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Examiners' Report
June 2025

Int Advanced Level Biology WBI16 01

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June 2025

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Introduction

Question one asked candidates to consider the practical aspects of investigating the effect of temperature on the rate of respiration of yeast using their knowledge of a core practical.

Question two was based on a core practical, an ecological investigation. This question focused on some aspects of suitable methods and data handling.

Question three can be based around any biological context, in this case the breakdown of crude oil by bacteria. The key parts of the question were data presentation and analysis.

Question four is based on a core practical involving the use of a spirometer.

In general candidates showed knowledge of the core practical methods. Candidates clearly identified variables that needed to be controlled but their descriptions as to how the control could be achieved frequently lacked the precision required for this examination. However, most candidates did try to tailor their answers to the context of each investigation.

Question 1(a)b

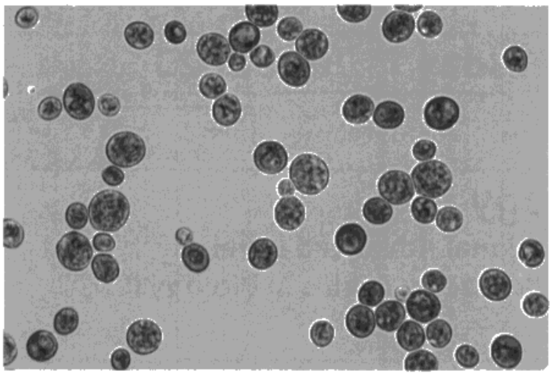
See below.

This question requires candidates to identify an appropriate artificial hydrogen acceptor. Candidates were then asked to describe a method to investigate the effect of temperature on the rate of respiration of yeast cells.

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)

TTC

2

P 7 8 7 4 1 A 0 2 2 4

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

(6)

- get yeast cells of same mass, age and place them in a test tube and control yeast volume e.g. 10cm³, water volume and glucose volume.
- ~~get~~ place 1cm³ of TTC in a test tube and leave them in a thermostatically controlled water bath to reach equilibrium.
- allow yeast cells to acclimatize.

~~- after 24 hours place TTC on yeast cells~~

- Place TTC on yeast cell and monitor time taken for TTC to change color from colorless to red using stopwatch.
- ~~can~~ repeat experiment with same temperature to get mean and calculate standard diviation
- repeat experiments with five other sets of temperature e.g. 0°C, 5°C, 10°C, 15°C, 20°C, 25°C.
- control PH using buffer solution and humidity using humidifier.
- to calculate rate of respiration ~~to~~ get time taken ~~to~~ for TTC to change colour then use $\frac{1}{\text{time taken}}$.

ResultsPlus
Examiner Comments

This answer identified TTC as a hydrogen acceptor. The described method was given in a logical order and gained maximum marks.

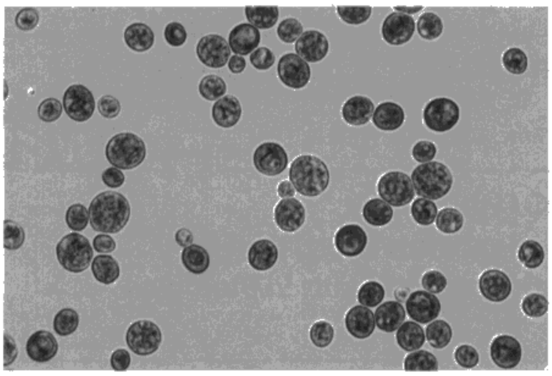
ResultsPlus
Examiner Tip

Candidates may use bullet points to help organise their answer.

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)

DCPIP solution

P 7 8 7 4 1 A 0 2 2 4

$O_2 \to CO_2$

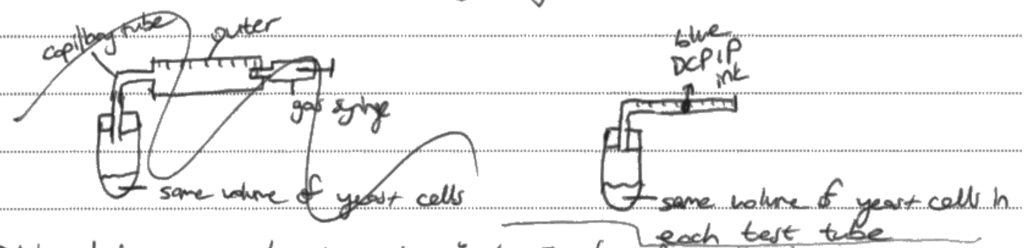
(b) Describe an experiment to investigate the rate of respiration of yeast cells at different temperatures, using an artificial hydrogen carrier.

(6)

Use 5 different temperatures: 15, 20, ~~20/38~~ 25, 30, 35°C

Control temperature by using thermostatically controlled waterbaths.

Keep pH constant by using buffer solution.



Add soda lime to absorb carbon dioxide so volume of gases do not mix

Place each test tube in waterbaths which are set at different temperatures. Leave yeast cells for some time for them to acclimatise to the temperature. Add same volume of glucose solution to test tubes and measure the distance moved by ink after a few minutes.

Repeat the whole experiment to calculate mean and standard deviation.

ResultsPlus
Examiner Comments

The use of DCPIP as a hydrogen acceptor was given credit. Much of this method described the use of inappropriate apparatus. Only two marks could be awarded.

ResultsPlus
Examiner Tip

Careful revision of the core practicals investigating respiration should have avoided these method errors.

Question 1(c)

See below.

Candidates were asked to describe how ATP and reduced co-enzyme are produced in anaerobic respiration.

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

(3)

① Reduced co-enzymes are produced in kreb's cycle.
② ATP is produced by ~~chemioso~~ chemiosmosis, hydrogen carriers pump hydrogen ions to inter membrane space, using the energy from electrons pass along electron transport chain.
③ Then the hydrogen ions diffuse back to matrix down concentration gradient through ATP synthase, and provide energy to produce ATP.

(Total for Question 1 = 10 marks)

4

P 7 8 7 4 1 A 0 4 2 4

ResultsPlus
Examiner Comments

This answer did not confine itself to anaerobic respiration. This error was not uncommon and examiners found it difficult to award marks.

ResultsPlus
Examiner Tip

Identify key terms in a question. In this case the term 'anaerobic' limited the scope of the description.

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

(3)

pyruvate acts as the final hydrogen and electron acceptor.

pyruvate ~~oxidises~~ ~~the~~ oxidises coenzymes NAD and FAD which

oxidises the ETC.

ATP is synthesised by the phosphorylation of ADP and Pi.

oxygen can no longer act as the final acceptor

(Total for Question 1 = 10 marks)

4

P 7 8 7 4 1 A 0 4 2 4

Examiner Comments

This example gains a mark for the formation of ATP. Unfortunately the inclusion of FAD was not correct.

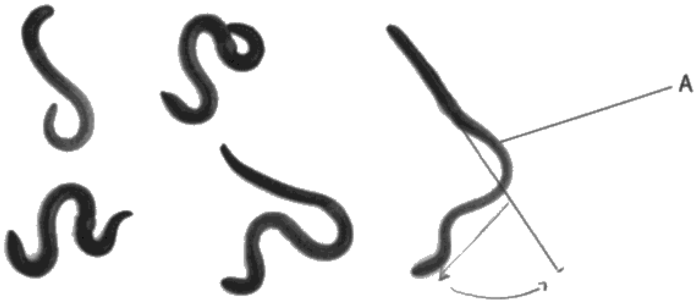
Question 2(a)

See below.

Candidates were asked to calculate the magnification of the image of an organism given its actual length.

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)

$$\frac{I}{A \mid M}$$

$$M = \frac{I}{A}$$

$$= \frac{5}{13.5}$$

$$= 0.37$$

$$= 0.40$$

Answer 0.37

5

Turn over ▶

P 7 8 7 4 1 A 0 5 2 4

ResultsPlus
Examiner Comments

Some candidates measured the length of worm A carefully and divided their measurement by actual length.

ResultsPlus
Examiner Tip

This example shows careful measurement and an appropriate answer.

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)

magnification $= \frac{13.5}{4.5} = 3$

Answer 3

ResultsPlus Examiner Comments

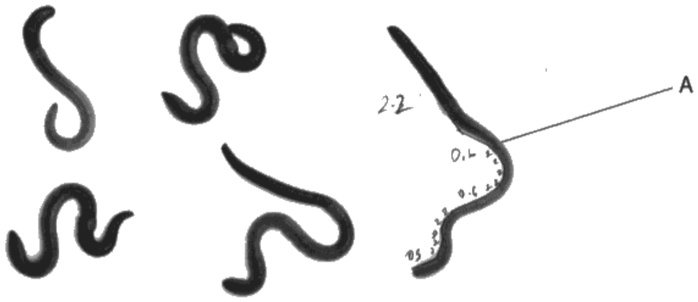
This example took a measurement from tip to tip which cannot give an appropriate answer.

ResultsPlus Examiner Tip

Careful reading of the question should prevent this type of error.

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)

$\frac{5.9}{13.5} = 0.437$

Answer 0.44

ResultsPlus
Examiner Comments

This is another example of careful measurement of the organism.

Question 2(b)i

See below.

(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)

Use a random number generator to find random cordinates. find the point in each site by drawing axes with units.

ResultsPlus
Examiner Comments

Candidates were asked to describe a method to select five sample sites by a random method. Answers that described producing a grid of a plantation and then a random method for selecting the co-ordinates of each sample site gained both marks. A significant number of candidates only gained credit for the second part of the answer.

ResultsPlus
Examiner Tip

Candidates should give consideration to the mark allocation for each question.

Question 2(b)ii

See below.

Candidates were asked to calculate the standard deviation for the samples from one of the plantations.

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	10.24
5	17.1	0.01
mean	17.0	3.88
Σ	84.9	19.39

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

$(13.8 - 17.0)^2 = 10.24$

$\frac{1.21 + 7.29 + 0.64 + 10.24 + 0.01}{5} = 3.878$

$S = \sqrt{\frac{19.39}{4}}$

$S = 2.2017 \approx 2.2$

SD 2.2

7

Turn over ▶

P 7 8 7 4 1 A 0 7 2 4

ResultsPlus
Examiner Comments

This is an example where the candidate used the formula correctly and found the correct answer. The majority of candidates completed the calculation correctly.

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	10.24
5	17.1	0.01
mean	17.0	4.0
Σ	~~x66.9889 187~~ 5.0	4.85

3.878

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

$$S = \sqrt{\frac{(4.85)}{5-1}}$$

$= 1.10$ // Ans.

SD 1.10

7

Turn over ▶

P 7 8 7 4 1 A 0 7 2 4

ResultsPlus
Examiner Comments

This example produced some correct working for the first marking point but then gave an incorrect value for the standard deviation.

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	10.24
5	17.1	0.01
mean	17.0	
Σ		19.39

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

$\sqrt{\frac{19.39}{5-1}} = 2.2017$

SD 2.2

7

Turn over ▶

ResultsPlus
Examiner Comments

This is an example of a completely correct calculation.

Question 2(b)iii

See below.

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

(2)

The means can be compared to see whether the 15 year old or 5 year old plantation has more worms. The 15 year old plantation has a higher mean hence more number of worms found there. The standard deviations can be used to decide if data is valid and significant. Using the SD we can find out if any data is overlapping which would reduce significance.

ResultsPlus
Examiner Comments

Candidates were asked to describe how the means and standard deviations could be used to compare the results from the two plantations. This answer covered both parts of the question.

ResultsPlus
Examiner Tip

Many candidates did not make any specific comment about the means that could be used, but just concentrated on the use of standard deviations.

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

(2)

The mean is the average of the mass of earthworms in each site, this will make it easier to compare ~~as~~ then the mass of earthworms in each site doesn't need to be compared 5 times. Standard deviations can tell us how valid the data we have obtained is, this way we can figure out, if the data is ~~not~~ reliable or not.

ResultsPlus
Examiner Comments

This answer described the use of the means; however the comment about the standard deviations did not give sufficient detail.

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

(2)

Means and standard deviations should be taken for both plantations and observed in a graph and see if they have a large standard deviations and if they overlap to determine if their data has significant difference between them.

ResultsPlus
Examiner Comments

This example gave a clear description of how to use the standard deviations.

Question 2(c)

See below.

plantation was lower so than the 15 year old plantation

(c) Some variables were measured during this investigation.

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

(2)

first variable

Soil pH

second variable

Soil mineral content

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

(1)

Variable

soil pH

Method of control

-inserting a pH probe into the soil and investigating sites from both plantations that have similar- or the same soil pH.

(Total for Question 2 = 10 marks)

ResultsPlus
Examiner Comments

Candidates nearly always stated abiotic variables and they were usually relevant to the investigation. In ecological investigations many variables can be measured as a form of control. This candidate realised that the sample sites should have similar pH values.

ResultsPlus
Examiner Tip

Make sure you know the difference between the terms 'abiotic' and 'biotic'.

(c) Some variables were measured during this investigation.

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

(2)

first variable

pH

second variable

moisture / humidity / water availability

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

(1)

Variable

water availability

Method of control

We could monitor it and if there would be differences then before the study begins we could use sprinklerers (hydration system) to make sure it is identical when study begins.

(Total for Question 2 = 10 marks)

ResultsPlus
Examiner Comments

The candidate gave two appropriate abiotic variables. However the comment on water content of the soil can only be applied to a laboratory investigation.

(c) Some variables were measured during this investigation.

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

(2)

first variable

pH

second variable

Soil moisture (water content in soil)

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

(1)

Variable

pH

Method of control

~~by to inserting a pH to probe to the soil~~ By using a buffer

(Total for Question 2 = 10 marks)

ResultsPlus
Examiner Comments

A significant number of candidates stated control pH using a buffer without thinking of the context of this investigation.

(c) Some variables were measured during this investigation. as * no overlap so sig. difference.

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

(2)

first variable

pH of the Soil

second variable and humidity

Water Content (moisture) & the Soil

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

(1)

Variable

pH

Method of control at Site

measuring the pH & the Soil and only taking mass of earthworms if the pH is Similar or Same. only take Sample if same.

(Total for Question 2 = 10 marks)

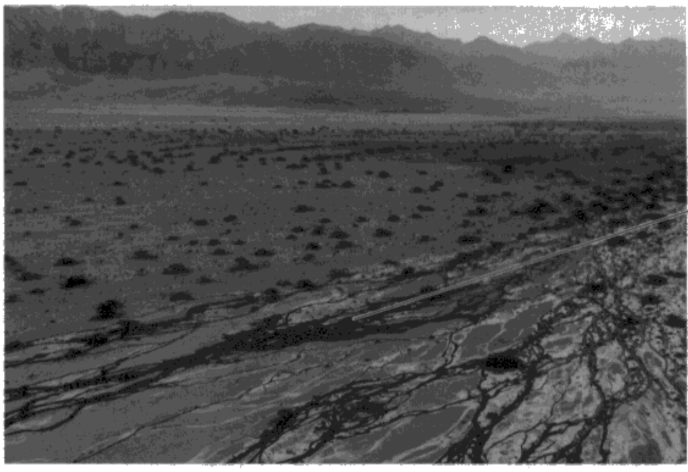
ResultsPlus
Examiner Comments

The examiners ignored humidity in the example; however, candidates should only give two answers.

Question 3(a)

See below.

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



crude oil

(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)

There is no significant correlation between the percentage of oil left in each soil tray and the time of crude oil addition to trays of desert soil

9

P 7 8 7 4 1 A 0 9 2 4

Turn over ▶

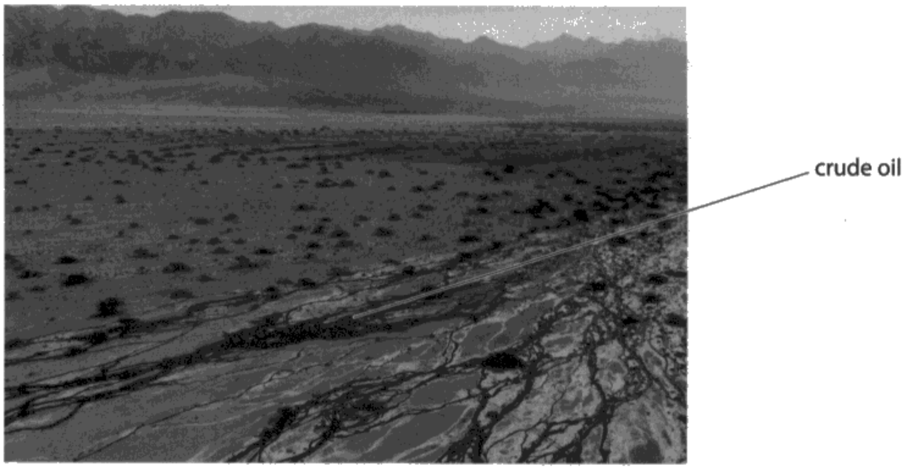
ResultsPlus
Examiner Comments

Candidates were asked to state a suitable null hypothesis.

ResultsPlus
Examiner Tip

In this question the examiners are looking for the idea that there will be no correlation between the percentage of oil remaining and the time the samples are left. Candidates may express this in different ways so long as the statement contains the three elements required as shown on the mark scheme.

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)

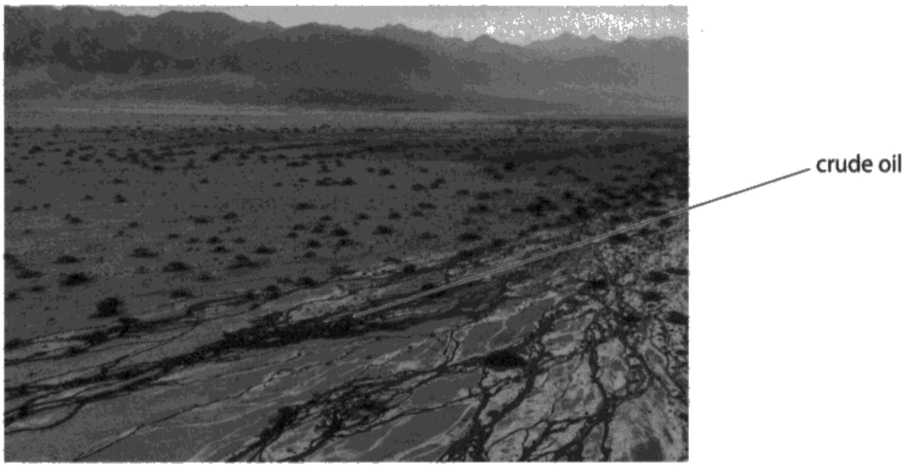
There is no significant correlation between time from beginning of investigation and mean percentage of crude oil left in soil trays.

ResultsPlus
Examiner Comments

A clearly stated answer.

See below.

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)

There is no significant ~~difference~~ correlation between the mean percentage of oil left in each soil tray.

9

Turn over ▶

P 7 8 7 4 1 A 0 9 2 4

ResultsPlus
Examiner Comments

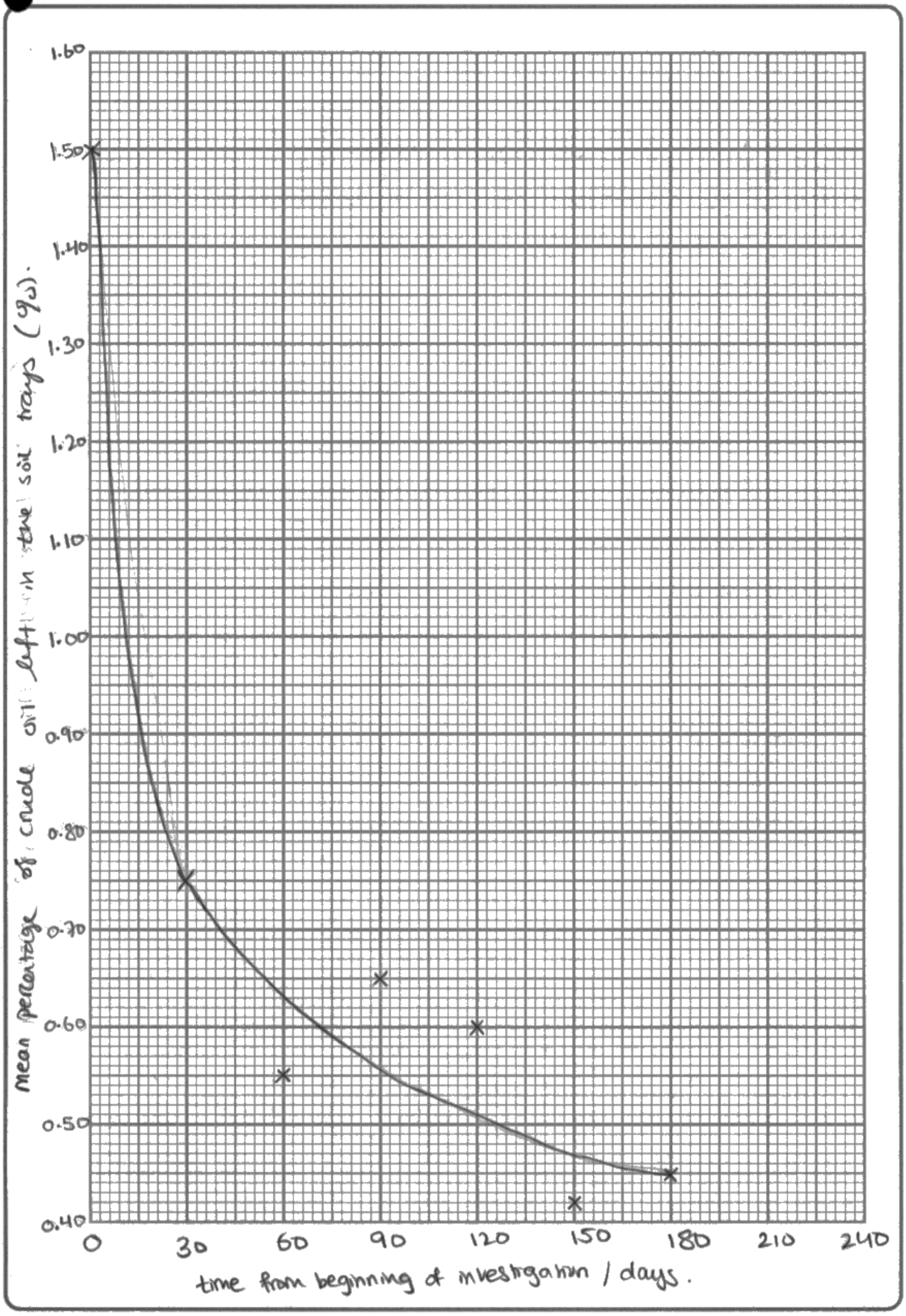
See below.

ResultsPlus
Examiner Tip

When stating a null hypothesis it must clearly cover both aspects of the investigation. This example did not mention the tray being left for different lengths of time.

Question 3(b)

See below.



11

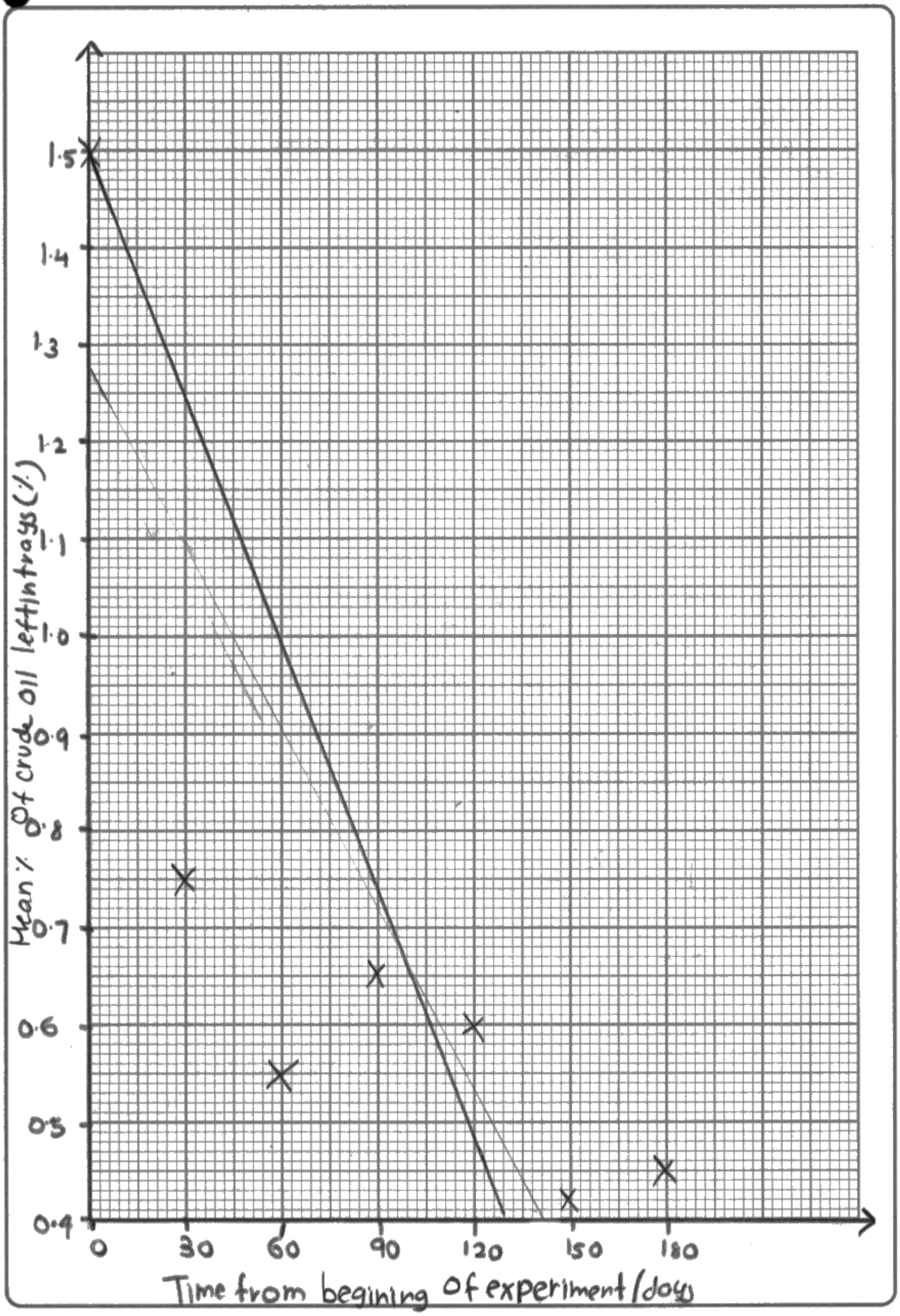
Turn over

ResultsPlus
Examiner Comments

Candidates were asked to plot the data as a graph and draw a line of best fit. A suitable straight line or a curve can be drawn as a line of best fit.

ResultsPlus
Examiner Tip

This example shows the candidate decided that a straight line was not going to be the best option. Here the curve shows the initial rapid decline and points either side of the curve.



11

Turn over ▶

P 7 8 7 4 1 A 0 1 1 2 4

ResultsPlus
Examiner Comments

This example shows a straight line that does not conform to a best fit. The line needed to start somewhere between 1.05 and 1.15 and end somewhere between 0.25 and 0.35.

ResultsPlus
Examiner Tip

Most candidates drew straight lines that either started at 1.50 or well below 1.0.

Question 3(c)i

See below.

See below.

(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	36
30	0.75	2	6	–4	16
60	0.55	3	3	0	0
90	0.65	4	5	–1	1
120	0.60	5	4	1	1
150	0.42	6	1	5	25
180	0.45	7	2	5	25

(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)

$r_s = \frac{1 - 6(104)}{7(48)}$

$= \frac{1-624}{336}$

$= \frac{-623}{336}$

$= -1.85$

Answer -1.85

12

P 7 8 7 4 1 A 0 1 2 2 4

ResultsPlus
Examiner Comments

Candidates were asked to complete the calculation for the correlation coefficient. The table was usually completed correctly and the data substituted in the formula to give the correct answer.

ResultsPlus
Examiner Tip

This example showed a negative correlation indicated by the minus sign. However the answer should have been either -1.857 or -1.86

(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	36
30	0.75	2	6	–4	16
60	0.55	3	3	0	0
90	0.65	4	5	–1	1
120	0.60	5	4	1	1
150	0.42	6	1	5	25
180	0.45	7	2	5	25.

(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)

$\Sigma d^2 = 36+16+0+1+1+25+25. = 104.$ **(2)**

$$r_s = 1 - \frac{6(104)}{7(49-1)}.$$

$$r_s = 1 - \frac{624.}{336.}$$

Answer -0.857

$r_s = -0.857.$

12

P 7 8 7 4 1 A 0 1 2 2 4

ResultsPlus
Examiner Comments

This example showed clear working to arrive at the correct answer.

ResultsPlus
Examiner Tip

Always show clear working as in this example. Examiners can usually give one mark for an intermediate step even if the answer is not quite correct.

(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	36
30	0.75	2	6	–4	16
60	0.55	3	3	0	0
90	0.65	4	5	–1	1
120	0.60	5	4	1	1
150	0.42	6	1	5	25
180	0.45	7	2	5	25

7

Σ 104

(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)

$\Sigma d^2 = 104$

$$1 - \frac{6 \times 104}{7(7^2-1)}$$

$$= -0.857$$

Answer − 0.86

12

P 7 8 7 4 1 A 0 1 2 2 4

ResultsPlus
Examiner Comments

A correct rounded example.

(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	36
30	0.75	2	6	–4	16
60	0.55	3	3	0	0
90	0.65	4	5	–1	1
120	0.60	5	4	1	1
150	0.42	6	1	5	25
180	0.45	7	2	5	25

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

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

$7 \times (49-1)$

7×48

Where:

d = the difference between each pair of ranks

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

(2)

$$r_s = 1 - \frac{6 \times 104}{7(7^2-1)}$$

$$1 - \frac{624}{336}$$

$$1 - 1.8571$$

$$= -0.85714$$

Answer ~~[illegible]~~ 0.857

Examiner Comments

See below.

Examiner Tip

Negative correlation values must have a minus sign to gain the second mark.

Question 3(c)ii

See below.

(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)

* critical value = 0.786
* 0.786 > 0.357, this means the null hypothesis is accepted.
* So there is no significant difference in mean percentage oil left in soil trays before and after 180 days

13

Turn over ▶

P 7 8 7 4 1 A 0 1 3 2 4

ResultsPlus
Examiner Comments

Candidates were asked to deduce conclusions from the investigation.

ResultsPlus
Examiner Tip

Calculated values from a correlation test always ignore the minus sign when the value is compared to the critical value. This example made the mistake of comparing a negative number. If the statement that followed was logical the second marking point could be awarded. However in this case the candidate referred to difference instead of correlation. So no marks could be given.

Question 3(d)

See below.

(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)

Extract the bacteria from the soil. ~~every 30 days~~. using a sterile inoculating loop. Add 1cm³ the bacteria in the first test tube and add 9 cm³ of water. Then, extract 1cm³ ~~this~~ ~~solut~~ mixture from the first test tube and add to the second test tube. Add 9 cm³ of water again to the second test tube. Repeat this process with other test tubes until bacteria colonies can be seen and counted.

Then, count the number of bacteria colonies and multiply with the dilution factor.

Repeat this every 30 days to measure changes.

Carry this experiment near bunsen burner so there is no contamination of other bacteria.

Use sterile equipments ; inoculating loop and test tube. Wear gloves throughout the experiment.

(Total for Question 3 = 14 marks)

14

P 7 8 7 4 1 A 0 1 4 2 4

ResultsPlus
Examiner Comments

Candidates were asked to describe the dilution plating technique. This is part of a core practical. Each step in the method needed to be justified.

ResultsPlus
Examiner Tip

Many candidates did not take enough notice of the command word 'justify'. A straightforward reason for each step as outlined in the mark scheme was required. This example went some way to providing justifications.

(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)

From a liquid culture, of the specific bacterium, $10cm^3$ of that culture are placed in chosen volume of liquid medium where the bacteria can keep growing. By using aseptic techniques like ~~a~~ working near a bunsen burner and ~~keeping the~~ flaming the necks of the conical flasks used to contain the bacteria, ~~the liquid bed medium is incubated at 25°C for 48hours, and~~ the now new culture medium is taken a sample of and a lawn is created on nutrient, sterile agar plate which is then incubated at 25°C for 48hours. While the plate is incubating the process is repeated using the newly diluted culture atleast 5 times. After all plates are incubated, the culture with distinct bacterial colonies - no clumping - will be used to determine the number of bacteria in the culture.

(Total for Question 3 = 14 marks)

ResultsPlus
Examiner Comments

See below.

ResultsPlus
Examiner Tip

This is a good example showing the candidate did understand the need to carry out some of the steps.

Question 4(a)

See below.

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

• Before ~~to~~ using the spirometer, students should be allowed to breath with just the mouthpiece to ~~mat~~ see if their comfortable with it or not.

• Informed consent should be obtained from the participants

Safety precaution

Using a new mouthpiece each time: Because ~~Since~~ it can cause infectections if the same mouthpiece is used over and over again with the students.

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Turn over ▶

P 7 8 7 4 1 A 0 1 7 2 4

ResultsPlus
Examiner Comments

Candidates were asked to describe one ethical concern and one safety precaution. This example did give a clear ethical concern, the need for participants to give consent. Nearly all candidates gave appropriate safety precautions.

ResultsPlus
Examiner Tip

Candidates have to identify a concern or risk and then go on to say how these can be mitigated.

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

The person should ~~be given breaks~~ volunteer willingly to partake, as exercise can have impact on body.

Safety precaution

Multiple people using same mouthpiece could ~~ka~~ risk infection.

ResultsPlus
Examiner Comments

This example identified the risk of infection but did not say how this risk could be reduced.

Question 4(b)

Question 4(c)

Question 4(d)

Paper Summary

Based on the information on this report, candidates are offered the following advice:

- Read the whole question before you start to answer, and check that your answer covers everything the question asks for.
- Make sure your answer relates to the specific context of the question.
- When studying Core Practicals, think about what the techniques might be used for and the types of scientific question they might help to answer.
- Carry out every Core Practical for yourself, so you understand how it works and any difficulties that might be encountered.
- If you are given the procedure for a practical technique, put yourself in the shoes of the person writing the procedure: how would they have worked out the details (such as volumes, concentrations, and times)? They will have used preliminary practical work.
- Consider the strengths and limitations of each Core Practical technique.
- Practice writing null hypotheses for experiments you carry out, even if you will not necessarily be applying a statistical test.

Grade boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link: https://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

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