GradeMax

Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Friday 09 January 2026

Morning (Time: 1 hour 30 minutes)

Paper reference **WBI11/01**

Biology

International Advanced Subsidiary / Advanced Level
UNIT 1: Molecules, Diet, Transport and Health

You must have:
Scientific calculator, ruler, HB pencil

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In the questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points you make are related or follow on from each other where appropriate.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 The structure of the cell membrane controls the movement of substances into and out of the cell.

Read through the following description of how substances move through the cell membrane.

Complete the description by writing the most appropriate word or words on the dotted lines.

The ..... prevents large polar molecules from passing through the membrane.

If there is a concentration gradient, these molecules can pass through protein channels by a process called ..... .

Some substances are transported against a concentration gradient by a process called ..... .

This process requires ..... .

Larger substances are taken into the cell when the cell membrane forms a vesicle around them.

This process is called ..... .

(Total for Question 1 = 5 marks)

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2 Cystic fibrosis can impair gas exchange.

(a) The rate of diffusion of gases through a surface is dependent on the properties of the gas exchange surface.

(i) Whose law can be used to calculate the rate of diffusion?

(1)

- ☒ **A** Benedict's
- ☒ **B** Fick's
- ☒ **C** Meselson's
- ☒ **D** Stahl's

(ii) Explain how the rate of diffusion through gas exchange surfaces is affected by cystic fibrosis.

(3)

(b) Prenatal testing can be used to detect cystic fibrosis.

Describe how **one** named method of prenatal testing can be used to detect cystic fibrosis.

(3)

Method of prenatal testing

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Description of method

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(Total for Question 2 = 7 marks)

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3 Body mass index (BMI) can be used as an obesity indicator.

(a) Name **one** other obesity indicator.

(1)

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(b) The table shows the BMI range for four weight categories.

BMI range	Weight category
<18.5	underweight
18.5 to 24.9	healthy weight
25 to 29.9	overweight
>30	obese

(i) Determine the weight category of a person who is 160 cm tall with body mass of 76 kg.

(1)

Use the formula:

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

Weight category .....

(ii) Another person had a BMI of 25.2.

Explain how a person with a BMI of 25.2 could change their diet to reduce their risk of coronary heart disease.

(3)

(Total for Question 3 = 5 marks)

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4 Some characteristics show sex-linked inheritance.

(a) One example is the eye colour in fruit flies.

The photograph shows two fruit flies.



(Source: © Aleksandar Kitanovic/ Alamy Stock Photo)

The gene coding for eye colour is located on the X chromosome.

Females have two X chromosomes and males have one X and one Y chromosome.

The normal allele (w^+) codes for red eyes but a mutant allele (w^-) codes for white eyes.

(i) The table shows the genotype and phenotype for eye colour in these fruit flies.

Genotype	**$w^+ w^+$**	**$w^+ w^-$**	**$w^- w^-$**	**w^+**	**w^-**
Phenotype		female with red eyes			

Complete the table to show the phenotype for each genotype.

(2)

(ii) In a population of 2 000 fruit flies, the ratio of red eyes to white eyes was 4 : 1.

Which is the number of fruit flies with red eyes in this population?

(1)

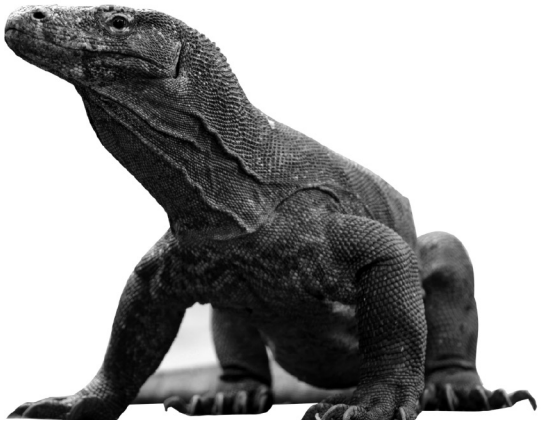
☒ **A** 400

☒ **B** 500

☒ **C** 1 500

☒ **D** 1 600

(b) The photograph shows a Komodo dragon.



(Source: © mike lane / Alamy Stock Photo)

The sex chromosomes in Komodo dragons are W and Z.

Female Komodo dragons have one W and one Z chromosome and male Komodo dragons have two Z chromosomes.

Compare and contrast the types of sex chromosomes found in female and male Komodo dragons with those found in humans.

(3)

(Total for Question 4 = 6 marks)

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5 There are several risk factors associated with coronary heart disease (CHD).

(a) State the meaning of the term **risk factor**.

(1)

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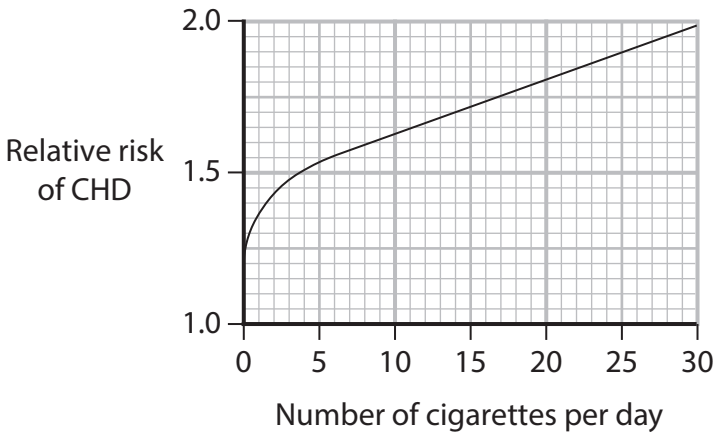
(b) Smoking is a lifestyle risk factor associated with CHD.

Which are **non-lifestyle** risk factors associated with CHD?

(1)

- ☒ **A** age and diet high in cholesterol
- ☒ **B** age and sex
- ☒ **C** inactivity and diet high in cholesterol
- ☒ **D** sex and inactivity

(c) The graph shows the relationship between the number of cigarettes smoked per day and the relative risk of CHD.



Describe the relationship between the number of cigarettes smoked per day and the relative risk of CHD.

(2)

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(d) In a survey, a person said that they smoked 5 cigarettes a day for 12 years.

(i) Calculate the **mean** number of cigarettes smoked per year.

Use 1 year = 365.25 days.

Give your answer as a whole number.

(1)

Answer ..... per year

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(ii) This person's perception was that they were at low risk from CHD.

Explain why this person's perception of their risk of CHD is likely to be different from their actual risk.

(3)

(Total for Question 5 = 8 marks)

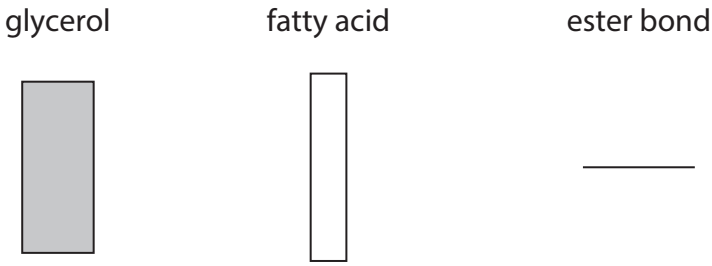
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6 Triglycerides can be saturated or unsaturated and have different numbers of carbon atoms in their fatty acid side chains.

(a) The diagrams show the components of a triglyceride.



Draw a diagram to show the structure of a triglyceride, using these shapes.

(2)

(b) Which row of the table is correct for a saturated fatty acid?

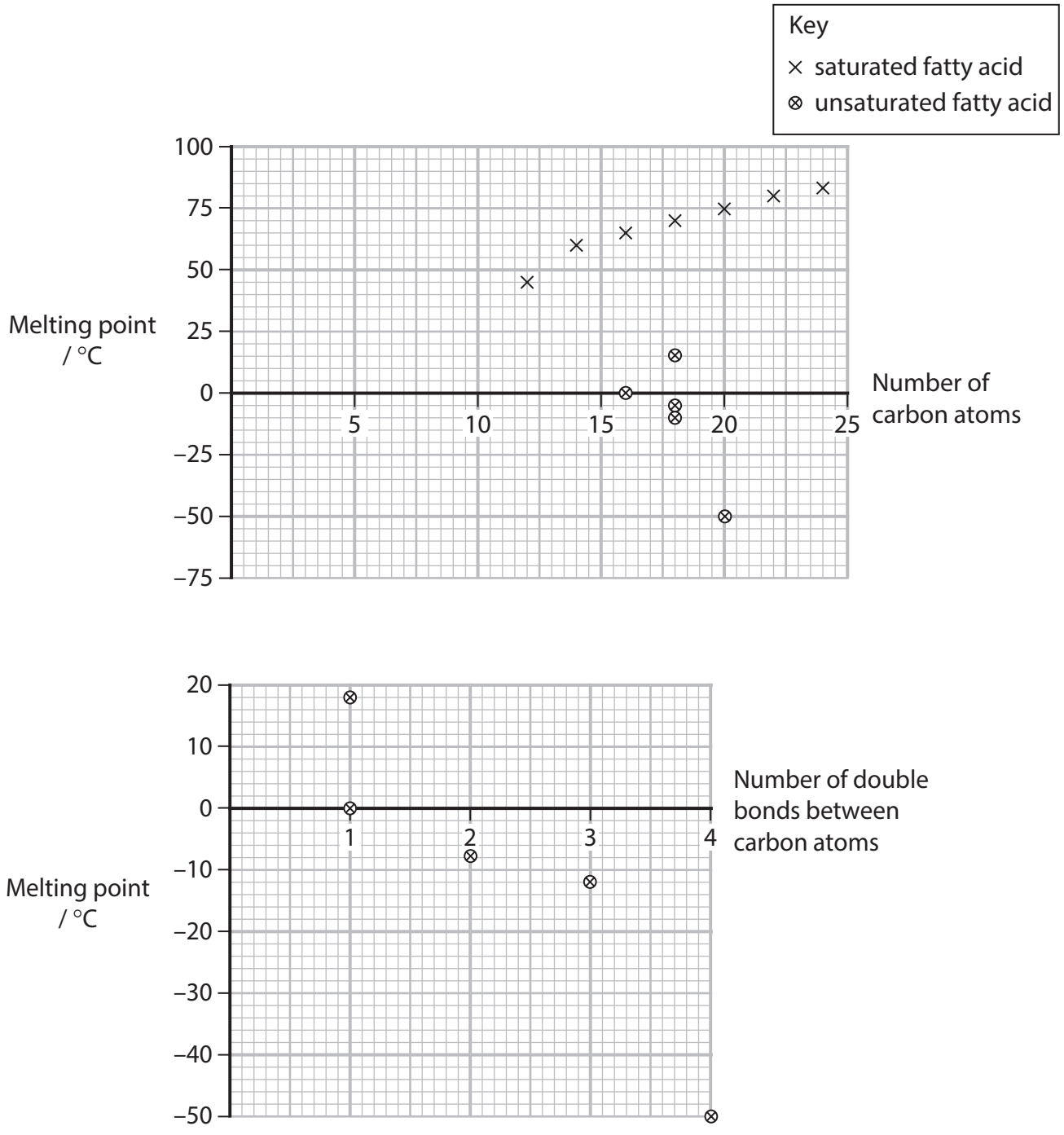
(1)

		Contains carbon-carbon double bonds	Has a higher carbon : hydrogen ratio than an unsaturated fatty acid
☒	**A**	no	no
☒	**B**	no	yes
☒	**C**	yes	no
☒	**D**	yes	yes

(c) The melting point of a fatty acid depends on three factors:

- the number of carbon atoms
- the presence or absence of carbon-carbon double bonds
- the number of carbon-carbon double bonds.

The graphs show the relationships between these factors and the melting points of some fatty acids.



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(i) A saturated fatty acid has a chain length of ten carbons.

Estimate the melting point of this fatty acid.

(1)

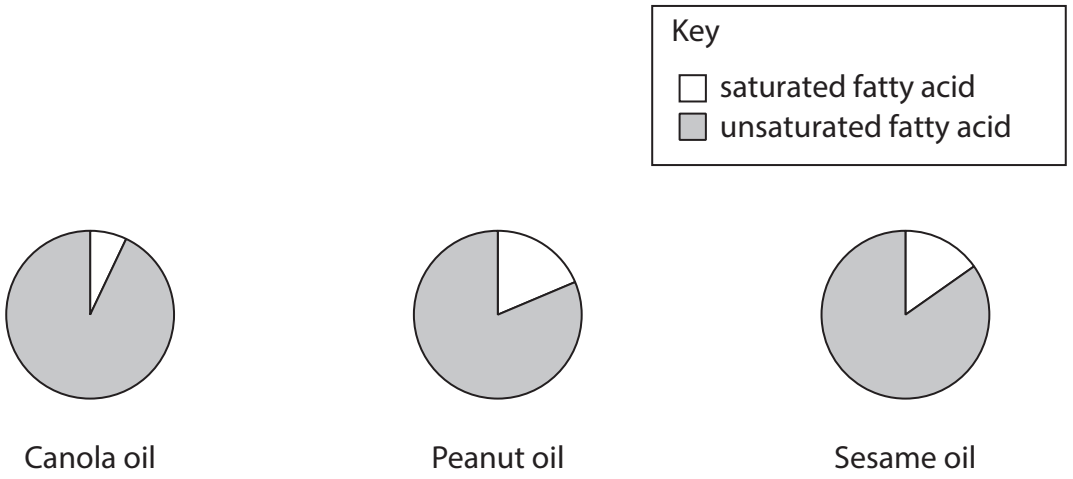
Answer ..... °C

(ii) Comment on the relationships between the melting points of fatty acids and

- the number of carbon atoms
- the presence or absence of carbon-carbon double bonds
- the number of carbon-carbon double bonds.

(4)

(iii) The pie charts show the proportions of saturated fatty acids and unsaturated fatty acids in three oils.



The melting points of these three oils are 3 °C, –6 °C and –10 °C.

Which row of the table shows the melting points for each of these three oils?

Use the information in the first melting point graph to help you.

(1)

		Canola	Peanut	Sesame
☒	**A**	3 °C	–10 °C	–6 °C
☒	**B**	–6 °C	3 °C	–10 °C
☒	**C**	–10 °C	3 °C	–6 °C
☒	**D**	–6 °C	–10 °C	3 °C

(Total for Question 6 = 9 marks)

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7 Lactase is an enzyme that digests lactose.

Lactose intolerance is due to insufficient lactase being produced.

(a) (i) Which are the products when lactose is digested?

(1)

- ☒ **A** fructose and sucrose
- ☒ **B** galactose and glucose
- ☒ **C** galactose and sucrose
- ☒ **D** glucose and fructose

(ii) Explain why lactase speeds up the **rate** of digestion of lactose.

(2)

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(b) It is estimated that 68 % of the world's population are lactose intolerant.

In 2024, the world population was 8.1×10^9 people.

How many people were lactose intolerant in 2024, to **two** significant figures?

(1)

- ☒ **A** 2.59×10^9
- ☒ **B** 2.6×10^9
- ☒ **C** 5.5×10^9
- ☒ **D** 5.51×10^9

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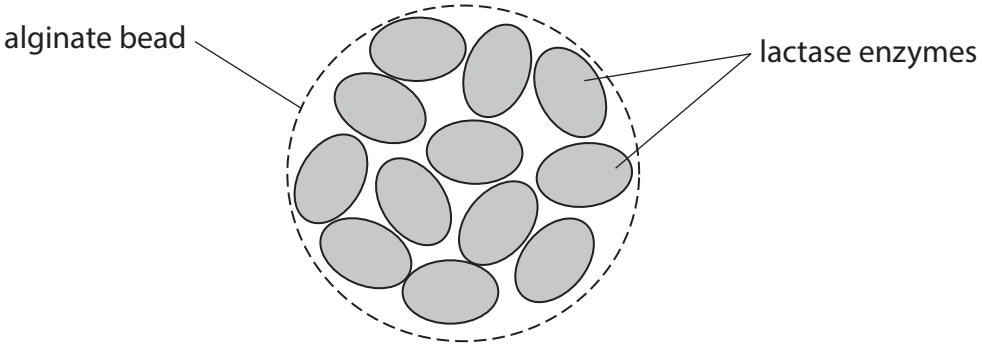
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*(c) Lactose-free milk can be produced by treating milk with lactase.

The lactase can be added directly to the milk as free lactase or can be added after being trapped inside alginate beads. Alginate beads are jelly-like beads that trap the lactase but still allow the milk to come into contact with the enzyme.

The milk is poured onto the alginate beads and the lactose is digested as it passes over the beads.

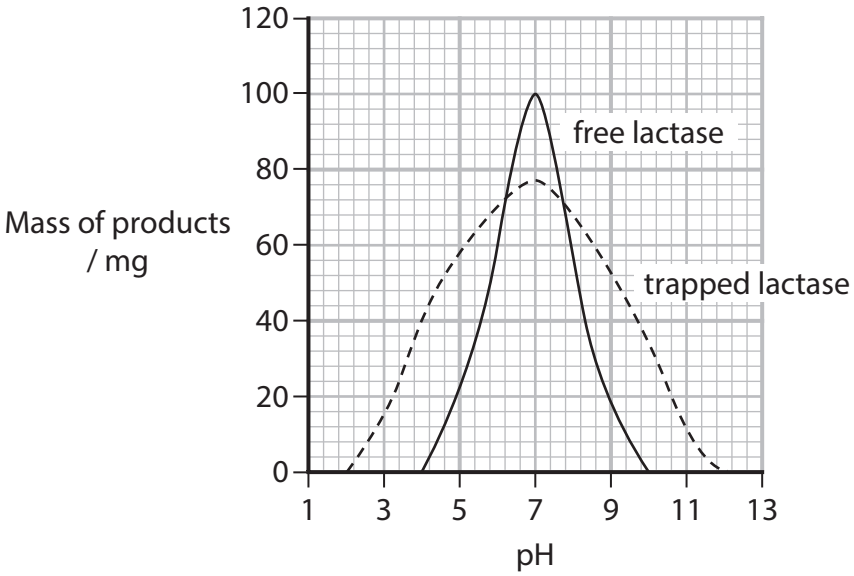
The diagram shows lactase trapped in an alginate bead.



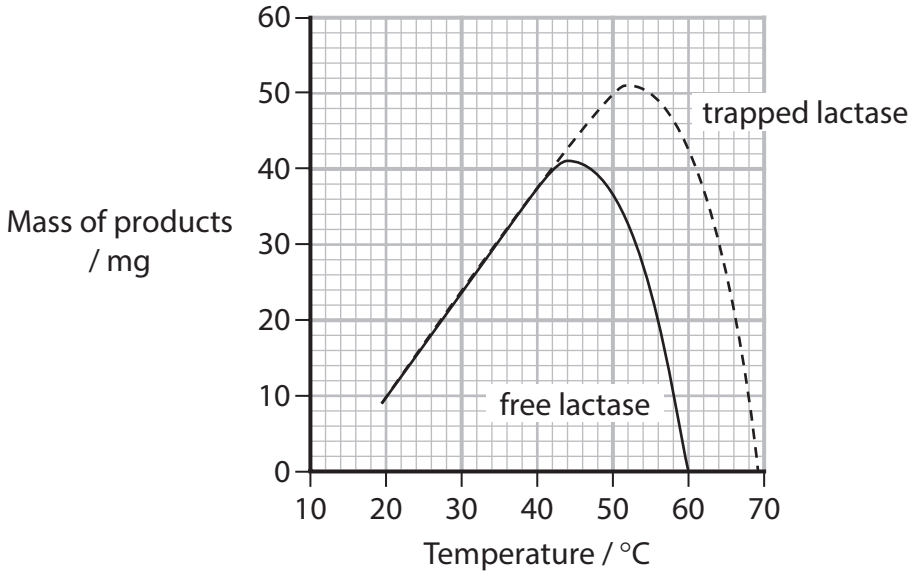
The graphs show the effect of pH and temperature on the activity of free lactase and lactase trapped in alginate beads when added to milk.

The number of enzymes in each reaction mixture was the same.

Effect of pH



Effect of temperature



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Explain why the activity of lactase changes when it is trapped in alginate beads.

Use the information in both graphs to support your answer.

(6)

(Total for Question 7 = 10 marks)

8 New treatments for cancer need to be found to improve the quality of life of patients. This is because some treatments are not very effective and have side effects.

Cancer of the colon is the third most common cancer in the world.

In a study, scientists have found a compound, Sch B, in the berries of the Chinese magnolia-vine that affects cancers of the colon.

The photograph shows some berries on a Chinese magnolia-vine.



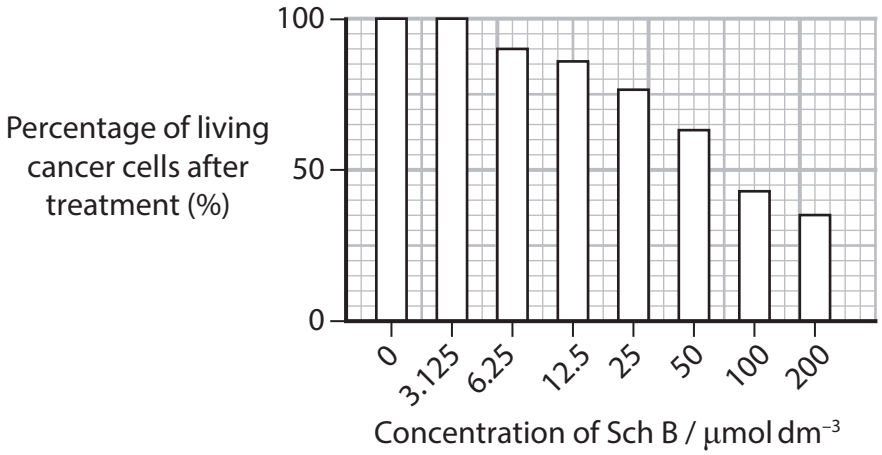
(Source: ©blickwinkel / Alamy Stock Photo)

(a) As part of this study, cancer cells were grown in the laboratory and treated with different concentrations of Sch B.

After treatment, measurements were taken to determine

- the percentage of living cells
- the ability of cancer cells to divide.

(i) The graph shows the percentage of living cancer cells after treatment with Sch B.



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Describe **two** conclusions that can be made from the data shown in this graph.

(2)

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(ii) The ability of the cancer cells to divide after treatment with Sch B was assessed by measuring DNA synthesis.

State why the measurement of DNA synthesis was used to assess the ability of cells to divide.

(1)

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(b) As part of the same study, tumours were formed in mice by injecting them with cancer cells under the skin.

One group of mice was treated with Sch B and another group of mice was the control group.

(i) Each mouse in the treated group was injected with 200 µl of a suspension of cells at a concentration of 1×10^7 cells per cm^3.

Calculate how many cells were injected into each mouse.

(1)

Answer .....

(ii) Suggest what the control group of mice was treated with.

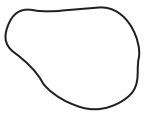
(1)

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(iii) The diagram shows a tumour from a control mouse and a tumour from a mouse treated with Sch B.



Tumour from control mouse

Magnification × 1



Tumour from a mouse treated with Sch B

Magnification × 1

The volume of each tumour was calculated using the formula

$$\text{Volume} = \frac{\pi \times l \times w^2}{6}$$

where l = the longest diameter of the tumour

w = perpendicular diameter of the tumour

Calculate the actual volume of the tumour from the mouse treated with Sch B.

The perpendicular diameter of this tumour is 10 mm.

Give your answer to an appropriate number of significant figures.

(2)

Answer ..... mm^3

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(iv) The values calculated for the volumes of these tumours using this formula may not be accurate.

Explain why using this formula may **not** give accurate values for the volumes of these tumours.

(2)

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(c) Pancreatic cancer is less common than many other types of cancer and it is not easily treatable.

Approximately half of pancreatic cancers result from a mutation called G12D.

The G12D mutation results in one amino acid being replaced by another amino acid in the polypeptide.

One glycine is replaced by aspartate.

(i) Explain how a mutation in the DNA can result in a glycine being replaced by an aspartate in the polypeptide synthesised by the cells.

(4)

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(ii) A drug has been developed that binds to the aspartate in this polypeptide.

Suggest why it is difficult to develop drugs that target **only** the polypeptide synthesised from the gene with the G12D mutation.

(2)

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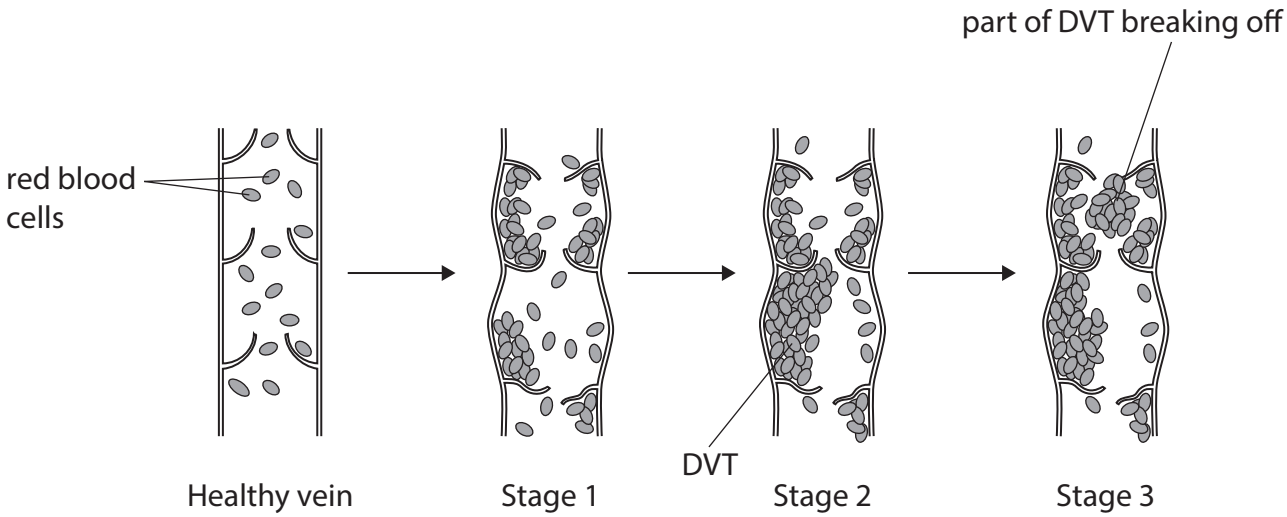
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(Total for Question 8 = 15 marks)

9 Deep vein thrombosis (DVT) is a blood clot in a vein located deep within the body.

One cause of DVT in the leg is sitting still for long periods of time, such as on a long flight in an aeroplane.

*(a) The diagram shows stages in the development of DVT in the leg.



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One serious result of a DVT in the leg is a pulmonary embolism. This is when part of the DVT breaks off and gets stuck in the **pulmonary artery**.

Explain how the development of a DVT in the leg can result in death from a pulmonary embolism.

Use the information in the diagram and your own knowledge of blood clotting and the circulatory system to support your answer.

(6)

(b) Anticoagulants are used in the treatment of DVT.

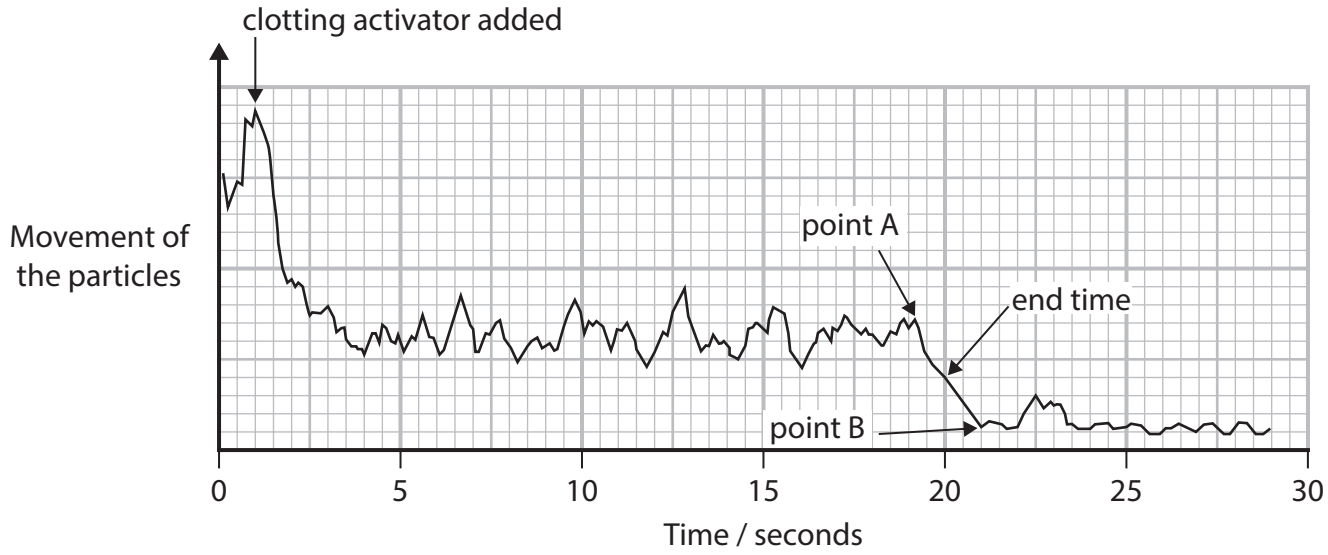
People taking anticoagulants must monitor their blood clotting times.

A method using a smartphone is being developed to monitor blood clotting time.

Tiny copper particles are added to a drop of blood. A smartphone's vibration motor and camera are used to record the movement of the particles.

A drop of a clotting activator is added and timing starts.

The graph shows a recording made of the movement of the particles using this method.



(i) Explain why people taking anticoagulants must monitor their blood clotting time.

(2)

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(ii) Explain why the copper particles will almost stop moving in the blood.

(2)

(iii) Determine the blood clotting time in this recording using the end time shown on the graph.

(1)

Answer ..... seconds

(iv) Suggest why an end time, halfway between points A and B, was used to determine the blood clotting time.

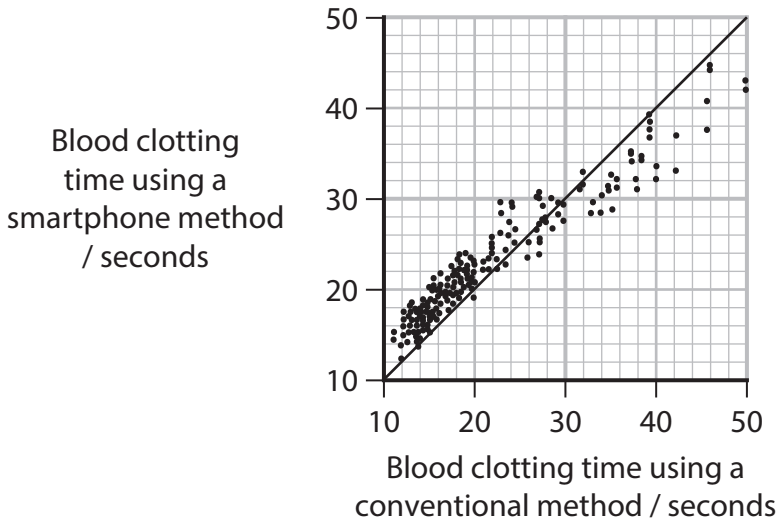
(2)

(v) The clotting times of blood samples from a large number of people were measured using this method and a conventional method.

The graph shows the blood clotting time measured using this smartphone method and a conventional method.

Each point on the graph represents the two measurements taken from one person.

The solid line represents the expected result if there is no difference between the two methods.



Comment on the blood clotting times measured using these two methods.

(2)

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(Total for Question 9 = 15 marks)

TOTAL FOR PAPER = 80 MARKS

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