Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 3 GCE

Monday 15 May 2023

Morning (Time: 1 hour 30 minutes)

Paper reference **8BI0/01**

Biology B

Advanced Subsidiary

PAPER 1: Core Cellular Biology and Microbiology

You must have:
Scientific calculator, HB pencil, ruler

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.*

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 question(s) marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically showing how the points that 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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P 7 1 9 2 4 A 0 1 2 8

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Answer ALL questions.

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 ☒.

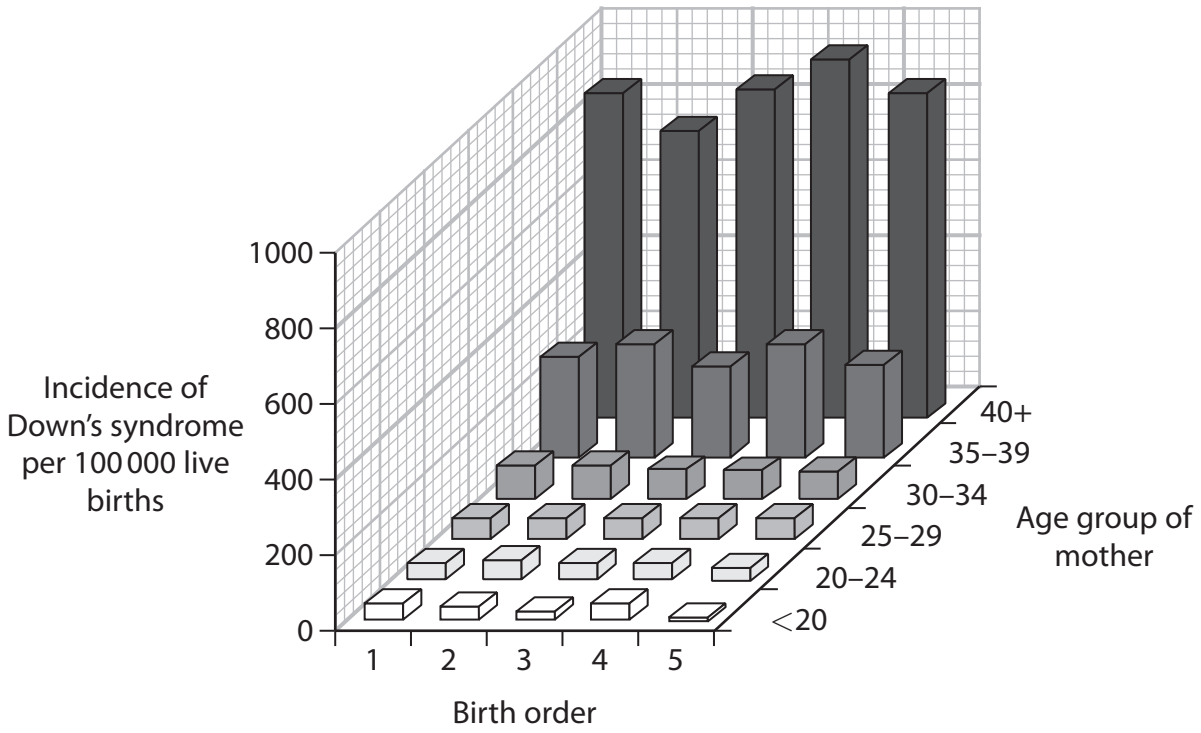
1 Down's syndrome is a genetic condition.

(a) Which row in the table describes the cause of Down's syndrome?

(1)

		Type of mutation	Result of non-disjunction
☒	**A**	chromosome	monosomy
☒	**B**	chromosome	polysomy
☒	**C**	gene	monosomy
☒	**D**	gene	polysomy

(b) The graph shows the effect of the age of the mother and the order in which babies are born in a family (birth order) on the incidence of Down's syndrome.



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Determine the effects of birth order and age of the mother on the incidence of Down's syndrome.

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(Total for Question 1 = 4 marks)

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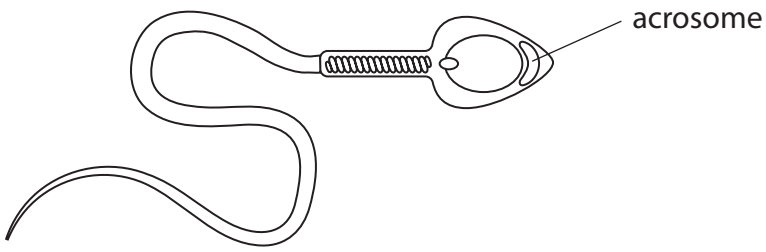
2 The diagram shows a mature sperm cell.



(a) Describe the role of the acrosome in fertilisation.

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(b) Describe how the enzymes are synthesised and packaged during the development of the acrosome.

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(Total for Question 2 = 5 marks)

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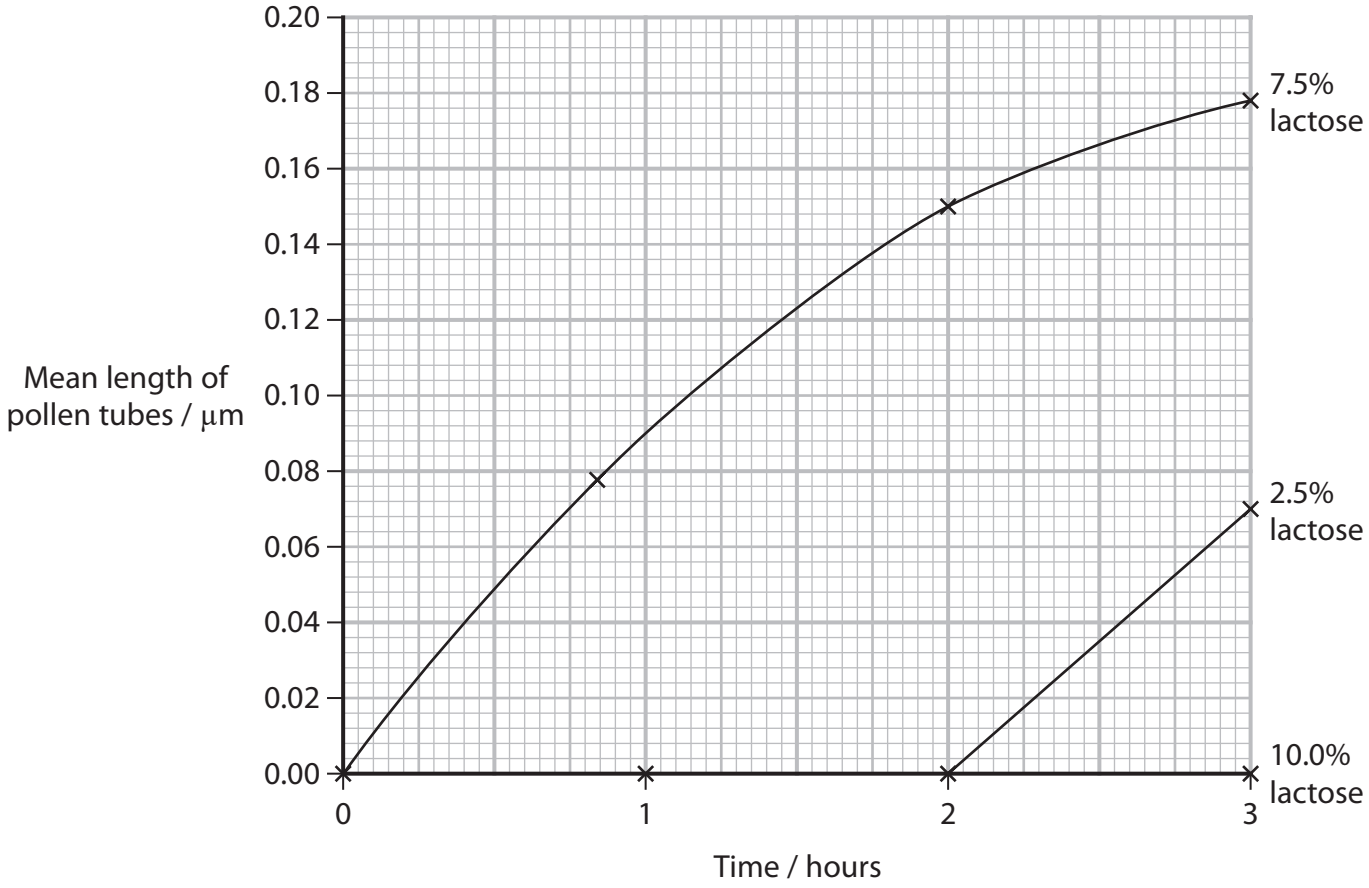
3 The effect of lactose concentration on the growth of pollen tubes was investigated.

The graph shows the results of this investigation.



(a) Describe the structure of lactose.

(2)

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(b) Calculate the rate of growth of the pollen tubes, at 2 hours, for the 7.5 % lactose.

Use a tangent to help you with your calculation.

(2)

Answer ..... $\mu m\ hour^{-1}$

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(c) Describe **three** conclusions that can be made from the results of this investigation.

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(d) Give **two** reasons why lactose was an unusual choice of sugar to investigate.

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(Total for Question 3 = 9 marks)

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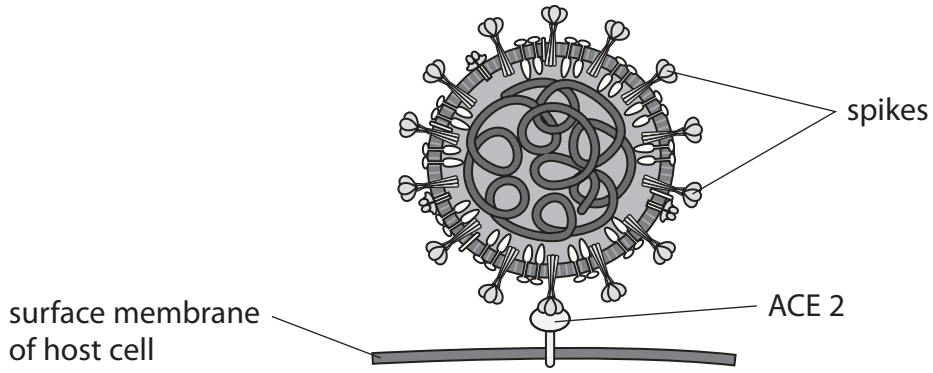
4 The diagram shows a virus attached to the enzyme ACE 2, on the surface membrane of its host cell.



(a) This virus is classified as an enveloped RNA virus with a helical capsid structure.

Which virus is also classified in the same way?

(1)

☒ **A** Ebola

☒ **B** human immunodeficiency virus

☒ **C** λ (lambda) phage

☒ **D** tobacco mosaic virus

(b) The enzyme ACE 2 catalyses the hydrolysis of angiotensin II into angiotensin.

Which of the following describes hydrolysis by ACE 2?

(1)

☒ **A** a bond is split to produce angiotensin, using water

☒ **B** a bond is split to produce angiotensin, producing water

☒ **C** a bond is formed to produce angiotensin, using water

☒ **D** a bond is formed to produce angiotensin, producing water

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(c) The spikes are proteins with polysaccharide molecules attached.

(i) Compare and contrast the structure of polysaccharides with the primary structure of proteins.

(3)

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(ii) Lectins are molecules that bind to polysaccharides.

Some lectins bind to the spikes of this virus.

Explain why scientists are hoping that lectins can be used to prevent disease caused by this virus.

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(Total for Question 4 = 8 marks)

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5 Mitosis occurs in plant roots, plant shoots and during the formation of gametes.

(a) A squash preparation of a root tip can be used to show the stages of mitosis.

The statements below describe some of the steps in a squash preparation.

They are **not** listed in the correct order.

1. Use needles to tease cells apart.
2. Soak root tip in acetic orcein stain.
3. Heat root tip in acid.
4. Warm gently to intensify staining.
5. Gently squash cells with a thumb.
6. Place a cover slip on top of the cells.

(i) Which is the correct order for these steps?

(1)

☒ **A** 2, 3, 1, 6, 5, 4

☒ **B** 2, 3, 5, 1, 4, 6

☒ **C** 3, 2, 1, 6, 5, 4

☒ **D** 3, 2, 5, 1, 4, 6

(ii) Explain why the tip from a growing root is used in this preparation.

(2)

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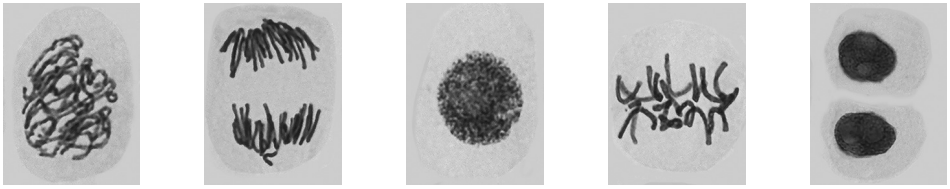
(iii) The photographs J to N show stages of mitosis.



J K L M N

(Source: © STEVE GSCHMEISSNER/SCIENCE PHOTO LIBRARY)

Which is the correct order of these stages?

(1)

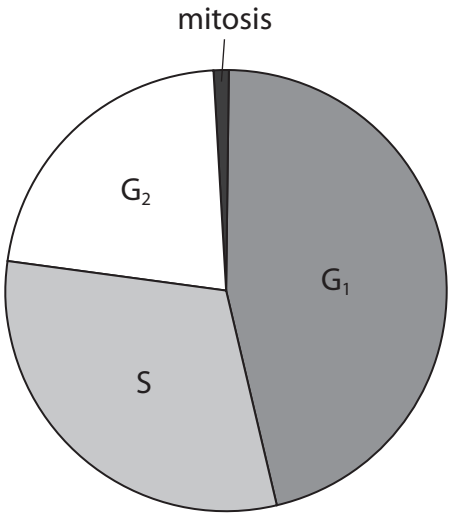
☒ **A** J, L, M, K, N

☒ **B** L, J, M, K, N

☒ **C** M, J, L, N, K

☒ **D** N, K, J, M, L

(b) The pie chart shows the proportion of time that cells spend in the cell cycle in one species of plant.



The cell cycle in this plant lasts 22 hours.

Give an estimate of the duration of S.

(1)

Answer ..... hours

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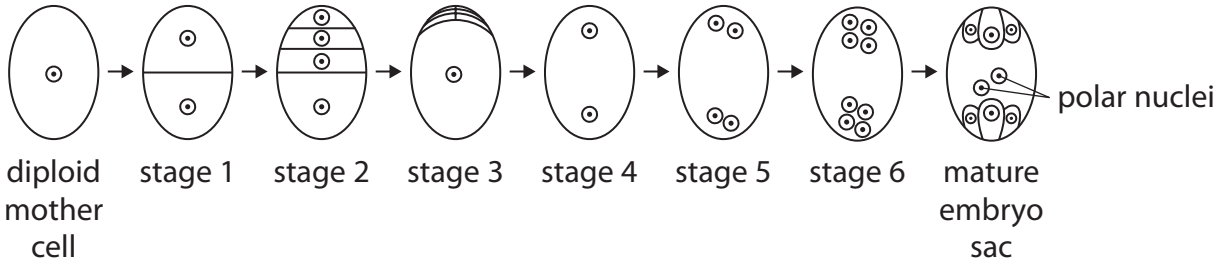
(c) The diagram shows the stages in the formation of an embryo sac in a flowering plant.



(i) When does mitosis take place?

(1)

☒ **A** in the formation of stages 1, 4 and 6

☒ **B** in the formation of stages 1, 2 and 5

☒ **C** in the formation of stages 2, 4 and 5

☒ **D** in the formation of stages 4, 5 and 6

(ii) Which shows the order of tissues that the pollen tube grows through to reach the embryo sac?

(1)

☒ **A** stigma style ovary

☒ **B** stigma ovary style

☒ **C** style ovary stigma

☒ **D** style stigma ovary

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(iii) Describe what happens to the polar nuclei once the pollen tube has grown into the embryo sac.

(3)

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(Total for Question 5 = 10 marks)

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6 Eukaryotic cells contain a number of organelles that are absent in prokaryotic cells.

(a) (i) The size of a typical eukaryotic cell is in the range 10 μm to 100 μm.

The size of a typical prokaryotic cell is in the range 100 nm to 5000 nm.

Calculate how many times bigger the largest eukaryotic cell is than the smallest prokaryotic cell.

(1)

Answer .....

(ii) Eukaryotic cells and prokaryotic cells both respire aerobically.

Only eukaryotic cells have mitochondria.

A number of enzyme reactions involved in aerobic respiration take place in mitochondria.

Explain why eukaryotic cells need mitochondria whereas prokaryotic cells do not need them.

(2)

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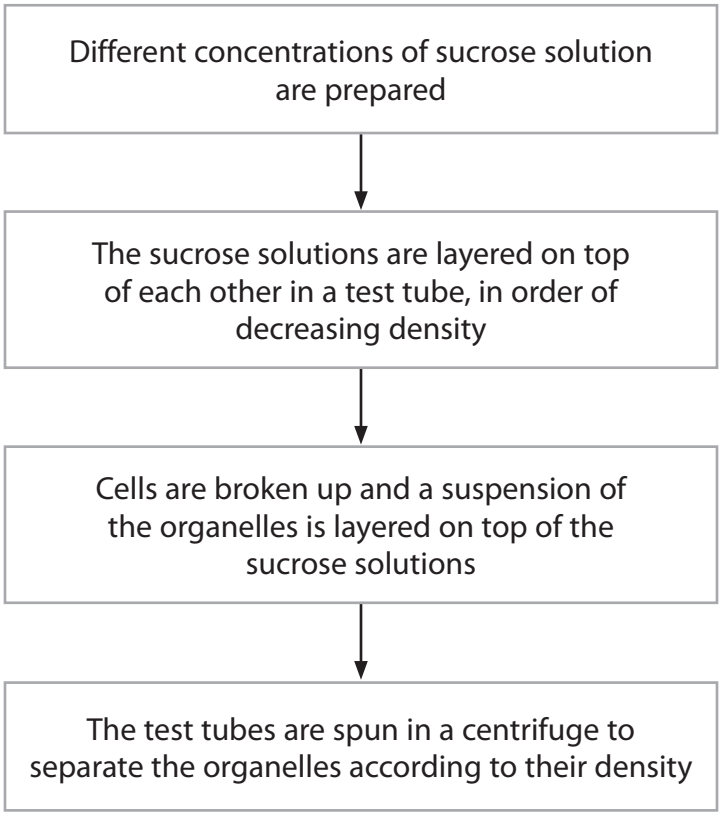
(b) Cell organelles can be separated according to size using a sucrose density gradient.

The flow diagram shows how this can be done.



(i) A student prepared a 1.25 g cm^{-3} sucrose solution by diluting a sucrose solution with a concentration of 5 g cm^{-3}.

Calculate the ratio of sucrose solution to water that would be needed to make this dilution.

(2)

Answer .....

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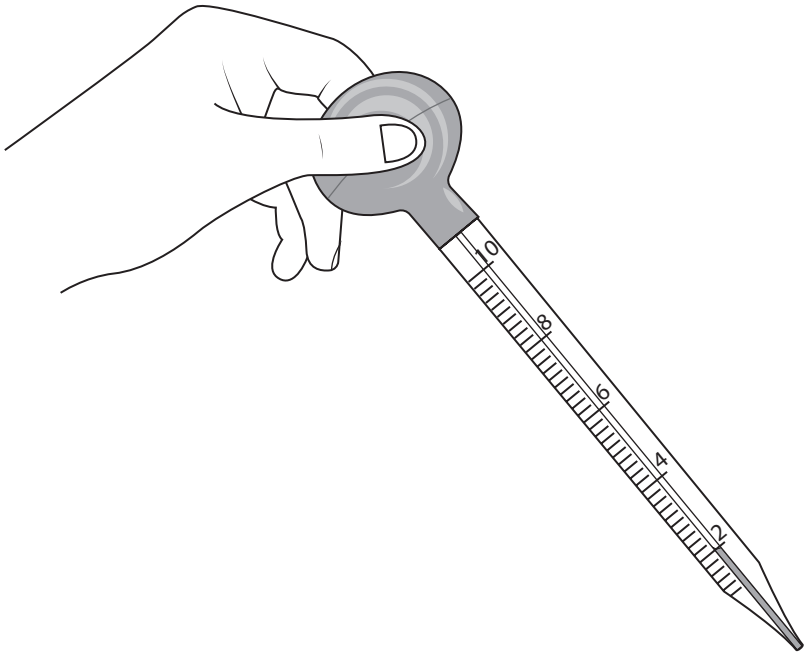
(ii) The diagram shows the student measuring 2.00 cm^3 of the organelle suspension using a pipette.



Analyse the diagram to explain why this method will produce an inaccurate measurement of volume.

(2)

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(iii) The student actually measured 2.01 cm^3 of the suspension using the method shown in this diagram.

Calculate the percentage error of this measurement.

(1)

Answer .....%

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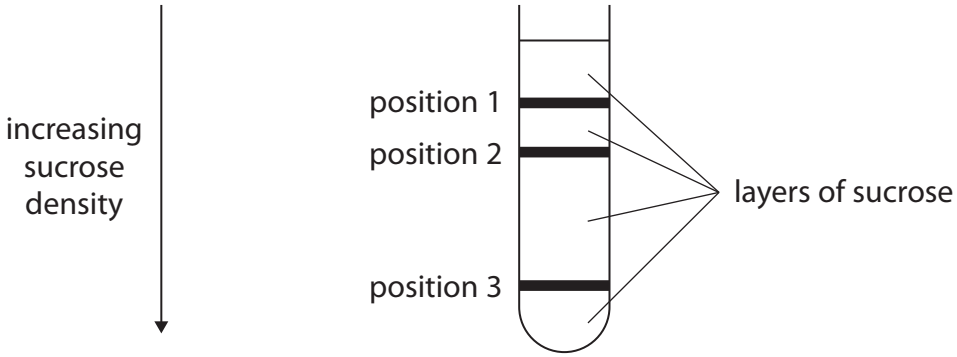
(iv) The diagram shows the positions of three organelles in a sucrose density gradient after centrifuging.



Which row of the table identifies the organelles found at each position?

(1)

		Position 1	Position 2	Position 3
☒	**A**	mitochondria	ribosomes	nuclei
☒	**B**	nuclei	ribosomes	mitochondria
☒	**C**	nuclei	mitochondria	ribosomes
☒	**D**	ribosomes	mitochondria	nuclei

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*(c) Cells can be grown in media containing radioactively-labelled amino acids.

In an investigation, scientists grew cells in the media and removed a sample of cells every five minutes.

The organelles were separated and the radioactivity measured.

The table shows the results of this investigation.

Time / mins	Percentage of radioactivity found in different parts of the cells (%)					
	Smooth endoplasmic reticulum	Ribosomes	Rough endoplasmic reticulum	Golgi apparatus	Vesicles	Other
5	0	67	2	0	0	31
10	0	70	16	4	0	10
15	0	16	60	12	2	10
20	0	2	20	55	13	10
25	0	0	2	10	78	10
30	0	0	0	2	88	10
35	0	0	0	0	45	10

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Explain the changes in the levels of radioactivity in the different parts of these cells.

(6)

(Total for Question 6 = 15 marks)

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7 The image shows a bowhead whale.

(Source: © Panther Media GmbH/Alamy Stock Photo)

These marine mammals have a thick layer of blubber beneath their skin that acts as an energy store and an insulator.

Blubber is composed of fat cells and fibrous tissue.

(a) The lipids in blubber contain mostly unsaturated fatty acids.

(i) Describe **two** differences between the structure of an unsaturated fatty acid and a saturated fatty acid.

(2)

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(ii) Explain why lipids are used for energy storage and insulation.

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(b) The effect of seasonal feeding and age on the blubber of bowhead whales was investigated.

Samples were removed from three layers in the blubber and analysed for the:

- mean number of fat cells
- mean area of the sample of blubber occupied by fat cells
- mean area of fibrous tissue.

(i) Describe how a light microscope can be used to determine the area of one fat cell.

Assume that a fat cell is circular in shape.

(3)

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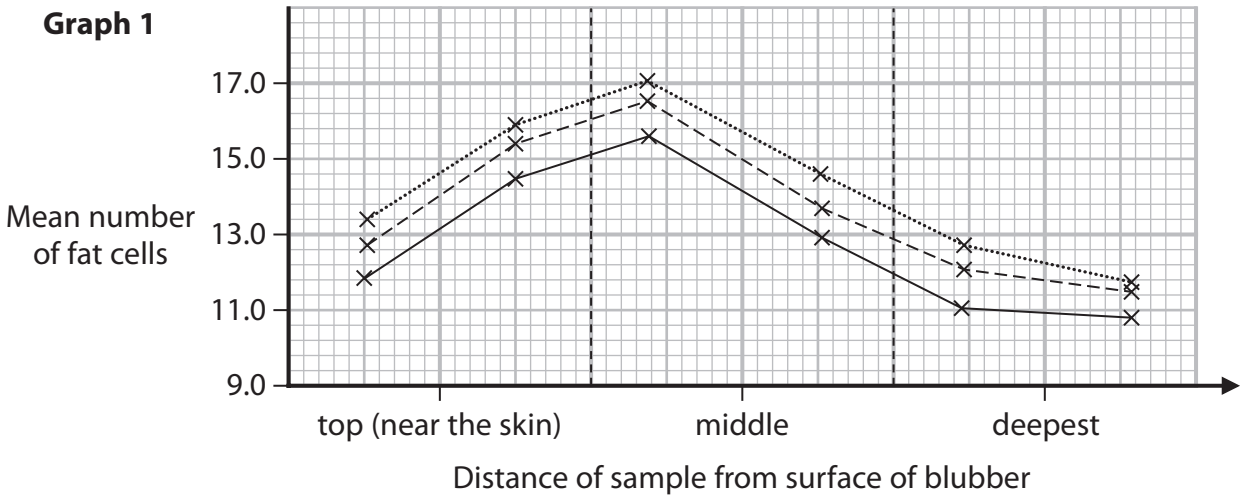
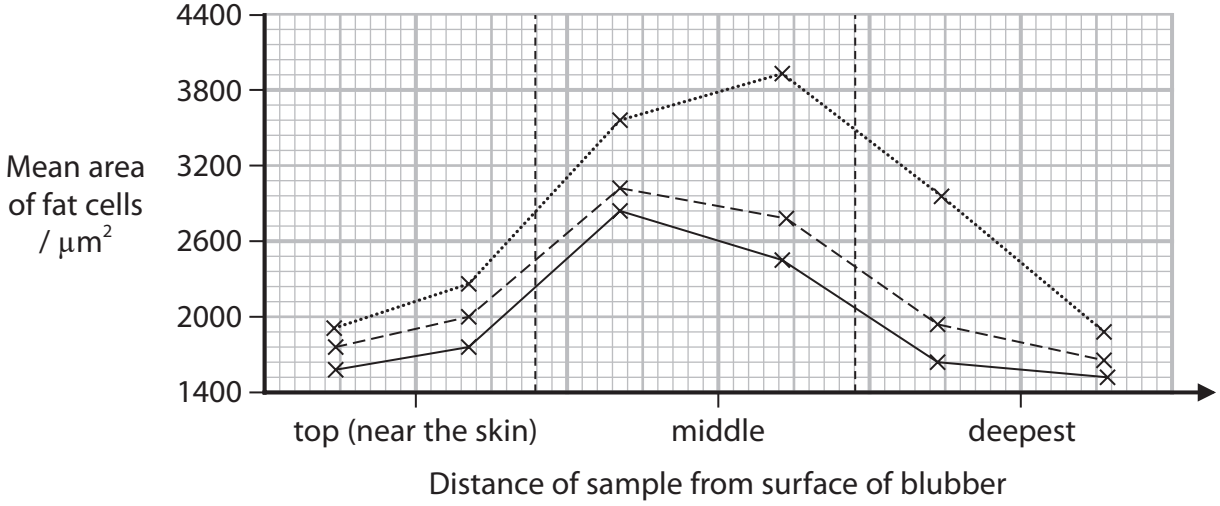
*(ii) The graphs show the results of this investigation.

Key:	young whales feeding from mother	adult whales feeding	adult whales after a winter of fasting

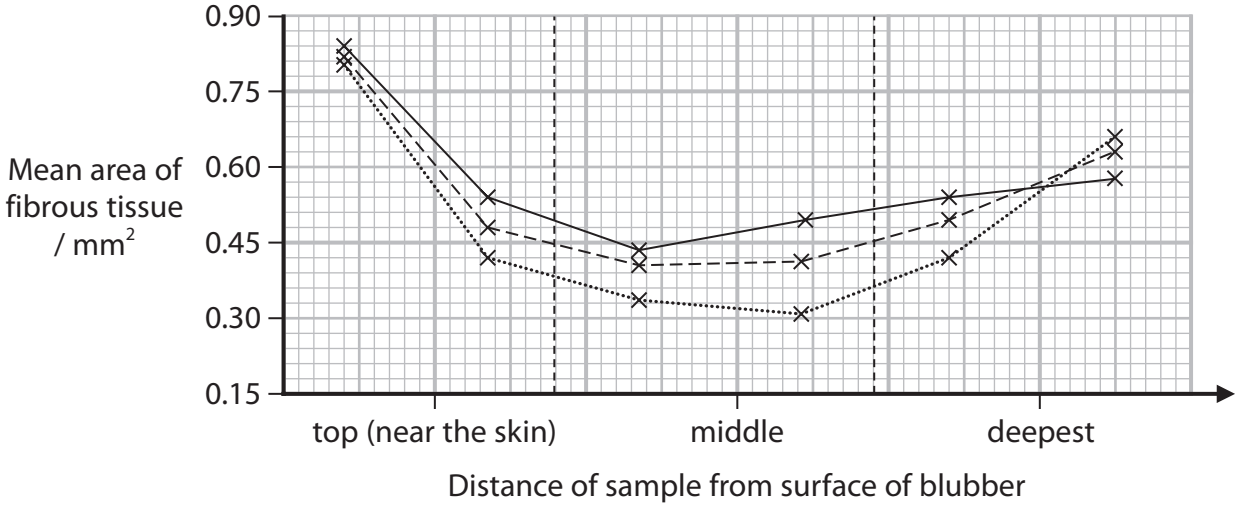
Graph 1



Graph 2



Graph 3



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Analyse the data to explain the results of this investigation.

(6)

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8 Some microorganisms can break down plastics, including polyesters.

Cows are a group of plant-eating mammals that have bacteria living in one of their four stomachs.

These bacteria play a role in the digestion of the plant material consumed by the cow.

Scientists have studied these bacteria to see if they can break down polyesters.

(a) Polyesters account for 15 % of the 25.8 million US tons of plastic waste accumulated in Europe.

Calculate the mass, in kilograms, of polyester in this accumulated plastic waste.

1 US ton = 907.185 kg

(2)

Answer ..... kg

(b) State why scientists think that these bacteria might be able to break down polyesters.

(1)

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(c) The bacteria were incubated with polyester at 40 °C in a pH 7 buffer solution.

Explain why these conditions were used.

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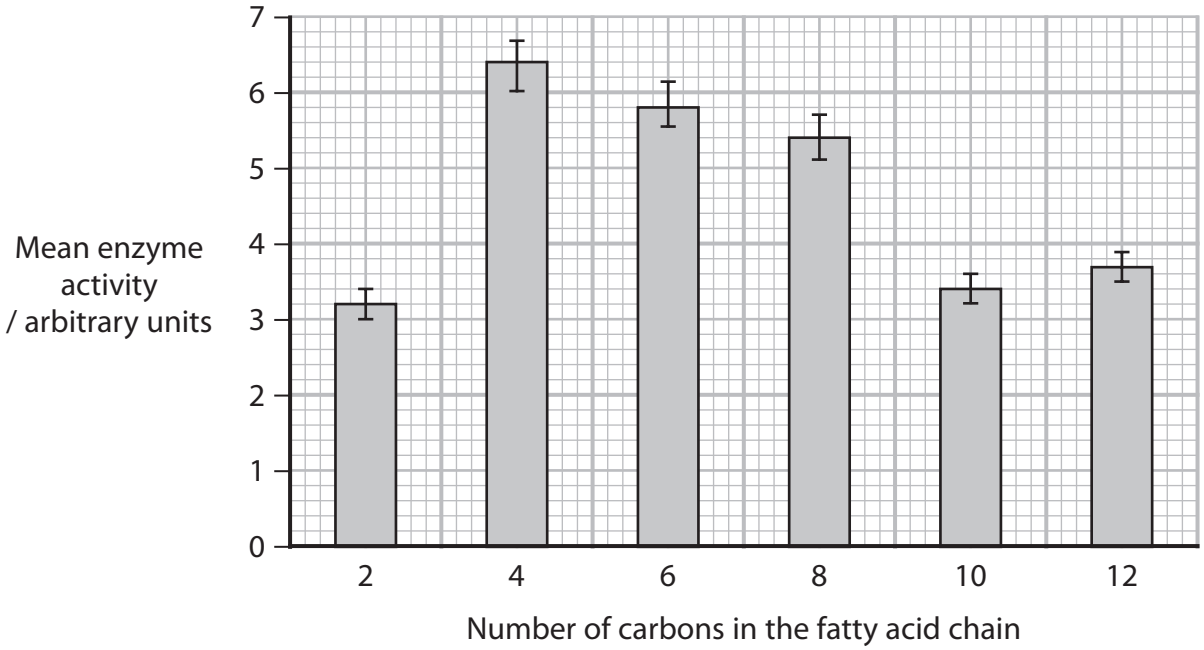
(d) One study investigated the breakdown of one type of polyester with different fatty acid chain lengths.

The graph shows the mean enzyme activities and standard deviations from this study.



(i) Analyse the data to comment on these results.

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(ii) Devise an experiment to confirm these results.

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(e) In another study, scientists measured the concentration of the breakdown products from two types of polyester, P1 and P2, using bacteria.

The table shows the results of this study.

Breakdown product	Concentration of breakdown products / arbitrary units	
	from P1	from P2
A	38	68
B	30	0
C	5	0
D	0	20
E	0	30

Explain why the scientists thought that the bacteria were producing more than one type of enzyme.

(2)

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(Total for Question 8 = 15 marks)

TOTAL FOR PAPER = 80 MARKS

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