

Science at the Roman Baths

Teachers' guide – surface area and volume

About the activity

This activity requires pupils to consider the link between surface area and heat loss. They will make a rough calculation of the surface area of the Great Bath and suggest why its temperature is lower than the temperature of the water in the Sacred Spring. They will then go on to calculate the volume of water in the Great Bath in metres cubed and then convert the volume figures into litres.

Curriculum links

This activity touches on concepts contained within Unit 8I in the Key Stage 3 National Curriculum on heat transfer; however, pupils should have already encountered basic ideas about heat loss at Key Stage 2. It also links in with topics on surface area and volume in the Maths curriculum.

Pre-visit suggestions

It is suggested that, prior to attempting this activity, pupils should have done some work on surface area and volume. They should be comfortable calculating these for simple objects. Pupils should also be comfortable with the units used for these quantities.

To support the heat loss aspect of the activity, an experiment could be carried out to illustrate the heat loss from fixed volumes of water when the surface area is varied (i.e. using different sized containers).

Supporting pupils

This activity is largely pupil led and should not require much teacher input. The pupils will measure the length and width of the Great Bath using their strides and assuming that 1 stride = 1 metre. Although it is likely that their strides will be shorter than this, it will still allow them to obtain a rough figure for their calculations. They can compare the figures they obtain with the actual figures on the signs around the Great Bath. Pupils may require a calculator to carry out surface area and volume calculations – consider bringing a couple of calculators or instruct them to use their mobile phones if it is possible for them to do this.

During this activity pupils should take care when walking around the edges of the Great Bath – they should carry out their measurements at a safe distance from the water.

Great Bath length = 19 metres
Great Bath width = 9 metres
Great Bath surface area = 171 metres squared
Great Bath depth = 1.5 metres
Great Bath volume = 2256.6 metres cubed
Great Bath volume (in litres) = 256.500

Post-visit suggestions

This activity could be used as a lead-in to examining the heat transfer topic at Key Stage 3. The experiment suggested in the pre-visit section could alternatively be carried out after the visit. Students could draw on the knowledge they gained at the Roman Baths to predict which container would lose heat quickest.

Pupils could also develop the ideas gained during the visit by considering how heat loss could be minimised – what steps they could take to reduce the heat loss from a beaker of hot water? This could then be extended into a practical investigation.

As the volume of the Great Bath in litres is a very large number that pupils are unlikely to be able to visualise, it could be helpful to express it in terms of 2L fizzy drink bottles – it would take 128,250 of these to fill the Bath. This impresses on pupils the volume of water involved.