17 Liquid Measures

By studying this chapter you will be able to gain knowledge on the,
* units of the volume of liquids.
* multiplication and division of units of liquid measure.
* application of liquid measures in day-to-day life.

Can you understand that all the containers in the given figure can be filled with liquid upto to the measurement shown?

* A special feature of a liquid is that it has the ability to flow.
* A liquid has no definite shape.
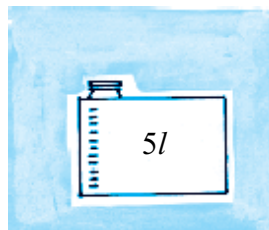* A liquid takes the shape of the container into which it is poured.

17.1 Volume and Capacity

Any empty container, whatever shape it has, can be filled with a liquid. The maximum quantity of liquid that can be filled into a container is its capacity.
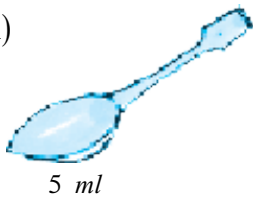
(i)

(ii)

(iii)

5 ml

(iv)

The capacity of each of the containers above is marked on it. The volume of liquid in a container when it is filled to its brim is the capacity of the container. When one half of a container is filled with a liquid, its volume is half the capacity of the container.
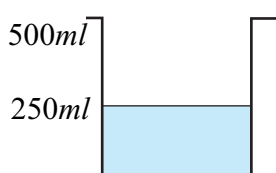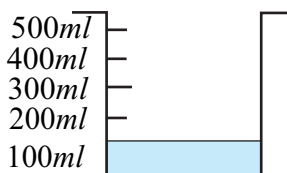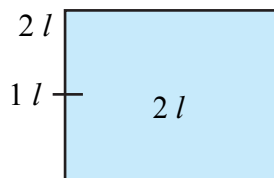
Activity 17.1

Figure 1

Figure 2

Figure 3

Complete the following table.

	Capacity	Volume of the liquid contained
Figure 1	500 *ml*	250 *ml*
Figure 2		100 *ml*
Figure 3		

17.2 Measuring the volume of liquids

Let us find out about the units used to measure the volume of a liquid. Consider the cubical container of which the interior measurements are length 1 cm, breadth 1 cm and height 1 cm.
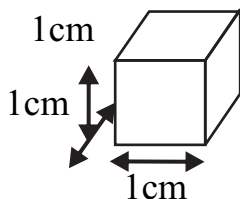
The volume of this cubical container = length × breadth × height
= 1 cm × 1 cm × 1 cm
= $1cm^3$

When the cube is filled with a liquid, the volume of the liquid is 1 cm^3. This quantity of 1 cubic centimetre is equivalent to a millilitre. Accordingly the volume of the liquid that, the above cube is filled with is, one millilitre. It is written as **1 *ml*.** Accordingly the unit 'millilitre' can be used as an elementary unit of measuring the volume of a liquid.

$$1cm^3 = 1 \text{ m}l$$

Since a millilitre is a small unit; a larger unit, by the name **litre,** which is 1000 millilitres, is used to measure the volume of liquids.

$$1000 \text{ m}l = 1 \text{ } l$$

Fill in the blanks.

(i) $5 \ l = \boxed{} \ ml$
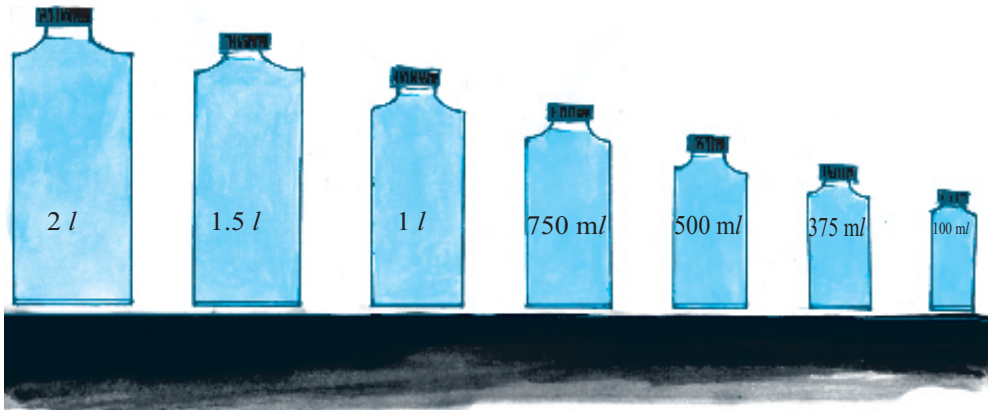
(ii) $250 \ ml = \boxed{} \ l$

(iii) $2000 \ ml = \boxed{} \ l$

(iv) $11 \ l = \boxed{} ml$

(iv) $750 \ ml = \boxed{} l$

Activity 17.2

| 2 l | 1.5 l | 1 l | 750 ml | 500 ml | 375 ml | 100 ml |

Find a few bottles or containers, of which the capacity is marked as, $2 \ l$, $1.5 \ l$, $1 \ l$, $750 \ ml$, $500 \ ml$, $375 \ ml$, $100 \ ml$.

Fill the $500 ml$ bottle with water and pour that quantity of water into the $1l$ bottle. Do it again and then you will see that the $1 \ l$ bottle is full.

$\therefore \ 2 \times 500 \ ml = 1 l = 1000 \ ml$

Do the above activity using bottles of different capacity as suitable. Thereby find out whether the following statements are true.

(1) 5 × 100 *ml*　　　　= 500 *ml*

(2) 10 × 100 *ml*　　　= 1000 *ml*　　= 1 *l*

(3) 3 × 500 *ml*　　　= 1500 *ml*　　= 1.5 *l*

(4) 4 × 500 *ml*　　　= 2000 *ml*　　= 2 *l*

(5) 2 × 375 *ml*　　　= 750 *ml*

(6) 4 × 375 *ml*　　　= 1500 *ml*　　= 1.5 *l*

(7) 2 × 750 *ml*　　　= 1500 *ml*　　= 1.5 *l*

Example 1

The capacity of the dropper shown in the figure is 8 *ml*. When a liquid is put ten times by it into the container seen in the left, it will be full. Hence the capacity of the container is 80 *ml*.

$$\therefore \quad 80\,ml = 10 \times 8\,ml$$

> The multiplication of a volume given in millilitres or litres by a whole number is done in the same way as multiplying a number by another whole number.

Example 2

(i)　Multiply: 2 *l* 250 *ml* by 3.
　　Method I
　　First write the given volume in millilitres.
　　　　2 *l* 250 *ml* =　2000 *ml* + 250 *ml*

　　　　　　　　=　2000 *ml*
　　　　　　+　250 *ml*
　　　　　　=　2250 *ml*

Then multiply.

$\therefore \quad 3 \times 2 \, l \ 250 \, ml \qquad = 3 \times 2250 \, ml$
$\qquad\qquad\qquad\qquad = 6750 \, ml$
$\qquad\qquad\qquad\qquad = 6 \, l \ 750 \, ml$

Method II

First let us multiply units $2 \, l$ and $250 \, ml$ separately.

$\qquad\qquad 3 \times 2 \, l \qquad = 6 \, l$
$\qquad\qquad 3 \times 250 \, ml \ = 750 \, ml$

Now add them and you get a volume of $6 \, l \ 750 \, ml$.

$\qquad \therefore \quad 3 \times 2 \, l \ 250 \, ml \ = \ 6 \, l \ 750 \, ml$

(ii)   Let us multiply $3 \, l \ 800 \, ml$ by 2. This can also be done by any of the two methods given in example (2).

$\qquad\qquad 2 \times 3 \, l \qquad = 6 \, l$
$\qquad\qquad 2 \times 800 \, ml \ = 1600 \, ml$
$\qquad\qquad\qquad\qquad = 1 \, l \ 600 \, ml$

	l	ml
$\therefore \ 2 \times 3 \, l \ 800 \, ml =$	6	000
	1	600 +
=	7	600

$\qquad\qquad\qquad\qquad = 7 \, l \ 600 \, ml$

Exercise 17.2

(1)   Multiply the following volumes and give the results in litres.

(i) $2 \times 500 \, ml$ (v) $2 \times 1.5 \, l$

(ii) $3 \times 400 \, ml$ (vi) $2 \times 2 \, l \ 125 \, ml$

(iii) $5 \times 300 \, ml$ (vii) $4 \times 1 \, l \ 300 \, ml$

(iv) $3 \times 3 \, l$ (viii) $3 \times 3 \, l \ 500 \, ml$

(2)   Find the quantity of milk needed for one week for a boutique which buys 5 *l* per day.

(3)   A person needs to drink 2 *l* of water per day. What quantity of water does he need for a week?

(4)   If an athlete drinks 200 *ml* of milk twice a day,
      (i) what is the quantity of milk he needs for one day?
      (ii) what is the quantity of milk needed for a week?

(5)   A bottle 'P' can be filled with water by using a small bottle of capacity 200 *ml* five times. What is the capacity of the bottle 'P'
      (i) in litres?
      (ii) in millilitres?

17.3 Division of volumes of liquid by a whole number

Example 3

(i)   When a 2 litre bottle of soft drink is divided equally among 4 children , the quantity one will get is 2 *l* ÷ 4.
      But, since 2 *l*   = 2000 *ml*
      ∴ The quantity of drink one will get
      $$= 2\ l \div 4 = 2000\ ml \div 4 = 500\ ml$$

(ii) When a 2 *l* bottle of soft drink is divided among 5 children, the quantity one will get is 2 *l* ÷ 5.
      ∴   The quantity of drink one will get
      $$= 2\ l \div 5 = 2000\ ml \div 5 = 400\ ml$$

(iii) Similarly when a 5 *l* bottle of oil is divided among 5, the quantity one will get is 5 *l* ÷ 5.
      That is, 5 *l* ÷ 5 = 1 *l*

Example 4

(i)   Divide 1l 200 ml by 3.

```
        l      ml
              400
    3  │1     200
       │└→   1000
       │     1200
       │     1200
       │        0
```
$\therefore$ 1 l 200 ml ÷ 3 = 400 ml

(ii)   Divide 2 l 400 ml by 2.

```
        l      ml
        1      200
    2  │2      400
       │2      400
       │         0
```
$\therefore$ 2 l 400 ml ÷ 2 = 1 l 200 ml

(iii)   Divide 5 l 600 ml by 4.

```
        l      ml
        1      400
    4  │5      600
       │4
       │1 →  1000
       │     1600
       │     1600
       │        0
```
$\therefore$ 5 l 600 ml ÷ 4 = 1 l 400 ml

Exercise 17.3

(1)   Divide each of the volumes given below.

(i)	500 ml ÷ 2	(vi)	350 l ÷ 5
(ii)	150 ml ÷ 3	(vii)	2 l 200 ml ÷ 5
(iii)	300 ml ÷ 2	(viii)	6 l 200 ml ÷ 2
(iv)	1000 ml ÷ 2	(ix)	7 l 500 ml ÷ 3
(v)	3 l ÷ 3	(x)	4 l 350 ml ÷ 3

(2) The capacity of a tank is 500 *l*. If 20 *l* of water from it is consumed per day , for how many days will the volume of water in the tank be sufficient?

(3) At a certain function one person has to be served with 200 *ml* of a drink. For how many will 100 *l* of the drink be sufficient?

(4) 50 *ml* of milk is needed for a cup of yoghurt . Find the number of cups of yoghurt that can be made out of 10 *l* of milk.

17.4 Finding the volume of liquid in a cubical container

Example 5

One half of a cubical glass container is filled with water. One side of the cube is 10cm. Find the volume of water in the container.

Volume of the container $= 10 \times 10 \times 10 \text{ cm}^3 = 1000 \text{ cm}^3$

∴ Capacity of the container $= 1000 \ ml$

If the whole container is filled, the volume of water $= 1000 \ ml$

But since only half of the container is filled,
the volume of the liquid $= 500 \ ml$

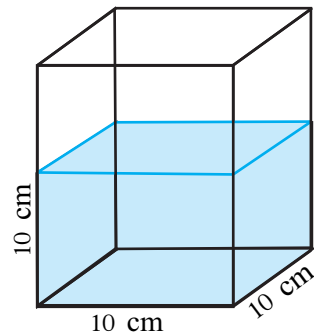This can also be shown as follows.

The volume of the container $= 10 \times 10 \times 10 \text{ cm}^3$
$= 1000 \text{ cm}^3$

The volume of half of it $= \dfrac{1000}{2} \text{ cm}^3$

$= 500 \text{ cm}^3$

∴ The volume of water in the container $= 500 \ ml$

Example 6

The length of a cuboid shaped container is 10 cm, the breadth is 10 cm and the height is 12 cm. If $\frac{1}{3}$ of the container is filled with water, find the volume of water in the container.

The capacity of the container $= 10 \times 10 \times 12 \text{ cm}^3 = 1200 \text{ cm}^3$

A quantity of $\frac{1}{3}$ of the capacity $= \frac{1200}{3} \text{ cm}^3 = 400 \text{ cm}^3$

$\frac{1}{3}$ of the capacity of the container $= 400 \ ml$

The volume of water in the container $= \underline{400 \ ml}$

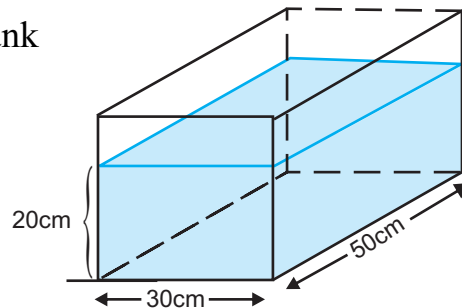| The volume of liquid in a cuboid shaped container | = | length of the container | × | breadth of the container | × | height of the liquid |

Example 7

The length and the breadth of a cuboid shaped fish tank are 50 cm and 30 cm respectively. If the height of the level of water in it is 20cm, find the volume of water.

The volume of the water in the tank
$$= 50 \times 30 \times 20 \text{ cm}^3$$
$$= 30000 \ ml$$
$$= \underline{\underline{30 \ l}}$$

20cm

30cm

50cm

Do you know?

✱ The volume of a reservoir is important in many ways. If there is a volume of water which is more than what the reservoir can hold there is a danger of cracks developing in the dam. Hence it is very essential to control the volume of water.

✱ The volume of fuel in an aeroplane is very important. If the volume of fuel in it is less than the amount needed, it cannot travel to the terminus. Similarly if the amount of fuel is more than is needed, the weight carried by it should be reduced; otherwise the aeroplane cannot take off.

Exercise 17.4

(1)   Write the following volumes in millilitres. (*ml*)
      (i) 15 *l*   (ii) 30 *l*   (iii) 0.375 *l*   (iv) 0.001 *l*

(2)   Write the following volumes in litres. (*l*)
      (i) 250 *ml*   (ii) 750 *ml*   (iii) 5 *ml*   (iv) 100 *ml*

(3)   Find the total volume when 4 *l* 50 *ml* of water is added to 50 *l* 525 *ml* of water in a container.

(4)   A container had 5 *l* of a liquid. Due to a leak in the container, there was only 2 *l* left after some time. Find the quantity of liquid that went waste.

(5)   A patient takes 5 *ml* of a liquid medicine twice a day. For how many days will 50 *ml* of the medicine be sufficient?

(6)   If one person needs 100 *l* of water for a day, what quantity of water is needed for a week for a family of 4 members?

(7)   The length of a cuboid shaped water tank is 100 cm and its breadth is 50 cm. It is filled with water to a height of 20 cm.
(i)   Find the volume of water in the tank.
(ii) If 50 *l* of water is added to the tank, what is the volume of the new quantity of water?
(iii) What is the new height of the level of water in the tank?

(8)   The measurements of the bottom of a tank are 50 cm and 50 cm. It is filled with water to a height of 10 cm.
(i)   Find the volume of water in litres and millilitres.
(ii)   When a container full of water was added to the tank, the level of water went up to 15 cm. Find the volume of the container.

Summary

*   Millilitre (m*l*) is a unit of the volume of liquids.

$$1cm^3 = 1\ ml$$

*   The litre (*l*) can be used as a larger unit of volume.

$$1\ l = 1000\ ml$$

*   Basic mathematical operations can be perfomed on the volume of liquids.