Vital LEAVING CERT GUIDEBOOK

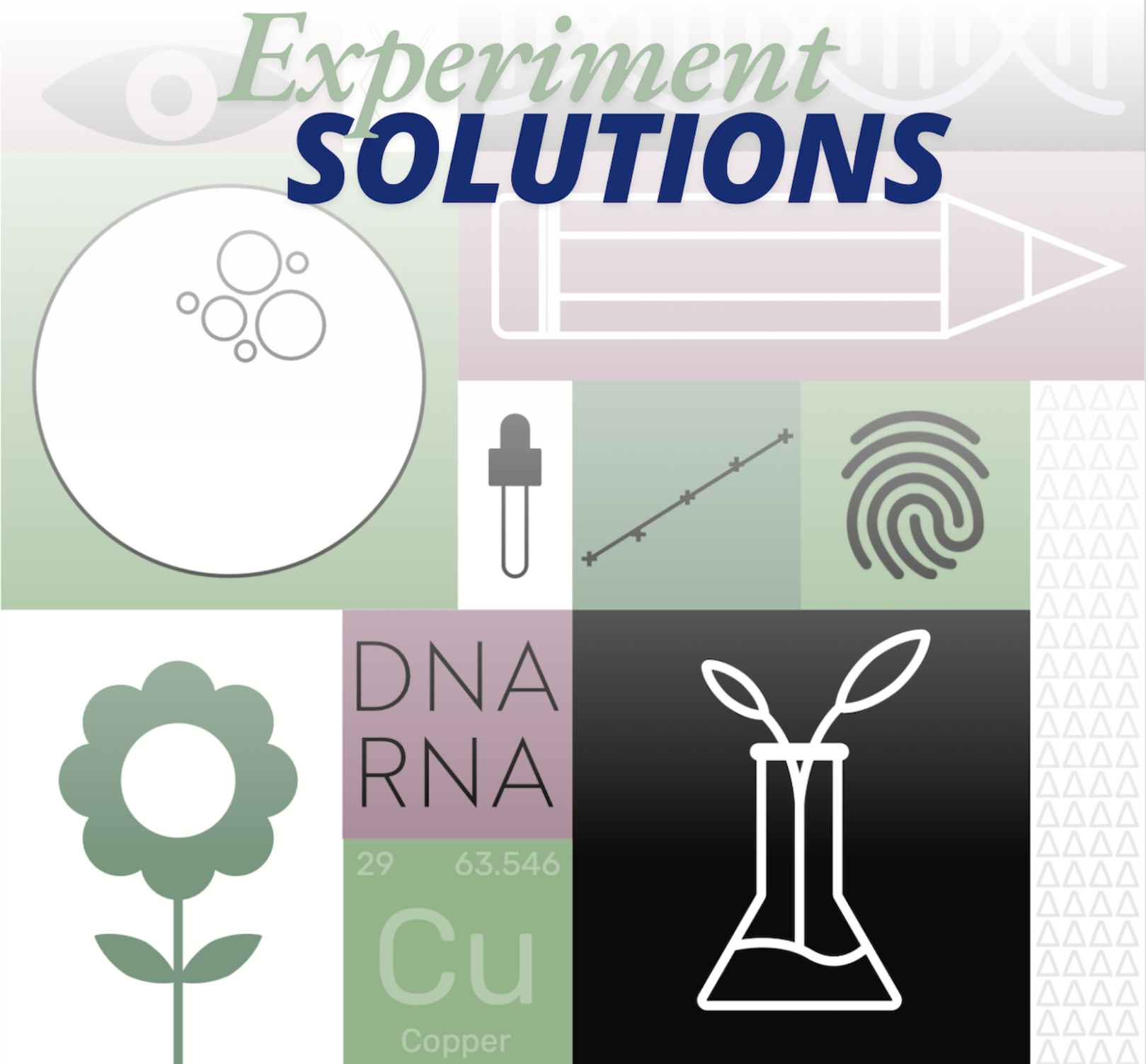
Biology: Experiments

HIGHER & ORDINARY LEVEL

Róisín Doyle

Experiment

SOLUTIONS



Vital Leaving Cert Guidebook – Biology Experiments

Experiment Solutions

Róisín Doyle

Contents

Ecology: Quantitative survey of named animal

From pg 18 of Vital Leaving Cert Guidebook – Biology Experiments

a) Grassland
b) Habitat: Soil/ On a leaf/ Under a stone
   Niche: Decomposer or food source for other organisms
c) Using an identification key
d) Pitfall trap → Dig hole in the ground, insert jar in hole with lid left agar
e) Return 24hrs after setting up trap. Count and record number of ladybirds → mark ladybirds with non-toxic paint on belly → release into habitat → repeat set up and return 24hrs later → count and record number of ladybirds and note the number with paint from previous day.
f) - nontoxic paint → Not to poison ladybird
   - marked in a discrete location → avoid attention of predators
g) Ensure results are consistent and no possibility of outliers
   Testing location chosen at random
h) $\frac{\text{animals caught day 1} \times \text{animals caught day 2}}{\text{number of aminals (re)captured}}$
i) Amount of <u>an</u> organism in an ecosystem
j) (non-living factor): Air temperature: if air temp too low the population of ladybirds will be low as ladybirds will go into hibernation

Cell structure: Viewing animal/plant cells under microscope

From pg 21 of Vital Leaving Cert Guidebook – Biology Experiments

1. Cheek
2. Onion
3. Iodine
4. Methylene blue
5. Make cell organelles visible
6. Description pts 1 → 4
7. Prevent cells from drying out
8. Hold cells in place or protect the objective lens
9. Slowly with a mounted needle at an angle to prevent air bubble formation
10. $10 \times 40 = 400$
11. $\text{Magnification of objective lens} \times \text{Magnification of eye piece}$
12. Roughly focus image or move stage
13. Swab with a cotton bud inside of cheek
14. Peeled with a scalpel/tweezer a thin (single) layer of onion

Enzymes: Effect of temp

From pg 24 of Vital Leaving Cert Guidebook – Biology Experiments

1. Substrate
2. Enzyme
3. Celery
4. pH → pH buffer 9
5. Temperature → Temp controlled waterbath
6. Oxygen
7. Volume of foam per unit time
8. Water
9. a) Trap oxygen produced
   b) Dissolve call membrane
10. Broad
11. Biological catalyst
12. Chemical composition: Protein Shape:3D/Folded/Globular
13. Optimum temp
14. Plant in this experiment. Also found in animals
15. 25 – 30°C
16. Each enzyme works on one substrate only
17. $\text{Hydrogen peroxide} \xrightarrow{\text{Catalase}} \text{Oxygen and Water}$

Enzymes: Effect of pH

From pg 27 of Vital Leaving Cert Guidebook – Biology Experiments

1. Substrate
2. Enzyme
3. Catalase
4. Temperature → Temp controlled waterbath fixed at 25-30°C
5. Temp also effects enzyme activity and can only have 1 variable
6. pH → Different pH buffers
7. Oxygen
8. Volume of foam per unit time
9. Water
10. a) Dissolves cell membrane
    b) Traps oxygen and helps measure enzyme activity
11. Narrow
12. Biological catalyst
13. a) Protein
    b) 3D/Folded/Globular
14. Optimum pH
15. Plant in this experiment. Also found in animals
16. 25-30°C opt pH is 9
17. Each enzyme works on one substrate
18. $\text{Hydrogen peroxide} \xrightarrow{\text{Catalase}} \text{Oxygen and Water}$

Enzyme: Denatured by boiling

From pg 29 of Vital Leaving Cert Guidebook – Biology Experiments

1. Substrate
2. Enzyme
3. Celery
4. a) pH
   b) pH buffer 9
5. Temperature → Temp controlled waterbath
6. Oxygen
7. Volume of foam per unit time
8. Water
9. a) Dissolves cell membrane
   b) Traps oxygen and helps measure enzyme activity
10. N/a
11. Biological catalyst
12. Plant in this experiment. Also found in animals
13. 25-30°C
14. Each enzyme works on one substrate
15. $\text{Hydrogen peroxide} \xrightarrow{\text{Catalase}} \text{Oxygen and Water}$
16. - Large volume of foam produced at 30°C
    - no foam
17. 30°C – enzyme working at optimum temp
    100°C – enzyme had lost its shape as it had been denatured and therefore no foam

Enzyme: Immobilisation

From pg 32 of Vital Leaving Cert Guidebook – Biology Experiments

1. Sucrose
2. Yeast
3. Sodium alginate
4. Forms and hardens beads
5. Steps 1 → 5 of preparation
6. Diagram
7. Glucose
8. Glucose test strips or Benedict's solution
9. Attaching an enzyme to an inert material
10. – sterilise all equipment with disinfectant
    - place a straw (metal) or paper clip in tap
    - ensure all equipment made of glass

Photosynthesis: Effect of light intensity

From pg 35 of Vital Leaving Cert Guidebook – Biology Experiments

1. Elodea
2. Easier to see and count O_2 bubbles
3. Count the no. of $\underline{O_2}$ bubbles per min
4. Temp/ CO_2/light intensity
5. 25 – 30°C
6. Optimum temp for enzymes in plants
7. Light intensity
8. Move the lamp closer/ further to elodea
9. Temp or CO_2 conc.
10. Temp controlled waterbath Sodium bicarbonate
11. Source of carbon dioxide
12. Source of light
13. To prevent light intensity from influencing the result
14. Respiration and decomposition
15. Graph
16. Despite an increase in light intensity, the rate of photosynthesis remains constant
17. – As light intensity increase, rate of photosynthesis increases
    - Light intensity continues to increase, rate of photosynthesis remains constant
18. – More light sources
    - Jars of sodium bicarbonate
    - Heaters
19. $6C0_2 + 6H_2O \xrightarrow{\text{Light+Chlorophyll}} C_6H_{12}O_6 + 6O_2$

Respiration: Fermentation of ethanol

From pg 37 of Vital Leaving Cert Guidebook – Biology Experiments

1. Fermentation: production of ethanol by anaerobic respiration
   Anaerobic: release of energy from food in absence of oxygen
2. Free from M.O.
3. Avoid M.O. contributing to respiration
4. Remove O_2
5. Layer of oil or fermentation lock
6. Enzymes in yeast work best at this temp
7. Ethanol and carbon dioxide
8. Test for presence of carbon dioxide
9. No bubbles visible
10. All glucose has been used up by yeast
11. Potassium iodide and sodium hypochlorite
12. Colourless → yellow (crystals)
13. Same experimental set up without yeast
14. $\text{Glucose} \xrightarrow{\text{Yeast}} \text{ethanol} + \text{carbon dioxide}$

Osmosis demonstration

From pg 39 of Vital Leaving Cert Guidebook – Biology Experiments

1. Solute and solvent
2. Dialysis tubing
3. Act as a selectively permeable membrane
4. Structure with pores that controls the movement of molecules from one location to another based on size
5. Selectively permeable
6. Expanded or gained mass or fuller in appearance
7. Osmosis had occurred or water had moved from the beaker into visking tubing
8. Movement of water molecules from an area of high water concentration to low water concentration across a selectively permeable membrane
9. Acts as a control
10. For comparison with experimental results
11. Fully turgid

Genetics: Isolation of DNA from plat tissue

From pg 41 of Vital Leaving Cert Guidebook – Biology Experiments

1. Kiwi
2. Breakdown cell wall
3. Clump DNA
4. Dissolve membrane (nucleus and cell)
5. 3 seconds
6. Do not want to destroy DNA
7. DNA is soluble in ethanol at room temperature
8. Slowly down the side of test tube using dropper
9. Solid mass of white matter or snot like clump
10. Deoxyribo Nucleic Acid
11. Mitochondria or chloroplast

Fungi: Growth of leaf yeast

From pg 44-45 of Vital Leaving Cert Guidebook – Biology Experiments

1. Fungi
2. Budding
3. Unicellular (one cell)
4. Contains food M.O. need to grow and reproduce
5. Solid form of nutrient medium that contains food M.O. need to grow
6. Free from all M.O.
7. Ignore
8. For comparison with experiment
9. With clippers
10. To attach leaf to lid of agar plate
11. Waxy cuticle side
12. Avoid external contamination
13. 30°C
14. Optimum temp for enzymes in leaf yeast
15. Minimum 72 hours
16. Empty/no colonies
17. – time of year (temp too low)
    - Poor air quality/high levels of pollution in air
18. Soaked in disinfectant
19. Diagram

Plant structure: Viewing dicot steam

From pg 47-48 of Vital Leaving Cert Guidebook – Biology Experiments

1. A seed leaf
2. – One seed leaf
   - two seed leaves
3. Grass
4. Celery
5. Firmly with hand or encased in pitted potato
6. As thin slice as possible with scalpel
7. Allow light of microspore to pass through and make vascular tissue visible
8. Tweezers
9. Iodine
10. Make vascular bundles visible
11. Prevent cells drying out
12. Protect objective lens and hold cell in place
13. To prevent formation of air bubbles
14. Dermal – protection
    Ground – support and storage
    Vascular – transport
15. Vascular bundles organised in a ring
16. - Place slide on stage of microscope
    - Turn on light
    - Observe under lowest, magnification using coarse + fine focus
    - Move to higher magnification adjusting image using fine focus only
17. Easier to cut and more light can pass through
18. $10 \times 100 = 1000$

Heart dissection

From pg 51 of Vital Leaving Cert Guidebook – Biology Experiments

Internal: diagram

External: diagram

1. Sheep or ox
2. - Wear gloves
   - Wash out heart
   - Disinfect equipment
3. Left: firmer when pressed right: softer/springer/spongier when pressed
4. Coronary vessels
5. Aorta
6. Arteries: thicker muscle wall veins: thinner muscle wall
7. Next to aorta, passing down through left atrium and left ventricle
8. scalpel
9. Bicuspid: 2 flaps tricuspid: 3 flaps semi-lunar: half moon
10. Base of aorta and pulmonary artery
11. Sealed bag and returned to teacher
12. Cut with scalpel at base of aorta and pulmonary artery
13. Soaked in disinfectant

Effect of exercise on pulse (heart) rate

From pg 53 of Vital Leaving Cert Guidebook – Biology Experiments

1. Place two fingers on wrist and feel for pulse
2. Count number of beats/pulses for 1 min
3. 1 minute
4. Increases
5. Heart is working faster to replace CO_2 with O_2
6. Returns to resting rate
7. a) increases with exercise
   b) lower resting rate of fit person
   c) longer recovery time for fit people

Effect of exercise on breathing rate

From pg 55 of Vital Leaving Cert Guidebook – Biology Experiments

1. Place hand close to mouth and feel warm air
2. Counted no of breaths per minute
3. One minute
4. Increases
5. Lungs are trying to replace at a faster rate the CO_2 with O_2
6. Decreases to eventually return to resting rate
7. Graph

Plant responses: Effect of different conc. of IAA on plant growth

From pg 57 of Vital Leaving Cert Guidebook – Biology Experiments

1. Radish or cress seeds
2. Soaked in water night before
3. Serial dilutions
4. Upright/vertically @ 25 – 30°C for 72hrs
5. Diff IAA conc. replaced with water
6. 72hrs
7. 25-30°C
8. Measured with a ruler the length of the roots and shoots
9. At low conc. (10^{-4} – 10^{-2} ppm); roots grew, and shoots did not
   At high conc. (10^{-1} – 10^{2} ppm); shoots grew, and roots did not
10. Roots and shoots grew in equal amounts

Plant repro: To show starch digestion during germination

From pg 61 of Vital Leaving Cert Guidebook – Biology Experiments

1. Regrowth of an embryo from a seed when conditions favourable
2. Suitable temperature – for enzymes to work
3. Oxygen – aerobic respiration
   Water – soften testa, activate germination, medium for chem reactions
4. Soak in water to activate germination
5. Control – denatured enzymes
6. Dip in disinfectant to ensure no M.O. grow
7. Sterile: free from all M.O. asepsis
8. Starch
9. Avoid external contamination
10. Incubator at 25-35°C for 48hrs
11. Iodine
12. Flood plates with iodine using dropper and record colour change
13. Colour – entire plate turned blue/black – no starch digestion as seeds dead
    Experimental – plate went/stayed brown (with clear patches under seeds) – embryo in seed germinating and digesting starch so all starch gone