WJEC Biology Unit 5
Condense Guide
IGC HK Exam

Index

1.1 ⭐ Food Test ⭐

Hazzard	Risk (Action + Body Part)	Control measure
Biuret is an irritant	Could splash onto hands or into eyes when transferring biuret to test tube	Wear gloves/ eye protection
Ethanol is flammable	Could catch fire if used near a Bunsen burner	Ensure all Bunsen burners are turned off before ethanol is used

Reducing Sugar – Benedict's Test

1. Add equal volume of test solution and Benedict's reagent
2. Heat in a warm water bath
3. Positive Result: Blue → Orange / Red precipitate

Non Reducing Sugar

1. Add equal volume of test solution and Benedict's reagent
2. Heat in a warm water bath
3. Observe colour change. If not a reducing sugar → remains blue
4. Add 2 drops of HCl and heat
5. Add 2 drops of NaOH
6. Add Benedicts' reagent
7. Heat in warm water bath
8. Non reducing sugar: Blue → Orange / Red precipitate

Proteins – Biuret Test

1. Add equal volume of test solution and Biuret reagent
2. Cover the top and invert it once. Positive: Colour change from pale blue to purple

Starch – Iodine

1. Add $2cm^3$ of test solution and 2 drops of Idodine
2. If starch is present the solution will change colour from yellow brown to blue/ black

Fats and Oils

1. Add equal volume of test solution and alcohol in a boiling tube
2. Shake the tube
3. Pour the mixture into another boiling tube half full of cold water
4. If lipids are present a cloudy white emulsion will form

1.3 ⭐ Determination of water potential by measuring change in mass or length ⭐

- Different water potentials are separated by a selectively permeable membrane
- Water move into solution with lower water potential

Hazzard	Risk	Control measure
Scalpel blades are sharp	May cut skin when cutting cylinders	Cut away from body onto a white tile
Cork borers are sharp	May cut skin when cutting cylinders	The cylinders of tissue must be cut on the chopping board with the force directed downwards

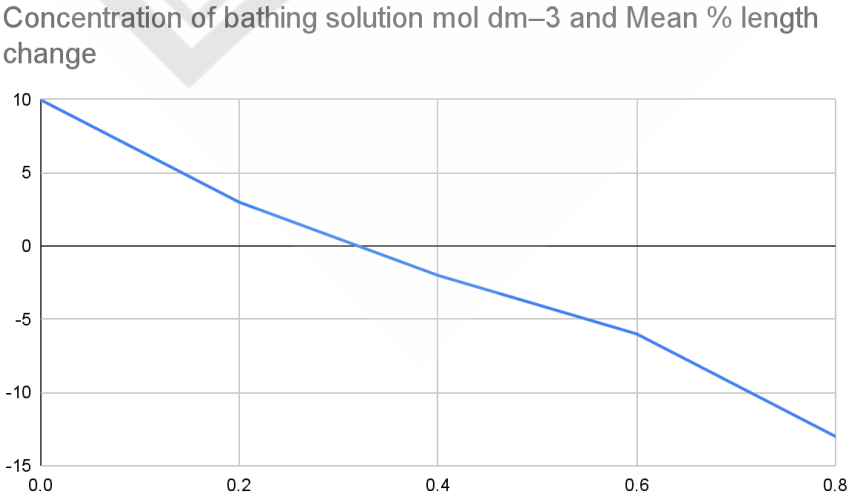
Method

- Remove skin from potato as it makes it waterproof and present osmosis
- Weight the potato
- Place the potato in solution of different concentration and leave it for 20 minutes
- Blot the cylinders to remove water from surface of potato
- Reweight the potato and calculate **percentage change**
- Use **percentage change** as the potato have different starting mass + allow comparison

Sample Results

Concentration of bathing solution mol dm^{-3}	Initial Length / mm	Final Length / mm	Length change / mm	% length change	Mean % length change
0.0	52	57	5	10	10
	49	55	6	12	
	50	54	4	8	
0.2	48	49	1	2	3
	52	2	4	8	
	50	51	1	2	
0.4	58	55	-3	-5	-2
	50	48	-2	-4	
	53	54	1	2	
0.6	50	48	-2	-4	-6
	52	48	-4	-8	
	50	47	-3	-6	
0.8	49	41	-8	-16	-13
	50	43	7	-14	
	52	48	-4	-8	

Plot a graph of Concentration of bathing solution against Mean percentage length change



- No change in length (0%) $\Psi_p = 0$ $\therefore \Psi_{cell} = \Psi_s$ at this graph is 0.3

Molarity / mol dm^{-3}	Solute potential /kPa
0.05	-130
0.10	-260
0.15	-410
0.20	-540
0.25	-680
0.30	-860
0.35	-970
0.40	-1120
0.45	-1280
0.50	-1450

- If time to leave the potato in solution is too short results are still valid but error are larger so data are less accurate
- Dot to dot (not line of best fit)

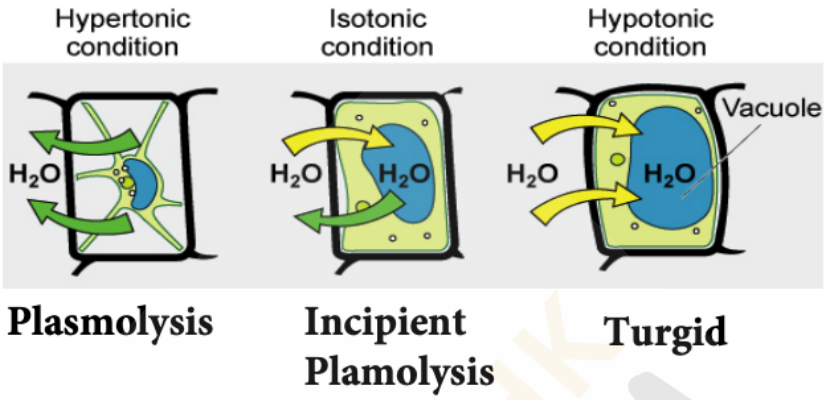
Potential WJEC 2026 Experiment

- Measure the change in mass / time / volume of solution / length / pH of solution
- Changing the sweetness of potato affects the intercept at x axis. A hypothesis states that horizontal axis would be at a higher concentration for sweet potato as sweet potato have a higher concentration of dissolving suagrs

Other Notes

- Definition: Water potential is the tendency of water molecules to move into / out of a cell or solution.
- Solute potential ψ_s: Measures how easy water molecules can move out of a solution
- Pressure Potential ψ_p: Measures the pressure exerted on the cell contents by the cell wall
- Raw potato, ✓ Osmosis – Differently permeable cell membrane present
- Peeled Potato, ✓✓ – High rate of Osmosis, because larger Surface Area for Osmosis
- Boiled Potato, X Osmosis – Damage cell membrane -> Fully Permeable
- Unpeeled Potato, X – Impermeable in H_2O

1.3 ⭐ Determination of solute potential by measuring the degree of incipient plasmolysis ⭐



At incipient plasmolysis:

- No <u>net</u> movement of water
- <u>Cell membrane is withdrawn from cell wall</u>
- Cell content <u>exert no pressure</u> on cell wall

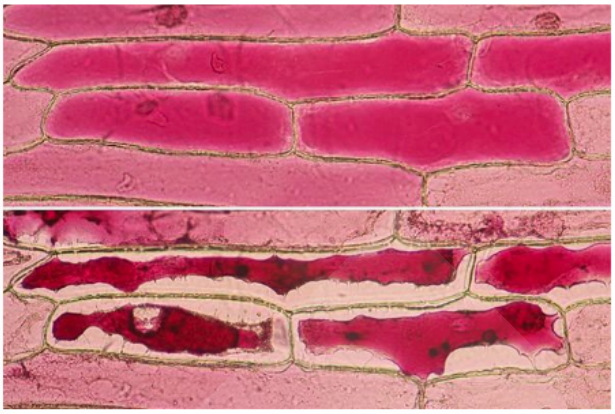
$$\Psi = \Psi_s + \Psi_p$$

$\Psi_p = 0$ at incipient plasmolysis
So $\Psi_{cell} = \Psi_s$

Hazzard	Risk	Control measure
Scalpel blades are sharp	May cut skin when cutting cylinders	Cut away from body onto a white tile

Method

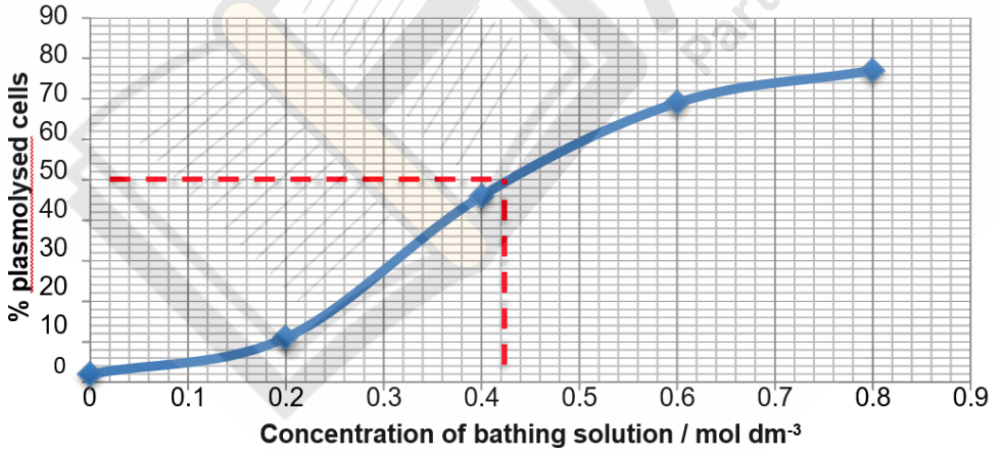
- Different concentration of solidum chloride solution (0.2, 0.4, 0.6, 0.8 mol dm^{-3}) are set up
- Extract the upper epidermis of onion leaf from mesophyll
- Spread the tissue out on a microscope so that it won't fold
- Add two drops of solution and apply to cover slip
- Use x10 and x40 objective lens to count the number of cells that are turgid and plasmolysed
- Record data in a table and plot a graph for % cell plasmolysed against concentration of solution
- Interpolate the concentration of solution where % plasmolysed cell is 50%
- Use the same table as above to determine the solute potential



- To ensure the same cell is not counted more than once, student can move the slide in the same direction across the field and use this as a tracking system
- If the cell is on the edge, only count it if it is at least half visible

Sample Results

Concentration of bathing solution / mol dm^{-3}	Number of cells in field of view						Total		
	1		2		3				
	plasmolysed	turgid	plasmolysed	turgid	plasmolysed	turgid	plasmolysed	turgid	% cells plasmolysed
0	1	30	0	32	1	36	2	98	2
0.2	4	28	2	32	5	29	11	89	11
0.4	20	15	10	19	16	12	46	54	46
0.6	20	9	25	11	24	11	69	31	69
0.8	19	7	34	8	24	9	77	23	77



Molarity / mol dm^{-3}	Solute potential /kPa
0.40	-1120
0.45	-1280

1.3 Investigation into the permeability of cell membranes using beetroot

- Motion of molecules within the membrane is affected by temperature
- Heating the membrane can cause membrane to become more permeable
- Heat can denature the membrane

- Beetroot contain betalain, a bright red, water soluble pigment in the cell vacuoles
- If the cell membranes are damaged, the pigment can escape from the cell and can be detected in an aqueous medium
- Beetroot must be raw, not cooked so the cell membrane are not damaged

Hazzard	Risk	Control measure
Scalpel blades are sharp	May cut skin when cutting cylinders	Cut away from body onto a white tile

Method

- Cur 5 piece of beetroot and wash the pigment released during cutting
- Place 5cm^3 of distilled water in a test tube and place in water bath to equilibrate for 5 minutes
- Place the beetroot in each test tube for 30 minutes
- After 30 minutes, shake the test tubes gently to make sure any pigment is well mixed in the water and remove the beetroot cores
- Place it in a colorimeter and measure absorbance
- Repeat the steps for different water bath temperature and plot a graph of absorbance against temperature

Sample Result of a colorimeter – measuring transmission of light at 530nm

Temperature (°C)	Observation	Colorimeter reading (% transmission of light)			
		Repeat 1	Repeat 2	Repeat 3	Mean
0	Clear	100	98.5	99.0	99.2
22	Very pale pink	93.9	95.0	96.0	95.0
42	Very pale pink	80.1	77.0	76.9	78.0
63	Pink	26.3	29.9	31.0	29.1
87	Dark pink	0.7	0.7	1.0	0.8
93	Red	0.0	0.1	0.0	0.0

WJEC 2026 Possible Variation

- Investigating the effect of alcohol or detergents on membrane permeability
- Identifying systematic and random variables (errors)
  Systematic: Stop clock that is running slow, so there will be an increase in the amount of pigment that leaks
  Random: Different piece of equipment (balance) measures data slightly differently
- Plotting error bars to assess the variation in repeats

3.2 Investigation into the separation of chloroplast pigments by chromatography

- Photosynthetic (chloroplast) pigmenters are located on membranes of thylakoids and grana
- Photosynthetic pigments are used for harvesting light in the light-dependent reaction for photosynthesis and transferring its energy to the light independent ration
- Chloroplast Pigments

  Chlorphylls
  - Chlorophyll a is the most commonly found pigment in all photosynthetic organisms
  - Chlorophyll b is found in flowering plants
  - *Phaeophytin: a breakdown product of chlorophyll a molecule, lacking the central magnesium ion is seen in flowering plants and in purple sulphur bacteria*

  Carotenoids
  - Carotenes: α- and β-carotene are orange but lycopene is bright red is found in tomatoes
  - Xanthophylls: such as lutein and zeaxanthin appear yellow

Hazzard		Risk	Control measure
Propaponone Petroleum either	May cause eye dammage	Macerating leaf material; Pouring solvent for chromatography	Eye protection
	May degrease the skin	Macerating leaf material; Pouring solvent for chromatography	Wear gloves
	Inhalation may exacerbate respiratory problems, including asthma	Macerating leaf material; Pouring solvent for chromatography	Work in fume cupboard
	Fire hazards	Accidental ignition	Work in fume cupboard

Method

Preparing the pigment solution

1. Chop 2g of leaf material, add a pinch of sand and 5 cm^3 of propanone in a mortar and grin the leaf fragment to a slurry. And transfer it into a boiling tube
2. Add 3cm^3 of instilled water, shake vigorously and stand for 8 minutes
3. Add 3cm^3 of petroleum ether mix by gentle shaking and allow layers to separate
4. Collect the upper petroleum ether layer which contains chloroplast pigment and using a pipette, transfer to a vial

Preparing the chromatography paper

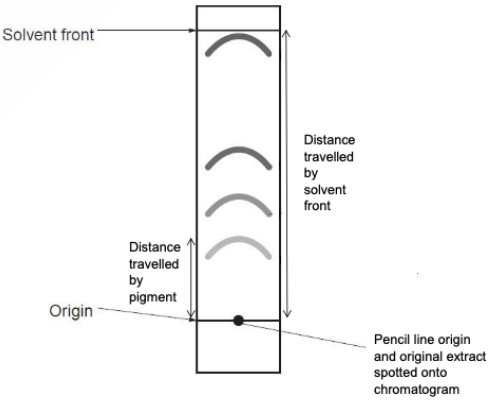
1. Draw a pencil line across the chromatography paper approximately 2cm from one end
2. Draw chloroplast pigment solution in a capillary tube and put a small spot in the center of the pencil line. Ensure that the capillary tube does not pierce or tear the chromatography paper
3. Dry the spot as quickly as possible to prevent it spread
4. Repeat steps 2 and 3 until there is a small but more intense spot of pigment

Running the chromatogram

1. Place freshly-made 1:2 propanone:petroleum ether solvent mixture in a boiling tube until it is approximately 5mm deep
2. Slide the chromatography paper into the boiling tube so that one end is below the surface of phenol but the spot its above so not touching it
3. Hold the chromatography paper in place with the stopper, folding the paper over the rim of boiling tube at the top
4. Leave the boiling tube until the solvent has climbed up the paper to within 10mm of the top. Mark a pencil line across the paper indicating the solvent font.
5. Mark the position of the top of each pigment spot with a pencil

Identifying the pigments

$$R_f = \frac{\text{distance travelled by pigment}}{\text{distance travelled by solvent front}}$$



Published data for 1 propanone : 2 petroleum ether

Spot colour	Pigment	R_f
yellow	ß-carotene	0.96
grey	phaeophytin	0.70
blue-green	chlorophyll *a*	0.58
green	chlorophyll *b*	0.48
yellow-brown	xanthophyll	0.44 (TLC) 0.75 (paper chromatography)

Possible 2026 WJEC Experiment

- Use different solvent // Compare pigment in young and senescent deciduous leaves // Compare pigments in sun and shade leaves

3.2 Investigation into the effect of light on the rate of photosynthesis

$$\text{carbon dioxide + water} \xrightarrow{\text{Light}} \text{glucose + oxygen}$$

- Measure of a pH colour change due to carbon dioxide acidic properties
- When CO_2 is being absorbed in photosynthesis, it becomes less acidic
- When CO_2 is dissolved in water, carbonic acid is produced, and it dissociates releasing hydrogen ions, lowering the pH of water

$$CO_2 + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$$

- Photosynthesis removed CO_2 from solution, H^+ concentration decreased so pH increases

Hydrogen Carbonate Indicator Colour Change – Photosynthetic Protoctistan

$$\underset{\text{Yellow}}{\text{Acid}} \rightleftharpoons \underset{\text{Red}}{\text{Neutral}} \rightleftharpoons \underset{\text{Purple}}{\text{Alkali}}$$

Purple: Rate of Photosynthesis > Rate of Respiration
Yellow: Rate of Photosynthesis > Rate of Respiration
Red: Rate of Photosynthesis = Rate of Respiration (Compensation Point)

Hazzard	Risk	Control measure
Solid calcium chloride is an irritant to skin and eyes and in inhaled	Making calcium chloride solution	Solid to be weighted in fume cupboard; Students to be given solution.
Gas accumulation in culture vessel could cause the glass to break	During period of algal culture	Ensure cotton wool stopper allows ventilation; Stand culture vessel in deep tray
Excess heat from lamp may cause burns	When decanting from culture vessel	Ensure no contact with skin

Method

Making algal balls

1. Stir a mixture of 5cm^3 Scenedesmus culture and 3cm^3 3% sodium alginate solution gently
2. Draw the mixture into a 10cm^3 syringe barrel
3. With constant pressure on the plunger, drop the mixture, one drop at a time, into 200cm^3 calcium chloride solution
4. Leave the balls for 20 minutes
5. Strain the balls through the tea strainer
6. Return the balls to the beaker and swirl them in distilled water
7. Repeat step 5 and 6 twice more
8. Use immediately or store at 4^{o}C, but bring to room temperature for approximately 20 minutes before use

Running the experiment

1. Place 20 algal balls in a viral
2. Add 10cm^3 hydrogen carbonate indicator
3. Place the vials at a distance from a light source
4. After a given time assess the pH of the indicator in the vial using teh colour chart or read its absorbance at 550m in a colorimeter

Sample Results

Distance of vial from lamp / cm	Colour of indicator after 1 hour	Absorbance after 1 hour / a.u.	pH after 1 hour
10	purple	0.92	9.0
30	magenta	0.81	8.8
50	red	0.56	8.4
70	orange	0.39	8.2
90	yellow	0.25	8.0

Possible WJEC 2026 Practical

- Varying light intensity to determine colour change
- Cover the vials in different colours filtered to expose algae at different wavelengths. In order that the algae receive the same light intensity readings must be taken with a light meter with the filters over the probe, to find distance for each wavelength which has the same light intensity

3.2 Investigation into the role of nitrogen and magnesium in plant growth

- Plants require nitrogen in the form of nitrate in absorbed by the roots to make amino acids, chlorophyll and nucleotides
- Magnesium ions are also absorbed by the roots of a plant and use as a component of chlorophyll

Hazzard	Risk	Control measure
Sach's culture solution can be an irritant	Very low risk of irritation to the eye or skin.	Wear goggles. Wash skin thoroughly if solution comes into contact with skin.

Method

1. Select equal size barley seedlings.
2. Set up 5 test tubes with Sach's complete culture solution, 5 test tubes with Sach's culture solution lacking nitrate and a further 5 test tubes with Sach's culture solution lacking magnesium.
3. Solutions should be topped up when necessary and completely replaced weekly.
4. All 15 barley seedlings should be placed in the same conditions for example light and temperature.
5. After a month examine the seedlings, record any differences between them and measure the length of the roots and shoot.
6. Dry the seedlings in an oven and record the dry mass

Sample Results

Lacking in nitrogen – poor growth, plants short and spindly and chlorosis (yellowing), especially in the older leaves. The young leaves at the tip may be green but small.

Lacking in magnesium – interveinal chlorosis.

Possible Questions

Why use Dry mass → Dry in oven until no weight change to get rid of water

- Dry mass = Organic Mass (carbohydrate, lipid, protein)
- As some organism might live in water

Why top up solutions daily?

- Volume must be kept constant

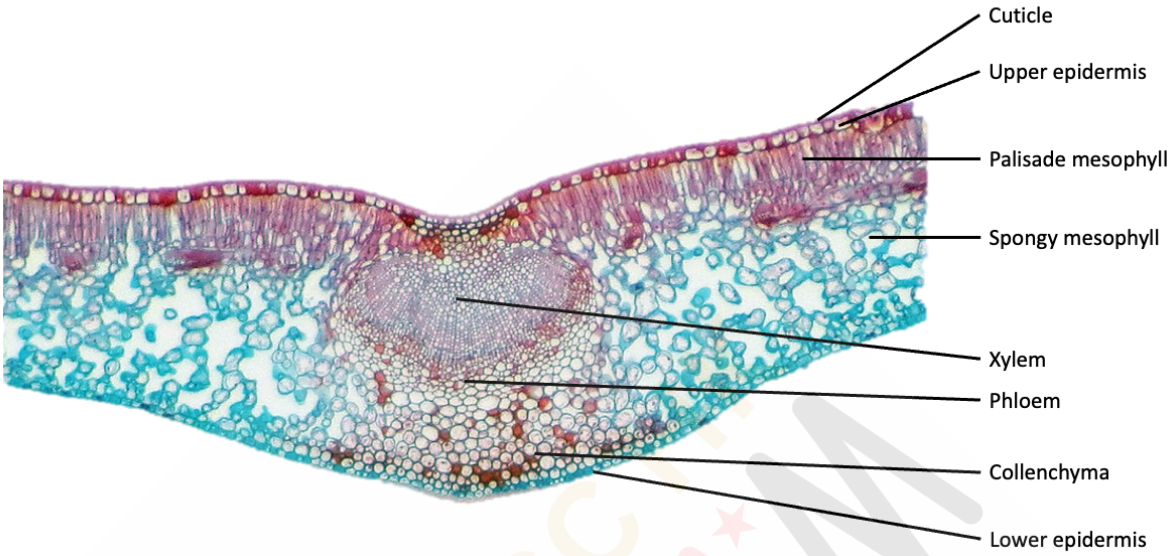
Why change the solution weekly?

- Allow conc of mineral same and ensure the minerals are sufficient for growth

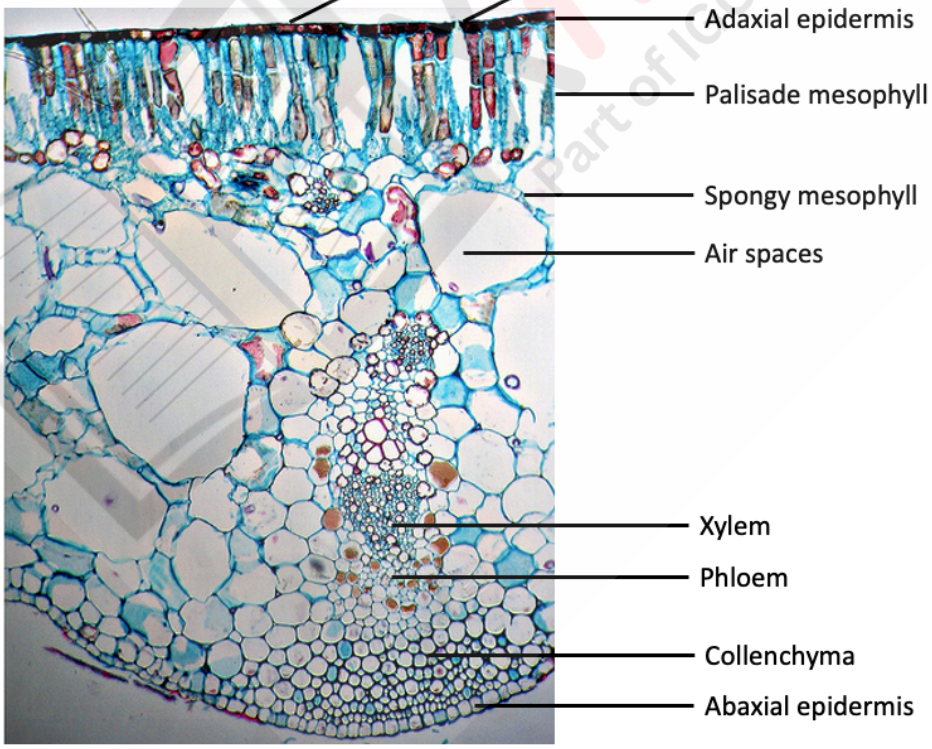
Lack of Nitrogen - No Amino acid / protein → cannot growth / no new cell growth - No Nucleotide - No Chlorophyll → yellow → chlorosis → very little photosynthesis	Lack to Magnesium - No Chlorophyll → yellow → chlorosis → little photosynthesis as some leaf might have chlorophyll	Lack of Calcium - Weakens cell wall

3.2 Cross-section of a leaf

Low power Leaf



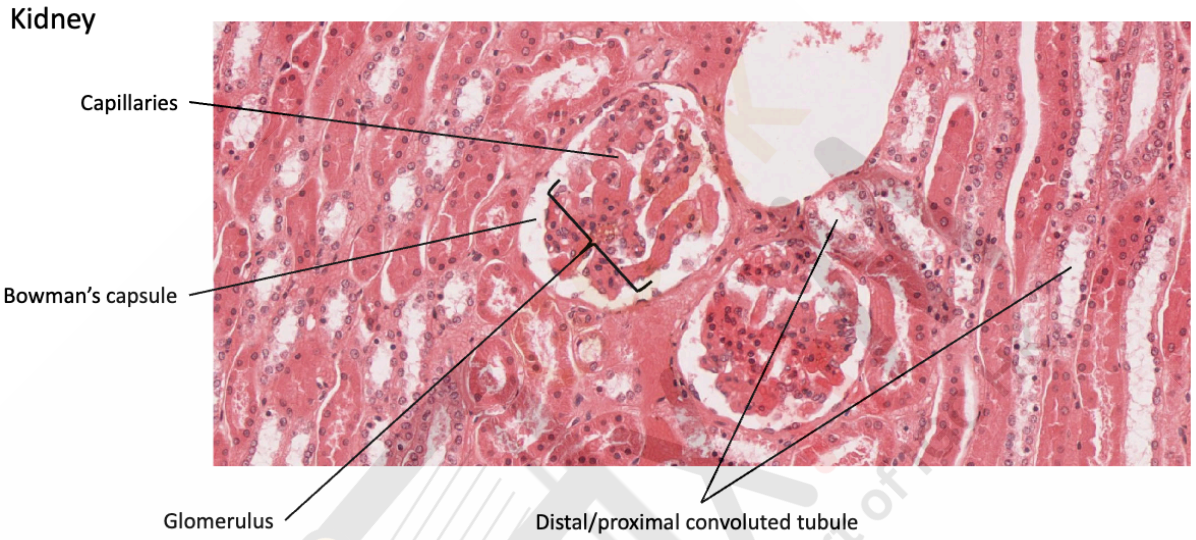
Low power Water Lilly Leaf T.S.



3.8 ⭐ Dissection of a mammalian kidney ⭐

- Kidney functions are to remove nitrogenous wastes urea, from body to balance pH and ion of blood

Hazzard	Risk	Control measure
Dissecting instruments are sharp	Can pierce or cut the skin	Care with use



4.4 ⭐ Investigation of a continuous variation in a species ⭐

Hazzard	Risk	Control measure
Ivy leaves may be allergenic and generate contact dermatitis	Skin contact on handling may occur	Avoid skin contact
Berries are toxic	If leaves are collected in autumn, berries may be present	Avoid ingesting berries

- T test shows the difference in two sample means
- Formula to calculate standard deviation from sample

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

- Formula to test that the means are different using Student's t test.

$$t = \frac{\left|\bar{x}^1 - \bar{x}^2\right|}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s^2}{n_2}\right)}}$$

Where,

$\left|\bar{x}^1 - \bar{x}^2\right|$ = the difference in mean values of sample 2 and sample 2

s_1^2 and s_2^2 are the squares of the standard deviation of the samples

n_1 *and* n_2 are the number of readings in each sample.

Sample Data

Maximum width of ivy leaf (mm) grown in	
shade	sun
17	7
16	11
18	8
21	8
19	9
20	10
17	9
19	10
18	9
17	10
18	10
18	11
16	12
15	18
18	10
mean = 17.8	mean = 10.1

The Student t test

1. Formulate a null hypothesis: there is no statistically **significant** difference between the **mean** maximum widths of the two populations of ground ivy leaves growing in the sun and shade.
2. Process data

Ivy leaves growing in shade			Ivy leaves growing in the sun		
Maximum width / mm	Deviation from mean $(\bar{x} - x)$	Deviation from mean^2 $(\bar{x} - x)^2$	Maximum width / mm	Deviation from mean $(\bar{x} - x)$	Deviation from mean^2 $(\bar{x} - x)^2$
17	0.8	0.64	7	3.1	9.61
16	1.8	3.24	11	-0.9	0.81
18	-0.2	0.04	8	2.1	4.41
21	-3.2	10.24	8	2.1	4.41
19	-1.2	1.44	9	1.1	1.21
20	-2.2	4.84	10	0.1	0.01
17	0.8	0.64	9	1.1	1.21
19	-1.2	1.44	10	0.1	0.01
18	-0.2	0.04	9	1.1	1.21
17	0.8	0.64	10	0.1	0.01
18	-0.2	0.04	10	0.1	0.01
18	-0.2	0.04	11	-0.9	0.81
16	1.8	3.24	12	-1.9	3.61
15	2.8	7.84	18	-7.9	62.41
18	-0.2	0.04	10	0.1	0.01
mean = 17.8		sum = 34.4	mean = 10.1		sum = 89.75
		s_{shade} = 1.57			s_{sun} = 2.53

$$t = \frac{|\bar{x}_{shade} - \bar{x}_{sun}|}{\sqrt{\frac{s^2_{shade}}{n} + \frac{s^2_{sun}}{n}}}$$

$$t = \frac{|17.8 - 10.1|}{\sqrt{\frac{6.41}{15} + \frac{2.46}{15}}} = \frac{7.7}{0.77} = 10.0$$

3. Degree of Freedom = $(df) = (15-1) + (15-1) = 28$
4. For df = 28 and level of significance, p = 0.05, the critical value of t = 2.048
5. Comparing the critical value with the calculated value: the calculated value is greater than the critical value so the null hypothesis is rejected (10>>2.048) at the 5% level of significance, or p = 0.05
6. Conclusion: the maximum mean widths of the two populations are significantly different at the 5% level of probability. The maximum width of ivy leaves is greater growing in the shade than growing in the sun.

Risk Assessment

- Hazzard: Irritant (etc) [if cannot think about it, organism might cause allergy to human]
- Risk: Action + Body Part
- Control Measure: Wash hands, Lab coat, Wear gloves

Range Bar

Provide provide information on <u>reliability</u> of the readings

Use percentage Change in mass instead of actual mass

- DIfferent starting mass (1)
- Allows **<u>comparison</u>** (1)

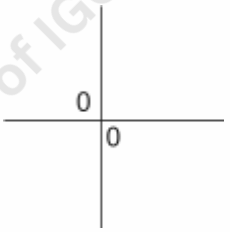
'Must Get' mark from Practical Paper

Table:

- Table with heading and **be specific** [eg: mass → ✓ mass of potato] (do not include irrelevant colum)
- Units (if use short term ✓min X mins)
- Same significant figure (2sf) down and across

Graph

- More than ½ space
- Labels (be specific eg: **mean** percentage change)
- Units
- Axis
- Plots correctly
- Line (dot to dot)
- Range bar



T Test

- <u>T Test Null Hypothesis: There is **no statistically significant difference** between the **means** of [height / mass / description] of the two samples and that any difference is due to chance.</u>
- Find t value
- T Test Degree of Freedom: Number of Sample 1 + Number of Sample 2 – Number of Samples (so 2 in this case)
- Probability: 5% (or 0.05)

This means there are only 5% probability that is due to chance

- Find critical value
- If <u>t value > critical value</u> → reject null hypothesis → not due to chance → due to other factors: (for example lack of Mg^{2+})
- If t value < critical value → accept null hypothesis → any difference is due to chance

Maths: higher the t value / chi^2 value, the smaller the probability it will occur (nothing related to probability so do not use the binomial hypothesis testing mindset as it is literal opposite)

- To be more accurate use a smaller percentage
- Use 1 more sf than the sf number in the significance level chart give

WJEC Experiment Task Sample Answer

Using the plates in **Images 1**, **2** and **3** measure the **maximum diameter** of the clear zone for each concentration of amylase to the **nearest mm**. There is space to record these readings on page 5.

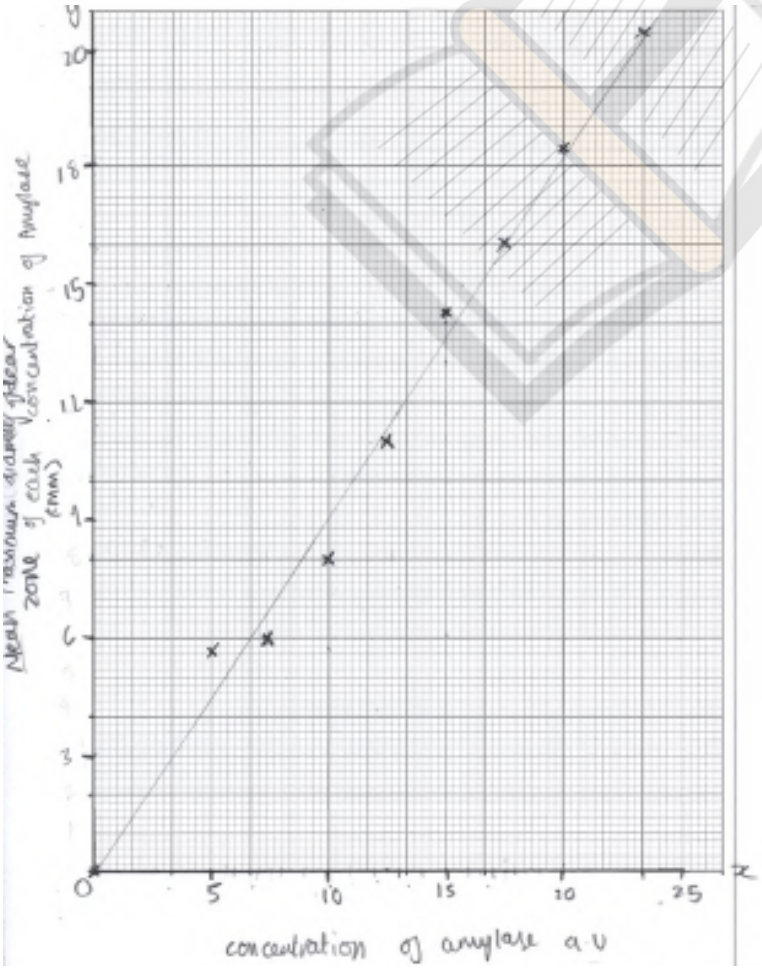
(a) Construct a suitable table to include the maximum diameter of clear zones at **each concentration of amylase** from **each Image** and the calculated mean for each concentration. **Your table should include a value of 0 mm at a concentration of 0 au amylase.** [4]

concentration of amylase (au)	maximum diameter of clear zone (nearest mm)			
	Image 1	Image 2	Image 3	mean
0	0	0	0	0
5	5	6	6	6
7.5	8	7	6	7
10	9	8	9	9
12.5	10	11	13	11
15	13	15	14	14
17.5	17	16	15	16
20	18	19	18	18
25	19	21	21	20

- both headings correct and logical organisation (1)
- units correct: (mark) (only present in headings)(1)
  IV = au;
  DV = mm / millimetres
- all maximum diameters recorded **to nearest mm** (1)
- means calculated and rounded correctly **to 0 or 1 dp** (1)

Candidates were given clear instructions as to the data they needed to collect and how to display this data:

- Measurements to the nearest mm
- To use concentration of amylase and maximum diameter in their table
- To include values for 0 au amylase



Candidates were asked to draw a standard curve or calibration curve of mean maximum diameter against concentration – a concept covered in the use of base ladders in PCR.

They were asked for a **straight line of best fit** through the origin (0,0) .
This means that no breaks could be used on the axes, and a suitable distribution of plots on either side of the line was expected.

Graph:
use of more than half the graph paper **for both x and y axes** (1)

labels: x axis = concentration of amylase
+ y axis = **mean** maximum diameter of clear zone (1)

correct units: x = au
+ y = mm (1)

linear scales correct on both axes with 0,0 at origin (1)

plots correct +/- ½ small square (2)

straight line of best fit drawn through the origin (1)

5. Turn both plates upside down on a paper towel and measure and record the **maximum** diameter of each clear zone to the **nearest mm**.

6. Calculate the mean maximum diameter of the clear zones around the three discs for both sample **A** and sample **B**. Use these means and your graph in part (b) to estimate the concentration of amylase in samples **A** and **B**.

(c) Record your measurements and the results of your calculations in the table below. You should **show on your graph** how you estimated the concentration of amylase in samples **A** and **B**. [2]

Unknown sample	Maximum diameter of clear zone /mm			Mean maximum diameter of clear zones /mm	Estimated concentration of amylase in the sample /au
	Trial 1	Trial 2	Trial 3		

Unknown sample	Maximum diameter of clear zone /mm			Mean maximum diameter of clear zones /mm	Estimated concentration of amylase in the sample /au
	Trial 1	Trial 2	Trial 3		
A	8	8	7	8	9.0
B	7	6	7	7	8.0

2 marks – correct calculation of mean to nearest mm
Lines drawn on graph and read correctly

Candidates set up two plates to determine the concentration of amylase in two samples. Most candidates followed the instructions given but many did not:

- Measurements were not made to the nearest mm
- Lines were not drawn on the graphs

Errors were again made in calculating mean values and in reading from their graphs – even when lines were drawn.

WJEC Practical Analysis Sample Answer

Risk Assessments:

Hazard	Risk	Control measure
Plants may sting/scratch	Small cuts can get infected by dirt	wear gloves and cover bare skin

Candidates should be familiar with risk assessments from GCSE. Many are still not relating the risk to a step in the method

Reading and following instructions:

(b) An experiment was designed to test the null hypothesis that there are equal numbers of coffee species growing in the wild in each category of risk of extinction.

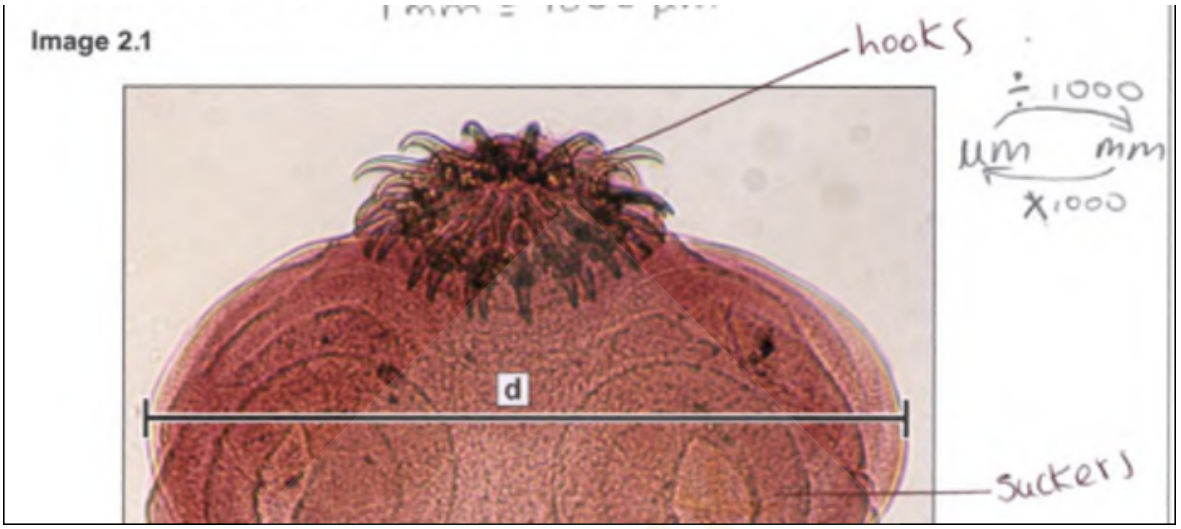
(i) This null hypothesis was tested using a χ^2 (Chi^2) test.
Complete **Table 1.3** and calculate χ^2 **to three decimal places**, using the

Table 1.3

Category	Number of species		$(O-E)$	$(O-E)^2$	$\frac{(O-E)^2}{E}$
	O	E			
Critically endangered	13	22	-9	81	3.681
Endangered	40	22	18	324	14.72
Vulnerable	22	22	0	0	0
Near threatened	10	22	-12	144	6.54
Least concern	25	22	3	9	0.409
Total	110 ✓	110			25.35

Rounding continues to be an issue – either rounding too early in the calculation (individual Chi2 values) or rounding the total Chi2 . This value should be 14.727… or rounded to 14.73.

Candidates were told to calculate Chi^2 to **three decimal places** – many ignored this.



Labelling structures correctly requires the label lines to **end in the structure being labelled** or at least touching the structure.

2 marks – both hooks and suckers correctly labelled

Candidates should be able to rearrange the following relationship to calculate sizes and / or check proportionality of drawings:

$$\frac{\text{Actual size of } \mathbf{A} \text{ (h)}}{\text{Actual size of } \mathbf{B} \text{ (d)}} = \frac{\text{Image size of } \mathbf{A}}{\text{Image size of } \mathbf{B}}$$

Where **A** and **B** are lines on an image / drawing.

For this question:

$$\text{Actual height} = \frac{0.980 \times h}{d}$$

OR
Magnification = image d / actual d and then
Actual height = image h / magnification

IGC HK Exam - WJEC

GCE Biology Unit 5
Condense Notes

Though the resources are comprehensive, they may not cover every aspect of the specification and do not represent the depth of knowledge required for each unit of work.

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