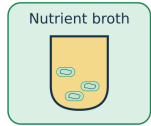


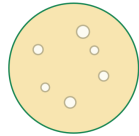
Culturing microorganisms

AQA Separate Biology 8461 | Paper 1 extras | Foundation + Higher

1 Growing bacteria



A liquid culture



Colonies on nutrient agar

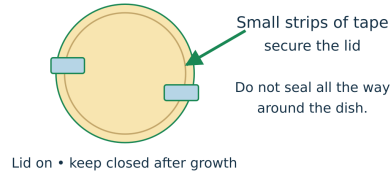
Binary fission: one cell becomes two. Bacteria need nutrients and a suitable temperature.

Broth: liquid nutrient medium.

Agar: nutrient gel in a Petri dish.

A visible colony contains many cells.

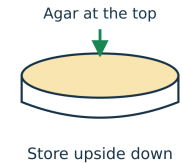
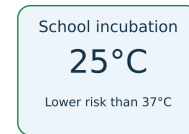
2 Aseptic technique



Aseptic = prevents contamination.

Sterilise dishes and medium. Flame a loop, then let it cool before transferring bacteria. Disinfect the bench; lift the lid only briefly. Secure with short tape strips; do not seal the whole rim.

3 Incubation and observation

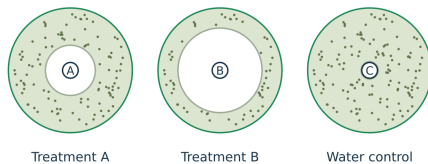


Store plates **upside down**: condensation cannot drip onto the agar and spread colonies.

School incubation: about **25°C**, reducing risk compared with 37°C. It does not make cultures risk-free. Observe through the closed lid.

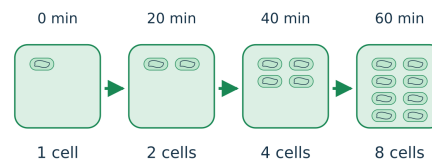
4 Required practical 2

Same bacterium • same conditions



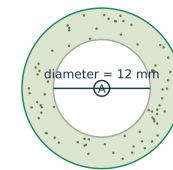
Compare antiseptics or antibiotics. Use the same bacterial culture, equal discs and a **sterile-water control**. Keep dose, agar, time and temperature comparable. Measure clear-zone diameters; repeat on independent plates and find means.

5 Double after each division



Number of divisions = time ÷ division time.
Start with 5 cells, division every 20 min.
After 60 min: 3 divisions.
 $5 \times 2 \times 2 \times 2 = 40$ cells.
Model assumes all divide and none die.
Standard form: Higher Tier extra.

6 Clear-zone area



radius = $12 \div 2 = 6$ mm
area = $\pi \times \text{radius}^2$
 $\pi \times 6^2 \approx 113$ mm²
Whole clear circle

Radius = diameter ÷ 2.

Area = πr^2 ; use squared units, e.g. mm².

Check whether to include the disc.

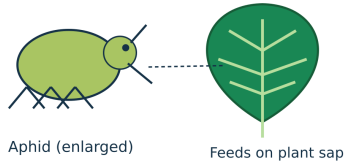
Larger zone: more inhibition in this test.

Different diffusion rates can affect results; a plate test cannot prove clinical effectiveness.

Plant health and defences

AQA Separate Biology 8461 | Paper 1 extras | Foundation + Higher

1 Disease and insect pests



Shared recap: **TMV** is a virus; **rose black spot** is fungal. Bacteria can also infect plants. **Aphids** feed on sap, weakening plants. They can carry viruses from plant to plant.

2 Nitrate deficiency



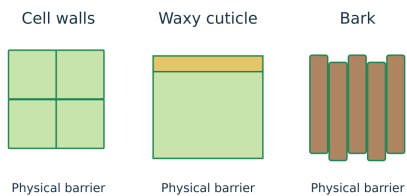
Plants use **nitrate ions** to make amino acids and then proteins. Too little nitrate → less protein synthesis → **stunted growth**. A mineral deficiency is non-communicable: it is not a pathogen.

3 Magnesium deficiency



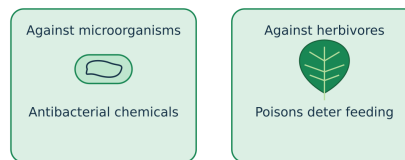
Magnesium ions are needed to make **chlorophyll**. A shortage causes yellowing (**chlorosis**). Less light is absorbed, so photosynthesis may fall. Yellowing alone can have several causes.

4 Physical barriers



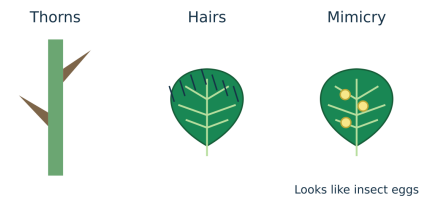
Cellulose cell walls resist entry. A tough **waxy cuticle** protects leaves. **Bark** consists of outer layers of dead cells. Shedding bark can remove pathogens on those layers.

5 Chemical defences



Antibacterial chemicals: act against bacteria. **Poisons:** deter herbivores from feeding. Plants do not use antibodies like animal immune cells.

6 Mechanical adaptations

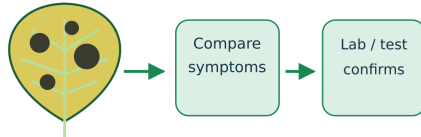


Thorns and hairs deter herbivores. Leaves may **curl or droop** when touched, discouraging feeding. **Mimicry:** a misleading appearance, such as leaf markings that look like insect eggs and deter egg laying.

Higher Tier Biology extras

AQA Separate Biology 8461 | Paper 1 extras | Higher Tier only

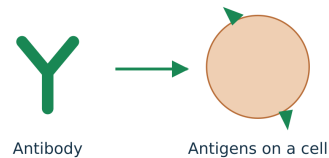
1 Investigate plant disease



A symptom alone may have several causes.

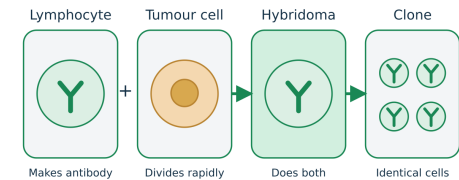
Clues: stunting, spots, rot, growths, malformed parts, discolouration or pests. Compare a reliable reference; send a sample to a lab or use a suitable specific test. Symptoms alone may not identify one cause.

2 One clone, one antibody



Monoclonal antibodies come from **one clone** of cells. They have identical binding sites specific to a particular **antigen**. A test using them can detect its matching target.

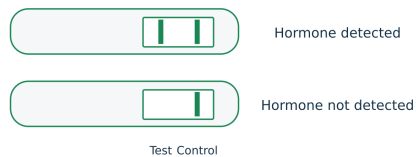
3 Make and clone a hybridoma



Stimulate mouse lymphocytes to make the antibody wanted. Fuse a selected lymphocyte with a dividing tumour cell. **Hybridoma: divides + makes antibody.** Clone a selected single cell; grow the clone, collect and purify its antibodies.

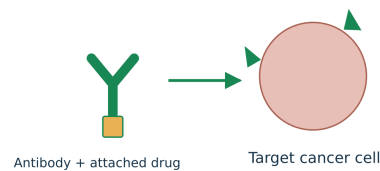
4 Detection and research

Pregnancy test: an example



Uses include detecting hormones or pathogens and measuring chemicals in blood. Fluorescent labels locate targets in tissues. Pregnancy test example: antibodies bind **hCG**. Learn specific binding; test details may be given.

5 Targeting and evaluation



An antibody can deliver a toxic drug or radioactive substance to cancer cells with the matching antigen. **Benefit:** more targeted delivery. **Limits:** side effects; testing needed; animal use can raise ethical issues.

6 Standard form

Standard form

$$32\,000 = 3.2 \times 10^4$$

3.2 is at least 1 and less than 10.

10^4 means $\times 10 \times 10 \times 10 \times 10$

After finding the population, write it as **$a \times 10^n$** , with $1 \leq a < 10$.
1,000 cells, five divisions:
 $1,000 \times 2^5 = 32,000 = 3.2 \times 10^4$.
 32×10^3 has the same value, but is not standard form.