Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7905061902

BIOLOGY **9700/52**

Paper 5 Planning, Analysis and Evaluation **February/March 2019**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **8** printed pages.

DC (KN/TP) 164194/4

Cambridge Assessment International Education

1 In an investigation to find the water potential of onion tissue, some students used epidermal tissue from the storage leaves of a red onion. The vacuoles of the cells in this tissue contain a red pigment.

The students researched one method to use in this investigation. The first step in this method is to find the concentration of sucrose solution at which 50% of the cells in the epidermal tissue are plasmolysed and 50% are not plasmolysed.

The students decided to use sucrose solutions of different molar concentrations in their investigation and record the effect on the number of cells plasmolysed in the onion epidermis.

(a) State the independent variable **and** the dependent variable in this investigation.

independent variable ....

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dependent variable ....

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[2]

(b) **(i)** Describe how the students could make 250 cm^3 of a 1.0 $mol\,dm^{-3}$ solution of sucrose.
(mass of one mole of sucrose molecules = 342 g)

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(ii) Outline how the students should use **proportional** dilution to make a suitable number and range of sucrose concentrations from the 1.0 $mol\,dm^{-3}$ solution of sucrose. 20 cm^3 of each concentration will need to be prepared.

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(iii) Suggest why a cell with a coloured pigment in the vacuole is suitable for the students' investigation.

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(iv) Describe a method the students could use to find the percentage of cells that are plasmolysed at each of the different concentrations of sucrose solution.

Your method should be set out in a logical order and be detailed enough to let another person follow it.

You should **not** include how to make the different concentrations of sucrose solution already described in **(b)(ii)**.

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(v) Describe how the students could use their results to find the concentration of sucrose solution in which 50% of the cells in the epidermal tissue are plasmolysed.

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.... [2]

(c) The students then investigated the water potential of two other tissues that have epidermal cells with coloured pigment in their vacuoles.

For each of the three tissues investigated, the students determined the concentration of sucrose solution in which 50% of the cells were plasmolysed. All three investigations were carried out at 20 °C.

Table 1.1 shows these results.

Table 1.1

type of tissue	concentration of sucrose solution in which 50% of the cells were plasmolysed / mol dm^{-3}	water potential of the tissue / MPa
leaf epidermis of red onion	0.35	–0.85
leaf stalk epidermis of rhubarb	0.50	–1.22
petal epidermis of antirrhinum	0.44	–1.07

Use the data in Table 1.1 to explain the direction of water movement occurring in isolated cells from each of these three tissues placed in a solution with a water potential of –1.16 MPa.

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[Total: 18]

2 Cancer of the blood, including leukaemia and lymphoma, can be caused by mutations of stem cells in the bone marrow.

A long-term study into the effects of radiation on the frequency of blood cancer was carried out on two groups of people: group 1 and group 2. These people were all born to mothers exposed to nuclear radiation during pregnancy.

Table 2.1 summarises information about the two groups of people included in this study.

Table 2.1

	group 1	group 2
when born	between 1948 and 1988	between 1950 and 1961
how the mothers were exposed to radiation	working in a nuclear power plant **and** living in the town next to the nuclear power plant	living next to a river contaminated by nuclear wastes from an accident at the same nuclear power plant
time when mothers were exposed to radiation	any time between January 1948 and December 1982	any time between January 1950 and December 1960
method of determining radiation exposure of mothers	using badges worn by workers at the nuclear power plant to record their exposure to radiation	from external radiation levels measured in the area
individuals for whom blood cancer data were collected	people who continued to live in the same town as the nuclear power plant	people who continued to live in the area where they were born
when blood cancer data were collected	January 1948 until December 2009	January 1953 until December 2009

Until 2005, the data sources used for all of this information were paper based and obtained from hospitals, clinics and medical records.

After 2005, data were collected electronically from databases at cancer clinics and from online death certificates.

(a) Table 2.2 shows some of the results from this study.

Table 2.2

	group 1	group 2	group 1 and group 2 combined
number of people in the group studied	8466	11070	19536
male	4361	5588	9949
female	4105	5482	9587
outcomes up to December 31 2009			
number of people not developing any cancer who were still alive	4053	5648	9701
number of people not developing any cancer who had died	898	1864	2762
number of people developing any cancer	220	288	508
number of deaths from any cancer	103	145	248
number of people developing blood cancer	32	26	58
number of deaths due to blood cancer	21	15	36
number of people where outcome not known	3295	3270	6565

(i) In group 1, the proportion of people who were known to develop blood cancer out of all the people who were known to develop any cancer was 0.145.

Calculate for group 2 the proportion of people who were known to develop blood cancer out of all the people who were known to develop any cancer.

Give your answer to three decimal places.

.... [1]

(ii) It is possible to carry out a chi-squared test on the data in Table 2.2 to test whether there is a difference in the probability of individuals in group 1 and group 2 developing blood cancer.

State **one** reason why the chi-squared test can be used with these data.

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(b) The data were analysed to assess how the number of people who developed blood cancer was affected by their mothers' exposure to radiation during pregnancy.

Fig. 2.1 shows the results of this analysis for the combined data from group 1 and group 2. Each plotted number includes all those people whose mothers' exposure to radiation during pregnancy was below, or up to, the exposure to radiation shown.

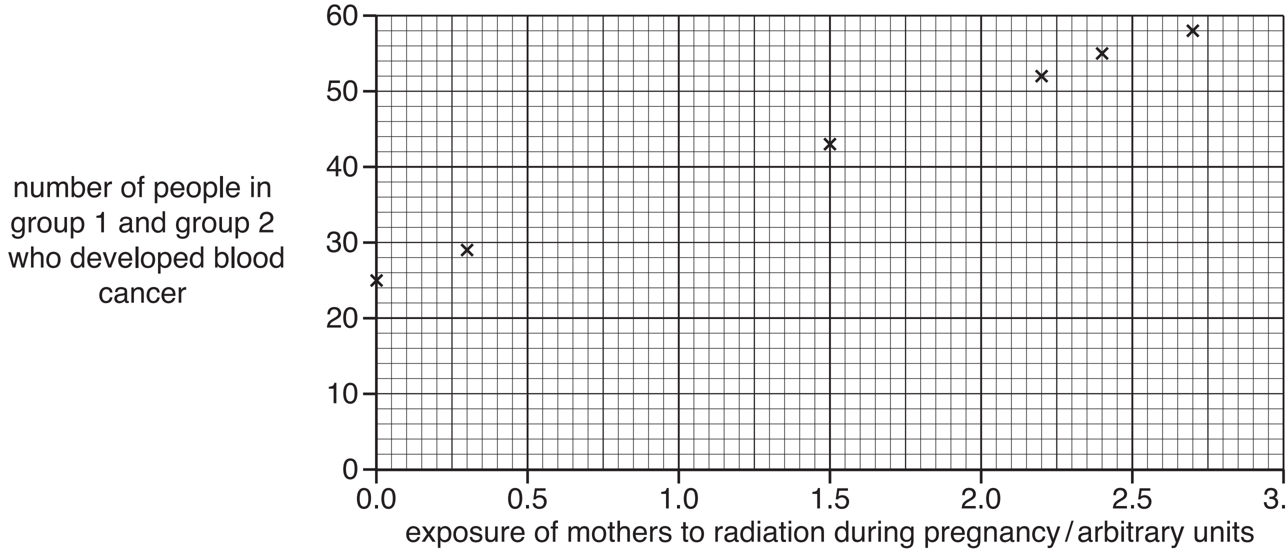

Fig. 2.1

(i) Use Fig. 2.1 to describe the relationship between the number of people who developed blood cancer and their mothers' exposure to radiation during pregnancy.

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(ii) Suggest an explanation for the relationship shown between the number of people who developed blood cancer and their mothers' exposure to radiation during pregnancy.

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(c) Evaluate the validity of the results of this study with reference to all the information provided.

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(d) Plant scientists were interested in the effect of radiation on the germination of seeds.

They exposed seeds to the same intensity of radiation for different lengths of time and measured the proportion of seeds that germinated.

Suggest **three** variables, other than intensity of radiation, that would need to be standardised in an investigation of this type.

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[Total: 12]