Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number	Candidate Number

Tuesday 21 May 2019

Afternoon (Time: 1 hour 30 minutes)	Paper Reference **8BI0/01**

Biology B

Advanced Subsidiary
Paper 1: Core Cellular Biology and Microbiology

You must have: 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.
- Show your working in any calculation questions and include units in your answer where appropriate.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You may use a scientific calculator.
- 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.

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.*

Advice

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

Turn over ▶

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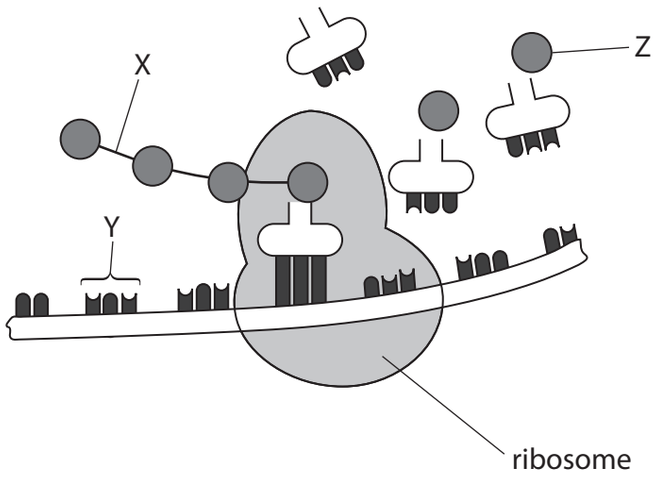
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Answer ALL questions.

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 (a) The diagram represents part of protein synthesis.



(i) Name the stage of protein synthesis shown in the diagram.

(1)

.....

(ii) The stage shown in the diagram takes place in the

(1)

☒ **A** cytoplasm

☒ **B** Golgi apparatus

☒ **C** nucleus

☒ **D** smooth endoplasmic reticulum

(iii) The part labelled X on the diagram represents

(1)

☒ **A** an ester bond

☒ **B** a glycosidic bond

☒ **C** a hydrogen bond

☒ **D** a peptide bond

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(iv) The part labelled Y on the diagram represents

(1)

- ☒ **A** an anticodon
- ☒ **B** a base pair
- ☒ **C** a codon
- ☒ **D** a DNA triplet

(v) Name the molecule represented by the part labelled Z on the diagram.

(1)

(b) The table shows the number of bases in the DNA strand used in the synthesis of mRNA.

Complete the table to show the percentage of bases in the mRNA synthesised.

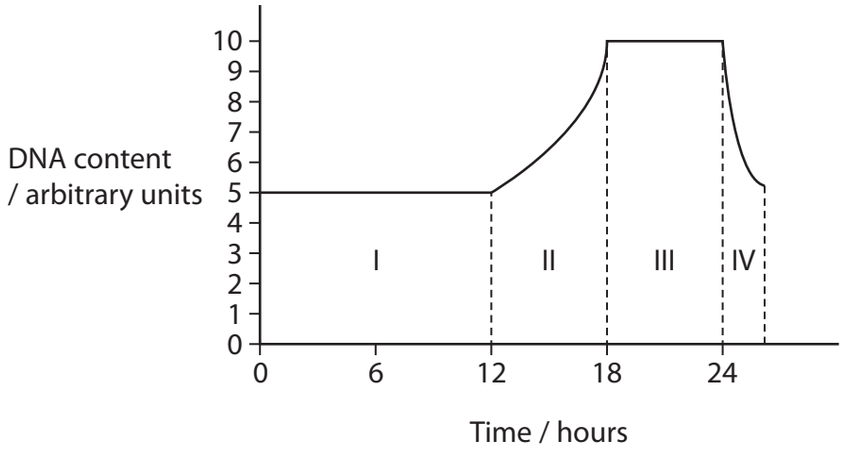
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Bases	Number of bases in the DNA strand	Percentage of bases in the mRNA (%)
Adenine	31 000	23.3
Cytosine	22 000	
Guanine	26 000	
Thymine	24 000	

(Total for Question 1 = 8 marks)

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2 The graph shows the DNA content of a cell during four stages, I, II, III and IV, of one cell cycle.



(a) (i) In which stage does DNA replication take place?

(1)

☒ **A** stage I

☒ **B** stage II

☒ **C** stage III

☒ **D** stage IV

(ii) Explain the role of the enzyme ligase in DNA replication.

(3)

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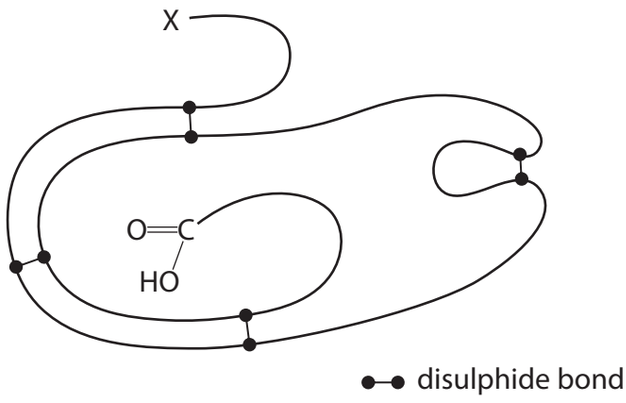
(b) Describe what is happening during stage IV in the cell cycle.

(3)

(Total for Question 2 = 7 marks)

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3 The diagram shows the tertiary structure of a molecule of the enzyme RNase.



(a) (i) Which chemical group is found at position X?

(1)

- ☒ **A** amino
- ☒ **B** carboxyl
- ☒ **C** hydroxyl
- ☒ **D** nitrate

(ii) Give the meaning of the term tertiary structure of a protein.

(2)

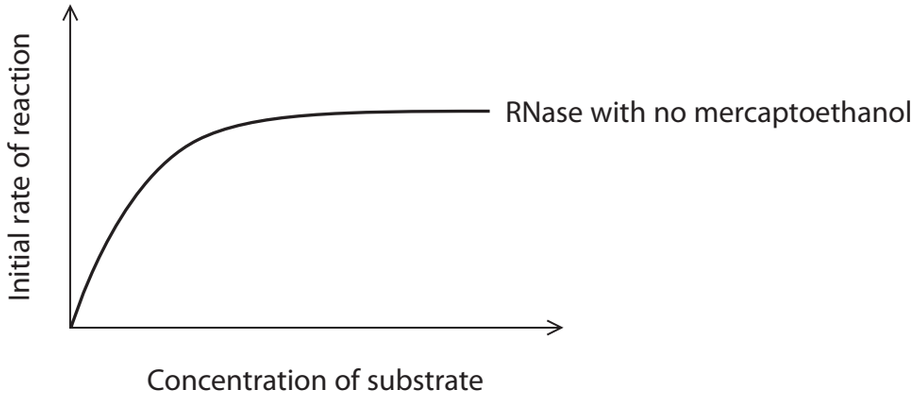
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(b) The chemical mercaptoethanol breaks disulfide bonds.

The graph shows the initial rate of reaction of RNase with no added mercaptoethanol.

Sketch a line on the graph to show the effect of a low concentration of mercaptoethanol on the activity of RNase.

(1)



(c) Analyse the information to explain the effect of adding mercaptoethanol on the activity of RNase.

(3)

(Total for Question 3 = 7 marks)

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4 (a) A queen bee can lay both fertilised and unfertilised eggs.

Fertilised eggs develop into diploid females.

Unfertilised eggs develop into haploid males.

(i) Explain which type of cell division produces gametes in female bees.

(2)

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(ii) Explain which type of cell division produces gametes in male bees.

(2)

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(iii) Which row identifies the features that contribute to genetic variation in the offspring of bees?

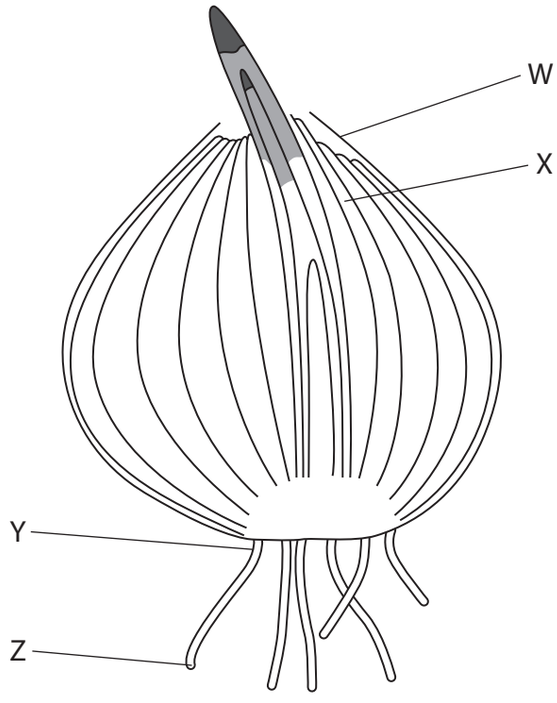
(1)

	Random fusion of gametes		Independent assortment of chromosomes		Crossing over	
	Female offspring	**Male offspring**	**Female offspring**	**Male offspring**	**Female offspring**	**Male offspring**
☒ **A**	✓	✓	✓	✓	✓	✓
☒ **B**	✓	×	×	✓	×	✓
☒ **C**	✓	×	✓	×	✓	×
☒ **D**	×	×	✓	×	✓	×

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(b) Onion bulbs that are growing can be used to make slides of plant tissue to observe the stages of mitosis.

The diagram shows a section through an onion bulb that is starting to grow.



(i) Which of the parts, W, X, Y or Z, should be used to prepare a slide showing mitosis?

(1)

- ☒ **A** W
- ☒ **B** X
- ☒ **C** Y
- ☒ **D** Z

(ii) Name a stain that can be used to show the stages of mitosis.

(1)

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(iii) Explain how to make a temporary preparation to show the stages of mitosis, after adding the stain to the slide.

(2)

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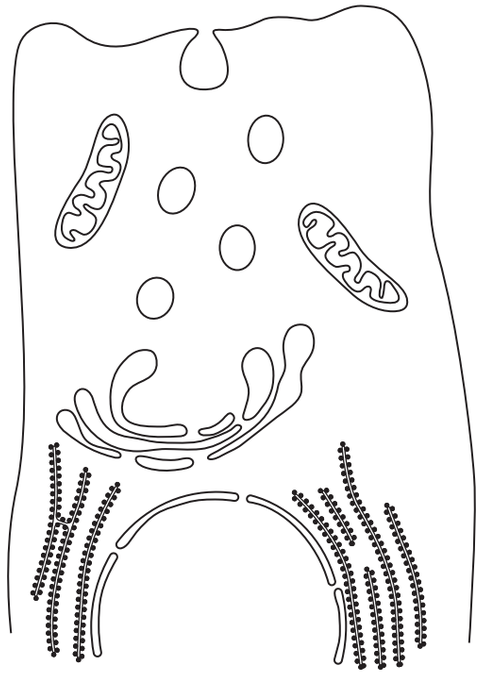
(Total for Question 4 = 9 marks)

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5 The diagram shows part of a cell from the pancreas that produces enzymes for use in the digestion of food.



(a) State one way in which the structure of a prokaryotic cell would differ from the cell shown in this diagram.

(1)

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(b) In an investigation, cells from the pancreas were grown in a culture medium containing radioactive amino acids.

Samples of these cells were taken and the level of radioactivity in three organelles was measured.

The table shows the results of this investigation.

Time after radioactive amino acids were added to the culture medium / min	Level of radioactivity present / arbitrary units		
	Golgi apparatus	Rough endoplasmic reticulum	Vesicles
1	21	120	6
20	52	88	6
40	86	39	8
60	71	23	15
90	50	27	28
120	23	11	51

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(i) Using the information in the table, draw arrows on the diagram showing the path of radioactivity through and out of the cell.

(2)

(ii) Comment on the results of this investigation.

(4)

(c) The diagram shows the position of the pancreas and the small intestine.



Lipase and protease enzymes produced by the pancreas are used in the small intestine during digestion.

Pancreatitis is a condition that occurs when the pancreatic duct becomes blocked.

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(i) Explain how the contents of the small intestine in a patient with pancreatitis would differ from the contents of the small intestine in a healthy person.

(2)

(ii) Some of the enzymes are produced in an inactive form.

In patients with pancreatitis, these enzymes can become active in the pancreas.

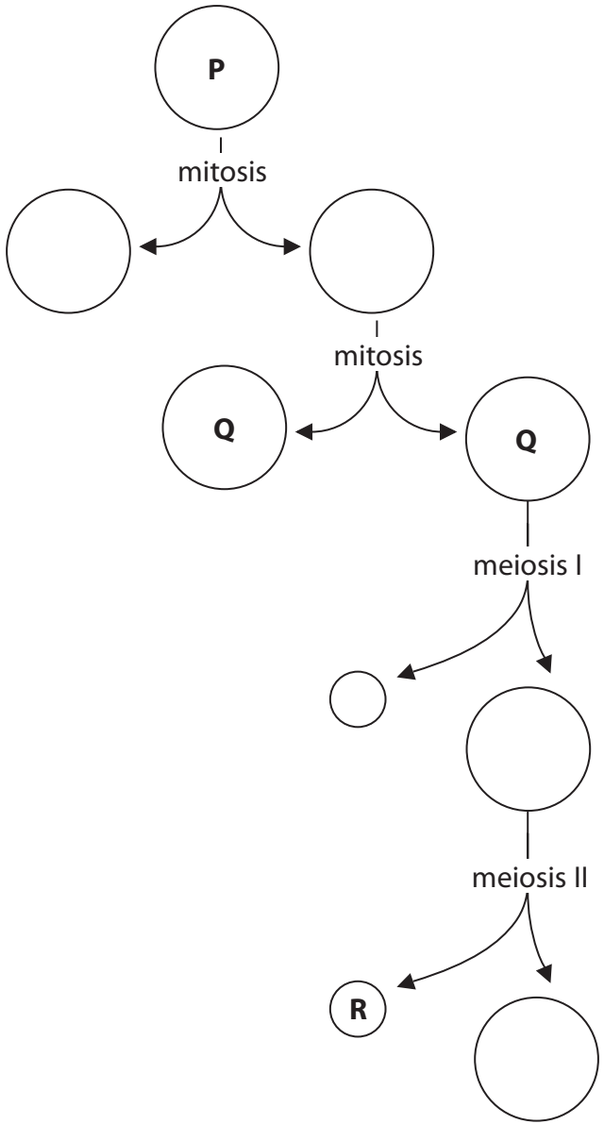
Explain how this activation could affect the pancreas.

(2)

(Total for Question 5 = 11 marks)

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6 The diagram summarises the process of oogenesis in humans.



(a) Which row contains the names for cells **P**, **Q** and **R**?

(1)

	P	Q	R
☒ **A**	germ cell	oocyte	polar body
☒ **B**	germ cell	polar body	ovum
☒ **C**	oocyte	polar body	ovum
☒ **D**	ovum	germ cell	oocyte

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(b) A study determined the number of oocytes in human females of different ages.

The table shows the results of this study.

Age / years	Mean number of oocytes per female
at birth	733 000
4 to 10	499 200
11 to 17	389 300
18 to 24	161 800
25 to 31	80 200
32 to 38	32 500
39 to 45	10 900

(i) Calculate the percentage change in the mean oocyte numbers between birth and 11 to 17 years.

(2)

Answer .....

(ii) Deduce when oocytes are produced in a female human.

(1)

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(c) Some men are infertile due to a condition called azoospermia.

Men with this condition produce semen that contains spermatids instead of mature spermatozoa.

(i) State one structural difference between a spermatid and a mature spermatozoon.

(1)

(ii) Explain why men with azoospermia are infertile.

(2)

(iii) Infertility caused by azoospermia can be treated by using intracytoplasmic sperm injection (ICSI).

This procedure injects a single spermatid directly into an ooctye.

One concern about this procedure is that it uses selected spermatids. This eliminates the normal competition between sperm that precedes fertilisation.

Explain the advantage of competition between sperm.

(2)

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(iv) Describe two ethical implications of the use of ICSI.

(2)

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(Total for Question 6 = 11 marks)

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7 When apples are cut, the enzyme polyphenol oxidase is released from the cells.

This enzyme converts colourless phenols into a brown pigment called melanin.

Citric acid or a protease enzyme can be added to apple slices to prevent this browning.

(a) (i) Explain why the addition of citric acid prevents the browning of apple slices.

(2)

(ii) Explain why the addition of a protease enzyme prevents the browning of apple slices.

(2)

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(b) An investigation was carried out into the activity of polyphenol oxidase by measuring the quantity of melanin formed.

An apple was cut into five equal slices and the first slice finely crushed and filtered.

The concentration of melanin in the filtrate was then measured.

The remaining four slices were finely crushed and filtered at 60 second intervals.

The table shows the results of this investigation.

Apple slice	Time / s	Melanin concentration / a.u
1	0	0
2	60	19
3	120	38
4	180	51
5	240	62

(i) Analyse the data to explain the results of this investigation.

(3)

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*(ii) The temperature at which apple slices are stored can affect the activity of the enzyme polyphenol oxidase.

Devise a valid method to investigate the effect of temperature on the browning of apple slices.

(6)

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(Total for Question 7 =13 marks)

8 During mitosis, microtubules form the spindle.

These microtubules are made of a protein called tubulin.

Individual tubulin molecules are globular with a diameter of 25 nm.

Thousands of tubulin molecules are assembled together to form long, hollow microtubules.

(a) (i) Describe the differences between a fibrous protein and an individual tubulin molecule.

(2)

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(ii) A microtubule is 40 μm in length.

Calculate how many times longer this microtubule is than a single tubulin molecule.

(2)

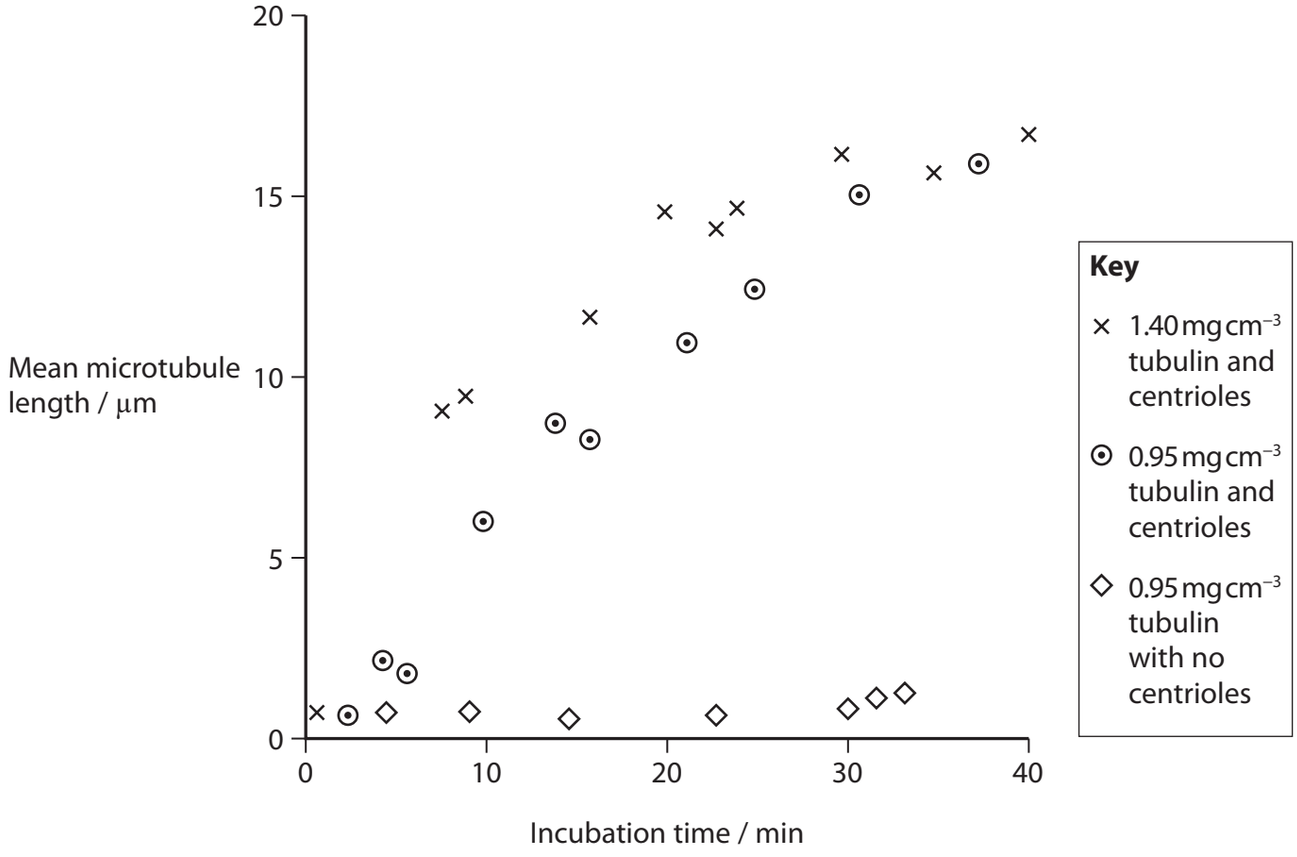
Answer .....

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(b) The involvement of centrioles in spindle formation was investigated using the following method:

- in the first experiment, purified tubulin at a concentration of 1.40 mg cm^{-3} was mixed with centriole fragments
- the mixture was incubated at 35 °C
- every few minutes, the length of any microtubules formed was measured
- in a second experiment, a mixture containing 0.95 mg cm^{-3} tubulin and centriole fragments was used
- in a third experiment, 0.95 mg cm^{-3} tubulin with no centriole fragments present was used
- each of these three experiments was repeated several times.

The graph shows the results of this investigation.



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(i) Analyse the data to comment on the relationship between centrioles and tubulin in the production of microtubules.

(4)

(ii) Explain why the centriole fragments and tubulin were each in a buffer solution at 35 °C before being used in these experiments.

(4)

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(c) It was observed that for the mixture of 1.40 mg cm^{-3} tubulin with centriole fragments the mean length of microtubules decreased after 40 minutes.

Explain why the microtubule length decreased after 40 minutes.

(2)

(Total for Question 8 = 14 marks)

TOTAL FOR PAPER = 80 MARKS

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