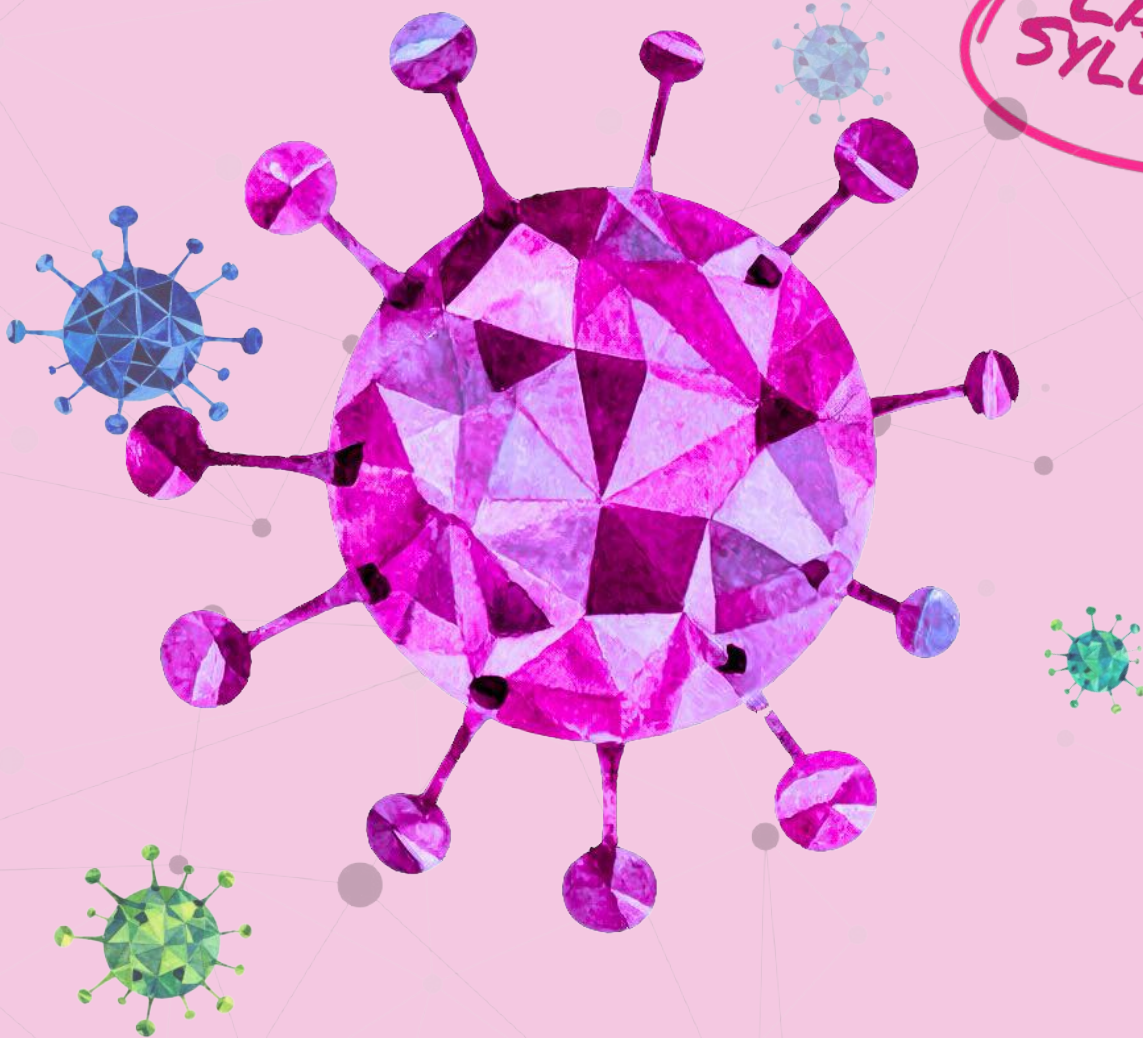


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Unit 6
Solved Past Papers



Edexcel IAL Biology

Unit 6 (WBI16/01) · Questions & Answers by Topic

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Transects & abundance

Edexcel IAL Biology - Solved Past Paper

January 2026 · Unit 6: Practical Skills in Biology II (WBI16/01) · Question 1

Sand-dune fieldwork - transects, abundance & xylem vs phloem

● hard ● medium ● easy

● 1

The photograph shows marram grass growing on a sand dune in Australia. Marram grass tolerates wind and salt. A student decided to investigate the distribution of marram grass from the sea to 200 m inland.



● 1 (a)

Identify · [2 marks]

Identify one risk that the student might encounter and describe how this risk could be reduced.

Model answer

✓ Risk: sunburn / heatstroke on the exposed dune (or wind blowing sand/salt into the eyes). ✓ Reduce it: wear sunscreen, a hat and suitable clothing (and eye protection against wind-blown sand).

Mark scheme 2 marks

✓ a suitable risk identified (1)

✓ a method of reducing the risk (1)

Accept: allergy to plant / sunburn / wind blowing sand in eyes / heatstroke / stings / bites / salt in eyes; qualified gloves

Examiner's insight

Give a fieldwork hazard on an exposed dune (sun, or wind-blown sand/salt) with a matching precaution.

● 1 (b)

Describe · [5 marks]

Describe an investigation to show the change in the distribution and abundance of these plants from the sea to 200 m inland. (any five)

Model answer

✓ Lay a line transect at 90° to the shoreline, running from the sea to 200 m inland. ✓ Place a quadrat of a defined size (e.g. up to 5 m²) at set, regular intervals along the transect, using a standardised placing method. ✓ At each quadrat, record the abundance of marram grass – count the number of plants or estimate the % cover (or use the ACFOR scale). ✓ Also measure/monitor one named abiotic variable along the transect – e.g. the pH or salinity of the sand, humidity, **temperature** or wind speed. ✓ Repeat with at least one more transect and take a mean, to make the data more reliable.

Mark scheme 5 marks · any five of:

- ✓ a (line) transect (1)
 - ✓ use of a quadrat (1)
 - ✓ a defined size of quadrat / transect at 90° to the shoreline (1)
 - ✓ a standardised method of placing the quadrat (at stated / regular intervals) (1)
 - ✓ {record / count the number of plants / % cover} in the quadrat (1)
 - ✓ {measure / monitor} one named abiotic variable (1)
 - ✓ repeat with at least one more transect (1)
- Accept:** quadrat up to 5 m²; the ACFOR scale; abiotic e.g. pH / salinity of sand / humidity / temperature / wind speed / time of year / aspect; repeat the experiment

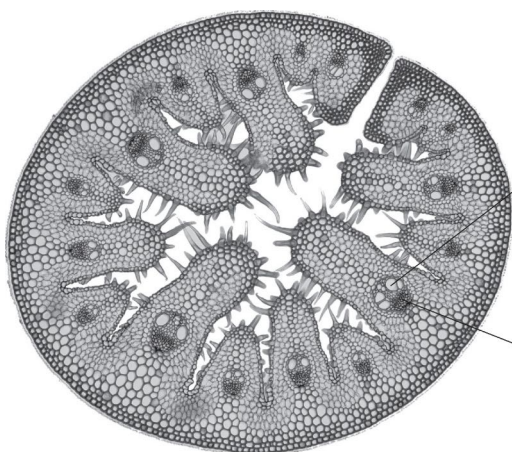
Examiner's insight

A belt/line transect at 90° to the sea, quadrats at set intervals recording abundance (count or % cover), monitor an abiotic factor, and repeat with another transect.

1 (c)

Describe · [4 marks]

The photograph shows a cross-section of a marram grass leaf (xylem vessel and phloem labelled). Describe the differences in the structures and functions of xylem vessels and phloem. (max three from structure or function)



Cross-section of a marram grass leaf (xylem vessel and phloem)

Model answer

✓ **Structure:** xylem has a larger lumen than phloem; xylem is hollow (dead, no cell contents) whereas phloem is made of living cells (with companion cells). ✓ **Structure:**

xylem has no end walls whereas phloem has sieve plates; xylem has lignified secondary thickening (giving support) whereas phloem does not. ✓ Function: xylem transports water and mineral ions (one-way, a passive process) whereas phloem transports organic molecules such as sucrose and amino acids (two-way, an active process).

Mark scheme 4 marks · max 3 from structure or function:

- ✓ xylem has a larger lumen than phloem (1)
- ✓ xylem is {hollow / dead} whereas phloem has living / companion cells (1)
- ✓ xylem has no end walls whereas phloem has sieve plates (1)
- ✓ xylem is {lignified / has secondary thickening} whereas phloem is not (1)
- ✓ xylem transports water/minerals; phloem transports organic molecules (1)
- ✓ xylem transport is one-way whereas phloem is two-way (1)
- ✓ xylem contributes to support but phloem does not; xylem transport is passive but phloem active (1)

Accept: ORA (or reverse argument); secondary cell wall; sucrose / amino acids; cytoplasmic streaming / active transport

Ignore: pits; transpiration / translocation

Examiner's insight

Contrast them point-by-point - xylem: wide, hollow, dead, lignified, one-way, passive, carries water; phloem: living, sieve plates, no lignin, two-way, active, carries sugars.

Revise from your notes

- Abundance & distribution of species / using quadrats and transects: 7.1 · 7.3
-

1 Seeds contain a plant embryo and a food supply. Cell growth in the seeds will begin when the temperature and moisture conditions are favourable. During cell growth, enzymes break down the stored food supply and ATP is generated by respiration.

(a) Describe an experiment to investigate the effect of temperature (the independent variable) on the rate of respiration in seeds.

(5)

Obtain 50 seeds from the same plant that were stored in the same conditions

Place 10 seeds on a wet cotton in a respirometer

Also put 10 g of soda lime in the bottom of the test tube to absorb CO₂

Use an identical tube that contains boiled seeds as a control

Place the apparatus in a thermostatically controlled water bath set at 20 °C

Allow the apparatus for 10 min to equilibrate

Measure the distance travelled by the coloured liquid in the respirometer in 5 min

Using the syringe in the respirometer, repeat the measurement for 5 times and calculate the average respiration rate (vol of oxygen consumed per min)

Repeat the entire experiment at temperatures 10, 30, 40 and 50 °C

(b) (i) State **two** variables, other than temperature, which could affect the investigation.

(2)

Age of seeds

pH

volume of water

mass of soda lime

- 1 Lemurs are primates found on the island of Madagascar. At least 33 different species of lemur are living on the island today. Scientists would like to know how closely related the different species of lemur are.

In one study, the scientists collected tissue samples from several individuals of each species. For each sample, they examined the DNA sequences of five different genes.

The polymerase chain reaction (PCR) was used to amplify the DNA in the samples.

- (a) Describe how to amplify a strand of DNA using the polymerase chain reaction (PCR).

(5)

A blood sample is first collected from the animal

DNA is then extracted from the white blood cells

DNA polymerase, deoxynucleotides, primers are mixed in a buffer solution and then loaded in the PCR machine

High temperature (about 90 °C) breaks the H-bonds in DNA for about 1 min

The temperature then drops to about 40 °C which allows primers to bind

The temperature is then risen to 70 °C which allows DNA replication to take place

The cycle is then repeated for about 25 times to allow the production of enough number of DNA molecules

✓ State the dependent variable – the **length** (increase in **length**) of the shoot after a stated time. ✓ Plant the same (stated) number of seeds of the same **age** and source in each pot. ✓ Use at least two (ideally five) stated temperatures across the range 20–35 °C, set in the greenhouse. ✓ Use a standardised method of watering (same volume, same timing). ✓ Describe how the shoot is measured – e.g. measure from the soil to the shoot tip with a ruler at set intervals. ✓ Calculate the rate of growth = increase in shoot **length** ÷ time. ✓ Identify two other variables to control – e.g. the light intensity and the volume/type of soil (compost). ✓ Describe how one is controlled – e.g. give all pots the same light (a lamp of set wattage / same position). ✓ Repeat at each **temperature** (several pots) and calculate a mean and SD.

Mark scheme 9 marks · nine of:

- ✓ clear statement of the dependent variable (length of shoot after a stated time) (1)
- ✓ a {same / stated} number/age/source of seeds (1)
- ✓ (at least two) temperatures stated (20–35 °C) (1)
- ✓ a standardised method of watering (1)
- ✓ a description of the shoot-measuring technique (1)
- ✓ a method of calculating the rate (of growth) (1)
- ✓ two variables that need to be controlled (1)
- ✓ a method of control of one variable (1)
- ✓ repeats to give a mean and SD (at each temperature) (1)
- Accept:** per unit time; same volume/timing of watering; carbon dioxide in excess; measure variability of data
- Ignore:** root/leaf/mass/seedling for the DV; pH and buffer

Examiner's insight

Measure the SHOOT length over time at several set temperatures (20–35 °C), standardise the seeds and watering, control light and soil, and repeat for a mean rate and SD.

4 (c)

Describe · [3 marks]

Describe how the results you would collect can be recorded, presented and analysed in order to draw conclusions from your investigation.

Model answer

✓ Record the raw data (shoot lengths) in a table with headings and units, with means calculated from the repeats at each **temperature**. ✓ If several temperatures are used, present a line graph of mean growth rate against **temperature** and analyse it with a **correlation** test. ✓ (If only two temperatures were compared, present a bar graph and use a t-test for a difference.)

Mark scheme 3 marks

- ✓ a table for the raw data with headings and units, and means from repeats (1)
 - ✓ a line graph (several temperatures) with a correlation test, OR a bar graph (two temperatures) with a t-test (1)
 - ✓ use of the appropriate statistical test for the graph chosen (1)
- Accept:** a description of the mean in text or a graph label; a bar graph (not a histogram) + a t-test for two treatments

Examiner's insight

Match the graph and test to the design - a range of temperatures -> line graph + correlation test; two temperatures -> bar chart + t-test.

4 (d)

Suggest · [2 marks]

Suggest two limitations of your proposed method. (any two)

Model answer

✓ It is difficult to control one aspect of the seeds - e.g. their **age**, source, storage, viability or **genetic variation** - which also affects growth. ✓ It is difficult to control other named variables (e.g. humidity, light or pests), and hard to measure the shoot accurately if it is bent or the starting point is unclear.

Mark scheme 2 marks · any two of:

- ✓ difficult to control one aspect of the seed (1)
 - ✓ difficult to control a named variable (1)
 - ✓ a reason given for the difficulty in measuring the shoot (1)
- Accept:** source / storage conditions / age / disease / genetic variation / viability of the seed; control of humidity / light / pests; the shoot is curved/bent, or it is hard to judge where the shoot starts

Examiner's insight

Give specific difficulties - uncontrolled seed properties (age/viability/genetics), other hard-to-control conditions (light, pests), or a bent shoot that is hard to measure.

Revise from your notes

- Investigating the effect of temperature / plant growth: 11.2
-

- 1 The photograph below shows an adult male frilled lizard (*Chlamydosaurus kingii*).



Magnification $\times 0.1$

Male frilled lizards display their frill to attract females. A successful male may mate with many females.

The female lays fertilised eggs in a nest on the ground and lightly covers them with soil.

Young lizards hatch from the eggs after an incubation period of approximately two months.

The temperature of the nest is usually between 20 °C and 40 °C.

- (a) In many species of lizard, the gender (sex) of the offspring is influenced by the temperature at which the eggs are incubated.

Describe an experiment that could be carried out to investigate the effect of temperature on the gender of the frilled lizard offspring.

You should include details of how **two** relevant variables are controlled.

(5)

Obtain 50 eggs from the same female

Place 5 eggs in soil inside an incubator at 20 °C for two months

And then then determine the gender of the offspring

Repeat the experiment temperature of 10, 30, 40 and 50 °C

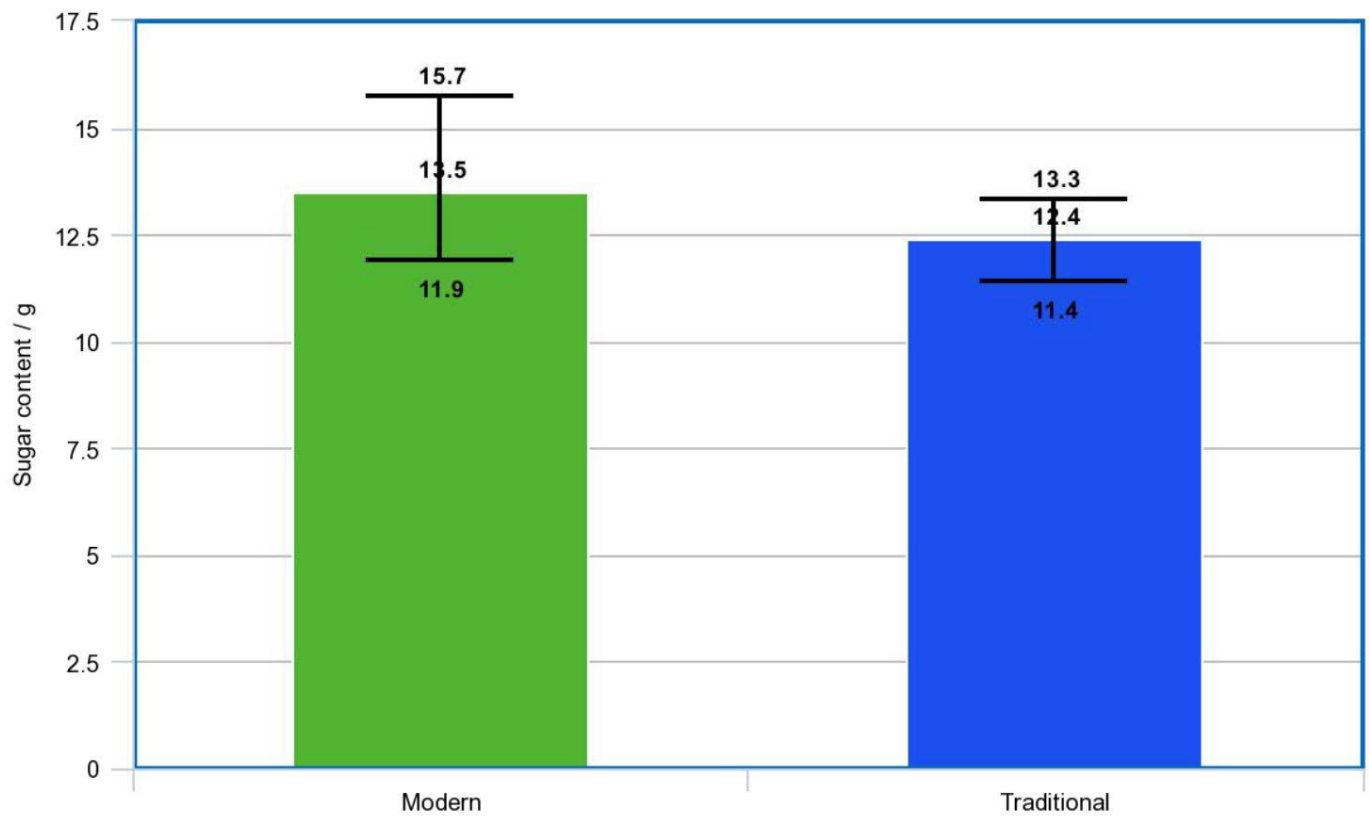
Ensure that the oxygen and humidity levels in the incubator are identical in each case

Also make sure that the mass and pH of the soil is the same at every temperature

Repeat the experiment at each temperature and calculate the mean

(c) On the graph paper below, draw a suitable graph to show the mean sugar content of modern apples and traditional apples. Include an indication of the variability of the data.

(3)



Examiner's insight

Candidates who engaged with the context scored well. 'Practising the method' earned nothing unless a specific purpose (a range, a time, a temperature) was given.

4 (b)

Devise · [8 marks]

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

Model answer

✓ State the dependent variable clearly - e.g. the size of the clear area produced (a measure of amylase produced). ✓ Use aseptic technique - rinse the endosperm in sodium hypochlorite / sterile water (disinfect the grain and apparatus). ✓ Soak the endosperm in a set ABA concentration, then place it on **starch** agar. ✓ Incubate for a stated time (24-72 hours). ✓ Determine the clear area - trace its total area, or take several diameter measurements (or use a colorimeter to measure transmission if a **starch-in-tube** method is used). ✓ Identify one variable to control and say how - e.g. **temperature**, in an incubator at a set value. ✓ Identify a second variable to control and say how - e.g. pH with a buffer, or the **mass/age** of the grains. ✓ Test at least five different ABA concentrations, and repeat at each concentration (or repeat the whole experiment) and take a mean.

Mark scheme 8 marks · eight of:

- ✓ clear statement of the dependent variable (e.g. size of clear area) (1)
- ✓ some description of aseptic technique (e.g. rinse endosperm in sodium hypochlorite / sterile water) (1)
- ✓ soak the endosperm with ABA and place on starch agar (1)
- ✓ stated time for incubation, 24-72 h (1)
- ✓ method of determining clear area (trace total area, or take diameter measurements) (1)
- ✓ identify one variable to be controlled and describe how (1)
- ✓ identify a second variable to be controlled and describe how (1)
- ✓ repeats at each ABA concentration (or repeat the whole experiment) (1)
- ✓ test at 5 different concentrations of ABA (1)

Accept: absorbance / transmission using a colorimeter; disinfect wheat or apparatus (not the bench); place endosperm in a tube of starch solution; control pH / temperature / humidity / light / species / age / mass of seed

Examiner's insight

Methods were logical and many scored full marks. Marks were lost on precision - say EXACTLY how each variable is controlled and give a concentration range and repeats.

4 (c)

Describe · [3 marks]

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

Model answer

✓ Record the raw data in a table with clear headings and units, and calculate a mean from the repeats at each ABA concentration. ✓ Present the means as a line graph (or scatter graph) of clear area against ABA concentration, with both axes labelled. ✓ Analyse the relationship with an appropriate **correlation** test (e.g. Spearman's rank or Pearson's).

Mark scheme 3 marks

- ✓ raw data table with headings and means calculated from repeats (1)
 - ✓ line graph format with labelled axes (1)
 - ✓ use of an appropriate statistical (correlation) test (1)
- Accept:** any header with units (even if incorrect); a scatter graph; a named correlation test
Do not accept: units in the body of the table

Examiner's insight

Tables and labelled graphs were done well. The mark most often missed was naming a suitable CORRELATION test rather than, say, a t-test.

● **4 (d)**

Suggest · [2 marks]

Suggest two limitations of your proposed method. (any two)

Model answer

✓ It is difficult to measure small clear areas accurately (or to judge the end point / read the colorimeter). ✓ It is difficult to maintain fully aseptic conditions, so the agar or seeds may become contaminated with bacteria. ✓ Growth regulators / chemicals already in the seed (or **genetic variation** between seeds) may affect amylase production.

Mark scheme 2 marks · any two of:

- ✓ difficult to measure small clear areas (1)
 - ✓ difficult to maintain aseptic conditions (1)
 - ✓ {growth regulators / chemicals} in the seed may affect amylase production (1)
- Accept:** difficulty using the colorimeter or judging an end point; seeds / agar contaminated with bacteria; genetic variation in seeds affects amylase production / endosperm size

Examiner's insight

Most gave at least one limitation - a specific difficulty (measuring small areas, maintaining sterility) scored better than a vague 'human error'.

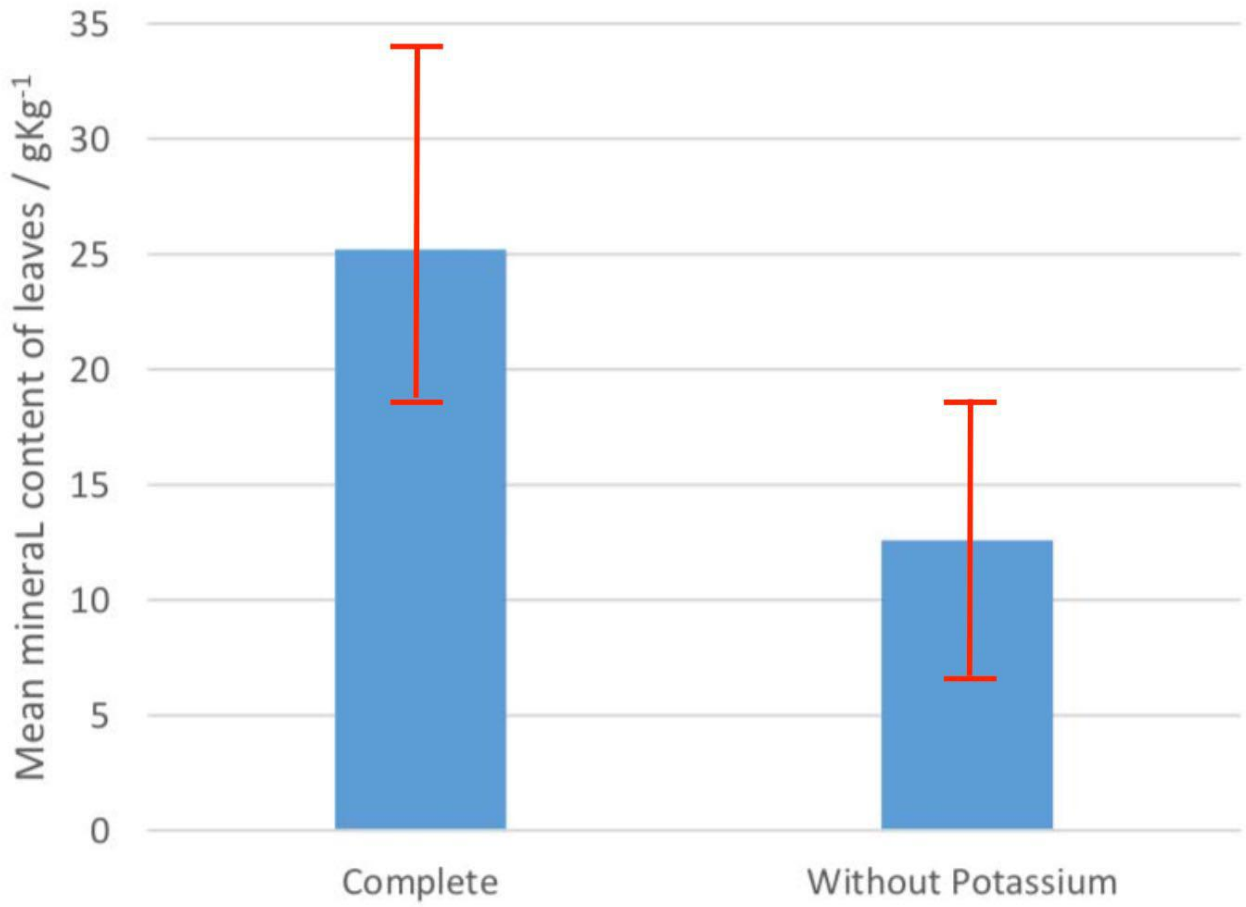
Revise from your notes

- Investigating amylase production in cereal grains: 21.5
-

- (c) On the graph paper below, draw a graph to show the mean mineral content for each set of results.

Include an indication of the variability of the data.

(3)



Edexcel IAL Biology - Solved Past Paper

June 2023 · Unit 6: Practical Skills in Biology II (WBI16/01) · Question 4

Planning an investigation - antibacterial activity of Piper betle leaves

● hard ● medium ● easy

● 4

The photograph shows leaves of Piper betle, eaten as a traditional cure for digestive disorders and thought to prevent the growth of some bacteria. A student's hypothesis: the leaves of Piper betle contain antibacterial compounds that reduce bacterial growth. Plan an investigation to test this hypothesis.



● 4 (a)

Describe · [2 marks]

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

Model answer

✓ Find a suitable **mass/age** of leaves, a suitable concentration of the leaf extract and a method of extracting it. ✓ Find a suitable **temperature** / pH / medium / incubation time and **species** of bacteria to use. ✓ Find a suitable way to measure the antibacterial effect (e.g. the size of the zone of inhibition).

Mark scheme 2 marks · any two of:

- ✓ find a suitable {mass / age of leaves / concentration of extract / method of extraction} (1)
- ✓ find a suitable {temperature / pH / medium / time / species of bacteria} (1)
- ✓ find a suitable method to measure the {inhibition / antibacterial effect} (1)

Accept: a method that provides quantitative results

Examiner's insight

Trial the things that make the results measurable - the extract concentration, the bacterium and conditions, and how to measure the zone of inhibition.

● 4 (b)

Devise · [9 marks]

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

Model answer

- ✓ State the dependent variable - the diameter of the zone of inhibition (clear zone) around the extract.
- ✓ Prepare the leaf extract (e.g. grind the leaves and make a known concentration).
- ✓ Prepare a bacterial lawn on an agar plate (spread/pour plate of the chosen bacterium).
- ✓ Apply the extract in a standard way - e.g. soaked discs / wells / a drop - using aseptic technique throughout (flame the loop, work near a Bunsen).
- ✓ Include a control (e.g. a disc with solvent only) for comparison.
- ✓ Incubate at a stated **temperature** (not above $\sim 30^{\circ}\text{C}$) for a set time.
- ✓ Measure the dependent variable in detail - the zone diameter with a ruler/grid, in several orientations, and calculate its area.
- ✓ Identify two variables to control (e.g. incubation **temperature/time**, disc size, volume/concentration of extract, **species** of bacteria) and describe how one is controlled.
- ✓ Repeat the whole experiment to calculate a mean and SD (error bars).

Mark scheme 9 marks · nine of:

- ✓ clear statement of the dependent variable (zone of inhibition) (1)
 - ✓ a method of preparing the extract (1)
 - ✓ a method of preparing a bacterial lawn / broth / pour plate (1)
 - ✓ a method of applying the extract (wells / discs / drops) (1)
 - ✓ detail of measuring the dependent variable (ruler / grid / orientations) (1)
 - ✓ a description of aseptic technique (1)
 - ✓ use of a control for comparison (1)
 - ✓ incubate at a stated temperature (not above $\sim 30^{\circ}\text{C}$) (1)
 - ✓ two variables to be controlled, and a method of controlling one (1)
 - ✓ repeat the whole experiment to calculate a mean and SD / error bars (1)
- Accept:** wells / discs / drop in broth / serial dilution; ruler / grid / different orientations; control variables e.g. temperature / pH / incubation time / disc size / medium / species / mass of leaves

Examiner's insight

A classic zone-of-inhibition plan - extract on a bacterial lawn (aseptically), a solvent control, incubate $\leq 30^{\circ}\text{C}$, measure the clear-zone diameter carefully, control variables and repeat for a mean and SD.

4 (c)

Describe · [3 marks]

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

Model answer

- ✓ Record the zone diameters in a table with headings and units, with means calculated from the repeats.
- ✓ Present the means as a bar graph (or a line graph if several extract concentrations are used), with labelled axes.
- ✓ Analyse the data with an appropriate statistical test - a test for a difference if comparing extract vs control, or a **correlation**

- (d) The student carried out a Mann-Whitney U test to analyse the data. This statistical test determines if the data obtained for insecticide **A** and for insecticide **B** are significantly different.

The calculation for this test produced a result of $U = 21$.

For the difference between the two insecticides to be significant, this U value has to be equal to, or smaller than, the critical value ($U \leq \text{critical value}$).

The table shows the critical values for the Mann-Whitney U test at $p = 0.05$, for four different sample sizes of insecticide **A** and insecticide **B**.

Sample size for insecticide A	Sample size for insecticide B			
	9	11	13	15
9	17	23	28	34
11	23	30	37	44
13	20	28	37	45
15	24	34	44	54

What conclusions can be drawn from this investigation?

Use information from the table and your graph to explain your answer.

(4)

The calculated value 21 is less than the critical value 37

therefore we'll have to reject the null hypothesis

So there is a significant difference between insecticide A and insecticide B

and this difference is not due to chance

- (e) Suggest why the conclusions from this investigation may not be valid.

(3)

Other factors such as the concentration of the insecticide might not have been considered

In addition, the sample size being too small might reduce the validity of this investigation

Lastly, error bars from both insecticides are overlapping

(Total for Question 2 = 16 marks)

- (d) A Mann-Whitney U test was used to analyse the data. This statistical test determines if the difference between the two sets of data is significant.

The calculations produced a U value of 44.

For the difference to be significant, the U value has to be equal to, or less than, the critical value shown in the table below.

The table shows the critical values for the Mann-Whitney U test at $p = 0.05$.

N_1 and N_2 are the number of samples in each set of data.

N_1 / N_2	10	11	12	13	14	15
10	23	26	29	33	36	39
11	26	30	33	37	40	44
12	29	33	37	41	45	49
13	33	37	41	45	50	54
14	36	40	45	50	55	59
15	39	44	49	54	59	64

Using your graph and the table of critical values, explain the conclusion that can be drawn from this investigation.

(4)

The calculated value is greater than the critical value 37

so the null hypothesis can be accepted

There is no significant difference between variety of wheat and the number of infected shoots

This is further supported by the overlapping in the error bars of the two samples

- (e) Suggest why it may **not** be reasonable to draw valid conclusions from the results of this investigation.

(3)

Abiotic factors such as temperature, soil type and mineral content may not

have been taken into consideration

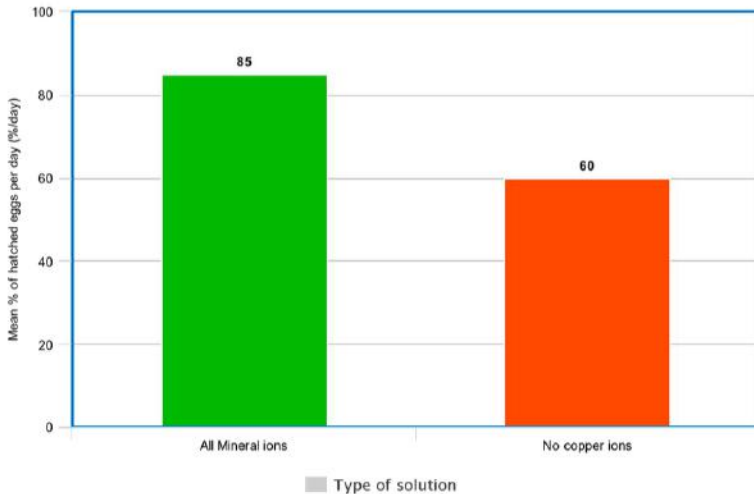
The samples could have been taken at different times of the year which would make a big difference

The sample size is small (only 12 samples)

(Total for Question 2 = 15 marks)

(iii) A clear explanation of how your data are to be recorded, presented and analysed in order to draw conclusions from your investigation.

(4)



Rate of hatched eggs (%/day)	Solution	
	All mineral ions	No copper ions
Day 1		
Day 2		
Day 3		
Day 4		
Day 5		
Day 6		
Day 7		
Mean		

The t-test can be done here to see if there is a significant results between the two between the rate of egg hatching results at each solution

(iv) The limitations of your proposed method.

(3)

It is difficult to control all other factors affecting brine shrimp hatching

Mineral concentration and oxygen levels would decrease during the time of investigation

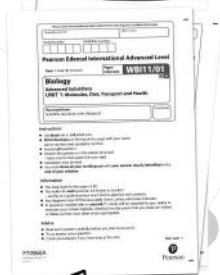
The small size of eggs would make it difficult to count their number

It is difficult to determine viability of eggs and their genetic diversity

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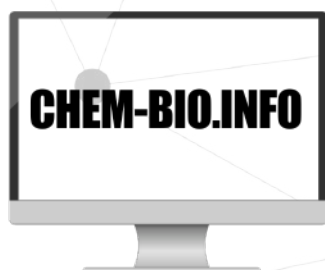
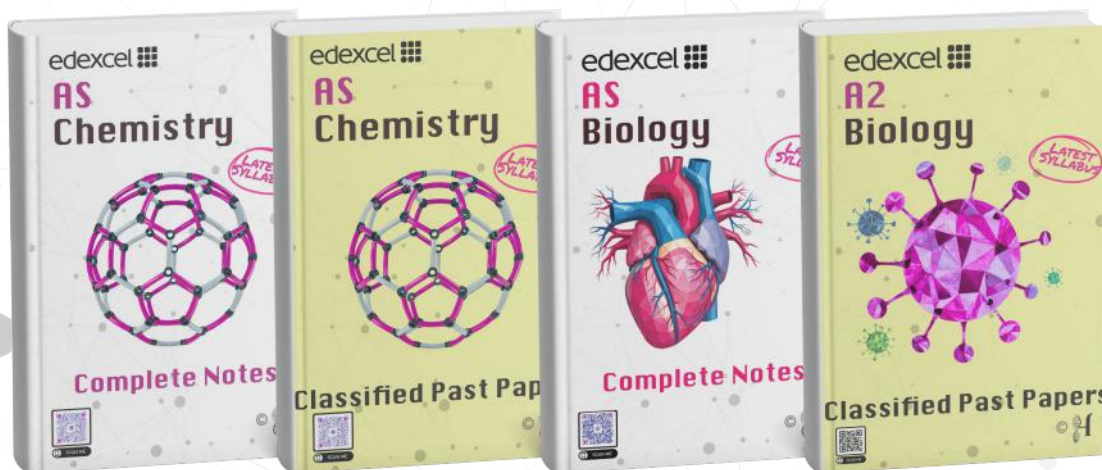


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