UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8814460582

BIOLOGY **9700/51**

Paper 5 Planning, Analysis and Evaluation **May/June 2011**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

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Write in dark blue or black ink.
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Total	

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Question 1 starts on page 3

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1 A student investigated the storage tissue in potato tubers of different ages

- a newly formed tuber
- an old tuber that was just beginning to form new shoots.

In one investigation, the water potential of different parts of the tubers was estimated using discs of potato tissue and sucrose solutions of different concentrations.

Fig. 1.1 shows

- the appearance of the tubers
- the places from where the tissues were removed.

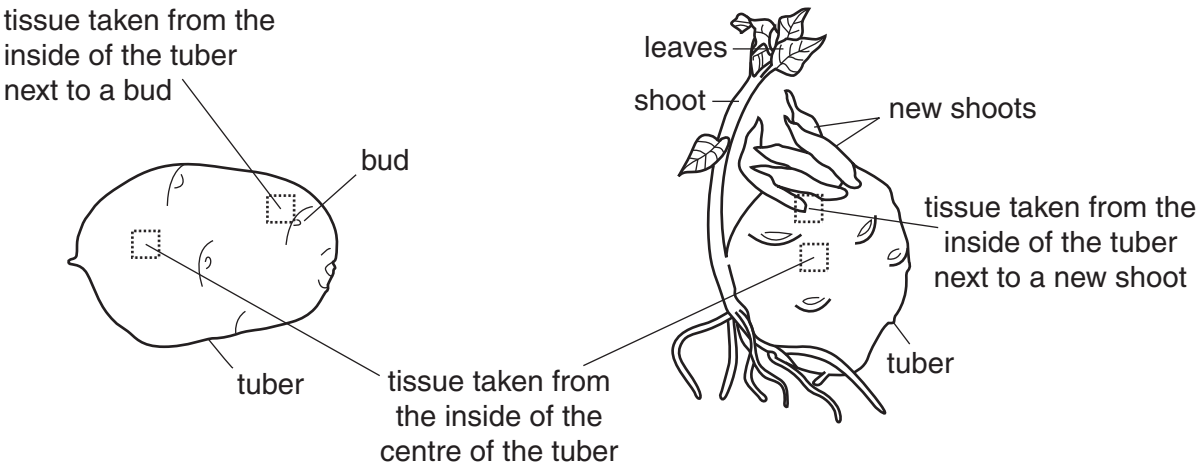


Fig. 1.1

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The results of the investigation are shown in Fig. 1.2.

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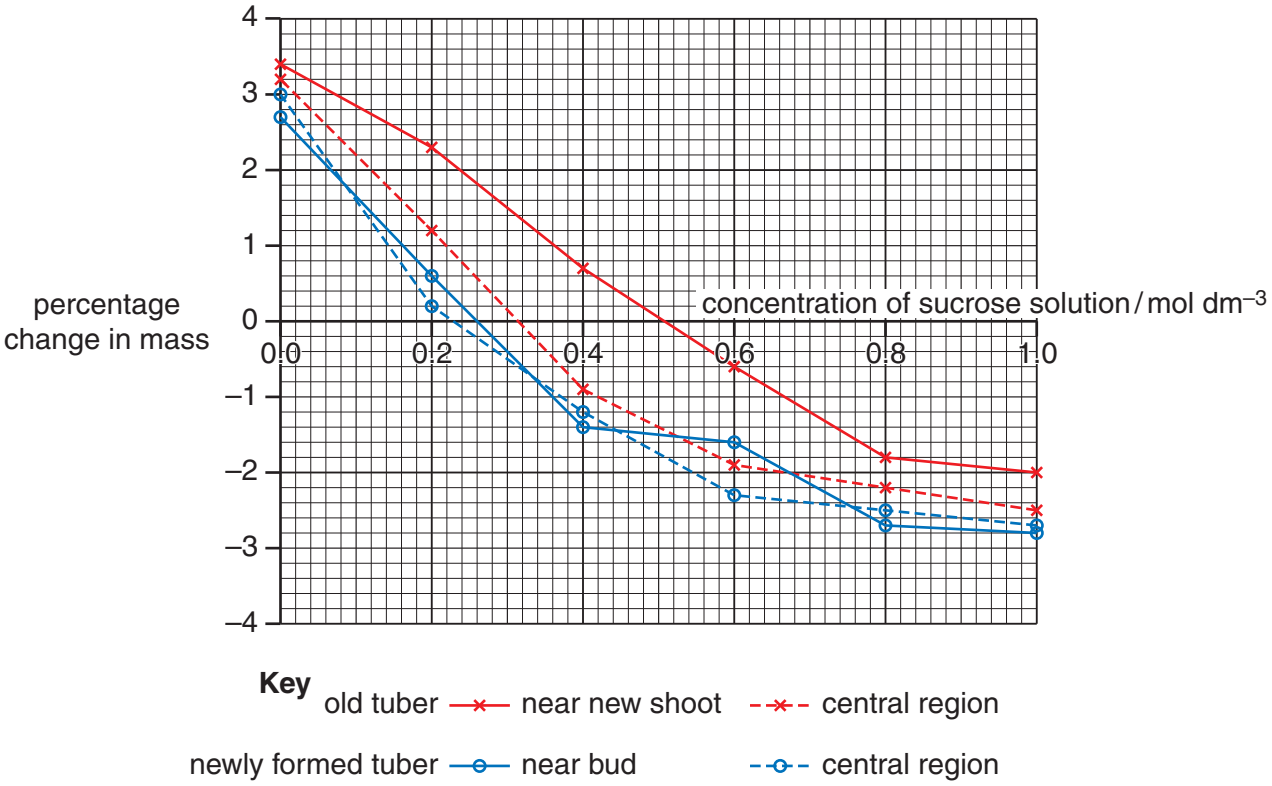


Fig. 1.2

(a) Describe a procedure by which the student could have obtained the results in Fig. 1.2.

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(b) (i) State how the percentage change in mass is calculated.

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.....[1]

(ii) Explain why the student used percentage change in mass rather than actual mass.

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[Turn over

Fig. 1.3 shows the same data as Fig. 1.2.

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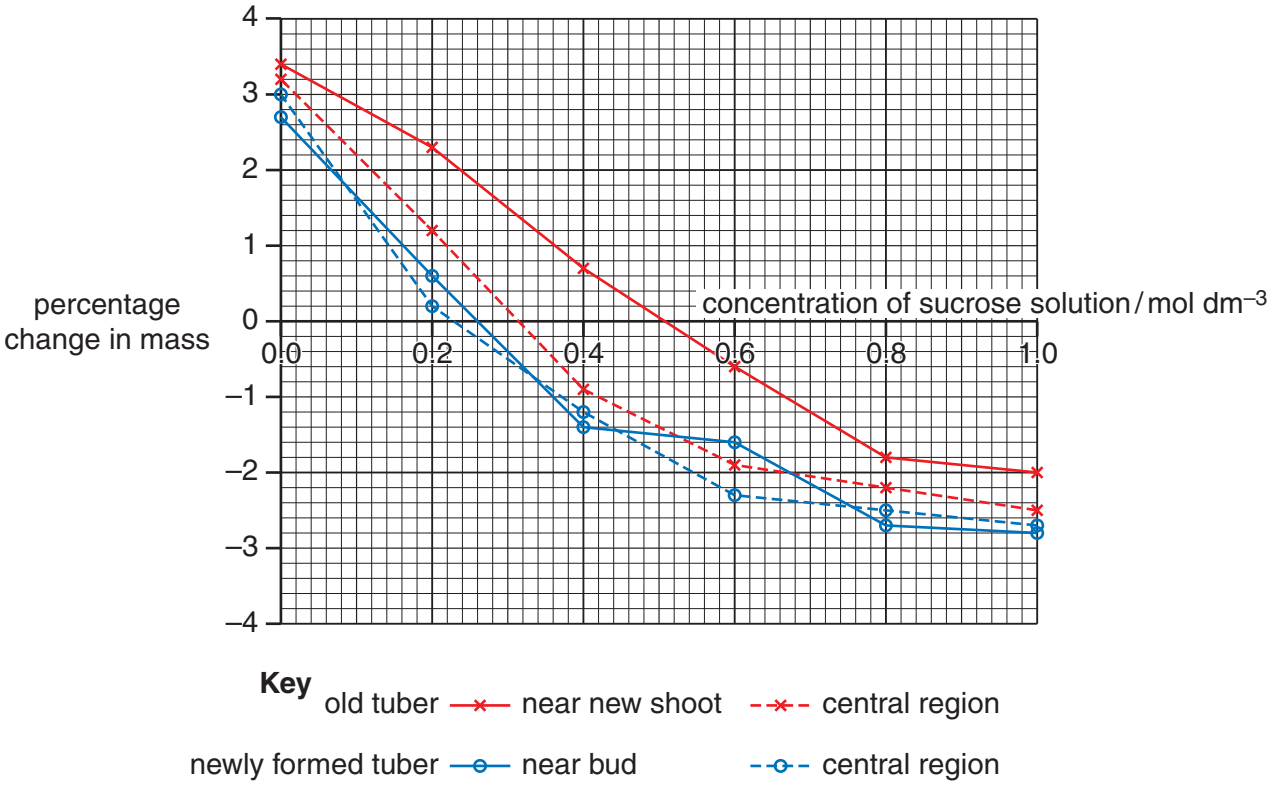


Fig. 1.3

The student looked at the graphs in Fig. 1.3 and estimated the water potential from where there was no change in mass.

The student decided to find out if the difference in the water potential between the central region of the old tuber and the central region of the newly formed tuber was significant.

- 20 samples of tissue were taken from the central region of each tuber.
- The change in mass was measured separately for each sample using the same procedure as in the original investigation.

(c) (i) Give **one** reason why the *t*-test is a suitable statistical test for this investigation.

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..... [1]

(ii) Explain how the student should use the value for *t* to find out if the difference in water potential between the tubers is significant.

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..... [2]

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From the readings in Fig. 1.3 the student concluded that

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- the tissue in the old tuber close to the growing shoot has the **lowest water potential**.
- in the old tuber close to a growing shoot, starch reserves were being converted to sugar.
- in the old tuber central region, starch was being converted to sugar.
- in the newly formed tuber all the sugar had been converted to starch.

(d) With reference to Fig. 1.3, state the evidence that supports these conclusions and the evidence that does not support these conclusions.

evidence to support these conclusions

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evidence that does not support these conclusions

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(e) Suggest what further investigations the student could do to provide more support for the conclusions about starch and sugar in the storage tissue.

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[Turn over

(f) The student found that newly formed tubers do not form shoots until a period of dormancy lasting several months has occurred.

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The student investigated tissues taken from tubers of different ages to test the hypothesis

Dormancy in tubers is caused by an inhibitory growth regulator.

Suggest what results would be obtained if this hypothesis was valid.

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.....[2]

[Total: 20]

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Question 2 starts on page 10

2 Organo-mercury compounds are toxic. They are used as pesticides, as preservatives for vaccines and as surface antiseptics.

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The effects of an organo-mercury compound on mitosis were investigated in a cell culture of human white blood cells. The cells were exposed to different concentrations of the compound for one hour.

Observations of the chromosomes in these cells were made using a light microscope at × 400 magnification. Two types of abnormal mitosis were seen.

Type 1 the chromosomes were clumped close together in the middle of the cell.

Type 2 the spindle had not formed in the cell.

The frequency of each type of abnormality was obtained by observing 100 cells.

Table 2.1 shows the results.

Table 2.1

concentration of organo-mercury compound / μmol dm^{-3}	frequency of the type of mitosis observed		
	Type 1	**Type 2**	**Normal**
0	0	18	82
2	0	19	81
10	0	38	62
20	1	44	55
50	16	50	34
100	55	28	17
200	89	11	0

(a) Outline how the white blood cells may have been treated so that the chromosomes could be observed.

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.....[2]

(b) (i) Identify the independent and dependent variables in the investigation.

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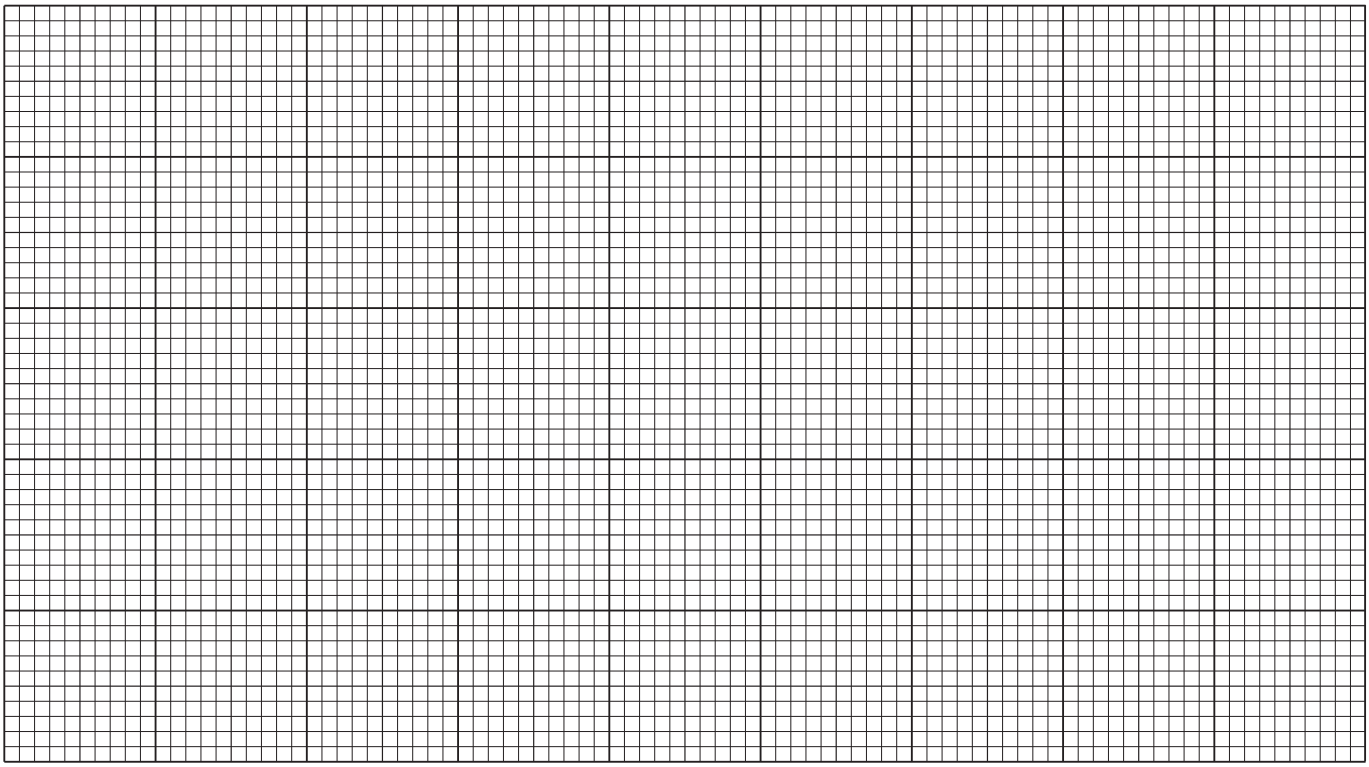
independent .....

dependent .....[2]

(ii) Identify the control for this investigation.

.....[1]

(iii) Use the grid and the data in Table 2.1 to plot a line graph showing the frequency of normal mitosis at each concentration of the organo-mercury compound.



[3]

(c) (i) Suggest an explanation for the effect of organo-mercury compounds on mitosis.

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..... [1]

(ii) The data in this investigation was considered to be reliable.

Suggest **one** reason why this is so.

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.....[1]

[Total: 10]

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General Certificate of Education Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4956470491

BIOLOGY **9700/52**

Paper 5 Planning, Analysis and Evaluation **May/June 2011**

1 hour 15 minutes

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No Additional Materials are required.

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[Turn over

1 A student used the procedure outlined below to find the water potential of a plant storage tissue that has coloured cell sap.

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- pieces of plant tissue are placed into different sucrose solutions of known concentrations to allow osmosis to occur
- damaged cells release pigment that colours the sucrose solutions that bathe the tissue
- the water potential of the sucrose solutions may change as a result of osmosis
- sucrose solutions become less dense if they **gain** water from the tissue
- a pipette is filled with the coloured sucrose solution that has bathed the plant tissue
- a drop of the coloured bathing sucrose solution is released half way down a tube of sucrose solution of the same concentration as the original bathing solution as shown in Fig. 1.1
- the direction and rate of movement of the drop of coloured solution is determined by its density

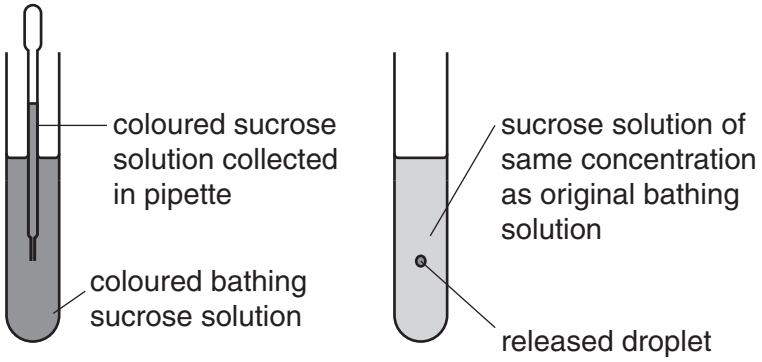


Fig. 1.1

Fig. 1.2 shows the results that the student plotted from the investigation.

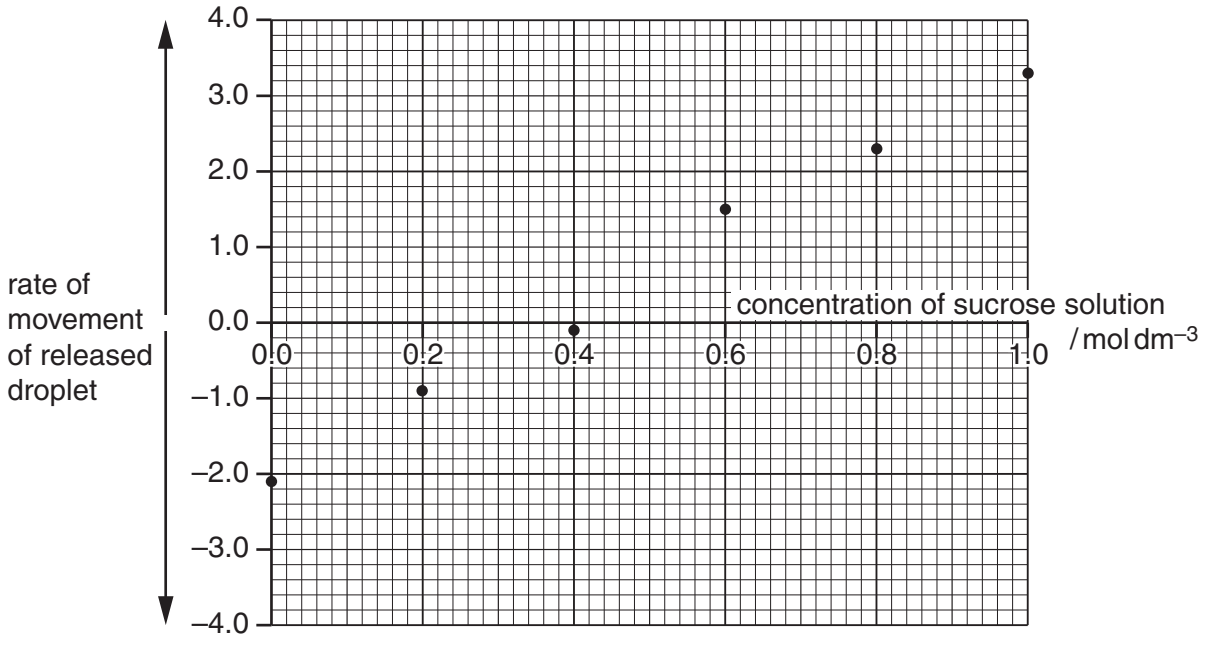


Fig. 1.2

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(a) Describe how the student could use this procedure to find the water potential of the plant storage tissue that has coloured cell sap.

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(b) (i) Suggest suitable units for the rate of movement of the drop.

.....[1]

(ii) State how the student would estimate the water potential of the plant tissue.

.....

.....

.....[2]

(c) (i) Identify the independent and dependent variables in this investigation.

independent .....

.....

dependent .....

.....[2]

(ii) Identify **two** variables which the student may not have adequately controlled during the investigation.

1. .....

2. .....[2]

(iii) State how **one** of the variables you have identified in **(c)(ii)** may have influenced the results.

.....

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.....[1]

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(d) The student made direct observations of the cells of the tissues that had been immersed in 0.2 mol dm^{-3} and 0.8 mol dm^{-3} sucrose solutions.

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(i) Predict the appearance of the cells under the microscope when immersed in

0.2 mol dm^{-3} sucrose solution .....

.....

0.8 mol dm^{-3} sucrose solution .....

.....[1]

Use the space below for any diagrams you include in your answer to **(i)**.

(ii) Explain your answers to **(d)(i)**.

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.....[2]

[Total: 19]

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2 One possible cause of infertility in women is the failure of immature oocytes to complete meiosis. Scientists studying the causes of infertility tested a naturally occurring compound, FF-MAS, to find out how it stimulates meiosis to restart in oocytes.

One hypothesis is that FF-MAS activates a specific membrane receptor, LXR alpha. This hypothesis was tested on mice using FF-MAS and three compounds known to activate this receptor in other cells.

The main stages of the experimental procedure were

- immature female mice were injected with follicle stimulating hormone (FSH) and their ovaries removed 48 hours later
- the oocytes were isolated and cultured in a medium that maintains them at the primary oocyte stage of development
- different concentrations of the test compounds were added to separate cultures of oocytes
- the whole procedure was repeated for each compound
- the effect of each test compound on meiosis was recorded after 24 hours
- the mean percentage of cells showing stimulation of meiosis was calculated together with the standard error (S_M)

Table 2.1 shows the results of this investigation.

Table 2.1

compound	mean percentage stimulation of meiosis ± S_M			
	concentration of the activator compound added to the oocytes / μmol dm^{-3}			
	0.00	0.07	0.70	7.00
FF-MAS	11.9 ± 2.6	11.5 ± 3.2	39.0 ± 5.6	86.1 ± 1.7
cholesterol	9.6 ± 1.6	13.8 ± 2.9	12.5 ± 2.7	15.5 ± 2.7
22R-HC	10.5 ± 1.3	14.7 ± 6.2	15.8 ± 1.6	6.0 ± 1.2
25-HC	15.1 ± 2.6	15.0 ± 2.2	9.8 ± 0.3	14.1 ± 1.7

(a) (i) Suggest why the mice were treated with FSH before the ovaries were removed.

.....

.....[1]

(ii) Suggest the purpose of keeping the oocytes in a medium that maintains them at the primary oocyte stage.

.....

.....[1]

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(b) Explain what S_M shows about the mean percentage values.

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.....[1]

Statistical tests were carried out to compare the stimulatory effects on meiosis of FF-MAS with the effects of the other compounds at each of the three concentrations used.

(c) (i) State the null hypothesis for these tests.

.....

.....[1]

(ii) State a statistical test that could be used and give the reason for your choice.

test .....

reason for your choice .....

.....[2]

(iii) The result of the statistical test comparing FF-MAS with 22R-HC at 0.70 μmol dm^{-3} was significant at 0.05 probability level. Explain what this means.

.....

.....[1]

(d) (i) State whether or not the evidence in Table 2.1 supports the original hypothesis that FF-MAS activates the specific membrane receptor, LXR alpha.

Explain your answer.

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(ii) State the conclusions that can be drawn from the results in Table 2.1.

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[Total: 11]

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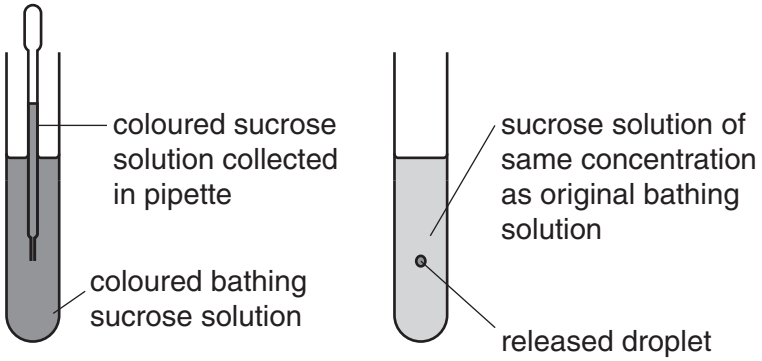


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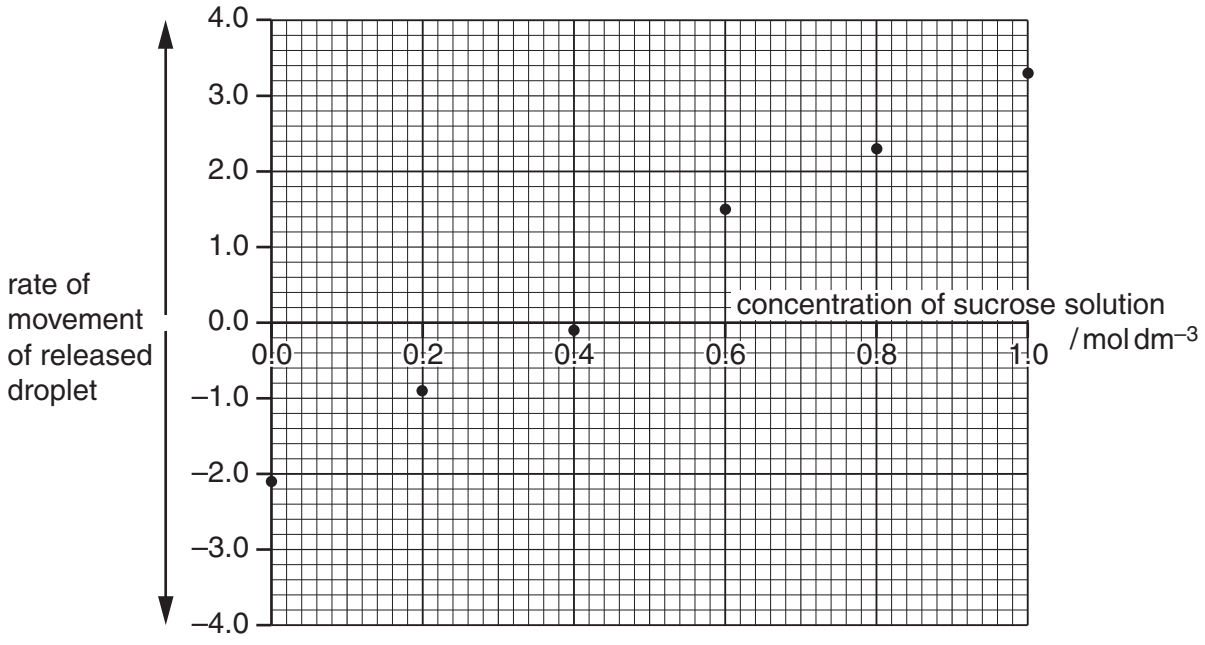


Fig. 1.2

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test .....

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.....[2]

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