Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7190243555

BIOLOGY **9700/52**

Paper 5 Planning, Analysis and Evaluation **February/March 2020**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 30.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Blank pages are indicated.

1 Seaweeds are photosynthetic multicellular organisms found on the coast of many parts of the world. There are green, brown and red seaweeds.

During a field study, some students observed that the differently coloured seaweeds grew at different distances from the highest part of the shore reached by the sea (the high tide line).

Fig. 1.1 shows the distribution of these differently coloured seaweeds.

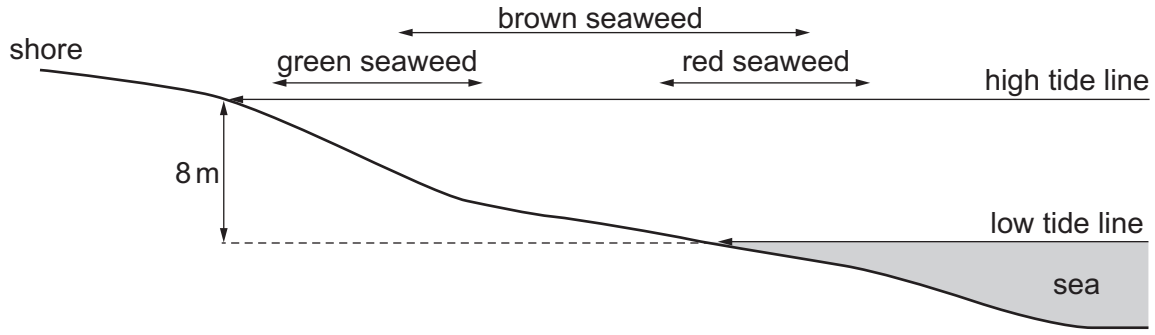

Fig. 1.1

The students were asked to compare the action spectra of the differently coloured seaweeds.

The students decided to:

- make a suspension of chloroplasts from each of the differently coloured seaweeds
- for each suspension of chloroplasts, find the time for methylene blue to change colour at different wavelengths of light.

Methylene blue is a redox indicator that changes colour from blue to colourless as a result of the reactions of the light dependent stage of photosynthesis.

(a) State the independent variable and the dependent variable in the experiment to find the action spectrum of green seaweed.

independent variable .....

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dependent variable .....

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[2]

(b) From the internet, the students found that:

- a chloroplast suspension can be obtained from a suspension of crushed seaweed tissue by filtering out and discarding the large fragments
- chloroplasts in suspension are easily destroyed by enzyme activity
- chloroplasts in suspension can burst by absorbing too much water by osmosis
- light of different wavelengths can be obtained from a light source using light filters of different colours, e.g. a red filter only transmits (allows through) red light from a light source.

(i) The students were provided with the materials listed.

- samples of green seaweed, brown seaweed and red seaweed in sea water
- bench lamp
- light filters of different colours that transmit light at known wavelengths
- ice cold phosphate buffer solution at pH 7
- 5 cm^3 dilute methylene blue solution with a dropping pipette
- squares of small mesh cloth for filtering suspensions
- crushed ice in a shallow plastic bowl
- balance
- scissors
- mortar and pestle
- blender
- 1 cm^3, 5 cm^3 and 10 cm^3 syringes
- 50 cm^3 measuring cylinder
- metal foil
- 100 cm^3 beakers
- test-tubes
- test-tube rack
- stop-clock or timer
- white tile or white card

Describe how the students could use this apparatus to:

- prepare a suspension of chloroplasts from each of the differently coloured seaweeds
- find the time for methylene blue to change colour at different wavelengths of light for each of the chloroplast suspensions.

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

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[10]

(ii) Describe how the students could use their results to find the action spectrum for each of the differently coloured seaweeds.

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(c) In another experiment, the students used thin layer chromatography to separate the chloroplast pigments from each of the differently coloured seaweeds.

Fig. 1.2 shows the chromatogram obtained and the colours of the pigments.

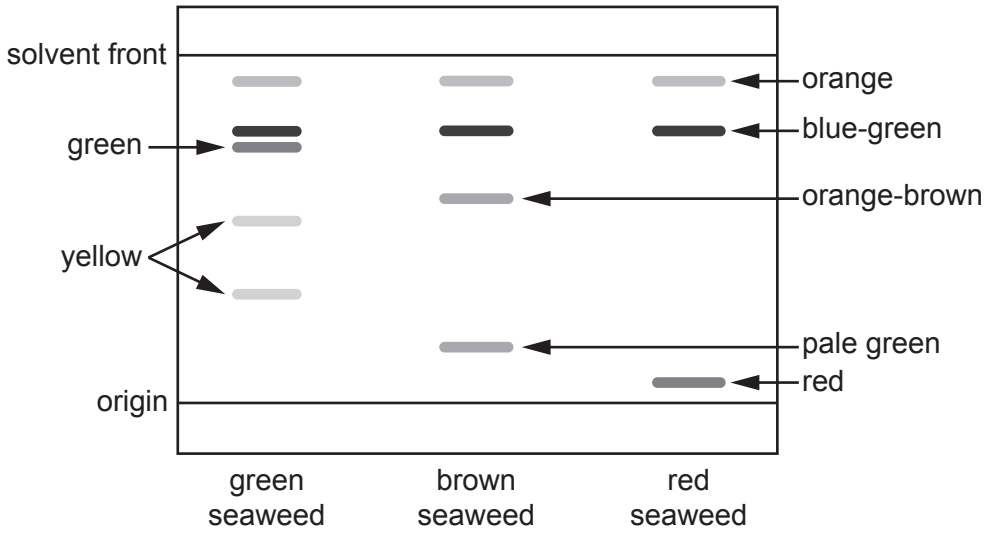

Fig. 1.2

(i) Compare the chloroplast pigments present in the three differently coloured seaweeds, as shown in Fig. 1.2.

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(ii) The students suggested that brown seaweed and red seaweed can photosynthesise in deeper water than green seaweed, due to differences in their pigments. The students based this suggestion on their observations shown in Fig. 1.1 and their results shown in Fig. 1.2.

The students found the wavelengths of light absorbed by each of the different chloroplast pigments that are shown in Fig. 1.2.

Table 1.1 shows the range of wavelengths at which light is absorbed by each of these pigments.

Table 1.1

pigment colour	wavelengths of light absorbed / nm
orange	425–475
blue-green	412–435 and 640–685
green	420–476 and 635–652
pale green	447–452
yellow	400–530
orange-brown	390–580
red	490–500 and 545–565

The depth that light reaches into water is dependent on wavelength. The shorter the wavelength, the further light can travel into water.

Discuss whether or not the data in Table 1.1 support the suggestion that brown seaweed and red seaweed can photosynthesise in deeper water than green seaweed, due to differences in their pigments.

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[Total: 18]

2 Parkinson's disease occurs when nerve cells in part of the brain die, resulting in less secretion of a neurotransmitter called dopamine.

Dopamine is involved in the control of muscle movement and in emotional responses. As a result, common symptoms of Parkinson's disease are muscle twitching and stiff muscles. Other symptoms can include depression, memory loss and problems with sleeping.

The disease is progressive, so over time the symptoms become worse.

(a) Scientists collected data on the number of males and females with Parkinson's disease in specific age groups in the USA.

Fig. 2.1 shows these data presented as number of people with Parkinson's disease per 100 000.

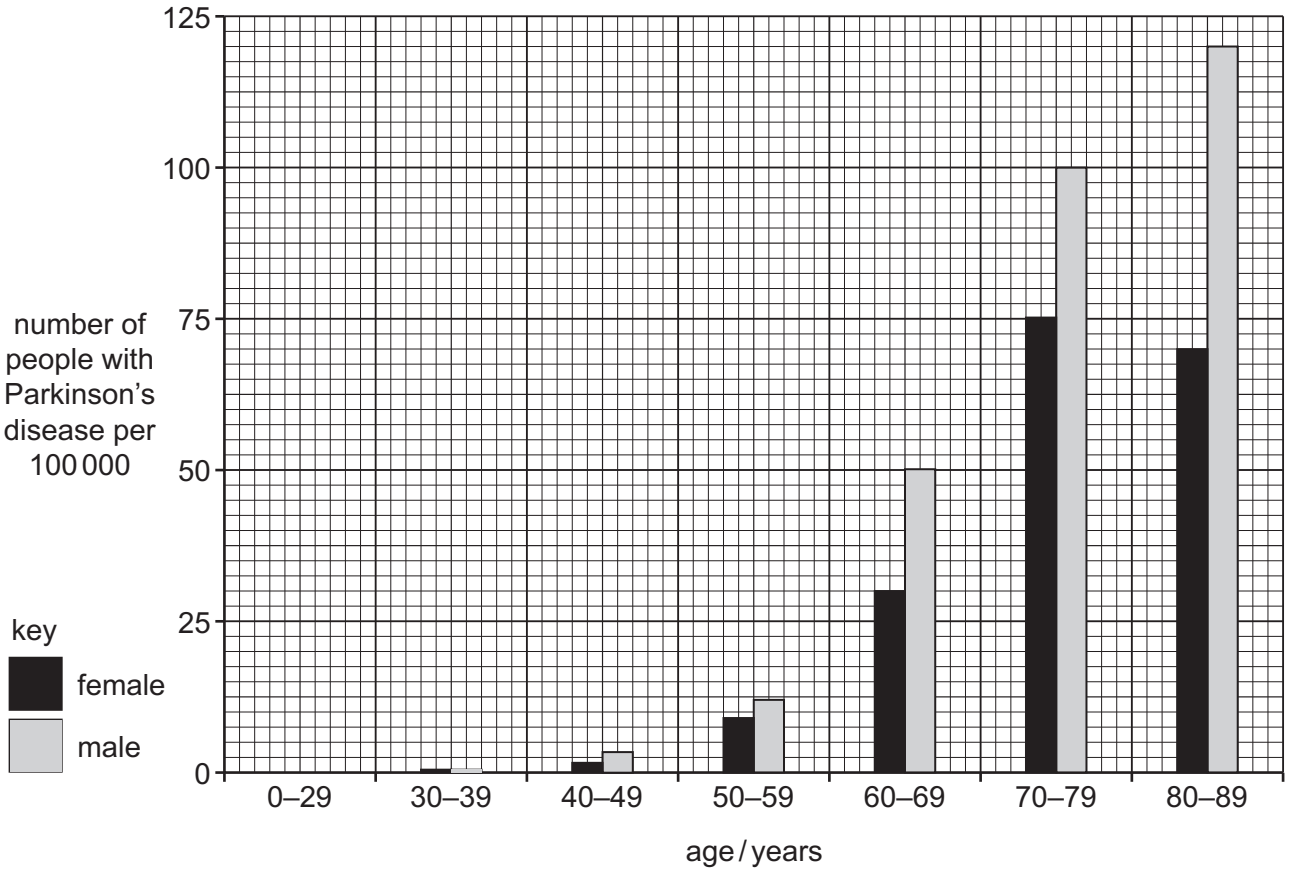

Fig. 2.1

(i) State what conclusions can be made from Fig. 2.1 about Parkinson's disease in the USA.

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(ii) A student suggested that the Spearman's rank correlation could be used to test the relationship between age and the occurrence of Parkinson's disease.

Give a reason why it is possible to use the Spearman's rank correlation to analyse the data shown in Fig. 2.1.

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(iii) State a null hypothesis for this test.

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(b) There is currently no cure for Parkinson's disease although a range of treatments can be used to relieve the symptoms. Drugs are given that are absorbed by brain cells and converted to dopamine. As the disease progresses, more brain cells die and so less of the drug is absorbed. As a result, the effectiveness of these drugs decreases.

Research into the use of neural stem cells (NSC) as a more effective treatment for Parkinson's disease is being carried out. One study was carried out to test the hypothesis that:

> The use of a Chinese herbal drug increases the differentiation of NSC into neurones that produce dopamine.

In this study, 48 healthy male rats of similar mass were randomly divided into four groups. Each rat was kept in a separate cage and supplied with food and water.

Fig. 2.2 shows the experimental design of the study.

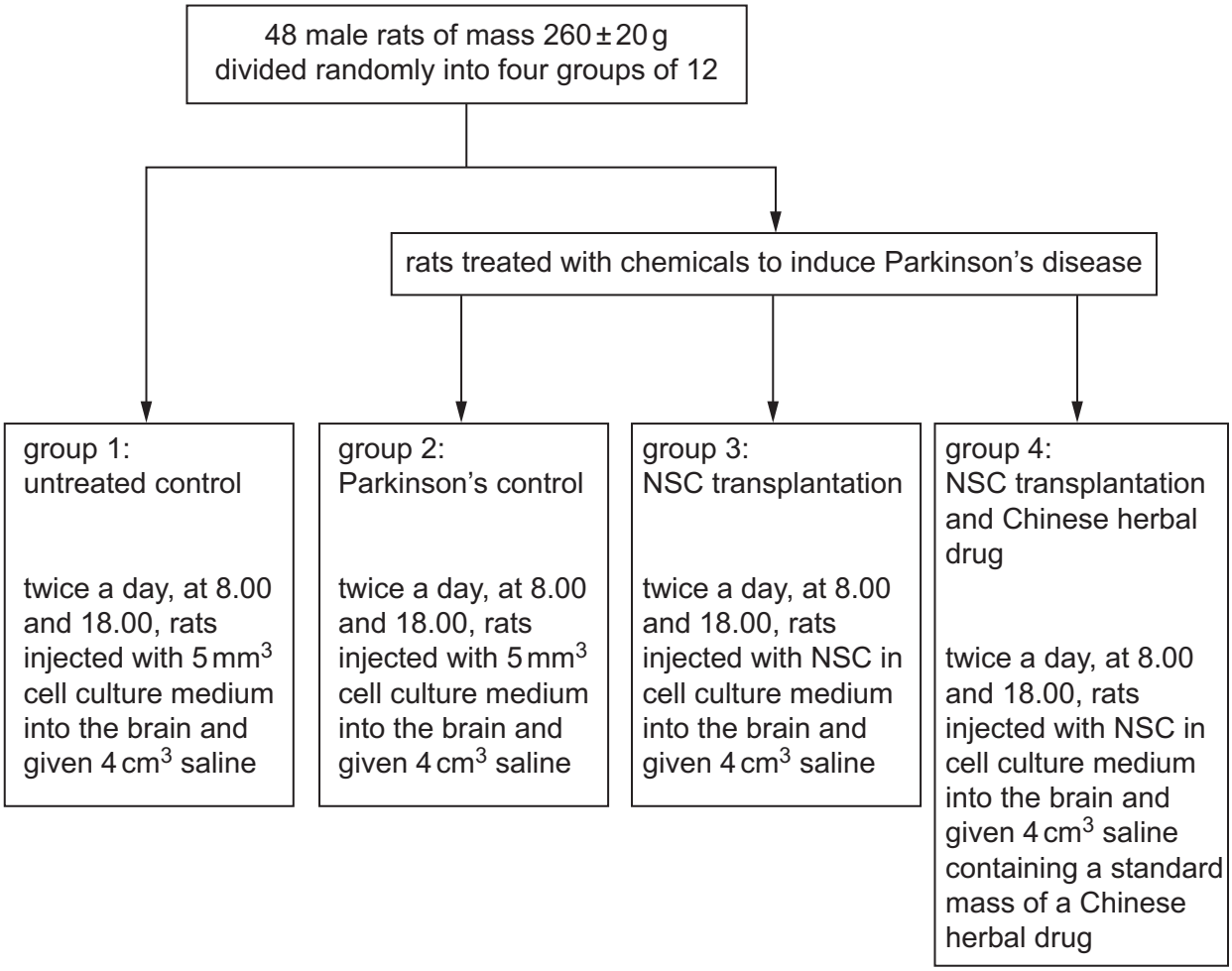

Fig. 2.2

(i) Identify **two** variables that have been standardised in this study.

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(ii) Suggest **one** variable that should have been standardised in this study but for which there is no information about how this was done.

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(c) At 7, 14 and 28 days after the start of the study, a sample of four rats from each group was tested to find the dopamine concentration in the brain.

The results are shown in Table 2.1.

Table 2.1

time after treatment / days	mean dopamine concentration ± standard deviation (*s*) / nmol per g of brain tissue			
	group 1: untreated control	group 2: Parkinson's control	group 3: NSC transplantation	group 4: NSC transplantation and Chinese herbal drug
7	59.8 ± 3.3	33.5 ± 5.1	50.2 ± 2.8	86.8 ± 4.7
14	60.0 ± 4.4	31.6 ± 7.6	49.9 ± 4.8	81.8 ± 27.1
28	60.1 ± 3.0	31.9 ± 3.7	39.5 ± 2.6	46.5 ± 1.1

State **two** advantages of calculating standard deviations (*s*) in studies of this type.

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(d) The researchers concluded that, in rats, the use of a Chinese herbal drug increases the differentiation of NSC into neurones that produce dopamine.

With reference to all the information about this study, give **one** piece of evidence that supports this conclusion and **one** piece of evidence that suggests this conclusion is not valid.

evidence that supports this conclusion .....

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evidence that suggests this conclusion is not valid .....

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[2]

[Total: 12]