GradeMax

Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Time 1 hour 20 minutes

Paper reference **WBI16/01**

Biology

International Advanced Level
UNIT 6: Practical Skills in Biology II

You must have:
Scientific calculator, ruler, HB pencil

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 learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Show all your working in calculations and include units where appropriate.**

Information

- The total mark for this paper is 50.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Answer ALL questions.

1 The photograph shows an aquatic plant, *Elodea canadensis*.



(Source: © Mikko Suonio/Alamy Stock Photo)

Magnification ×1

These plants were originally from North America but are now found in Europe, South America, Asia, Australasia and parts of Africa. They live in ponds, lakes and slow-flowing rivers.

If the stem of the plant is cut underwater, bubbles of oxygen gas are released from the cut end of the stem as the plant photosynthesises.

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(a) Describe an experiment to investigate the effect of different wavelengths of light on the rate of photosynthesis in *Elodea canadensis*.

(5)

(b) Explain how the features of the grana in a chloroplast enable photosynthesis to occur.

(3)

(Total for Question 1 = 8 marks)

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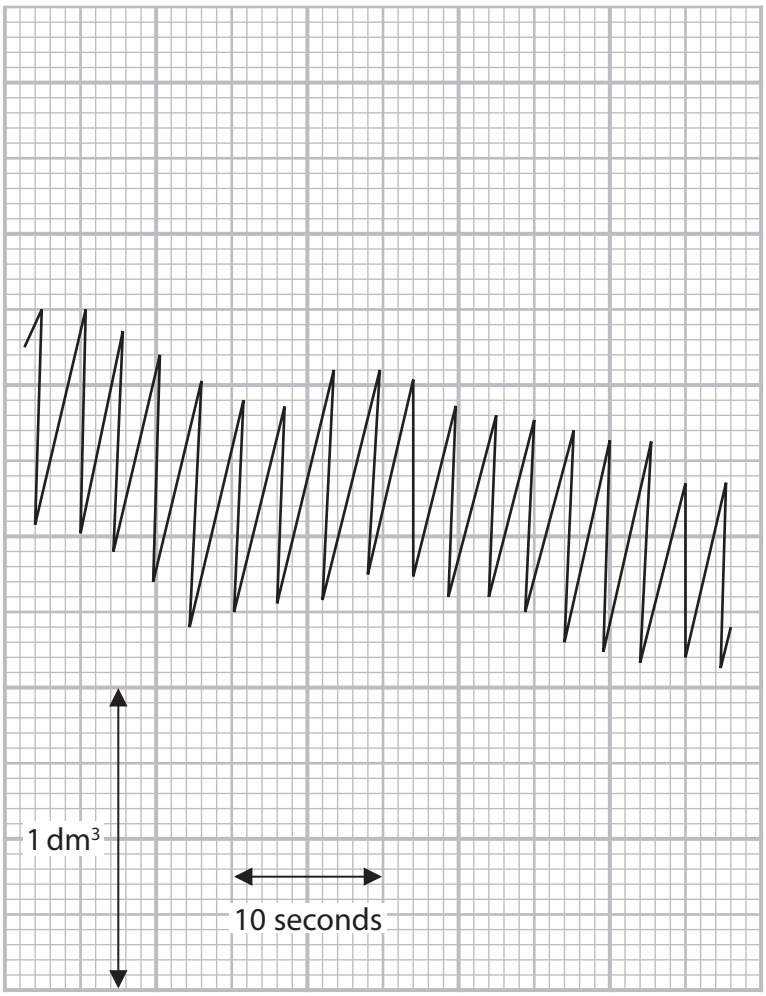
2 Information about depth and rate of breathing in humans can be obtained using a spirometer.

A student investigated the effect of exercise on breathing rate and respiratory minute ventilation.

The diagram shows a spirometer trace for a person resting quietly.



(a) (i) Calculate the mean breathing rate for this person.

(1)

..... breaths min^{-1}

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(ii) Estimate the mean respiratory minute ventilation for this person.

(2)

..... $dm^3\ min^{-1}$

(iii) During exercise, respiratory minute ventilation increases.

Explain why it is necessary for the respiratory minute ventilation to increase during exercise.

(2)

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(b) (i) State **one** abiotic and **one** biotic variable that could affect this investigation.

(2)

Abiotic variable

.....

Biotic variable

.....

(ii) Choose **one** of the variables you have identified in (b)(i).

Describe how this variable could be controlled and the effect it could have on the results if it is not controlled.

(2)

Variable .....

Describe how this variable is controlled.

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Describe the effect it could have on the results if it is not controlled.

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(Total for Question 2 = 9 marks)

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3 Marram grass, *Ammophila arenaria*, is a plant found on coastal sand dunes in Europe and North Africa.

The plant is well adapted for living on sand dunes. The leaves can grow to over one metre in length.

The photograph shows marram grass growing on sand dunes.



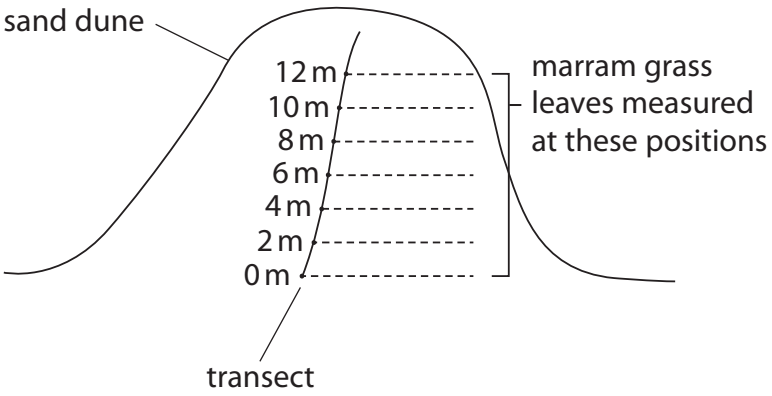
(Source: © Chris Millican)

A student observed that the leaves seemed to be longer in some parts of the dune than others.

A transect was set up from the base of the dune to the top of the dune.

At two-metre intervals along the transect, ten plants were selected.
One leaf from each plant was measured using a metre rule.

The diagram shows the transect on the sand dune.



(a) Identify one risk you might encounter when carrying out this investigation and how you could reduce this risk.

(2)

Risk

.....

.....

How to reduce this risk

.....

.....

.....

(b) The table shows the results of this investigation:

Position on dune / m	Length of leaf / cm										Mean length / cm
0	31	56	40	36	24	31	33	54	35	29	**37**
2	38	42	27	35	40	51	32	27	37	21	**35**
4	47	41	56	37	43	55	29	48	39	42	**44**
6	72	61	64	76	80	58	73	56	42	51	**63**
8	108	92	101	95	109	98	79	106	103	99	**99**
10	93	102	96	98	83	87	94	96	79	88	**92**
12	104	87	81	90	103	89	95	88	105	97	**94**

(i) State a suitable null hypothesis for this investigation.

(1)

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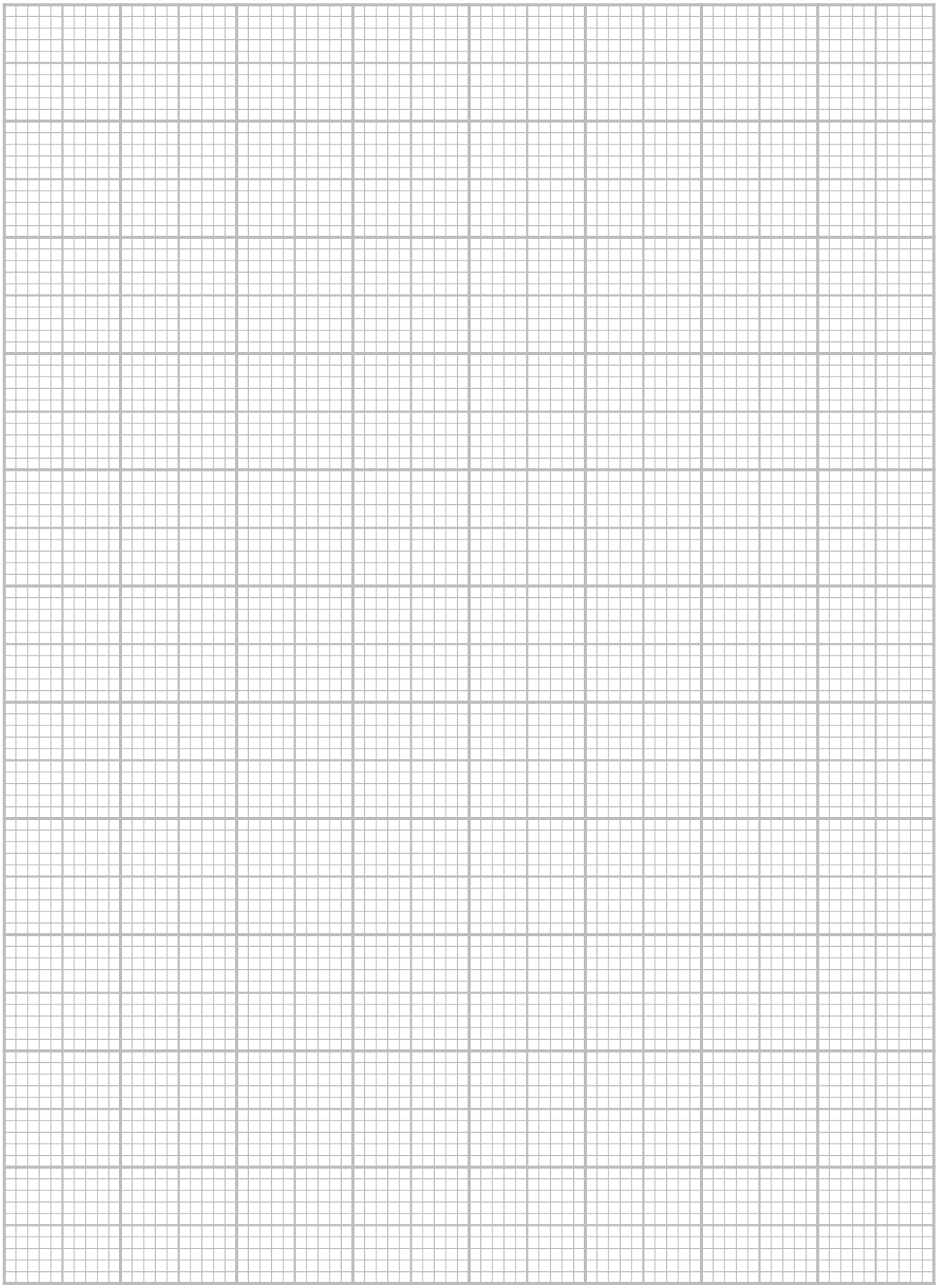
(ii) Plot a suitable graph to show the effect of position on dune on the mean length of marram grass.

(2)



(c) The student used a statistical test to analyse the data.

To calculate the correlation coefficient, the student produced this table.

Position on dune / m (a)	Mean length of marram grass / m (b)	Rank (a)	Rank (b)	d	d^2
0	0.37	1	2	–1	
2	0.35	2	1	1	
4	0.44	3	3	0	
6	0.63	4	4	0	
8	0.99	5	7	–2	
10	0.92	6	5	1	
12	0.94	7	6	1	

(i) Calculate the correlation coefficient, r_s, using the formula:

(2)

$$r_s = 1 - \frac{6\sum d^2}{n(n^2 - 1)}$$

Where:

$\sum$ = the sum of

d = the difference between each pair of ranks

n = the size of the sample (number of pairs of values)

Answer .....

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(ii) The table shows some critical values for this statistical test.

Number of pairs of values	Level of significance (p)		
	0.10	0.05	0.01
4	1.000	–	–
5	0.900	1.000	–
6	0.829	0.886	1.000
7	0.714	0.786	0.929
8	0.643	0.738	0.881
9	0.600	0.700	0.833
10	0.564	0.648	0.794

Explain the conclusion that can be drawn from this investigation.

Use your graph, your calculated r_s value and the table of critical values to support your answer.

(2)

(d) Describe **three** improvements that could be made to this investigation.

(3)

(e) (i) Suggest **one** abiotic factor that might cause the difference in length of the marram grass leaves at these positions on the dune.

(1)

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(ii) Describe how this factor could be measured to produce valid comparisons in this investigation.

(3)

(Total for Question 3 = 16 marks)

4 Fresh pineapple contains an enzyme called bromelain.

A student thought that fresh pineapple juice might affect the growth rate of bacteria.

The student formed the following hypothesis:

E. coli growing in liquid culture will have a slower growth rate if fresh pineapple juice is added to the liquid culture.

Bacteria can be grown in liquid culture using nutrient broth as the growth medium.

Plan an investigation to find evidence to support or reject this hypothesis.

(a) Describe preliminary practical work that you might undertake to ensure your proposed method would provide quantitative results.

(3)

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(b) Devise a detailed method, including how you would control and monitor important variables.

(8)

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(c) Describe how your results should be recorded, presented and analysed in order to draw conclusions from your investigation.

(3)

(d) Suggest **three** limitations of your proposed method.

(3)

(Total for Question 4 = 17 marks)

TOTAL FOR PAPER = 50 MARKS

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