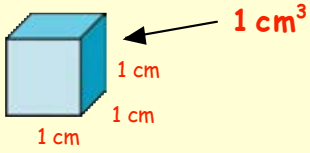
Volume by Counting Cubes

The volume of a shape is the "**amount of space**" it takes up.

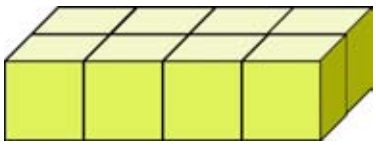
The basic unit of volume is the **cubic centimetre**.

A small cube which measures 1 cm by 1 cm by 1 cm is said to have a **volume** of **1 cubic centimetre** and is written as **1 cm^3**.



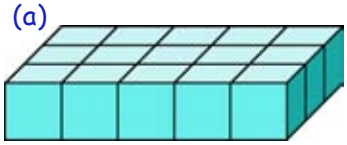
Exercise 6·1

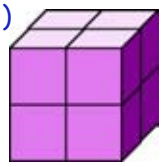
1. (a) How many "centimetre cubes" does this shape contain ?

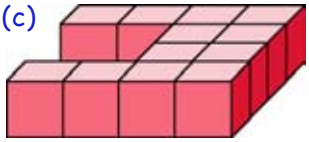


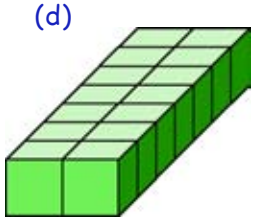
(b) **Copy** and complete :- "It's volume is .... cm^3".

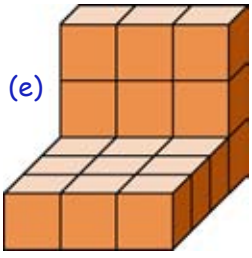
2. Write down the volumes of each of these shapes.
Each small cube has a volume of 1 cm^3.

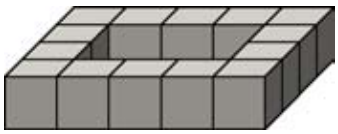
(a)


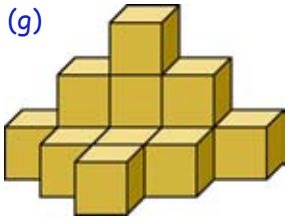
(b)


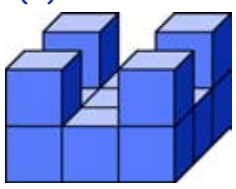
(c)


(d)


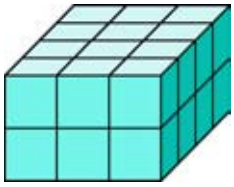
(e)


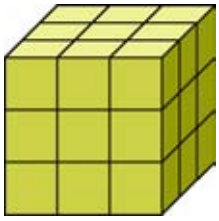
(f)


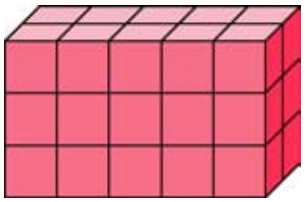
(g)


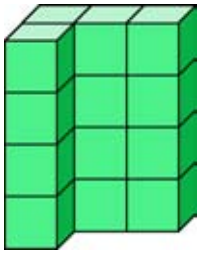
(h)


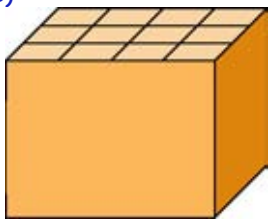
3. By counting the number of cubes on the top face, calculate and write down the volume of each of the shapes in cubic centimetres (cm^3).

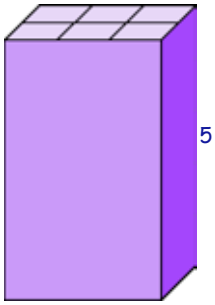
(a)


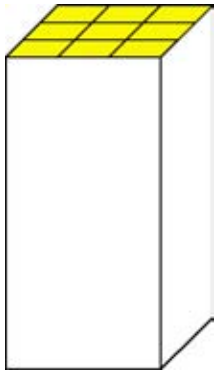
(b)


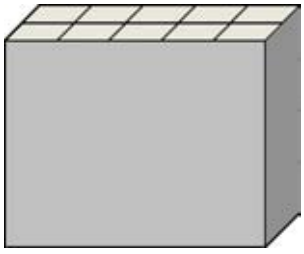
(c)


(d)


(e)


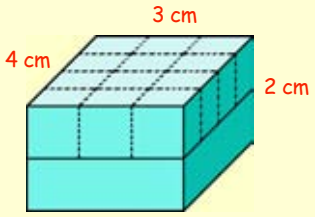
(f)


(g)


(h)


Volume - Cubes & Cuboids - a Formula

Look at the cuboid on the right and find out if we can determine its **volume** without having to count it cube by cube.



- The top layer consists of 4 rows of 3 cubes => 4 x 3 (= 12 cm^3)
- There are 2 identical layers => Volume = 2 x (4 x 3) (= 24 cm^3)

This means a simple process to determine the volume of a cuboid (or cube) is to multiply the 3 dimensions.

Volume = length x breadth x height or in symbols **$V = L \times B \times H$**

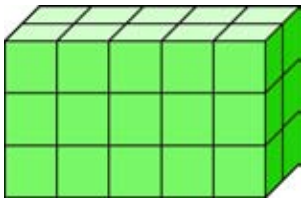
Exercise 6·2

1. **Copy** and complete :-

$Vol = L \times B \times H$

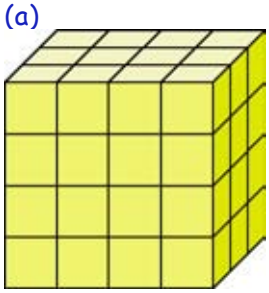
$V = 6 \times 2 \times 3$

$V =$ ..... cm^3

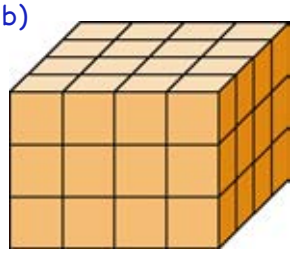


2. Use the above formula to calculate the volumes of these cuboids :- (*Show 3 steps each time*).

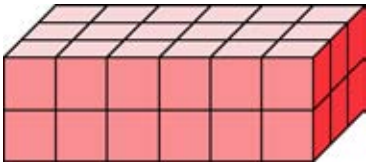
(a)



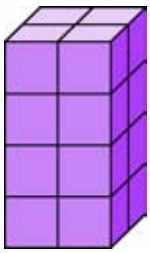
(b)



(c)



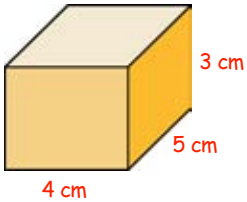
(d)



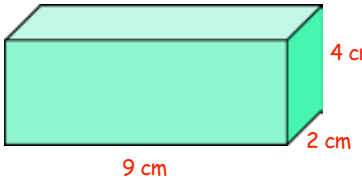
(*Check each answer by counting cubes*).

3. Use the above formula to calculate the volume of each of these cuboids :-

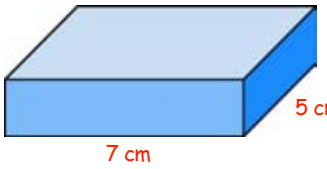
(a)



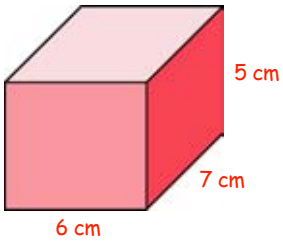
(b)



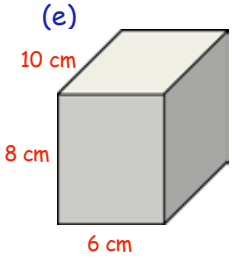
3. (c)



(d)



(e)



(f)

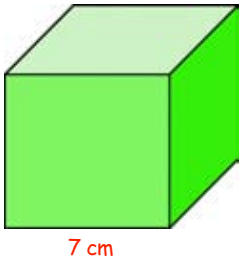
4. The same formula can be used to calculate the volume of a **cube**.
In a cube, all of the edges are the same length.

Copy and complete :-

$Vol = L \times B \times H$

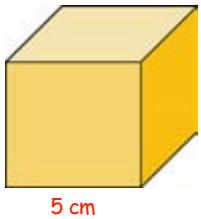
$V = 7 \times 7 \times 7$

$V =$ ..... cm^3

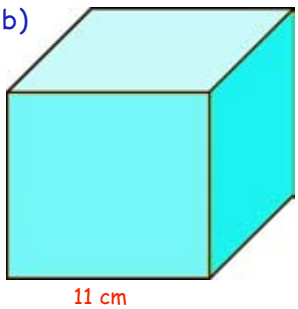


5. Calculate the volume of each of these **cubes** :-

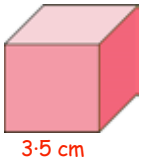
(a)



(b)

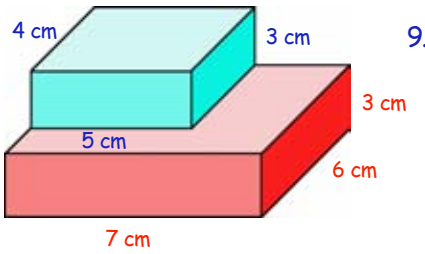


(c)



6. This shape consists of a blue cuboid on top of a pink one.

Copy and complete :-



Volume (blue) = $L \times B \times H$

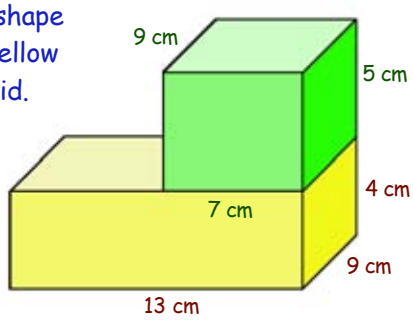
= $5 \times 4 \times 3$ = ... cm^3

Volume (red) = $L \times B \times H$

= $7 \times 6 \times 3$ = ... cm^3

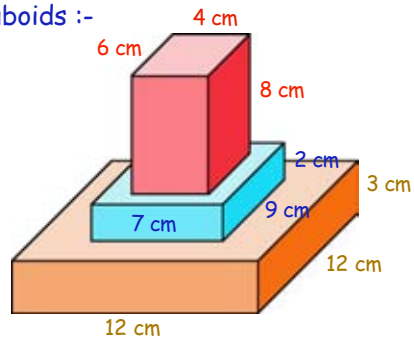
Total Volume = ... + ... = ... cm^3

7. Repeat for this shape consisting of a yellow and a green cuboid.

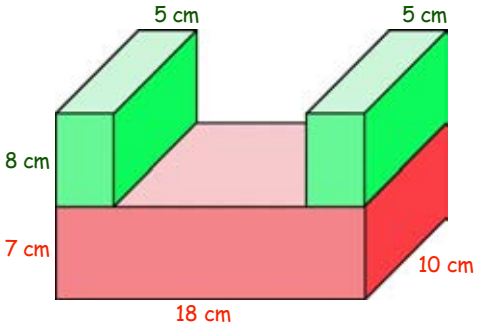


8. Find the volumes of these shapes consisting of 2 or more cuboids :-

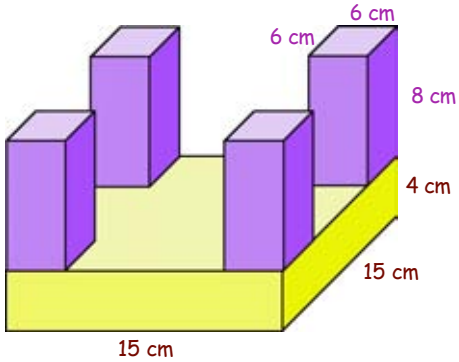
(a)



(b)

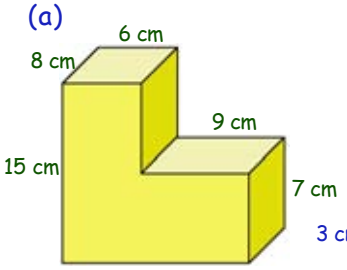


(c)

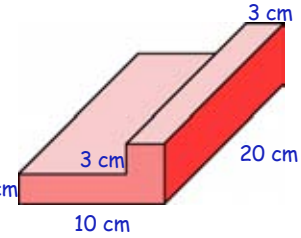


9. Find the volumes of these shapes :-

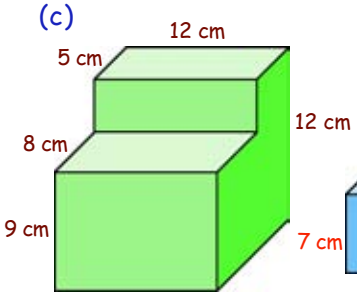
(a)



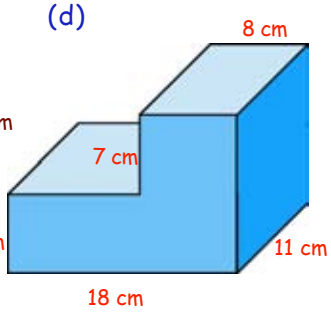
(b)



(c)

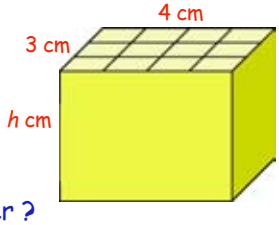


(d)



10. Look at the yellow cuboid.

It's volume is known to be 36 cm^3.

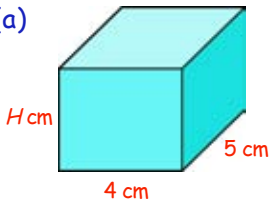


(a) How many cubes are there on the **top** layer ?

(b) Calculate what the **height** (*h* cm) of the cuboid must be.

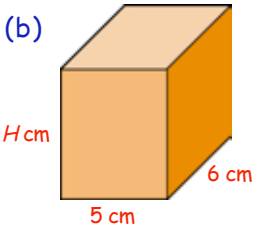
11. Calculate the **H**, **L** or **B** in these cuboids :-

(a)



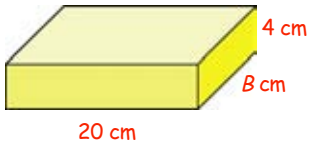
Volume = 80 cm^3.

(b)



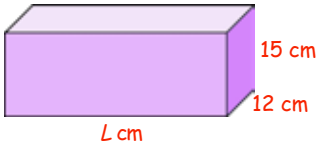
Volume = 210 cm^3.

(c)



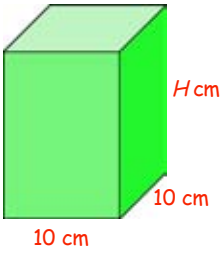
Volume = 960 cm^3.

(d)



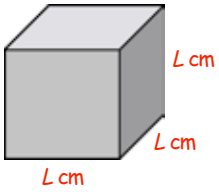
Volume = 3600 cm^3.

(e)



Volume = 1500 cm^3.

(f) A **cube**. (*hard !*)



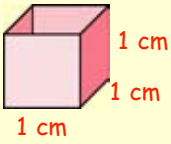
Volume = 125 cm^3.

Volumes of Liquids - Capacity

When talking about the volumes of **liquids**, we do **NOT** talk about buying **567 cm^3** of milk, or drinking a **330 cm^3** bottle of beer.

Look at this hollow cube with sides 1 cm long.

If we fill it with water, it will hold **1 cm^3**.



When discussing liquids, we refer to this as **1 millilitre**.

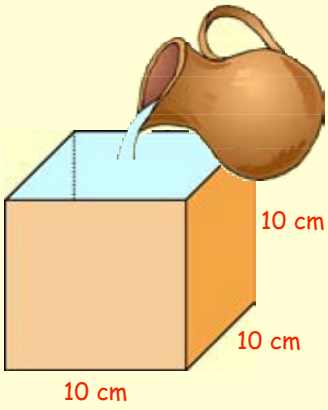
1 cm^3 = 1 millilitre = 1 ml

So a carton of milk might hold **567 ml** and a bottle of raspberry juice **330 ml**.

Look at this carton, measuring 10 cm by 10 cm by 10 cm.

Its volume is given by :- $V = L \times B \times H = 10 \times 10 \times 10 =$ **1000 cm^3**.

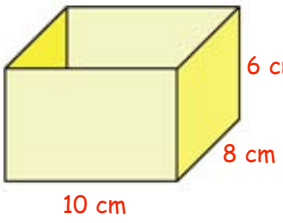
If filled with water, we say its **CAPACITY** is **1000 ml** or **1 litre**.



Exercise 6·3

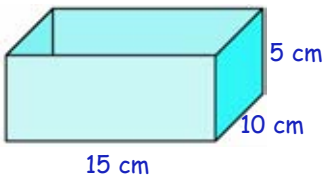
1. (a) Calculate the **volume** of this cuboid in cm^3.

(b) If it is filled with water, how many millilitres will it hold ?

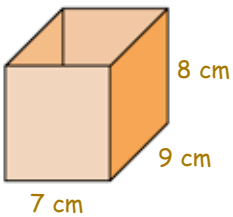


2. Calculate the **capacity** of each of these containers when full of liquid :-

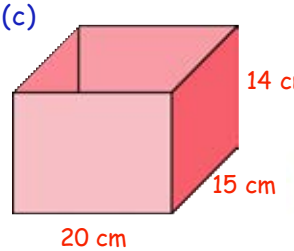
(a)



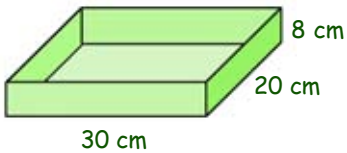
(b)



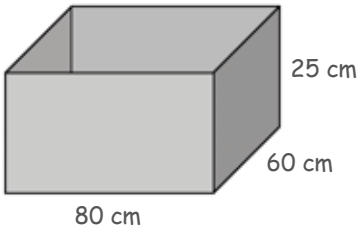
(c)



(d)



3. This metal tank is to be filled to the top with oil.



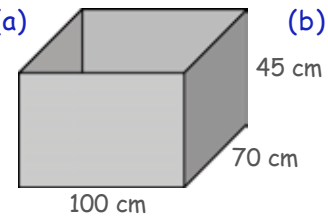
(a) Calculate its volume in cm^3.

(b) How many **millilitres** of oil will it hold ?

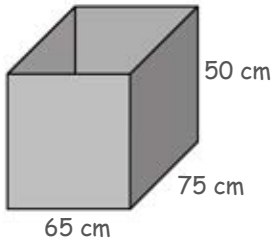
(c) What is its capacity in **litres** ?

4. How many litres of oil will each of these tanks hold when full ?

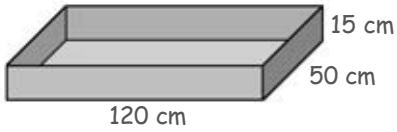
(a)



(b)



(c)



5. Remember : to change from:-

millilitres —> litres you simply **÷ 1000.**

Change each of the following to **litres** :-

(a) 4000 ml (b) 8000 ml (c) 21000 ml

(d) 6500 ml (e) 1200 ml (f) 172 500 ml

(g) 700 ml (h) 200 ml (i) 15 ml.

6. Remember : to change from:-

litres —> millilitres you simply **× 1000.**

Change each of the following to **millilitres** :-

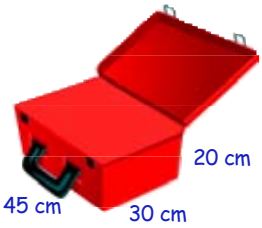
(a) 5 litres (b) 9 litres (c) 17 litres

(d) 8·5 litres (e) 2·3 litres (f) 19·5 litres

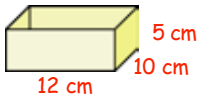
(g) 0·4 litres (h) 0·35 litres (i) 0·08 litres.

7. This lead-lined box is used to store liquid radio-active waste.

How many **litres** of waste can it hold when full ?



8. This bucket holds 4·8 litres when full.



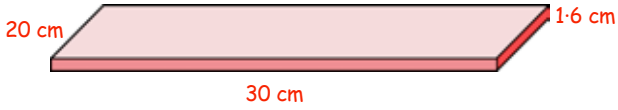
(a) How many **millilitres** is this ?

(b) The shallow plastic tray is used to fill the bucket with water.
Calculate its volume in cm^3.

(c) How many **millilitres** will the tray hold ?

(d) How many times will the tray have to be used to fill the bucket to the top ?

9. Davie buys a "slab" of pink plasticine.



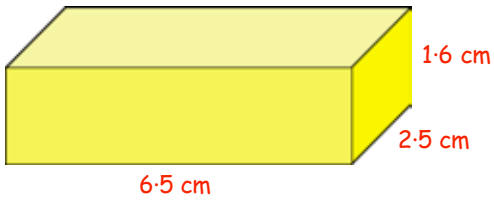
He cuts pieces off to form small **cubes** with sides 4 cm.

By calculating the volume of both the slab and the cube, find how many cubes he can make.

10. This little ingot of gold is in the shape of a cube of side 0·5 cm.

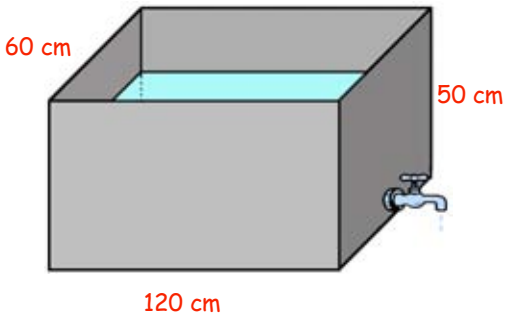
(a) Calculate its volume in cm^3.

(b) How many ingots like this must be melted down to make this gold bar ?



(c) What will the total weight of the bar be if 1 cm^3 of gold weighs 19·3 grams ?

11. This tank is **half** full of water.

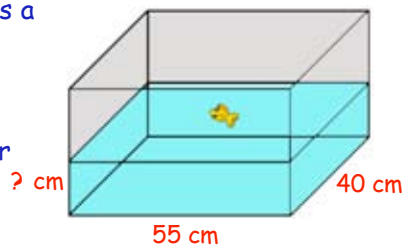


(a) Calculate how many **litres** of water are in the tank.

(b) When the tap is opened, water pours out at the rate of 12 litres per minute. How long will it take for the tank to empty ?

12. This fish tank has a base measuring 55 cm by 40 cm.

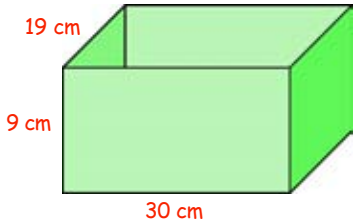
44 litres of water is poured into the tank.



(a) How many **millilitres** of water is this ?

(b) To what depth will the water fill the tank ?

13. This **5 litre** jug of water is poured into this tank.

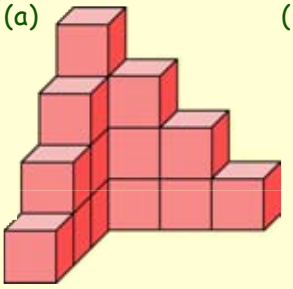


Will the tank overflow ? (*explain*).

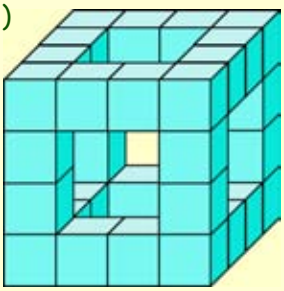
So What Have I Learned ?

1. Write down the **volumes** of each shape (*Each small cube is 1 cm^3*).

(a)



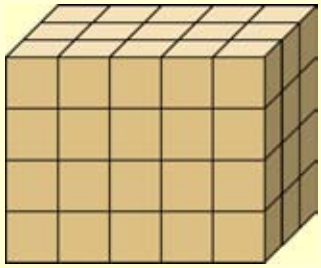
(b)



2. (a) How many cubes are there in the **top** layer of this shape ?

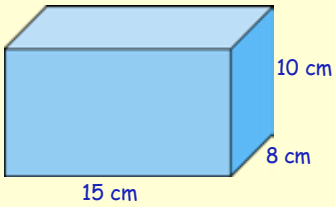
(b) How many layers are there ?

(c) What is the **volume** of the whole shape ?

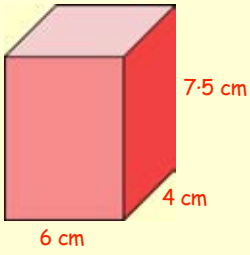


3. Calculate the **volumes** of the following cuboids using the standard formula.

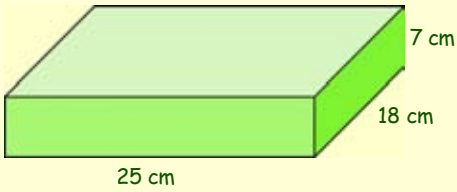
(a)



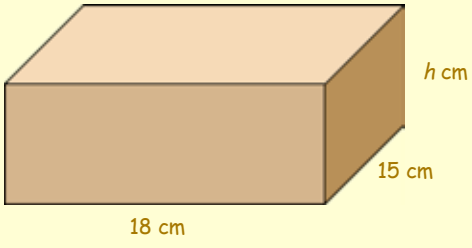
(b)



(c)

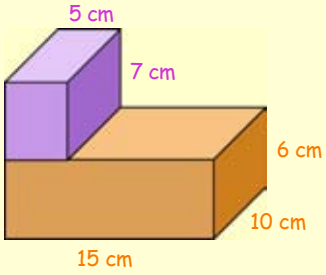


4. The volume of this cuboid is 1620 cm^3.

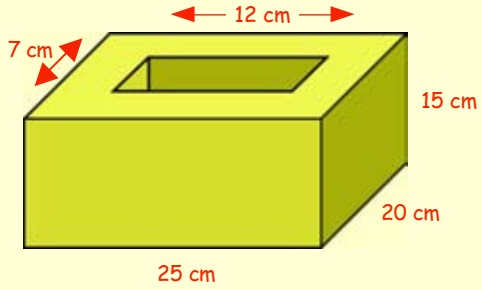


Given that its length is 18 cm and its breadth is 15 cm, calculate its **height**.

5. Calculate the total **volume** of this shape :-



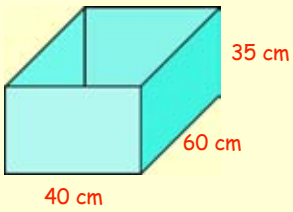
6. This yellow metal block has a hole running from top to bottom.



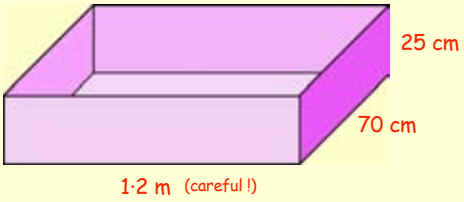
Calculate the **volume** of metal used to make it.

7. (a) Calculate the volume of this tank in cm^3.

(b) How many **litres** of water will it hold ?



8. What is the maximum **capacity** of this tray ?



9. This water tank holds 36 litres of water.

How many times can a small plastic container measuring 12 cm by 15 cm by 5 cm be filled from the tank ?