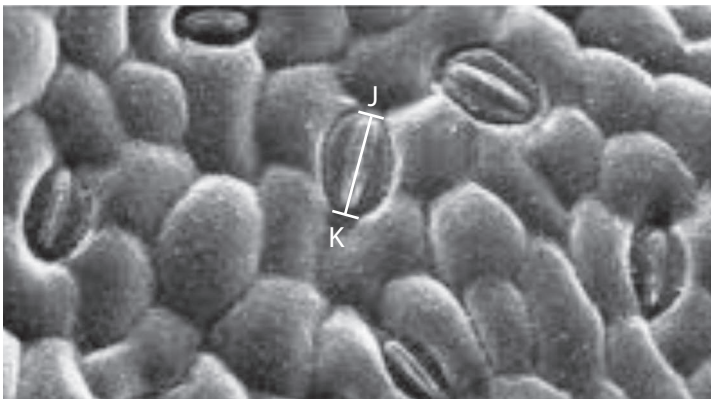
1 The diagram below shows the lower surface of a leaf as seen under a microscope.



× 400

(a) **(i)** **JK** shows the length of the stoma in the diagram above.

Measure the length of **JK**.

length of **JK** .....mm [1]

(ii) Calculate the actual length of the stoma.

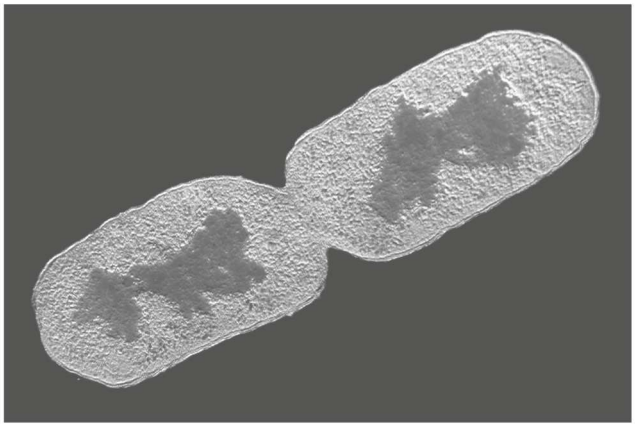
Show your working.

actual length of stoma .....mm [2]

[Total: 3]

2 Bacteria are useful in biotechnology and genetic engineering.

The diagram below shows a photomicrograph of a bacterium.



magnification ×27 000

The actual width of the bacterium is 0.0008 mm.

Convert this value to micrometres (μm).

Space for working.

..... μm [1]

[Total: 1]

3 One of the functions of the placenta is to provide a barrier to toxins and pathogens.

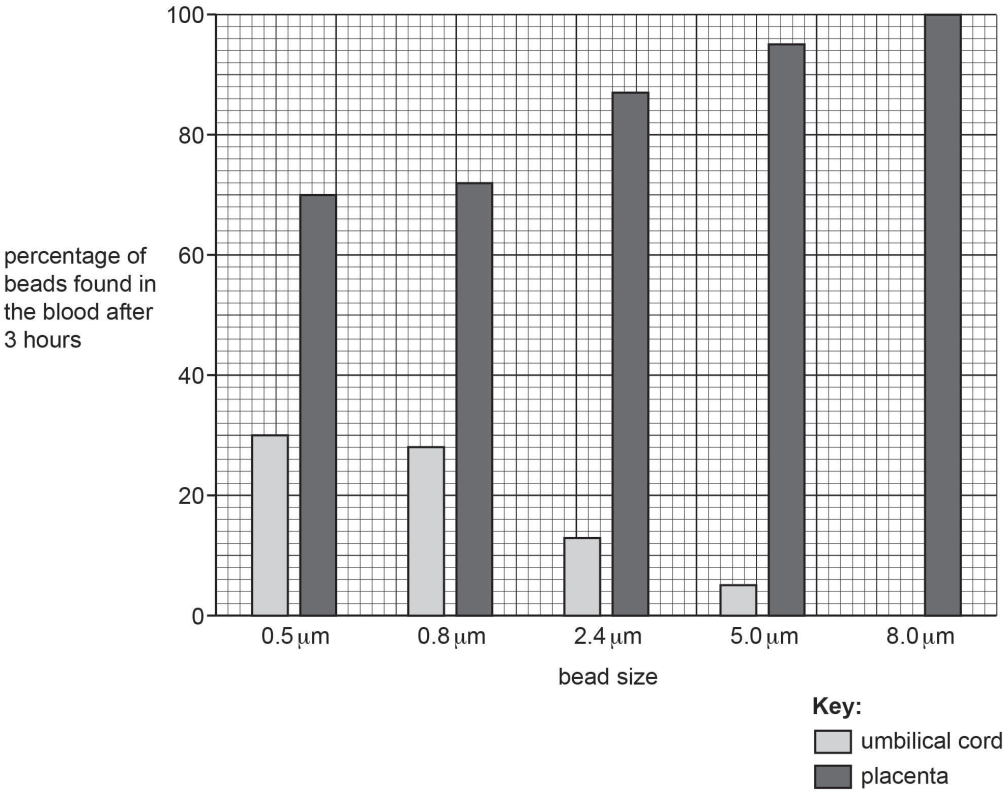
A study was done on donated afterbirths. The afterbirth is a placenta with part of the umbilical cord attached.

The purpose of the study was to find the maximum size of particles that can pass through the placenta and enter the umbilical cord.

The researchers inserted beads with a diameter of 0.5 μm into blood vessels in the placenta. Three hours later they recorded the percentage of beads found in the blood in the placenta and in the umbilical cord.

They then repeated the tests using beads with diameters of 0.8 μm, 2.4 μm, 5.0 μm and 8.0 μm.

Their results are shown in the graph.



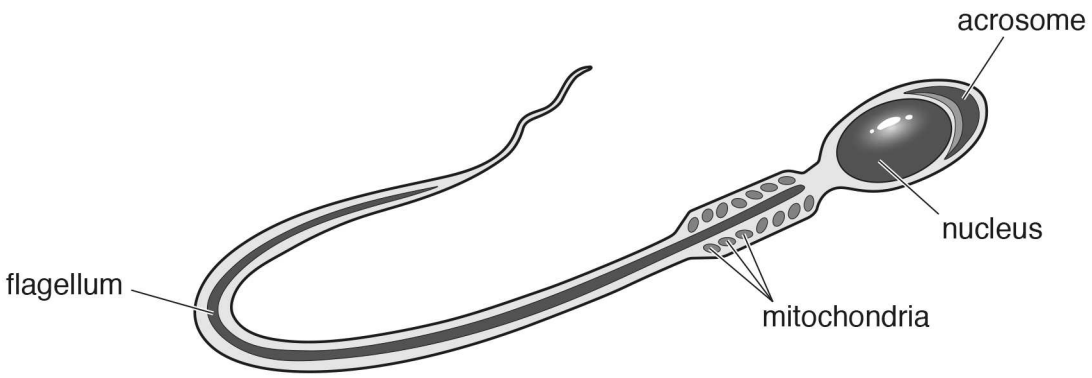
Convert the diameter of the 5.0 μm beads into millimetres (mm).

Space for working.

..... mm [1]

[Total: 1]

4 The diagram below shows a human sperm cell.



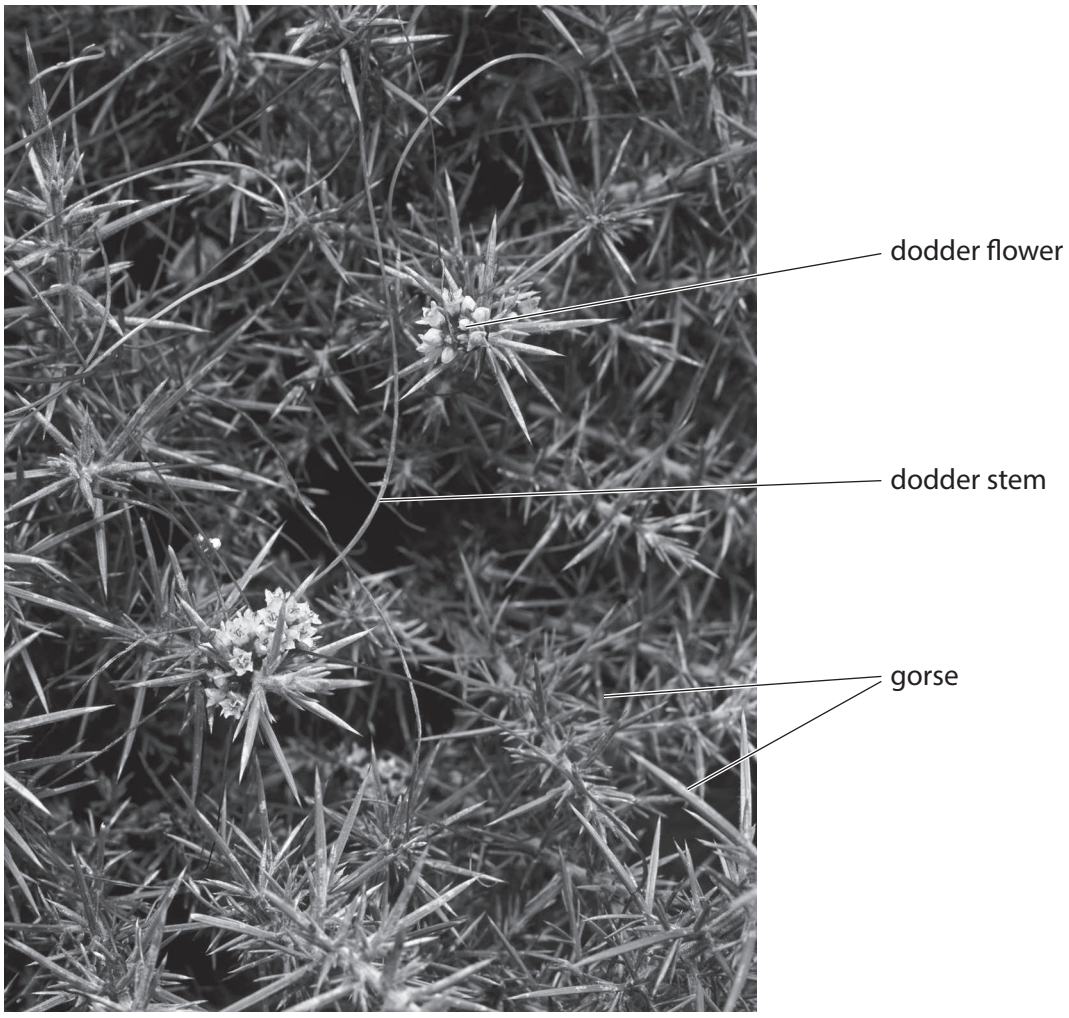
Write the formula that would be used to calculate the magnification of the diagram.

[1]

[Total: 1]

5 A parasite is an organism that obtains its nutrients from another living organism (the host).

The diagram below shows the parasitic plant dodder, *Cuscuta epithymum*, growing on the host plant, gorse, *Ulex* sp. The flower and stems belong to the dodder. This plant does not have leaves or roots, and obtains its nutrients and water from the gorse.

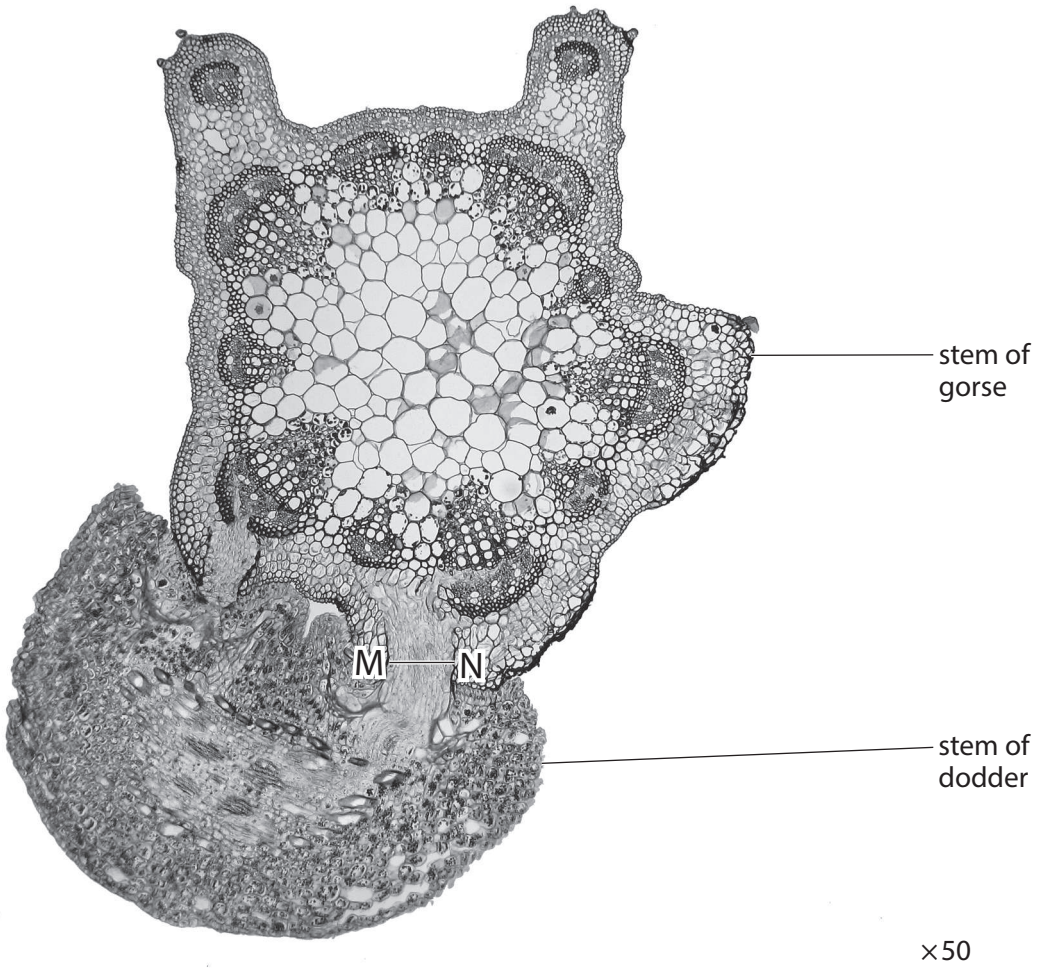


(a) Suggest how dodder obtains minerals from the gorse.

.....

..... [1]

(b) The structure that dodder uses to make contact with the gorse is called haustorium. The width of the haustorium is marked by the line **MN** on the diagram below.



Measure the length of **MN**.

..... mm [1]

(c) Calculate the actual width of the haustorium (**MN**).

Show your working.

actual width ..... mm [2]

[Total: 4]