

GCSE Biology A (Gateway)

J247/01 B1-B3 and B7 Foundation (Foundation Tier)

Question Set 20

1 (a)

A scientist clones a cauliflower plant.



He uses small pieces of the cauliflower plant called explants.

This is the method the scientist uses to get the explants:

- Place the equipment in a beaker of bleach and swab the bench with 70% alcohol.
- Collect a small piece of cauliflower and place on a white tile.
- Use a scalpel to cut the piece of cauliflower lengthways into small 3–5 mm pieces called explants.
- Measure the mass of the explants.

(i) Suggest why the scientist uses a scalpel rather than a kitchen knife. [1]

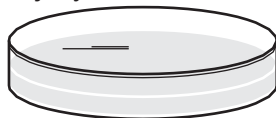
A scalpel is much sharper than a kitchen knife and enables finer control and precision when cutting the small cauliflower pieces. (because scalpel is smaller than kitchen knife)

(ii) Write down **one** safety precaution that the scientist should take when using a scalpel. [1]

The scientist should try to cut in a direction away from himself.

(iii) The explants are then prepared for cloning by placing on an agar jelly plate.

Agar jelly contains water, sugars and minerals.



Agar jelly plate

When the explants are placed on the agar jelly plate, they have no roots or leaves.

Explain why the explants must be placed on the agar jelly plate. [2]

The agar supports the explants, holding them in place. It also contains nutrients and plant hormones (e.g. auxins) required for growth and development of the clones.

(b) To grow the explants, the scientist places the agar jelly plate in a warm room near to a window.

(i) Explain why this will help the explants grow and develop into clones. [2]

A high light intensity and warm temperature provide optimum conditions for growth of the explants, mirroring that found in cauliflower's natural growth environment. Light exposure is required for photosynthesis. This produces sugars such as glucose which help plants grow. A warm temperature is required to provide optimum conditions for photosynthetic enzymes.

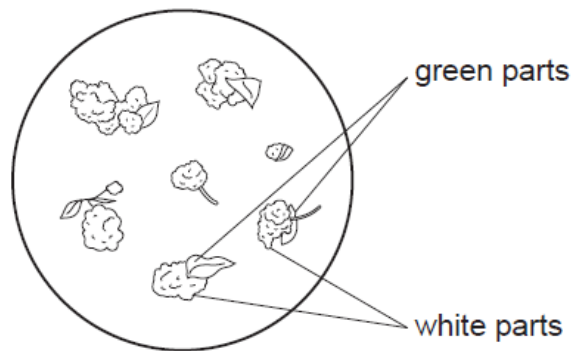
(ii) Using a heated cabinet with light bulbs inside the cabinet would improve this method.

Explain why. [2]

This would ensure that the explants grow under controlled conditions, remaining at a constant warm temperature and receiving continuous exposure to light of a certain intensity. It would help to maximise plant growth by ensuring constant high rates of photosynthesis, even at night when light exposure would normally be limiting.

(iii) The scientist examines the agar jelly plate regularly.

Growth of the explants is visible in the plate within 10 days and parts of the explants are turning green.



What conclusion can be made about why the explants have parts that are turning green?

[1]

The explant grows green parts containing chlorophyll to photosynthesise and further grow.

(c) The mass of the explants at the start was 15g.

After 10 days the mass of the explants was 28g.

Calculate the percentage increase in mass of the explants.

Give your answer to 1 decimal place.

$$\frac{28-15}{15} \times 100 = 86.7\%$$

Percentage increase = 86.7% % [3]

- (d) The cells in cauliflower explants behave the same way as embryonic stem cells do in animals.

Explain why it is more difficult to clone adult animals than to clone cauliflowers.

[2]

It is easier to clone cauliflowers because plant cells in meristematic tissue are able to differentiate into any cell type and can divide to form a whole organism. This ability is lost at an early stage in adult animal cells. They can only differentiate into a narrow range of cell types so cannot divide to form a clone. A more complicated method involving nuclear transfer must be used.

Total Marks for Question Set 20: 14

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