1 This question is about transport in plants.

**(a)** Two pea plants, **D** and **E**, were supplied with substances containing the radioactive isotopes, carbon-14 ($^{14}C$) or phosphorus-32 ($^{32}P$), as shown in Fig. 4.1.

A leaf of plant **D** was exposed to radioactive carbon dioxide.

Plant **E** was placed into a solution containing radioactive phosphate ions.

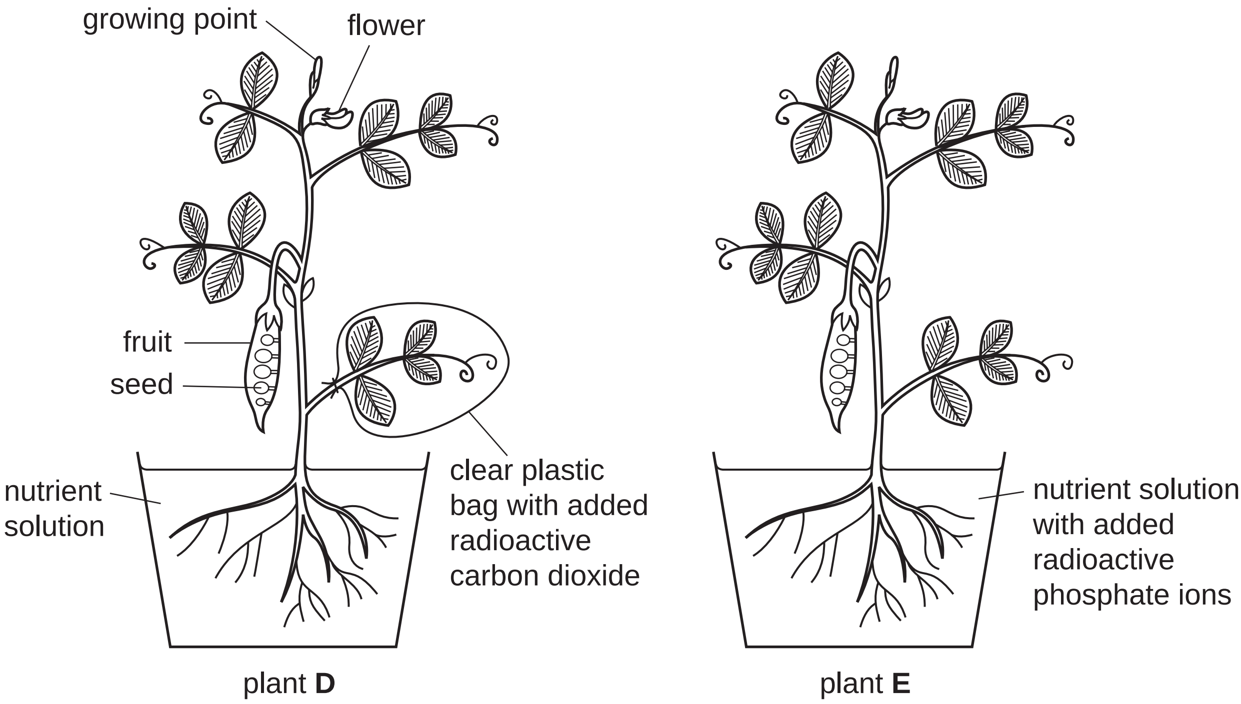


**Fig. 4.1**

After several hours the plants were analysed for the presence of the radioactive isotopes.

Sucrose containing $^{14}C$ was found throughout plant **D**.

Compounds containing $^{32}P$ were found throughout plant **E**.

Complete Table 4.1 to show:

- the tissue in which each substance is transported;
- **one** possible sink for each substance.

**Table 4.1**

| pea plant | **D** | E |
|---|---|---|
| substance transported | sucrose | phosphate ions |
| transport tissue | | |
| sink | | |

[4]

**(b)** State **one** substance, **other than sucrose**, that is produced in leaves and translocated to other parts of the plant.

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**(c)** Outline how sucrose is produced from carbon dioxide in pea plants.

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.............................................................................................................................. [3]

**(d)** State **two** uses of sucrose within a pea plant.

1 ..............................................................................................................................

2 .............................................................................................................................. [2]

**(e)** Explain how ions, such as phosphate ions, are absorbed by plant roots.

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**[Total: 13]**

2 **(a** Fig. 1.1 is a diagram of the human digestive system.

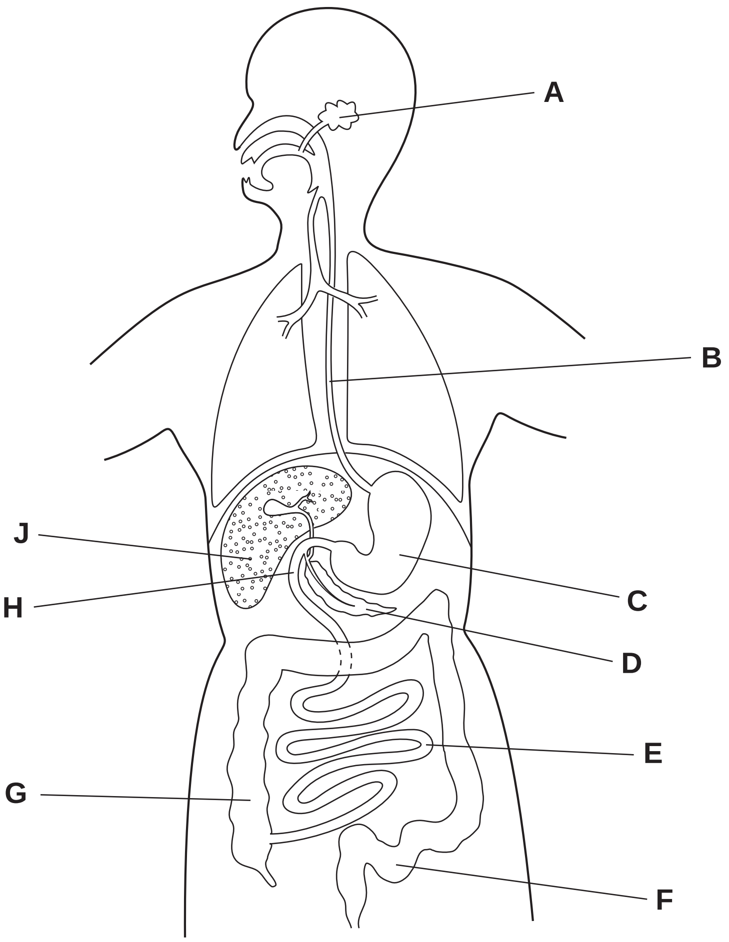


**Fig. 1.1**

Use the letters from Fig. 1.1 to complete Table 1.1 to give the part of the human digestive system that is identified by each function.

Write one letter only in each box. You may use the same letter more than once. There are some letters that you will not use. The first one has been done for you.

**Table 1.1**

| function | |
|---|---|
| peristalsis | **B** |
| protein digestion | |
| insulin production | |
| deamination | |
| partially digested food is mixed with bile | |
| most water is reabsorbed | |

[5]

The human diet provides nutrients for the synthesis of biological molecules that make up cells, cell products and tissues.

**(b) (i)** Complete Table 1.2 to show the nutrients that are absorbed from food to synthesise the large molecules listed.

**Table 1.2**

| large molecules | nutrients absorbed |
|---|---|
| protein | |
| glycogen | |
| fat | |

[3]

**(ii)** Mineral ions are required in the human diet in small quantities.

State the mineral ion required for each process:

making bone ..............................................................................................

making haemoglobin. .................................................................................. [2]

**(iii)** State another type of nutrient required in the human diet in small quantities.

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**(c)** One role of nutrients is to provide materials for the repair of damaged tissues. Fig. 1.2 shows the events that happen after a cut to the skin.

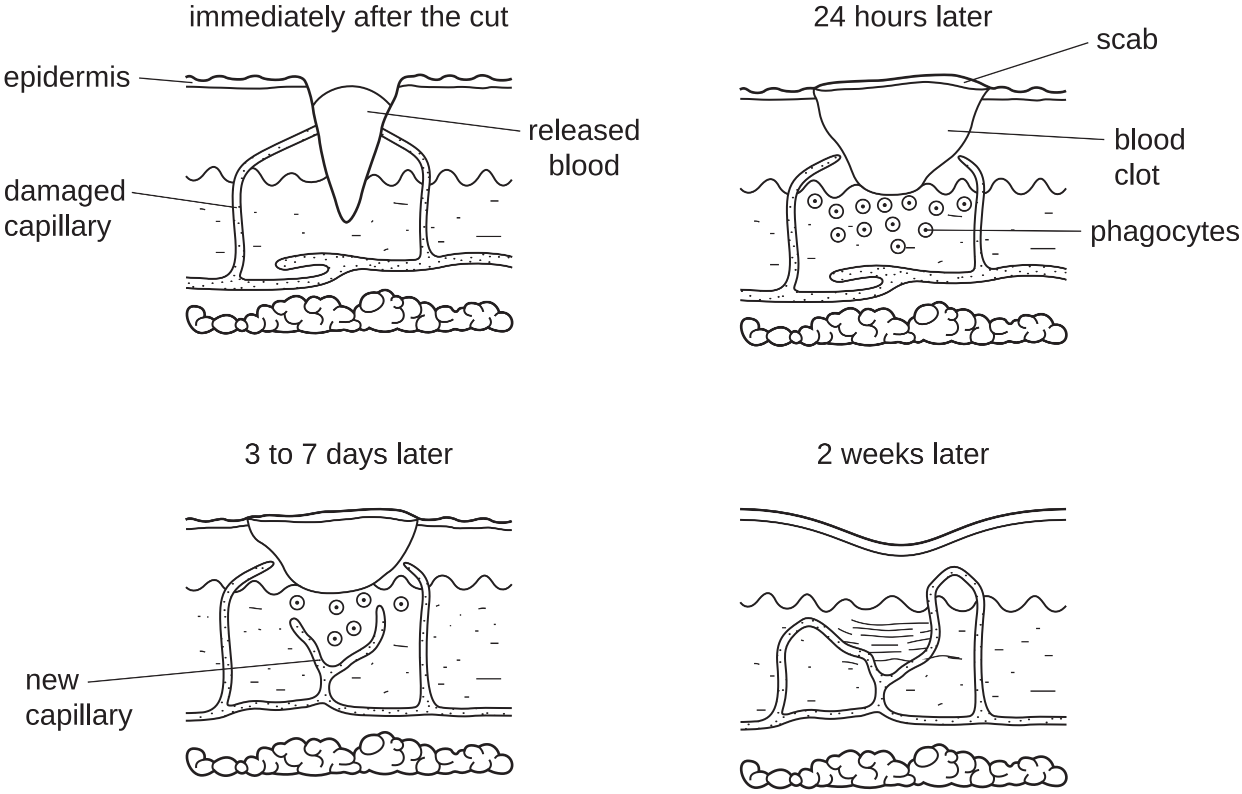


**Fig. 1.2**

Use the information in Fig. 1.2 to describe what happens to seal the wound in the skin and repair the skin tissue.

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[Total: 16]

3 Haemoglobin is a protein that is made inside developing red blood cells in the bone marrow.

**(a)** **(i)** State the function of haemoglobin.

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**(ii)** Name the small molecules that are combined to make haemoglobin.

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**(iii)** Name the mineral ion provided in the diet that is needed to make haemoglobin.

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There are many different varieties of haemoglobin. The gene for haemoglobin exists as two alleles, $\mathbf{Hb^A}$ and $\mathbf{Hb^S}$.

People with the genotype $\mathbf{Hb^SHb^S}$ have a condition called sickle cell anaemia.

**(b)** Describe the features of sickle cell anaemia.

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**(c)** The allele for $\mathbf{Hb^S}$ is rare in many parts of the world, but it is more common in parts of tropical Africa.

Explain why $\mathbf{Hb^S}$ is more common in parts of tropical Africa.

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**(d)** The parents of people with sickle cell anaemia rarely have this condition.

Explain, using a genetic diagram, how two parents who do not have sickle cell anaemia may have a child with the condition.

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*parental genotypes* ................ × ................

*gametes* ................ ................ + ................ ................

*genotype of child with sickle cell anaemia* ................

[3]

**(e)** Sickle cell anaemia is an example of variation in humans. There are many causes of variation, including nuclear fall-out.

Suggest how nuclear fall-out could cause variation in humans.

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[Total: 14]