

**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.

**Supercharging plants to reduce global warming**

The proportion of carbon dioxide in the atmosphere has increased in the last 100 years. In 2020, a mass of 727 gigatonnes of carbon dioxide was released into the atmosphere from natural processes, along with a mass of 37 gigatonnes from human activities. Scientists have estimated that plants naturally remove a mass of

5 746 gigatonnes of carbon dioxide from the atmosphere every year. The difference between what is removed and what is released causes atmospheric carbon dioxide to rise every year. Carbon dioxide is a greenhouse gas, and a significant rise will cause global warming.

To help solve the problem of rising concentrations of atmospheric carbon dioxide,

10 scientists are planning to produce transgenic, supercharged plants that can remove atmospheric carbon dioxide and store it in their roots. The scientists estimate that if these plants can be developed, the plants could remove a mass of carbon dioxide equivalent to 50% of the emissions from human activities.

Coastal plants that have their roots in seawater contain a substance called suberin in

15 the cell walls of the outer layer of the roots. Suberin is a waterproof substance that contains a high proportion of carbon atoms. Suberin is decomposed very slowly so remains in the soil for a long time.

The photograph shows a coastal plant called a mangrove.



(Source: © Snow At Night/Shutterstock)

To produce the supercharged plants, scientists intend to take the gene that codes

20 for high suberin production from a coastal plant and insert it into crop plants. The crop plants used are perennial plants. Perennial plants live for many years rather than dying each winter. The transgenic crops would take in large amounts of carbon dioxide and use the carbon atoms to make suberin. The carbon would then be locked up and stored as suberin in the roots. After successfully producing one plant, they will

25 use micropropagation rather than pollination to produce others.

These supercharged crop plants may have other uses. Suberin in roots helps to make them tolerant to soil with a high salt concentration, helping to produce higher crop yields in areas that have difficult growing conditions.

