16 Liquid Measurements

By studying this lesson, you will be able to,
- identify the units used to measure quantities of liquids,
- identify the relationship between millilitres and litres,
- add and subtract measurements of liquid amounts expressed in terms of millilitres and litres and
- estimate quantities of liquids.

16.1 Introduction

The different types of liquids that you bring from the shop are filled in bottles of various sizes. Several such bottles are depicted in the figure. Observe the quantities that are mentioned on the bottles.

The quantity of liquid contained in each bottle has been expressed in millilitres or in litres. Let us write the quantities mentioned on the bottles as follows.

Forty millilitres has been expressed as 40 ml using symbols,
Three hundred and fifty milliliters has been expressed as 350 ml using symbols, and
one litre has been expressed as 1 l using symbols.

Litres and millilitres are units used to measure quantities of liquids. The quantity of milk in a milk packet or the quantity of medicinal syrup in a bottle is usually measured in millilitres, while the fuel used in vehicles is measured in litres.

Activity 1

Complete the given table providing the most suitable unit to measure the quantity given in each situation.

Situation	Unit
Household water consumption	
Quantity of fuel pumped into a vehicle	
Quantity of milk given to a child during a meal	
Quantity of milk required for a cup of tea	
Quantity of water that should be drunk by a person during a day	
Quantity of medicinal syrup given to a patient as one dose	
The dose of vaccine administered to a patient	

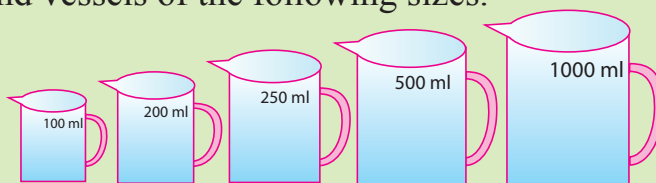## 16.2 Relationship between the units used to measure amounts of liquid

We have learnt that the units millilitres (ml) and litres (l) are used to measure amounts of liquids. A quantity of 1 litre of a liquid is equal to a quantity of 1000 ml of the liquid.

$$1\,l = 1000 \text{ ml}$$

Activity 2

Step 1- Find vessels of the following sizes.

Step 2 - Fill the 500 ml vessel completely with water and pour it into the 1 l vessel. How many times has the 500 ml vessel to be filled completely with water to fill the 1 l vessel completely?

Step 3 - Fill the 250 ml vessel completely with water and pour it into the 1 l vessel. How many times has the 250 ml vessel to be filled completely with water to fill the 1 l vessel completely?

Step 4 - Similarly, how many times must water be poured from a completely filled 200 ml vessel to fill the 1 *l* vessel completely?

Step 5 - How many times must water be poured from a completely filled 100 ml vessel to fill the 1 *l* vessel completely?

The results you will obtain by doing this activity are given below.

- The 1 *l* vessel is filled completely when water is poured into it twice from a completely filled 500 ml vessel. There are two 500 ml amounts in 1 *l*. Accordingly,

  500 ml + 500 ml = 1 *l*

  That is, 1000 ml = 1 *l*

- The 1 *l* vessel is filled completely when water is poured into it four times from a completely filled 250 ml vessel. That is, there are four 250 ml amounts in 1 *l*.

  250 ml + 250 ml + 250 ml + 250 ml = 1 *l*

  That is, 1000 ml = 1 *l*

- The 1 *l* vessel is filled completely when water is poured into it five times from a completely filled 200 ml vessel. That is, there are five 200 ml amounts in 1 *l*.

  200 ml + 200 ml + 200 ml + 200 ml + 200 ml = 1 *l*
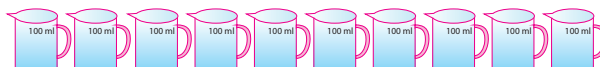
  That is, 1000 ml = 1 *l*

- The 1 *l* vessel is filled completely when water is poured into it ten times from a completely filled 100 ml vessel. That is, there are ten 100 ml amounts in 1 *l*.

  100 ml + 100 ml + 100 ml + 100 ml + 100 ml + 100 ml + 100 ml + 100 ml +100 ml + 100 ml = 1 *l*

  That is, 1000 ml = 1 *l*

• Representing liquid measurements expressed in litres in terms of millilitres

The amount of millilitres in certain amounts of litres is given below.

Since 1 l = 1000 ml,

2 l = 2000 ml

3 l = 3000 ml

Accordingly, to express a quantity of liquid given in litres, in terms of millilitres, the number of litres has to be multiplied by 1000.

Example 1

Express 12 l in millilitres.

12 l = 12 × 1000 ml

= 12 000 ml

Example 2

Express 1 litre 200 millilitres in millilitres.

1 l 200 ml = 1 l + 200 ml

Since 1 l = 1000 ml,

1 l 200 ml = 1000 ml + 200 ml

= 1200 ml

Example 3

Express 4 l 85 ml in millilitres.

4 l 85 ml = 4 l + 85 ml

Since 1 l = 1000 ml,

4 l 85 ml = 4000 ml + 85 ml

= 4085 ml

Exercise 16.1

(1) Complete the following table.

Quantity of water to be measured	Size of the vessel used to measure the quantity	Number of times the measuring vessel needs to be used
1 litre 500 millilitres	500 millilitres	
1 litre 250 millilitres	250 millilitres	
2 litres	100 millilitres	
4 litres	500 millilitres	
....	250 millilitres	8
3 litres	....	6

(2) Express each of the following liquid measurements in millilitres.

    (i) 8 l (ii) 1 l 100 ml   (iii) 5 l 10 ml
    (iv) 2 l 500 ml   (v) 3 l 100 ml   (vi) 3 l 250 ml
    (vii) 7 l 225 ml   (viii) 2 l 75 ml   (ix) 3 l 25 ml

● Representing liquid measurements expressed in millilitres in terms of litres

The amount of litres in certain amounts of millilitres is given below.

     Since 1000 ml   =   1 l,
             2000 ml   =   2 l
             3000 ml   =   3 l

Accordingly, to represent liquid measurements expressed in millilitres in terms of litres, the amount in millilitres needs to be divided by 1000.

Example 1

Express 2750 millilitres in terms of litres and millilitres.
      2750 ml = 2000 ml + 750 ml
Since 1000 ml = 1 l, 2000 ml = 2 l
      2750 ml = 2 l + 750 ml
             = 2 l 750 ml

Accordingly, to express an amount of 1000 millilitres or more, in terms of litres and millilitres, the amount of milliliters is written as lesser than 1000.

Example 2

Fill in the table by representing the liquid measurements expressed in millilitres in terms of litres and millilitres.

ml	l	ml
999	0	999
1000	1	000
2075	2	075
3008	3	008

Exercise 16.2

(1) Express each of the following liquid measurements in litres.

   (i) 1000 ml   (ii) 2000 ml   (iii) 3000 ml   (iv) 7000 ml

   (v) 10 000 ml

(2) Express each of the following liquid measurements in litres and millilitres.

   (i) 1300 ml   (ii) 1500 ml   (iii) 1050 ml   (iv) 3252 ml

   (v) 7756 ml   (vi) 3002 ml (vii) 4103 ml   (viii) 10075 ml

16.3 Adding liquid measurements

Let us find out the quantity of drink that is obtained when 350 ml of fruit juice is added to 750 ml of water.

These liquid measurements can easily be added together since they are both expressed in the same units.

Quantity of fruit juice   =   350 ml
Quantity of water   =   750 ml
Total quantity   = 1100 ml

That is, the total quantity of drink is 1 l 100 ml.

A producer of cinnamon oil produced 2 *l* 750 ml of oil during the first week and 5 *l* 500 ml of oil during the second week. Let us find out how much oil he produced during the two weeks.

Let us add these measurements by writing the millilitres in one column and the litres in another column, as shown below.

l	ml
2	750
+ 5	500
8	250

Let us add the quantities in the millilitres column.

750 ml + 500 ml = 1250 ml

Since 1250 ml = 1 *l* + 250 ml,

let us keep the 250 millilitres in the millilitres column and carry the 1 litre to the litres column.

Let us add the quantities in the litres column.

We obtain 1 *l* + 2 *l* + 5 *l* = 8 *l*

That is, the quantity of oil that was produced during the two weeks is 8 *l* 250 ml.

The quantity of oil that was produced during the two weeks can also be found in the following manner.

Let us express each quantity in millilitres and add them as follows.

$$2\ l\ 750\ \text{ml} = 2750\ \text{ml}$$
$$5\ l\ 500\ \text{ml} = 5500\ \text{ml}$$
$$8250\ \text{ml}$$

The total quantity of oil is 8250 ml. That is, 8 *l* 250 ml.

Exercise 16.3

(1) Add each of the following liquid measurements.

(i)
ml
350
+ 250

(ii)
ml
675
+ 250

(iii)
ml
750
+ 350

(iv)
ml
803
+ 373

(v)	l	ml		(vi)	l	ml		(vii)	l	ml
	3	150			2	75			5	624
+	2	600		+ 1		950		+ 2		750

(viii)	l	ml		(ix)	l	ml		(x)	l	ml
	4	305			12	450			6	425
+	2	915		+	10	850		+	12	755
	1	200			10	900				995

(2) Find the quantity of drink that can be made by adding 3 l 500 ml of water to 750 ml of fruit juice. Express this quantity in litres and millilitres.

(3) There is 4 l 750 ml of petrol in the petrol tank of a vehicle. If another 5 l 750 ml of petrol is pumped in, find the total quantity of petrol in the tank.

(4) There was 3 l 850 ml of water in a basin. 1 l 400 ml of water was added to this. If an amount equal to the total quantity of water in the basin is added again, how much water is there in the basin now?

16.4 Subtracting a liquid measurement from a given liquid measurement

There was 750 ml of water in Sumith's water bottle. He drank 150 ml of it. Let us find how much water there is in the bottle now.

Quantity of water in the bottle initially = 750 ml
Quantity of water Sumith drank = 150 ml
Quantity of water remaining = 750 ml − 150 ml
= 600 ml

The quantity of drink in a bottle in a refrigerator was 2 l and 100 ml. Of this amount, 200 ml was served to a guest. Let us find the amount of drink remaining in the bottle.

Initial quantity of drink = 2 l 100 ml
Quantity served to the guest = 200 ml

Let us subtract the quantity that was served from the quantity that was initially there.

2 *l* 100 ml is equal to 2100 ml. Now let us subtract 200 ml from 2100 ml.

$$\begin{array}{r} 2100 \text{ ml} \\ - \ \ 200 \text{ ml} \\ \hline 1900 \text{ ml} \end{array}$$

That is, the remaining amount is 1 *l* 900 ml.
The remaining amount can also be found in the following manner.

l	ml
2	100
−	200
1	900

100 is smaller than 200.
Let us carry 1 *l* to the millilitres column. There is 1 *l* remaining in the litres column.
Then there is 1000 ml + 100 ml, that is, 1100 ml in the millilitres column.

1100 ml − 200 ml = 900 ml
Therefore, the remaining amount is 1 *l* 900 ml.

Exercise 16.4

(1) Subtract.

(i)
$$\begin{array}{r} \text{ml} \\ 500 \\ - \ 250 \\ \hline \end{array}$$

(ii)
$$\begin{array}{rr} l & \text{ml} \\ 1 & 500 \\ - & 250 \\ \hline \end{array}$$

(iii)
$$\begin{array}{rr} l & \text{ml} \\ 1 & 000 \\ - & 250 \\ \hline \end{array}$$

(iv)
$$\begin{array}{rr} l & \text{ml} \\ 2 & 000 \\ - \ 1 & 500 \\ \hline \end{array}$$

(v)
$$\begin{array}{rr} l & \text{ml} \\ 3 & 250 \\ - \ 1 & 750 \\ \hline \end{array}$$

(vi)
$$\begin{array}{rr} l & \text{ml} \\ 5 & 150 \\ - \ 2 & 250 \\ \hline \end{array}$$

(vii)
$$\begin{array}{rr} l & \text{ml} \\ 2 & 50 \\ - \ 1 & 750 \\ \hline \end{array}$$

(viii)
$$\begin{array}{rr} l & \text{ml} \\ 15 & 105 \\ - \ 8 & 250 \\ \hline \end{array}$$

(2) A trader sells 1 *l* 500 ml of coconut oil from the 10 *l* that he had in store. Express the quantity that is remaining in terms of litres and millilitres.

(3) 15 *l* of fuel can be filled into a certain fuel tank. If the tank contains 8 *l* and 750 ml of fuel at present, how much more fuel is required to fill the tank completely?

16.5 Estimation of liquid amounts

First figure   Second figure
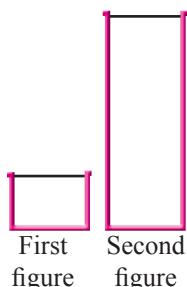
The quantity of milk in the vessel in the first figure is approximately 200 ml. Let us estimate the amount of milk there is in the vessel in the second figure.

The quantity of milk in the vessel in the second figure is about four times the quantity of milk in the bottle in the first figure. That is, 4 times 200 ml. Therefore, there is approximately 800 ml of milk in the vessel in the second figure.

Exercise 16.5

(1) Approximately 30 millilitres of oil is required for a clay oil lamp. Estimate the amount of oil that is required for 50 oil lamps in terms of litres and millilitres.

(2) Approximately 500 ml of Kithul honey was required to serve curd to ten guests. Estimate the amount of Kithul honey that is required to serve curd to 15 guests.

(3) There is approximately 650 ml of king coconut water in one king coconut (thambili). Accordingly, estimate the amount of king coconut water there is in a bunch of 10 fruits, in terms of litres and millilitres.

Miscellaneous Exercise

(1) The following table provides information on the quantities of milk collected by a milk collector from three houses during two days.

	Day 1	Day 2
House *A*	5 *l* 500 ml	6 *l* 250 ml
House *B*	7 *l* 250 ml	5 *l* 750 ml
House *C*	4 *l* 675 ml	5 *l* 500 ml

(i) Express the total quantity of milk that was obtained from house *A* during the two days, in terms of litres and millilitres.

(ii) By what amount was the quantity of milk collected from house *B* on the second day, less than the quantity that was collected on the first day?

(iii) By what amount was the quantity of milk provided by house *C* on the second day, more than the quantity that was provided on the first day?

(iv) Find separately, the total quantity of milk provided by the houses *B* and *C* during the two days.

(v) Accordingly, find the total quantity of milk that the milk collector collected during the two days.

(2) The quantity of acid in a certain vessel in a laboratory was 3 litres. The quantity of acid taken from this vessel for various practical experiments during each day of a certain week is given below.

Day	Quantity of Acid
Monday	750 ml
Tuesday	350 ml
Wednesday	200 ml
Thursday	150 ml
Friday	200 ml

(i) Find the total quantity of acid that was used during the five days.

(ii) What was the quantity of acid remaining in the vessel at the end of the week?

(3) A certain type of paint is marketed in tins of the following sizes; 500 millilitres, 1 litre, 2 litres and 4 litres.

(i) A person wishes to buy one litre of paint. What are the two ways in which he can purchase this?

(ii) The quantities of each type that were sold during a week is given below. Four tins of size 1 litre, three tins of size 2 litres, seven tins of size 500 millilitres. Express the total amount of paint that was sold during that week in terms of litres and millilitres.

(iii) A person who bought a tin of size 4 litres used 2 *l* 700 ml of it. How much paint was left over?

(4) At 8.00 a.m, there was 1500 litres of water in a calibrated water tank. The quantity of water that was used up during the 6 hours from 8.00 a.m. to 2.00 p.m. is given below.

Time	Quantity of water that was used
First hour : 8.00 a.m. – 9.00 a.m.	78 *l*
Second hour : 9.00 a.m. – 10.00 a.m.	120 *l* 750 ml
Third hour :10.00 a.m. – 11.00 a.m.	150 *l* 500 ml
Fourth hour :11.00 a.m. – 12.00 noon	400 *l* 750 ml
Fifth hour :12.00 noon – 1.00 p.m.	200 *l*
Sixth hour :1.00 p.m. – 2.00 p.m.	180 *l*

(i) Show by calculating the amount that by the end of the fourth hour, exactly half the quantity of water in the tank had been used up.

(ii) Find the amount of water remaining in the tank at the end of the six hours.

(iii) By what amount is the quantity that was used in the third hour greater than the quantity that was used in the second hour?

(iv) If the total amount of water that can be filled into the tank is 2000 litres, find how much water has to be added to the water remaining in the tank after the 6 hours, to fill it up completely.

Summary

- Liters and millilitres are two units used to measure quantities of liquids.
- 1000 ml = 1 *l*
- To convert a quantity expressed in litres into a quantity expressed in millilitres, the quantity in litres is multiplied by 1000.
- To convert a quantity expressed in millilitres into a quantity expressed in litres, the quantity in millilitres is divided by 1000.