Why Cells Divide

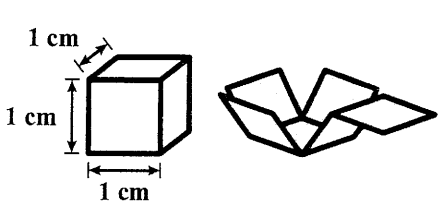
Introduction

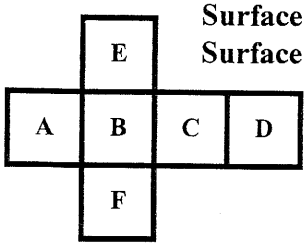
All the materials a cell needs to maintain itself and to grow must be brought in through the cell membrane. All waste materials produced by the cell must be removed through the cell membrane. As the cell grows, its ratio of cell membrane (surface area) to the inside of the cell (volume) decreases. If cells were to continue to grow indefinitely, eventually the ratio would reach a point where there would be insuf cient surface area to supply materials or remove waste products. When this point is reached, the cell must stop growing, die, or divide and form two smaller cells with better ratios of surface area to volume. The ideal ratio for maximum cell size varies from species to species and from cell type to cell type.

Directions

1. Calculate the surface area and volume of a cube (representing a plant cell) using the following formulas:

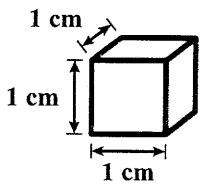
   Surface area of a cell or cubes is found by finding the area of each side of the object and then adding these together: length x width x 6 (# of sides). Imagine unfolding the sides of the cube as shown in the illustration.





Surface area = length x width x 6
Surface area = 1cm x 1cm x 6
Surface area = 6 cm^2

   Volume of a cube = length x width x height. The volume of a cube or cell is found by multiplying its length by its width by its height.



Volume = length x width x height
Volume = 1cm x 1cm x 1 cm
Volume = 1cm^3

Ratio of Surface Area to Volume: 6:1

2. On page 2, calculate surface area, volume, and ratio of surface area to volume for each cube. Then answer the questions below.

Questions

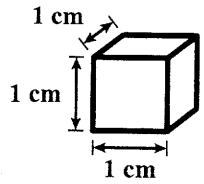
1. Explain what happens to the surface area to volume as the cell increases in size.

2. Explain the implications for individual cells as the cell increases.

3. Using these differences in ratios, explain why a cell must divide.

(Continued on next page)

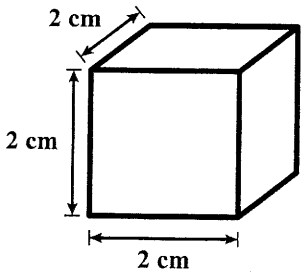
Why Cells Divide *(continued)*



Surface area = length x width x 6
Surface area = 1cm x 1cm x 6
Surface area = 6 cm^2

Volume = length x width x height
Volume = 1cm x 1cm x 1 cm
Volume = $1cm^3$

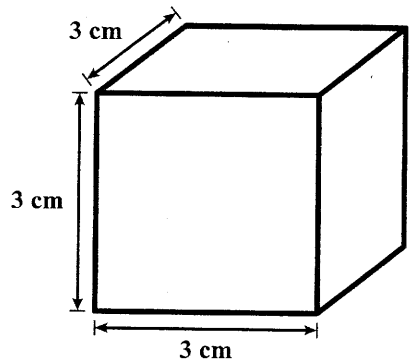
Ratio of Surface Area to Volume: 6:1



Surface area = length x width x 6
Surface area = __cm x __cm x 6
Surface area = ____ cm^2

Volume = length x width x height
Volume = __cm x __cm x __ cm
Volume = ____ cm^3

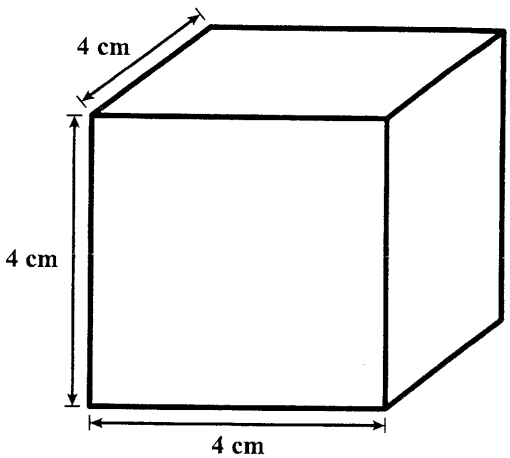
Ratio of Surface Area to Volume: ____ : ____



Surface area = length x width x 6
Surface area = __cm x __cm x 6
Surface area = ____ cm^2

Volume = length x width x height
Volume = __cm x __cm x __ cm
Volume = ____ cm^3

Ratio of Surface Area to Volume: ____ : ____



Surface area = length x width x 6
Surface area = __cm x __cm x 6
Surface area = ____ cm^2

Volume = length x width x height
Volume = __cm x __cm x __ cm
Volume = ____ cm^3

Ratio of Surface Area to Volume: ____ : ____