

Answer ALL questions.

Some questions must be answered with a cross . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

- 1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Tissue culture and plants

In micropropagation, plant tissues are grown *in vitro* on plant tissue culture media, under aseptic conditions in a controlled environment. This technique is possible because plant cells can differentiate and become specialised cells. This allows them to change their metabolism, growth and development to form a whole plant.



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- 5 Plant tissue culture media contain substances to support the normal growth and development of plants. The media are mainly composed of minerals, vitamins, and plant hormones. The pH of the media is kept constant.

Plant hormones play an essential role in determining how cells and tissues develop in culture media. Plant cells can differentiate into different tissues and cell types.

- 10 The concentration of hormones can determine the tissue that develops. Auxins and cytokinins are the most widely used. A balance of both auxin and cytokinin leads to the development of a mass of undifferentiated cells known as a callus.

In vitro cell culture offers an alternative method for conserving endangered species and varieties. Tissue culture can be used when the plant species produce seeds that do not germinate or have seeds that cannot be stored for a long period of time. These can be successfully preserved using *in vitro* techniques for the maintenance of gene banks.

- 20 Embryo culture is a type of plant tissue culture that is used to grow embryos from seeds in nutrient media. In embryo culture, the plant develops directly from the embryo or indirectly through the formation of a callus and then subsequent formation of shoots and roots. The technique has been developed to break dormancy in seeds, and to reproduce rare species and haploid plants.



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Scientists are also using cell suspension culture systems from which products can be extracted. A suspension culture is developed by transferring a portion of the callus into liquid media. The media are maintained under suitable conditions of agitation, light and temperature. This system can provide a continuous, reliable source of natural products independent of climate and soil conditions. The first commercial application of large-scale suspension cultivation of plant cells was carried out to produce shikonin. Shikonin is used in traditional Chinese medicine and is a potential anti-cancer treatment.



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