Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Wednesday 11 June 2025

Morning (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 candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

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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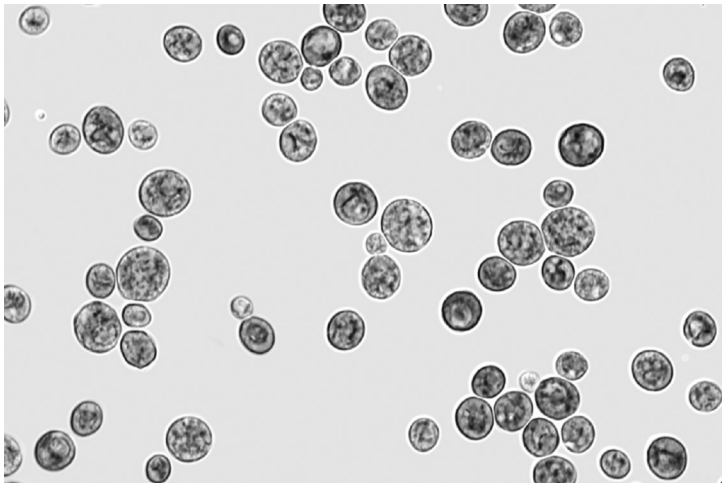
Answer ALL questions.

1 China produces more yeast than any other country. Yeast can be used to make bread rise.

The photograph shows yeast cells as seen using a light microscope.



(Source: © Herve Conge, ISM / Science Photo Library)

Yeast cells can break down a respiratory substrate and release carbon dioxide.

The rate of respiration can be investigated using an artificial hydrogen carrier (redox indicator).

(a) Name **one** artificial hydrogen carrier.

(1)

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(b) Describe an experiment to investigate the rate of respiration of yeast cells at different temperatures, using an artificial hydrogen carrier.

(6)

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(c) Describe how ATP and reduced co-enzyme are produced in anaerobic respiration.

(3)

(Total for Question 1 = 10 marks)

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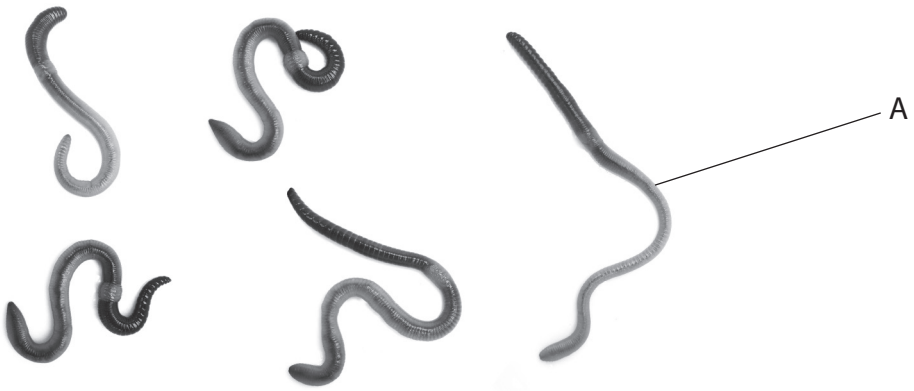
2 Soil contains many types of organisms such as earthworms.

(a) The photograph shows earthworms collected from the soil of a pineapple plantation in North East India.



(Source: © Wirestock, Inc. / Alamy Stock Photo)

The actual earthworm labelled A in the photograph is 13.5 cm long.

Estimate the magnification of this photograph.

(1)

Answer .....

(b) A scientist investigated the mass of earthworms present in the soil of a 5-year-old plantation and a 15-year-old plantation.

The method used in each plantation was:

- five sample sites were selected at random
- a block of soil with an area of 25 cm × 25 cm and to a depth of 10 cm was removed at each site
- the total mass of earthworms present in each block of soil was recorded.

(i) Describe a method to select at random the five sample sites.

(2)

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(ii) The tables show the results of this investigation.

5-year-old plantation	
Sample site	**Mass of earthworms / g**
1	12.3
2	14.7
3	15.2
4	10.8
5	11.1
mean	12.8
SD	2.0

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15-year-old plantation		
Sample site	**Mass of earthworms / g**	**$(X - \bar{X})^2$**
1	18.1	1.21
2	19.7	7.29
3	16.2	0.64
4	13.8	
5	17.1	0.01
mean	17.0	
$\sum$		

Calculate the standard deviation for the mass of earthworms present in the soil of the 15-year-old plantation.

(2)

Use the formula:

$$s = \sqrt{\frac{\sum(X - \bar{X})^2}{n - 1}}$$

Where:

n is the number of sample sites

X is the mass of earthworms from one sample site

$\bar{X}$ is the mean mass of earthworms

SD .....

(iii) Describe how the means and standard deviations could be used to compare the results from these two plantations.

(2)

(c) Some variables were measured during this investigation.

(i) State **two abiotic** variables, other than temperature, that could affect this investigation.

(2)

first variable

second variable

(ii) Choose **one** of the variables you have identified in part (c)(i). Describe how this variable can be controlled.

(1)

Variable

Method of control

(Total for Question 2 = 10 marks)

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3 The photograph shows crude oil leaking into a Middle Eastern desert.



(Source: © Xinhua / Alamy Stock Photo)

Scientists investigated the breakdown of crude oil in a laboratory.

Crude oil was added to trays of desert soil and stored at 30 °C.

Soil samples were taken from each tray every 30 days for 180 days.

The percentage of oil left in each soil tray was recorded.

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

(1)

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

Time from beginning of investigation / days	Mean percentage of crude oil left in the soil trays (%)
0	1.50
30	0.75
60	0.55
90	0.65
120	0.60
150	0.42
180	0.45

Draw a suitable graph for these results.

Include a line of best fit.

(3)

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(c) To calculate a correlation coefficient, the scientists produced this table.

Time from the beginning of the investigation / days (a)	Mean percentage of oil in soil tray (%) (b)	Rank (a)	Rank (b)	*d*	d^2
0	1.50	1	7	–6	
30	0.75	2	6	–4	
60	0.55	3	3	0	
90	0.65	4	5	–1	
120	0.60	5	4	1	
150	0.42	6	1	5	
180	0.45	7	2	5	

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

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

Where:

d = the difference between each pair of ranks

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

(2)

Answer .....

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

Number of pairs of values (n)	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

Deduce the conclusions that can be drawn from this investigation.

Use information from the table to support your answer.

(2)

(d) Bacteria in the desert soil can break down crude oil.

A scientist predicted that the number of bacteria in the desert soil would increase as the crude oil was broken down.

The scientist used the dilution plating technique to measure changes in the number of the bacteria.

Justify each step in the dilution plating method.

(6)

(Total for Question 3 = 14 marks)

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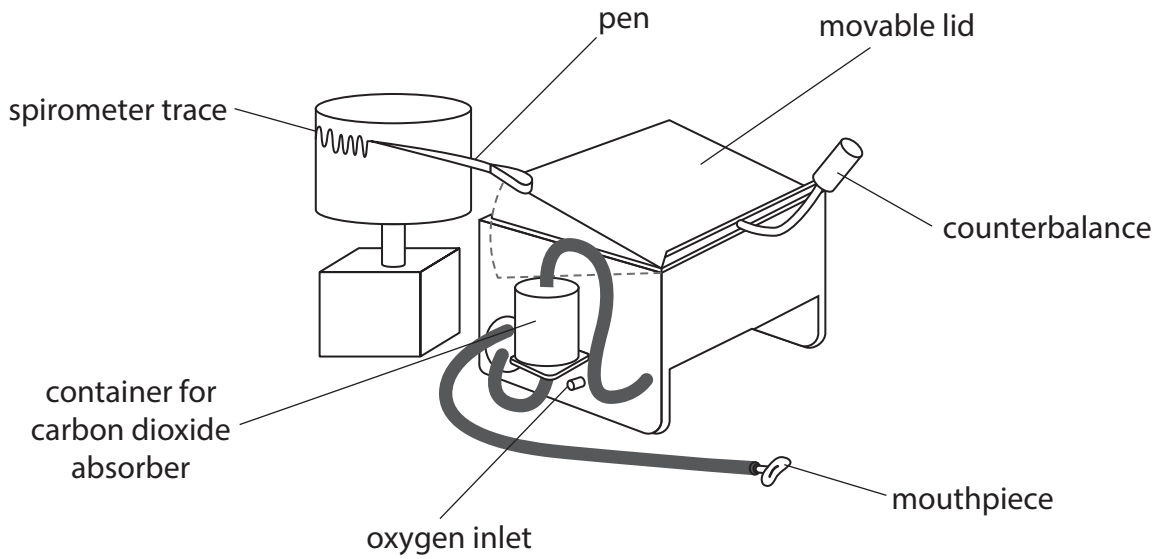
QUESTION 4 BEGINS ON THE NEXT PAGE

4 Fitness programmes affect the time it takes a person to recover after exercise.

The recovery rate is the time it takes for the breathing rate and tidal volume to return to their levels before exercise (resting rate).

A student observed that the recovery rate varied between students.

The diagram shows the apparatus used to investigate the recovery time of students after exercise.



The student formed the following hypothesis:

Students who have used a fitness programme have a shorter recovery time than those who have not used the programme.

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

(a) Describe **one** ethical concern and **one** safety precaution the student must consider before practical work can begin.

(2)

Ethical concern

Safety precaution

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

(9)

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

(3)

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(d) Describe **two** limitations of your proposed method.

(2)

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(Total for Question 4 = 16 marks)

TOTAL FOR PAPER = 50 MARKS

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