Surface Area & Volume Investigation

For this investigation, you will need access to a variety of packages with a range of shapes and sizes.

Phase 1: Calculate the volume and surface area of your 3-D shape. Find the surface area to volume ratio.

Eg:

$Volume = 8 \times 5.5 \times 3 = \mathbf{132cm^3}$

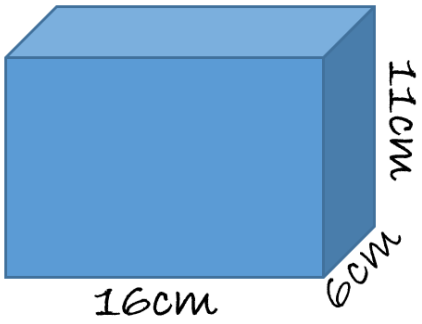
$Surface\ Area = 2(8 \times 5.5) + 2(8 \times 3) + 2(5.5 \times 3) = \mathbf{169cm^2}$

$Surface\ Area\ to\ Volume\ ratio = \frac{169}{132} \approx \mathbf{1.28cm^2\ per\ cm^3}$

Note: To find the volume of a prism, multiply the cross-sectional area by the length. Eg, the volume of a cylinder with radius r and height h is given by: $V = \pi r^2 h$. To find the surface area of a 3-D shape, add up the area of every face. To calculate the surface area to volume ratio, divide the surface area by the volume.

Phase 2: Investigate how scaling your shape up or down changes the volume, surface area and hence the ratio.

Eg:



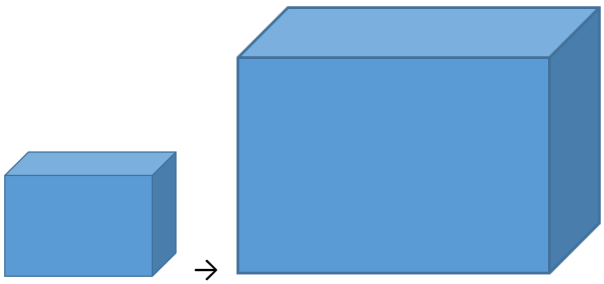
$Volume = \cdots$

$Surface\ Area = \cdots$

$Surface\ Area\ to\ Volume\ ratio = \cdots$

Phase 3: Using what you have found out about the effect of a length scale factor on area and volume, find a way of scaling your shape to give a volume of $\mathbf{1000cm^3}$, and work out the surface area of this scaled version.

Eg:



$Original\ V = 132cm^3 \qquad Required\ V = 1000cm^3$

$\Rightarrow \quad Volume\ Scale\ Factor = \frac{1000}{132} = 7.\dot{5}\dot{7}$

$\Rightarrow \quad Length\ Scale\ Factor = \cdots$

$\Rightarrow \quad New\ Dimensions: \ \ldots cm \times \ldots cm \times \ldots cm$

Note: Scaling your shape to this volume means we can then compare the surface area to volume ratio with different shapes without the size being a factor in our comparisons.

Phase 4: Compare your modified shape (volume $\mathbf{1000cm^3}$) to other shapes of the same volume and investigate what types of shape give the best (smallest) surface area to volume ratio.

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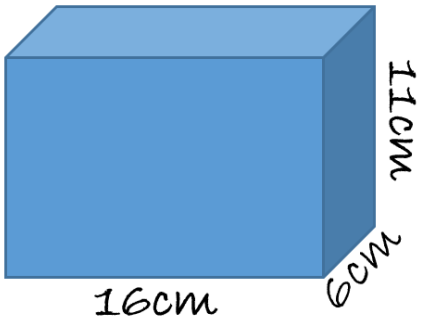

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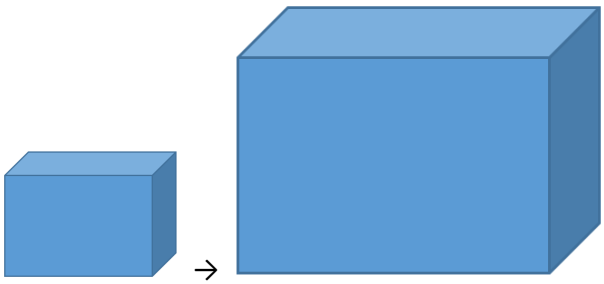

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