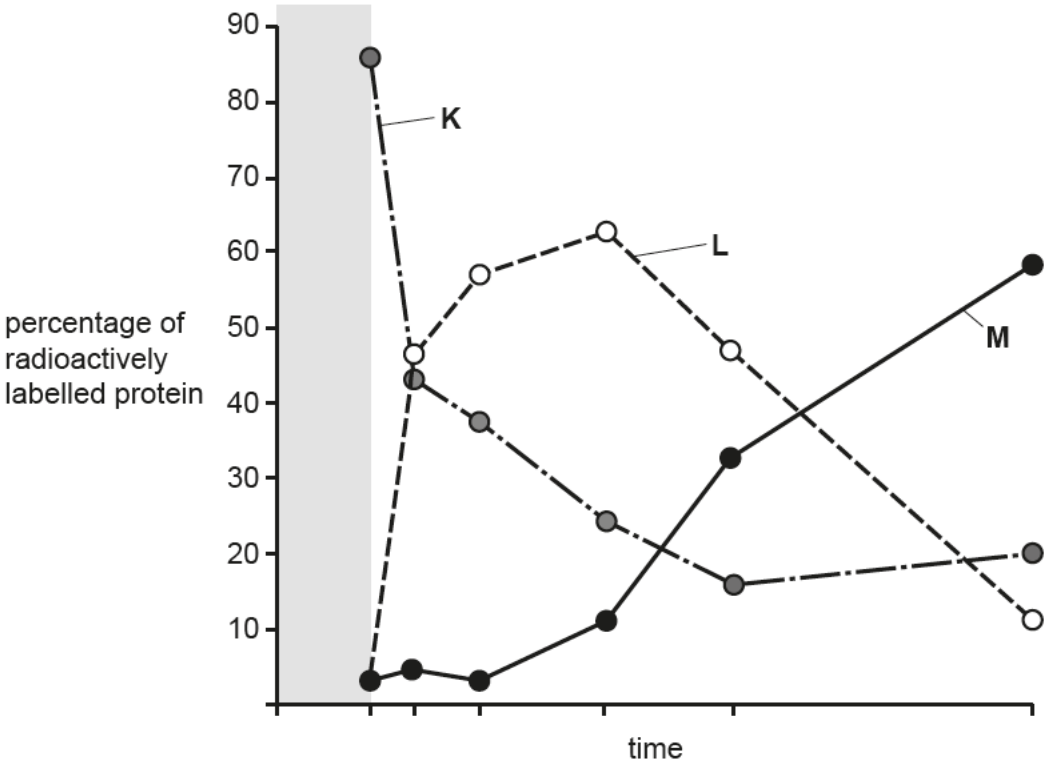
18 Researchers used radioactively labelled amino acids to track the movement of proteins through a cell.

The graph below shows the percentage of radioactively labelled proteins in three different organelles, **K**, **L** and **M**, from the time that protein translation began to the time the protein is packaged ready for secretion.



Which of the options, **A** to **D**, correctly identifies organelles **K**, **L** and **M** on the graph?

A **K** = Golgi apparatus, **L** = secretory vesicle, **M** = rough ER

B **K** = rough ER, **L** = secretory vesicle, **M** = Golgi apparatus

C **K** = rough ER, **L** = Golgi apparatus, **M** = secretory vesicle

D **K** = secretory vesicle, **L** = Golgi apparatus, **M** = rough ER

Your answer ☐

[1]

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19 As part of a class investigation, a student used pulse rate measurements to find out the change in his heart rate when he was at rest and when he was exercising.

The student recorded his heart rate at rest as 75.0 ± 2.0 bpm and noted that it increased by 23.0 bpm during exercise.

Which of the options, **A** to **D**, shows the relative uncertainty for the measured change in heart rate?

A 8.7%

B 17.4%

C 4.3%

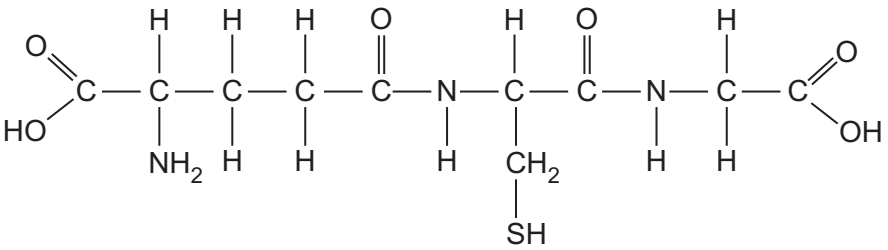
D 2.7%

Your answer ☐

[1]

20 Glutathione (GSH) is a small polymer found in most cells in the human body.

The structure of glutathione is shown below.



glutathione molecule

Which of the options, **A** to **D**, could be used to detect the presence of glutathione in body fluids?

A Benedict's test

B biuret test

C differential stain

D iodine/KI solution

Your answer ☐

[1]

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SECTION B

Answer **all** the questions.

21 A student wrote the following revision notes, **1** to **6**, about meiosis.

1. Chromosomes attach to spindle fibres by their centromeres.
2. Haploid cells are converted to diploid cells.
3. Bivalents line up on the equator of the cell.
4. Sister chromatids are separated.
5. Homologous chromosomes are separated.
6. Homologous chromosomes pair up to form bivalents.

(a) Use the information in the student's revision notes to answer the following questions.

(i) Which of the revision notes describes an event that occurs in **meiosis II**?

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

(ii) Which stage of meiosis is being described in revision note **6**?

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

(iii) One of the revision notes is **not** correct.

Identify this revision note and write a correction.

Revision note .....

Correction .....

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

(b) Crossing over is a process that occurs during meiosis.

Explain how this process can lead to genetic variation in daughter cells.

.....

.....

.....

.....

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

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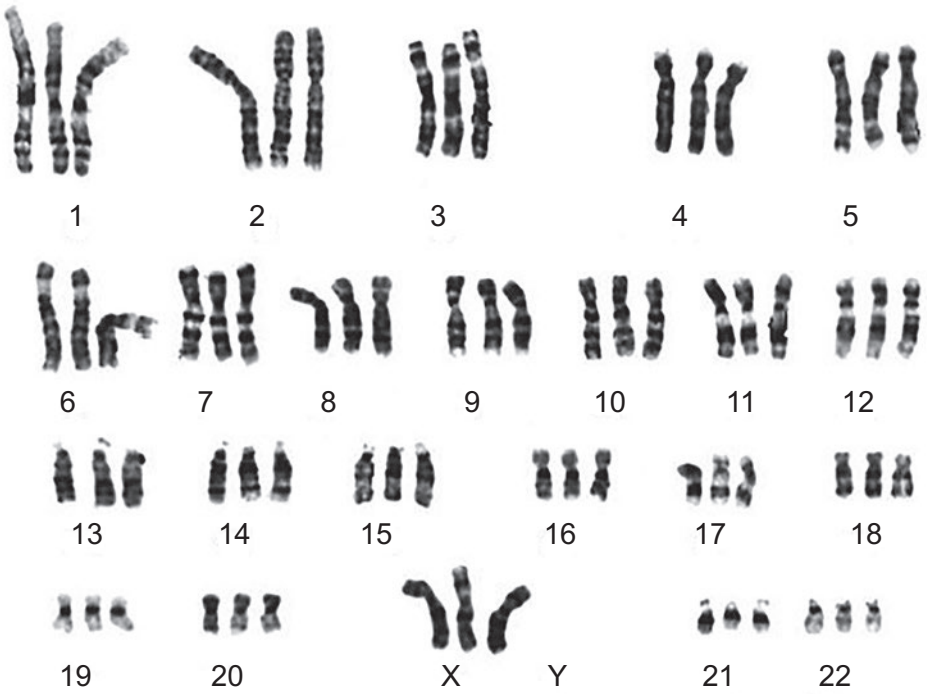
(c) The karyotype below shows a rare chromosome abnormality in a human fetus.



(i) Using the karyotype shown, what conclusions can be made about the fetus? Give reasons for your answer.

.....

.....

.....

.....

.....

.....

.....

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

(ii) Using your knowledge of meiosis, suggest how the chromosome abnormality shown in the karyotype could have occurred.

.....

.....

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

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(iii) This chromosomal abnormality usually results in miscarriage or death of the fetus.

- Fetuses have this abnormality in 2% of all pregnancies.
- 99% of fetuses with this abnormality are miscarried or die before birth.

Data for a human population recorded 3 live births of babies with this abnormality.

Using this information, calculate the number of pregnancies in this population.

Number of pregnancies = ... **[2]**

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22 A group of students investigated the effect of solute concentration on water movement across a semi-permeable membrane using a gas pressure sensor.

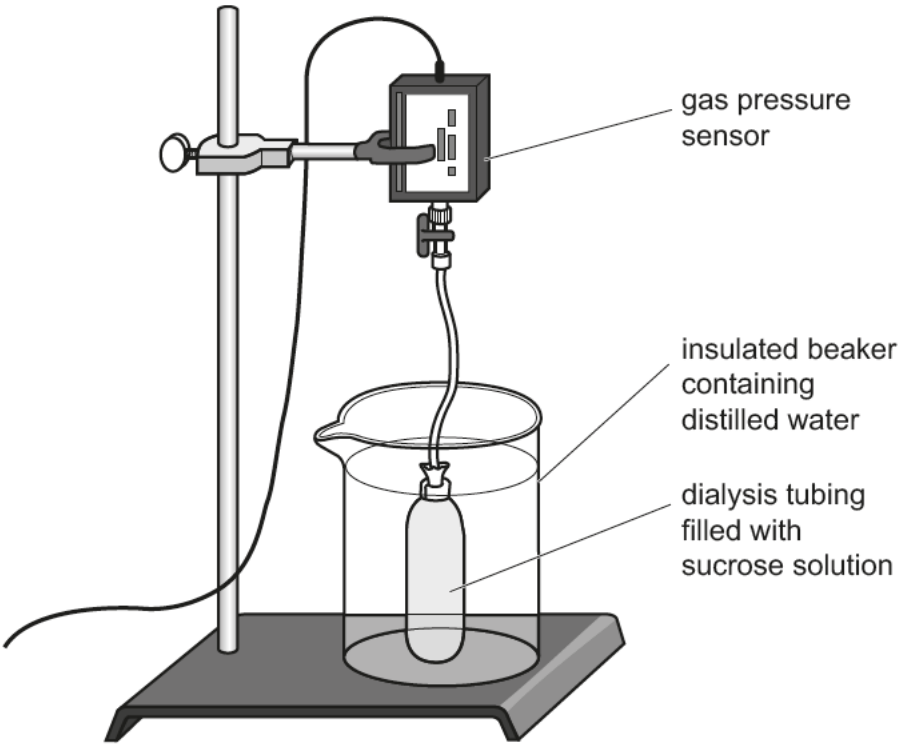

Fig. 22.1

Fig. 22.1 shows how the apparatus was set up to collect data during this investigation.

- The dialysis tubing was filled with 1.0 mol dm ^{3} sucrose solution and attached to a gas pressure sensor.
- The gas pressure sensor measured the pressure as water moved into or out of the dialysis tubing for 30 minutes.
- The investigation was repeated using 0.9, 0.8, 0.7 and 0.6 mol dm ^{3} sucrose solutions.

(a) **(i)** Identify **two** precautions that must be taken when using the apparatus in **Fig. 22.1** to obtain **valid** data.

1 .....

2 .....

[2]

(ii) For **one** of the precautions you identified in **(a)(i)** explain why it must be taken to ensure valid data.

.....

.....

.....

.....

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

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(b) **Fig. 22.2** shows some of the data recorded by the gas pressure sensor.

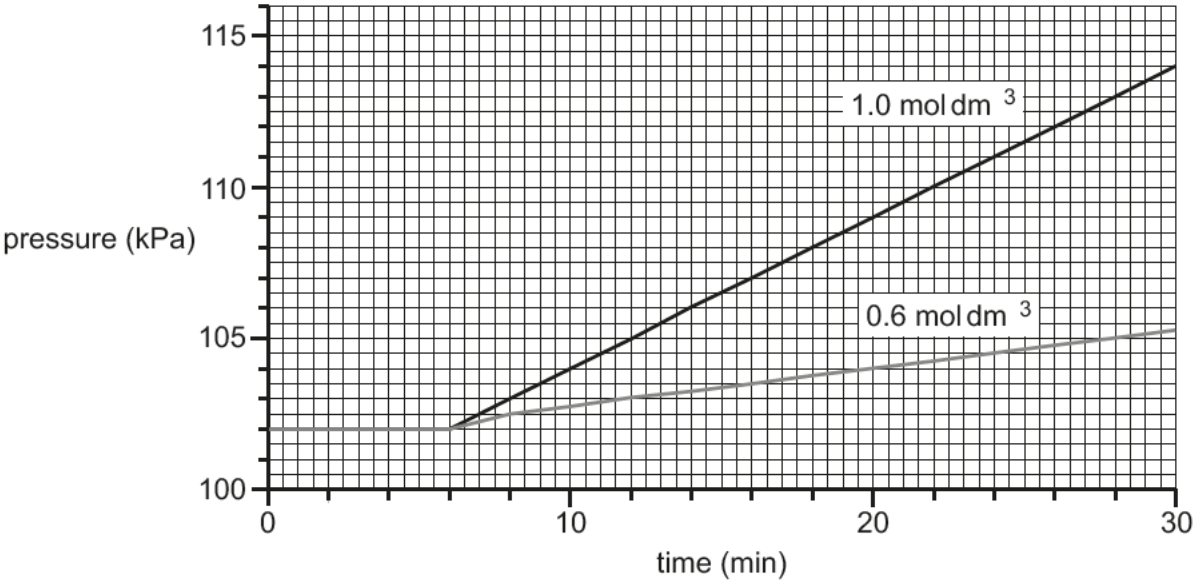

Fig. 22.2

(i) Using your knowledge of osmosis, explain the trends shown by the data in **Fig. 22.2**.

.....

.....

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.....

.....

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

(ii) The students used data collected to calculate the rate of pressure change for each concentration of sucrose. They recorded their results in **Table 22**.

Sucrose concentration ($mol\,dm^{-3}$)	**Rate of pressure change ($kPa\,min^{-1}$)**
1.0	
0.9	0.40
0.8	0.34
0.7	0.27
0.6	0.15

Table 22

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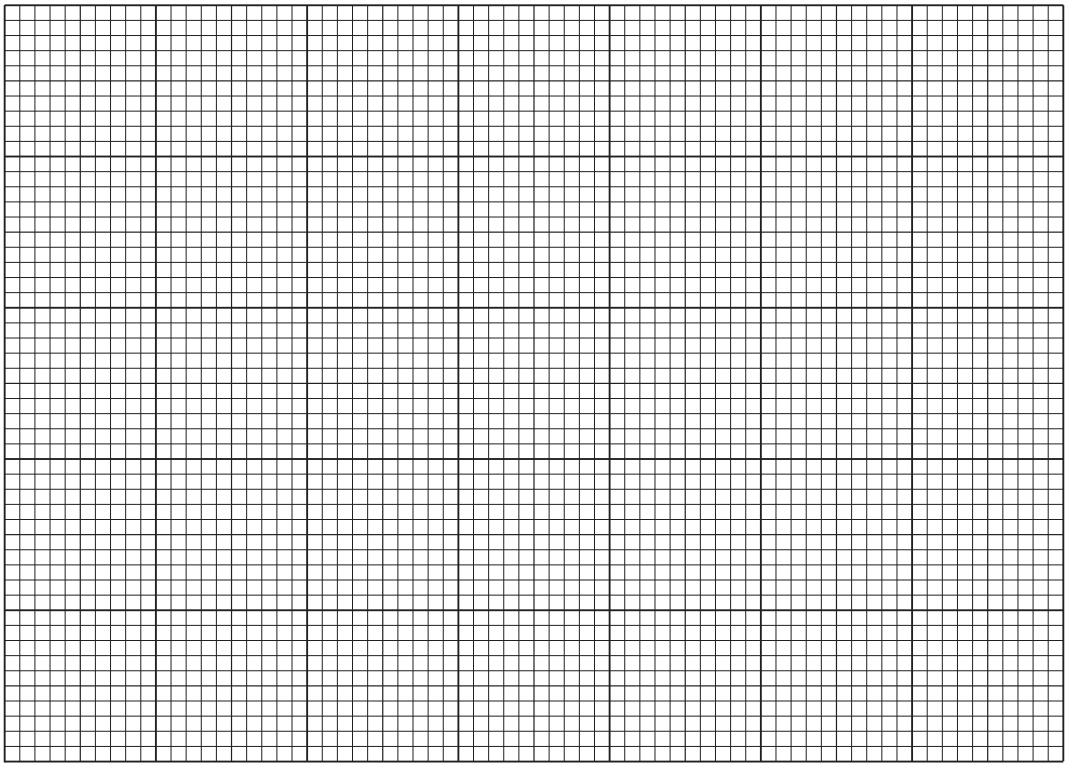
Using the graph in **Fig. 22.2**, calculate the missing value for rate of pressure change for sucrose concentration of 1.0 mol dm ^{3}.

Rate = ... kPa min ^{1} **[2]**

(iii) Using the grid below, draw a suitable graph to show the results recorded in **Table 22**.



[3]

(iv) Use your graph in **(b)(iii)** to estimate the concentration of sucrose solution for which the rate of pressure change was zero.

Concentration = ... mol dm ^{3} **[1]**

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23 Bacterial infections can lead to the presence of bacteria in the bloodstream and a severe illness known as sepsis.

- Antibiotics are used to treat sepsis.
- Different antibiotics work better with certain types of bacteria.
- Antibiotics that kill different types of bacteria are given immediately after diagnosis.
- Tests are then used to identify the type of bacterium that is causing the infection.
- After these tests, only antibiotics specific to the type of bacterium causing the infection are used in the treatment of sepsis.

(a) **(i)** Suggest **one** advantage and **one** disadvantage of using antibiotics to treat sepsis before test results confirm the type of bacterium causing the infection.

advantage .....

.....

disadvantage .....

.....

[2]

(ii) A Gram stain can be used to identify the type of bacterium causing the infection.

State **one** other method that can be used to identify different types of bacteria.

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

(iii) Outline a method that could be used to select an antibiotic specific to the type of bacterium.

.....

.....

.....

.....

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.....

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.....

.....

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

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(b) Viral infections can also cause sepsis but treatment with antibiotics is ineffective.

Suggest **two** reasons why antibiotics are effective against bacteria but not against viruses.

1 .....

.....

2 .....

.....

[2]

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24 Mammalian circulatory systems contain blood vessels, such as arteries and veins.

(a) State **two** advantages of having blood vessels in a circulatory system.

1 .....

.....

2 .....

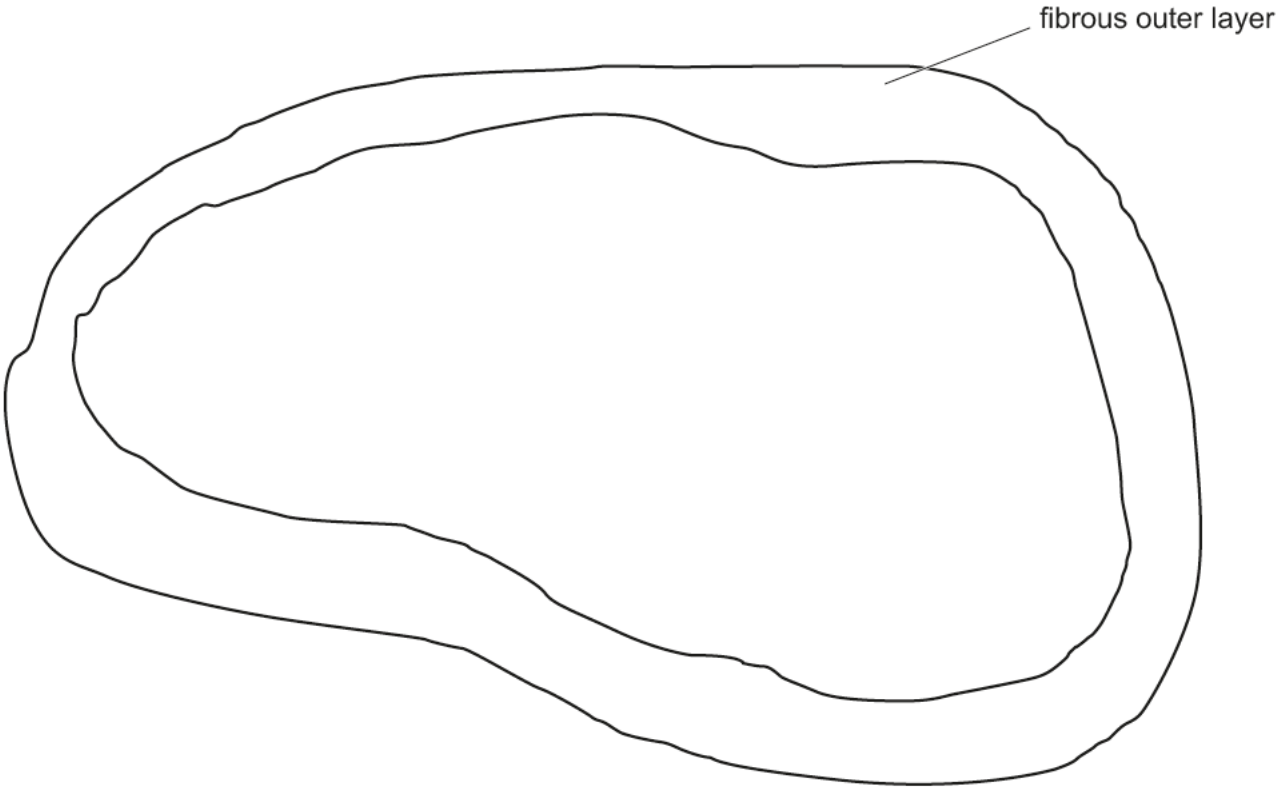
.....

[2]

(b) **Fig. 24.1**, **on the insert**, is a light micrograph of a transverse section through a mammalian vein.

(i) Complete the labelled plan diagram below of the vein in **Fig. 24.1**.

The fibrous outer layer (tunica externa) has been drawn and labelled for you.



[3]

(ii) Describe **one** function of the fibrous outer layer labelled in the drawing above.

.....

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

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(iii) Compare the structure of the vein in **Fig. 24.1** with that of a similar sized artery.

.....

.....

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.....

.....

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

(c) In transport systems of multicellular plants, water is transported throughout the plant in xylem tissue.

Fig. 24.2, **on the insert**, is a light micrograph showing types of xylem tissue.

(i) Identify the feature of xylem tissue, labelled **X** in **Fig. 24.2**.

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

(ii) Explain the importance of **X** in the movement of water through xylem tissue.

.....

.....

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

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25 The World Health Organisation (WHO) provides information about risk factors to support the prevention and control of non-communicable diseases (NCDs) such as bowel cancer.

Complete the passage below about bowel cancer using the most appropriate word or words.

Bowel cancer is one of the most common types of cancer in the UK. It usually starts in the large bowel but cancerous cells can spread to other organs in the body by ..... .

The use of .... that uses a combination of X-ray images taken from different angles can detect the spread of cancer to the liver or lungs. Risk factors, such as eating a diet high in processed meat are called ..... factors. These factors can increase the risk of bowel cancer but they can be controlled to reduce the probability of the disease. However, other risk factors, such as ..... cannot be controlled or reduced by intervention. Surgery is the most common treatment for bowel cancer which is often followed by ..... which uses drugs toxic to cancer cells to destroy them.

[5]

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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