

Title: Volume

Topics: Measurement, units, calculation of volume	Time: 60 minutes	Age: 10 - 12
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Differentiation:

Higher level: Pupils will be given the opportunity to calculate complex shapes aided only with a supplied descriptive sheet.

Lower level: Pupils will calculate volumes of a variety of shapes with some help.

Guidelines, ICT support etc.:

There are no specific requirements for this module.

Equipment needed for this activity:

Paper and a calculator, measurement apparatus such as rulers or tape measures. A large beaker and water.

Required knowledge:

The ability to perform simple calculations, record measurements and allocate units.

Health and Safety:

There are no issues for health and safety consideration.

Learning outcomes for this activity:

All pupils should be able to measure and record measurements of height, length and depth.

Most pupils will be able to calculate the volume for a variety of simple shapes.

Some pupils will be able to calculate the volume of various complex shapes unaided.

Lesson description

Starter Activity

Pupils are presented with a solid cubes of fixed dimensions. They are asked to measure the length, depth and height of these cubes.

These measurements are recorded.

It is suggested that cubes of

1cm x 1cm x 1cm

2cm x 2cm x 2cm

3cm x 3cm x 3cm

Many schools have these cubes already made up, however these can simply be prepared from plastecine.

Pupils are asked to mass each of the cubes.

They are then asked to comment on their findings.

They will then be asked to explain why the mass increases 1 to 8 to 27.

Then they view the cubes individually dropped into a beaker of water.

They record the volume of water both before and after the cube is dropped in, the difference in volume being the volume of the cube.

With cube 1 the increase in volume is 1 ml (1cm cubed), cube 2 gives an increase in 8 ml and cube 3 an increase of 27 ml (27 cubic cm).

Pupils are encouraged to discuss what they believe would be the effect of a 5cm x 5cm cube etc.

Pupils should be encouraged to the conclusion of squared as a mathematical technique and also this relationship to volume.

Main Activity

Pupils are given a series of boxes and diagrams and are required to calculate the volume.

Pupils are encouraged to give units and explain themselves when questioned by the teacher.

Other shapes may be used with more able pupils. (Work sheets supplied)

Plenary Activity / Cognitive conflict

Pupils should be supplied with a series of identical boxes.

The boxes must be of radically different masses.

Pupils should be asked to explain that size and mass are independent of each other.

Large boxes, which have a smaller mass than small boxes, should also be used to further create discussion.

Functional Skills Maths

Waqar buys a planter.



The planter is 2.5m wide, 3m long and 1.5m deep.

How much soil does Waqar need to fill the planter 75cm deep?

- A** 6.53m³
- B** 80.5m³
- C** 5.63m³
- D** 562.5m³

A standard die is a cube with sides measuring 15mm. What is the volume of the die?



A

45mm^3

B

90mm^3

C

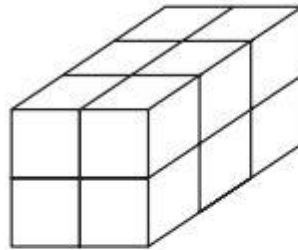
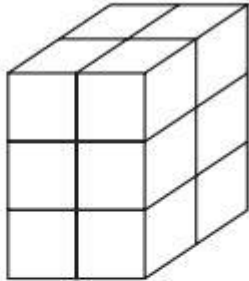
225mm^3

D

3375mm^3

General work sheet

1. You have 12 cubes, each with sides 1 cm long. How many different cuboids can you make using all the cubes for each one?



Two are shown here, but these are essentially the same, and could be described as $3 \times 2 \times 2$ cuboids. There are 3 other different cuboids that can be made from 12 cubes. Describe them.

2. How many different cuboids can you make using:
- (a) 16 cubes,
 - (b) 10 cubes,
 - (c) 7 cubes,
 - (d) 5 cubes,
 - (e) 9 cubes ?
3. Without drawing them or using cubes, decide how many different cuboids you could make using the following numbers of cubes:
- (a) 17,
 - (b) 8,
 - (c) 20,
 - (d) 49,
 - (e) 15.

Extension

Can you determine a general result which gives you the number of different cuboids it is possible to make possible using *any* number of cubes?

(*Hint:* write each number as a product of its prime factors and look at the sum of the powers for each number.)



A rectangular garage has a volume of 480 m^3 , a length of 12 m and a width of 8 m . What is the height of the garage?



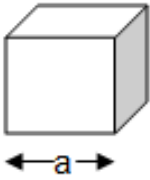
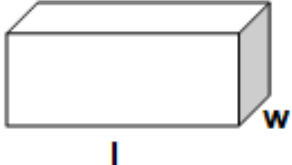
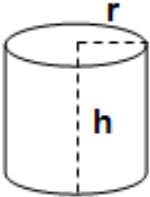
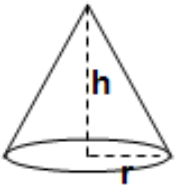
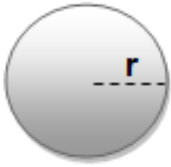
A $5m$

B $24m$

C $10m$

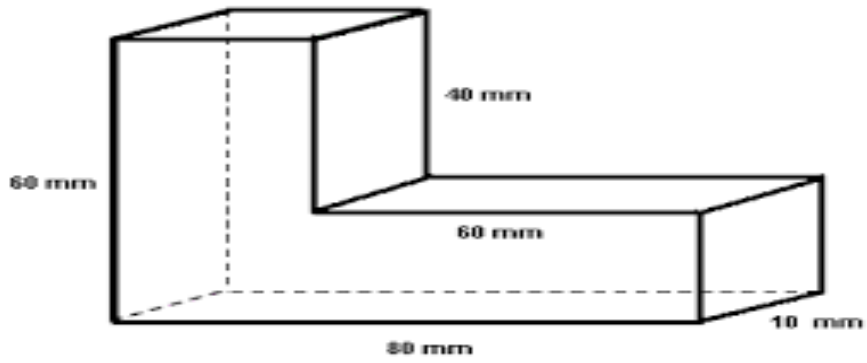
D $2.5m$

Volume formulae sheet

Figure	Formula	Variables
<p>Cube</p> 	a^3	<p>a = length of edge</p>
<p>Rectangular prism</p> 	$l \times w \times h$	<p>l = length w = width h = height</p>
<p>Cylinder</p> 	$\pi \times r^2 \times h$	<p>r = radius of circular face h = height</p>
<p>Cone</p> 	$\frac{1}{3} \times \pi \times r^2 \times h$	<p>r = radius of circular base h = height from tip to base</p>
<p>Sphere</p> 	$\frac{4}{3} \times \pi \times r^3$	<p>r = radius</p>

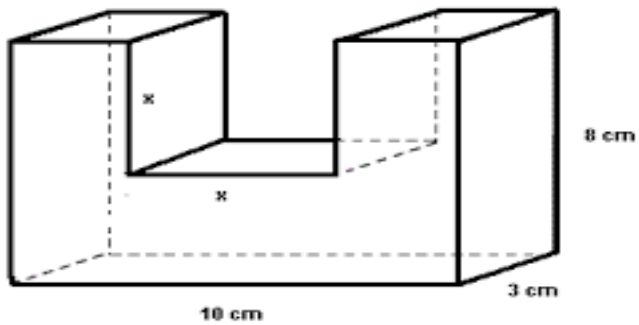
Calculate the volume of the following shapes (Main activity)

1



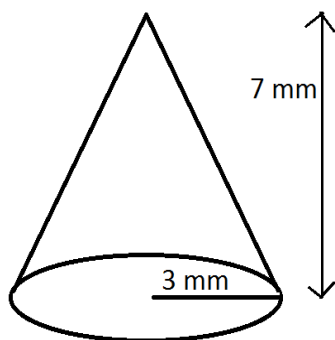
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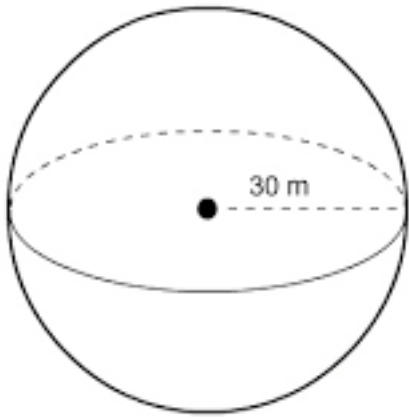


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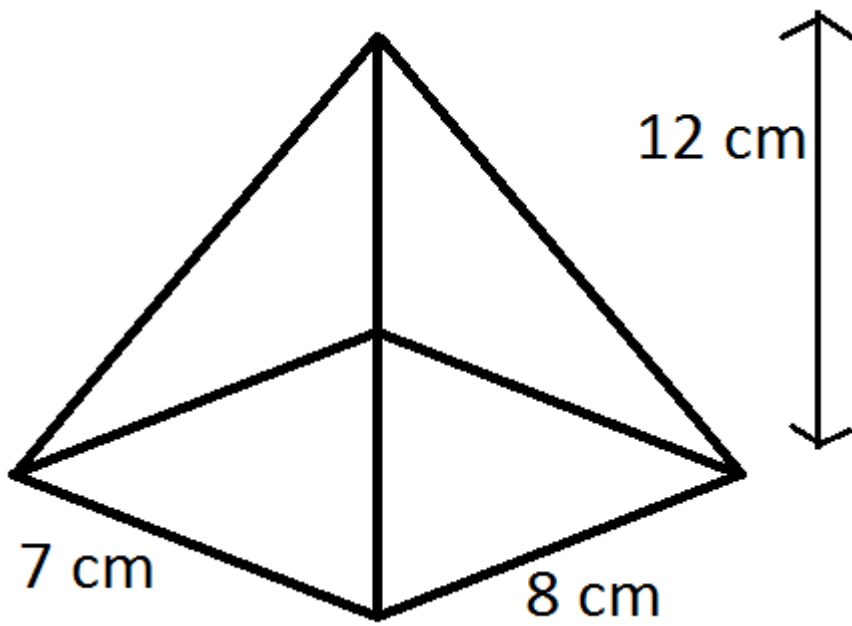
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5



6

